

Pondicherry University

B. Sc (Biotechnology)
Course Structure (with effect from 2006-2007 academic year)

Year	Semester	Course	Hours per week			Max. Marks	Min. Marks
			Theory	Practical	Total		
First	First	Language	6	0	6	100	40
		English	6	0	6	100	40
		Major Paper I : Cell Biology	4	2	6	100	40
		Major Paper II : Microbiology	4	2	6	100	40
		Allied Paper I : Allied Biochemistry , Paper I	4	2	6	75	30
		Major Practical – I				50	20
		Allied Biochemistry Practical – I				25	10
Total Marks : 550							
First	Second	Language	6	0	6	100	40
		English	6	0	6	100	40
		Major Paper III : Developmental Biology	4	2	6	100	40
		Major Paper IV : Biostatistics	4	2	6	100	40
		Allied Paper II : Allied Biochemistry , Paper II	4	2	6	75	30
		Major Practical – II				50	20
		Allied Biochemistry Practical – II				25	10
Total Marks : 550							
Second	Third	Language	6	0	6	100	40
		English	6	0	6	100	40
		Major Paper V : Molecular Biology	4	2	6	100	40
		Major Paper VI : Parasitology and Entomology	4	2	6	100	40
		Allied Paper III : Allied Biological Science , Paper I (General Biology)	4	2	6	75	30
		Major Practical – III				50	20
		Allied Biological Science Practical - I				25	10
Total Marks : 550							

Year	Semester	Course	Hours per week			Max. Marks	Min. Marks
			Theory	Practical	Total		
Second	Fourth	Language	6	0	6	100	40
		English	6	0	6	100	40
		Major Paper VII : Immunology	4	2	6	100	40
		Major Paper VIII : Genetic Engineering	4	2	6	100	40
		Allied Paper IV : Allied Biological Science - II	4	2	6	75	30
		Major Practical – IV				50	20
		Allied Biological Science Practical – II				25	10
Total Marks : 550							
Third	Fifth	Major Paper IX : Environmental Biotechnology	4	2	6	100	40
		Major Paper X : Marine Biotechnology	4	2	6	100	40
		Major Paper XI : Animal Biotechnology	4	2	6	100	40
		Major Paper XII : Bioprocess Technology and Downstream Processing	4	2	6	100	40
		Major Paper XIII : Genomics and Proteomics	6	0	6	100	40
		Major Practical – V (Major paper IX and Major Paper X)				50	20
		Major Practical – VI (Major Paper XI and Major Paper XII)				50	20
Total Marks : 600							
Third	Sixth	Major Paper XIV : Plant Biotechnology	4	2	6	100	40
		Major Paper XV : Medical Biotechnology	4	2	6	100	40
		Major Paper XVI : Pharmaceutical Biotechnology	4	2	6	100	40
		Major Paper XVII : Bioinformatics	4	2	6	100	40
		Major Paper XVIII : Entrepreneurial Development, Biosafety, Bio-ethics and IPRs	6	0	6	100	40
		Major Practical – VII (Major Paper XIV and Major Paper XV)				50	20
		Major Practical – VIII (Major Paper XVI and Major Paper XVII)				50	20
Total Marks : 600							

Total Marks: 550 + 550 + 550 + 550 + 600 + 600: 3400

MAJOR PAPER I

CELL BIOLOGY

UNIT I (13 hours)

History of Cell biology, Cell as basic unit of life, Cell theory, Protoplasm theory and Organismal theory, Broad classification of cell types, Prokaryotic cell and Eukaryotic cells and their characteristics. Organization, Ultra structure and comparison of Plant, Animal and Bacterial cells.

UNIT II (14 hours)

Structure of cell wall- bacterial cell wall and plant cell wall, Plasma membrane – Exocytosis, Endocytosis, Phagocytosis. Cytoskeleton structure – Microtubules, Microfilaments, Intermediate Filament.

UNIT III (13 hours)

Structure and functions of cell organelles- Endoplasmic Reticulum (Rough Endoplasmic Reticulum and Smooth Endoplasmic Reticulum), Golgi apparatus, Lysosomes, Microbodies (Peroxisomes and Glyoxysomes), Vacuoles, Ribosomes, Centriole and Basal bodies.

UNIT IV (15 hours)

Mitochondria-organization of respiratory chain, Chloroplasts-Photophosphorylation, Nucleus, Nucleolus, Nuclear membrane and Organization of chromosomes, Cell cycle: Cell division (mitosis and meiosis).

UNIT V (15 hours)

Definition of Signal transduction - specificity, amplification, desensitization, integration. Transport across membranes – Symport, Antiport, Uniport, Active and Passive Transport.

Cell Biology

Practicals:

1. Cell types- Microbial, animal and plant cells
2. Measurement of cell using ocular micrometer and stage micrometer
3. Cell counting methods- Haemocytometer and stomatal density
4. Feulgen procedure for staining nuclei.
5. Mitosis: Acetocarmine squash method.
6. Meiosis in Pollen mother of cells of plants
7. Meiosis in Grasshopper testis.
8. Identification of Barr bodies
9. Observing polytene chromosome from *Drosophila* salivary gland

Text Books:

- E.D. P. De Robertis and E.M.F. De Robertis, Jr. 1998 Cell and Molecular Biology (Eighth edition). B.I. Waverly Pvt.Ltd. New Delhi. Pages: 734
- Harvey Lodish, Arnold Berk, S. Lawrence Zipursky, Paul Matsudaira, David Baltimore and James Darnell, 2000. Molecular Cell Biology (Fourth Edition). Media Connected – W.H.Freeman and Company. Pages: 1084
- P.S. Verma and V.K. Agarwal, Concepts of Cell Biology. S.Chand & Company Ltd., New Delhi; Pages: 264

Further Reading:

- D.E – Sadava, Cell Biology - Organelle Structure and Function.
- B Alberts, Essential Cell Biology.
- Alberts Bruce, Molecular Biology of the Cell (Fourth Edition).

MAJOR PAPER II

MICROBIOLOGY

Unit I (14 hours)

Definition, Scope and History of Microbiology - Differences between the prokaryotic and eukaryotic microorganisms – Classification and characterization of bacteria according to Bergey's Manual of Systemic Bacteriology (9th edition) – Basic understanding of classification of Viruses, Algae, Fungi and Protozoa.

Unit II (15 hours)

Principles and applications of simple, compound, bright field, dark field, phase contrast, fluorescent and electron microscopy.

Principles of Staining: Nature of dyes, Types of staining – Simple, Differential, Negative and spore staining.

Unit III (13 hours)

Principles and Methods of Sterilization – Physical and chemical, Microbial Nutrition – Heterotrophic, Autotrophic, Growth of Bacteria, Fungus and Viruses, Media- Synthetic and non synthetic, effect of abiotic factors on growth

Unit IV (15 hours)

Ultrastructure of Bacteria, Subcellular structures and Cell envelope – Slime, Capsule, Cell Wall, Pili, Flagella, Cell Inclusions, Biosynthesis of bacterial cell wall, Cell membrane – Biomembrane, Liposomes. Preparation of media. Anaerobic cultivation of bacteria.

Unit V (13 hours)

Antimicrobial agents - chemotherapy- Antibiotics – source, classification – mode of action – antimicrobial resistance – Test for sensitivity to antimicrobial agents and its quality control.

Microbiology

Practicals:

1. Sterilization – Moist heat, Dry heat, Chemicals, Radiation and Filtration
2. Microscopic examination of: *E.coli*, Mycobacteria, Yeast, Aspergillus and Mucor.
3. Media preparation – Synthetic, Semisynthetic and Non synthetic, Solid and Liquid Media
4. Pour Plate, Streakplate, Single hyphal tip, Single spore isolaton.
5. Enrichment Culture technique
6. Microscopy – Light microscopy, Phase contrast microscopy, Bright field, Dark Field and Fluorescent microscopy.
7. Micrometry – Stage and Ocular micrometer
8. Staining – Simple staining, Gram staining, Acid Fast.
9. Antibiotic sensitivity test.

Text Books:

- M.J. Pelczar Jr. E.C.S. Chan and N.R. Kreig , Microbiology, Tata Macraw Hill, New Delhi; Pages: 1050
- R. Ananthanarayanan. and C.K.Jayaram Panickar, Text book of Microbiology, Orient Longman Publications, New Delhi: Pages : 960
- R.C. Dubey, D.K.Maheswari, A Text book of Microbiology, S.Chand & Company Ltd. New Delhi; Pages: 912
- Lansing M. Prescott, John. P. Harley, Donald A. Klein, 1999 Microbiology (fourth edition) WCB Macraw Hill, New York; Pages: 962

Further Reading:

- P. Chakraborty, A Text book of Microbiology.
- Hans G. Schlegel (seventh edition), General Microbiology.
- Barry L. Batzing, Microbiology an Introduction
- Ronald M Atlas Principles of Microbiology

ALLIED PAPER I

ALLIED BIOCHEMISTRY PAPER I

UNIT I

Introduction To Biological Molecules, Biological Importance Of Carbohydrates, Lipids, Proteins And Nucleic Acids, Molecular Interactions As A Basis For Biological Functions.

UNIT II

Carbohydrates: Definition, Classification, Structure, Simple And Complex Carbohydrate, Structure And Linkages In Disaccharides And Polysaccharides, Energy, Reserve And Structural Polysaccharides

Unit III

Amino Acids: Classification, Structure And Properties, Peptides And Peptide Bonds.
Proteins: Definition, Nature And Classification, Primary, Secondary, Tertiary And Quaternary Structure

Unit IV

Lipids: Fatty Acids, Classification And Structure, Properties Of Fats And Oils, Functions Of Triacylglycerols, Phospholipids, Sphingolipids, Glycolipids And Gangliosides.

Unit V

Nucleic Acids: Purines And Pyrimidines, Structure Of Nucleosides And Nucleotides, , Structure Of Dna And Rna.

ALLIED BIOCHEMISTRY-I

Practicals:

1. Qualitative Analysis Of Protein
2. Qualitative Analysis Of Aromatic Amino Acids
3. Qualitative Analysis Of Sulphur Containing Acids
4. Qualitative Analysis Of Carbohydrates
5. Qualitative Analysis Of Fats
6. Preparation Of Starch From Potatoes
7. Preparation Of Ovalbumin From Egg
8. Preparation Of Lactalbumin From Milk
9. Acid – Base Titration Curve

Text Books:

- Nelson And Cox, Lehninger. Principles Of Biochemistry (Fourth Edition) W.H Freeman Publishers.
- Roy Tasker, Carl Rhodes. Stryr's Biochemistry (Fourth Edition).
- Voet. D. Biochemistry (Second Edition) Academic Press.

Further Readings:

- Zubey. G. Principles Of Biochemistry October 2000 Oscar Publication Pages 848.
- Devlin T.M. Text Book Of Biochemistry. With Clinical Correlations (Fourth Edition) 2005 J.Wiley & Sons Publication , U.K Pages 1208.

Sstry's Biochemistry 2000, W.H Freeman Publication, New York.

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER III

DEVELOPMENTAL BIOLOGY

Unit I (10 hours)

Basic concepts of development biology, Cell fate and commitment; Mechanisms of development commitment, mosaic and regulative development, maintenance of differentiation, pattern formation and compartments, morphogenesis.

Unit II (10 hours)

Gametogenesis – Spermatogenesis: formation of spermatids - multiplication phase, growth phase, maturation phase, spermiogenesis, formation of head of spermatozoan, changes in nucleus, acrosome formation, tail formation and other events, structure of sperm cell.

Oogenesis – multiplication phase, growth phase – perivitellinogenesis, Growth of nuclear substance, gene amplification, vitellogenesis, cortical differentiation, maturation of egg, Menstrual cycle, structure of ovum.

Unit III (14 hours)

Fertilization: Acrosome reaction, fertilization, fertilization membrane formation, post fertilization changes, zygote.

Cleavage and gastrulation: Cleavage, blastula, morula, gastrulation, formation of three germ layers – ectoderm, endoderm and mesoderm.

Unit IV (20 hours)

Fate of ectoderm: The ectoderm : neural induction and the epidermis, Patterning the anteroposterior neuraxis, patterning the dorsoventral neuraxis, shaping the neural tube, Neurogenesis, The neural crest, Neuronal connections.

Mesoderm and endoderm: mesoderm induction and patterning, somitogenesis and patterning, somite differentiation, mammalian kidney development, heart development, endoderm development.

Unit V (16 hours)

Implantation and placentation: Placental types, implantation, amniotic fluid.

Human embryology: Human embryo development – First, second and third trimester. Artificial ovulation and invitro fertilization and assisted reproductive technology, Monozygotic and dizygotic twins.

Developmental Biology

Practicals:

1. Stages of development in chick embryo
2. Chick whole mount 24 hours embryo
3. Chick whole mount 48 hours embryo
4. Chick whole mount 72 hours embryo
5. 21 days chick embryo
6. CS of ovary
7. CS of testis
8. Development features of Human Fetus
9. Cleavage: 2 cells, 4 cells, 8 cells, 16 cells, 32 cells.

Text Books:

- Scott. F. Gilbert, 2000. Development Biology; 6th ed. Sinauer Associates, INC., Publishers, Sunderland, Massachusetts.
- T.Subramoniam, 2002. Development Biology, Narosa Publishing House.
- J.R.M.Twymann, 2001, Instant notes in Development Biology, Viva Books PVT. LTD.

Further Readings:

- Jonathan Slack., 2001. Essential Development Biology. Blackwell Science.
- Inderbir Singh., 1996, Human Embryology 6th ed. Macmillan India Limited.

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER IV

BIO-STATISTICS

UNIT I

Biostatistics-definition – nature and scope of statistics and limitations – Collection of data – primary and secondary – types and methods of data collection procedure – classification and tabulation of statistical data – frequency distribution for discrete and continuous data – diagrammatic representation (bar diagram and pie chart) – graphical representations (histogram, frequency polygon and Ogives).

UNIT II

Measures of central tendency: mean, median, mode, geometric mean, Harmonic mean-measure of dispersion: range, mean deviation, quartile deviation and standard deviation – coefficient of variation.

UNIT III

Moments –Skewness and Kurtosis – Correlation – types and methods of correlation. Simple Regression – equation fitting and prediction.

UNIT IV

Basic concepts of probability – definition –axioms of probability – addition and multiplication theorems (without proof) – conditional probability – Baye's theorem (without proof) – random variable – mathematical expectation and variance.

UNIT V

Binomial, Poisson and Normal distributions (application and simple problems) – concept of sampling distribution – test of significance based on t (one-sample, two-sample and paired t-test)- chi-square test (independence of attributes) – F-test. Experimental Design – CRD and RBD.

Bio-Statistics

Practical

1. Diagrammatic representations (Bar diagram and Pie chart)
2. Construction of univariate frequency distribution and graphical representation (Histogram and frequency polygon).
3. Measures of central tendency.
4. Measures of dispersions.
5. Moments, Skewness, Kurtosis.
6. Simple Correlation and regression.
7. Rank Correlation.
8. Test of significance based on t test.
9. Chi-square test for independence of attributes.

Text Books:

- N. Gurumani, 2005, An introduction to Biostatistics. MJP Publishers, Chennai.
- W. W. Daniel, 1987, Biostatistics, John Wiley Sons, NewYork.
- P.S.S. Sundar Rao and J. Richard, An introduction to Biostatistics, Third edition, Christian Medical College, Vellore.

Further Readings:

- G. W. Snedecar and W. G. Cochran, Statistical Methods, Oxford Press.
- R. C. Cambell ,1989, Statistics for Biologists, Cambridge University Press.

ALLIED PAPER ii

ALLIED biochemistry PAPER ii

UNIT I (15 hours)

Carbohydrates: Glycolysis, Citric acid cycle, HMP pathway, ET chain, Uronic acid pathway, Glucogenesis, Gluconeogenesis, Glycogenesis, Glycogenolysis,

UNIT II (15 hours)

Lipids: Absorption of dietary lipids, Transport form of lipids, the plasma lipo proteins- VLDL, LDL, HDL, Chylomicrons. Oxidation of fatty acids, ketone bodies, Cholesterol metabolism, biosynthesis of Fatty acid, Biosynthesis of phospholipids, Simple Triglycerides, Vit D.

UNIT III (15 hours)

Amino Acids: Utilisation of aminoacids, Transamination, Transamidation Deamination, Decarboxylation, Metabolism of Ammonia, Urea Cycle, Protein synthesis, Translatinal machinery, Biosynthesis of tryptophan and methionine.

UNIT IV (10 hours)

Ezymes: Introduction, Nomenclature and Classification , kinetics, Properties of Enzymes, Factors affecting enzyme activity, Coenzymes, Iso-enzymes, Allosteric enzymes , Enzyme inhibition

UNIT V (15 hours)

Nucleic acids: Synthesis of purine and pyrimidine bases, Nucleosides and Nucleotides and degradation of Purine and pyrimidine bases.

Allied Biochemistry - II

Practicals:

1. Separation of Blood plasma or Serum from blood cells by centrifugation technique.
2. Preparation of acetate buffer.
3. Verification of Beer's law.
4. Column Chromatography.
5. Paper Chromatography.
6. Estimation of proteins
7. Estimation of Glucose
8. Estimation of total and HDL Cholesterol
9. Enzyme Reactions (Temperature, Concentration, pH and Time)

Text Books:

- VOET. D -.BIOCHEMISTRY (SECOND EDITION)
- ZUBEY.G -PRINCIPLES OF BIOCHEMISTRY OCTOBER 2000 OSCAR PUBLICATION,PAGES 848
- WILSON AND WALKER PRINCIPLES AND TECHNIQUES OF PRACTICAL BIOCHEMISTRY, FIFTH EDITION, CAMBRIDGE UNIVERSITY PRESS, 2000

FURTHER READING:

- NELSON AND COX LEHNINGER PRINCIPLES OF BIOCHEMISTRY (THIRD EDITION) WORTH PUBLISHER 2000 PAGES 1013.
- ROY TASKER, CARL RHODES STRYR'S BIOCHEMISTRY (FOURTH EDITION) W.H FREEMAN & COMPANY 1996. PAGES 795.

mAJOR THEORY V

Molecular Biology

unit I (15 HOURS)

History of molecular biology, DNA and RNA as genetic materials, Experiments of Griffith, Avery, Macleod and McCarty, Hershey and Chase, Lederburg and Tatum, Chargaff's principles, Primary structure of DNA and RNA, Alternative forms of DNA double helices.

UNIT II (15 HOURS)

Chemical nature of DNA and RNA. Replicons, DNA replication in Prokaryotes, Models of DNA replication, Enzymes and proteins involved in DNA replication (Nucleases, Polymerases, Ligases, Helicases, Gyrase, Single Strand Binding Protein, Replisome / Primosome).

UNIT III (10 HOURS)

Transcription in Prokaryotes, RNA Polymerases I, II and III. Genetic Code, Deciphering the genetic code, Characteristics of genetic Code, Wobble Hypothesis, Central Dogma of life and Reverse Central Dogma.

UNIT IV (15 HOURS)

Translation in Prokaryotes. Mechanisms of action of Puromycin, Chloramphenicol and Streptomycin on protein synthesis. Regulation of gene expression in prokaryotes (*lac*, *trp*, *gal* operons)..

UNIT V (15 HOURS)

Spontaneous and induced mutations – mechanism of action of Base analogues, alkylating agents, UV and X-rays. Repair of damaged DNA – excision repair, SOS, photoreactivation.

MOLECULAR BIOLOGY

PRACTICALS:

1. Introduction to molecular biology lab techniques and development skills
2. DNA isolation from materials like *E.coli*, rat liver, plant material.
3. DNA estimation- calorimetric method.
4. UV irradiation-Percent Survival Curve
5. UV irradiation-Isolation of auxotrophic mutants, antibiotic resistant mutants
6. Effect of selected antibiotics on DNA synthesis.
7. Effect of selected antibiotics on protein synthesis.
8. Induction of mutants using EMS
9. Transformation.

Text Books:

- Benjamin Lewin, Genes VII, Pearson Prentice hall , Pearson Education , Inc.,2004,p.: 1027
- David Freifelder, Essentials of Molecular Biology, Jones & Bartlett, 1998 pages 532.
- P.S. Verma and V.K. Agarwal Concepts of Molecular of Molecular Biology, S.chand & company Ltd, New delhi

Further Readings:

- NELSON AND COX, LEHNINGER. PRINCIPLES OF BIOCHEMISTRY (THIRD EDITION).W.H FREEMAN PUBLISHERS.
- Harvey Lodish, Arnold Berk, S. Lawrence Zipursky, Paul Matsudaira, David Baltimore and James Darnell.: Molecular Cell Biology (Fourth Edition),W.H freeman & company,2000,p.:973.
- Molecular Biology, Robert F.Weaver, 2005, McGrawHill company.

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER VI

PARASITOLOGY AND ENTOMOLOGY

Unit I:

General Consideration :Taxonomy , Transmission of parasites , Pathogenesis and pathology , Host immunity in parasitic infections , Clinical manifestations of parasitic infections , laboratory diagnosis of parasitic infections , Prevention and control of parasitic infections .

Unit II :

Protozoa : Entamoeba ,Plasmodium, Leishmania, Giardia, Trichomonas, Balantidium. Toxoplasma and Cryptosporium and other intestinal coccidia

Unit III :

Cestodes and Trematodes: Taenia , Echinococcus , Schistosoma , Fasciola, Paragonimus
Platyhelminthes

Unit IV:

Nematodes : Strongyloides ,Trichinella , Hookworms , Ascaris , Enterobius , Trichuris , Wuchereria, Brugia , Dracunculus.

Unit V:

Entomology and disease transmission: Modern concepts of entomology, knowledge of the biology and life cycles of arthropod " vectors - Ticks, mites, Fleas, mosquitoes and Flies that are capable of transmitting diseases in humans and animals, Mechanism of disease transmission with particular references to vectors and diseases in India, Vector control measures.

Allied Parasitology and Entomology

Practicals:

1. Saline wet mount examinations of stool for parasites.
2. Iodine mount examinations of stool for parasites.
3. LPCB mount examinations of stool for parasites.
4. Vaginal swabs for Trichomonas.
5. Estimation of worm burden in stool
6. Floatation sedimentation techniques of stool examination.
7. Staining of peripheral blood smear for malarial and filarial parasites.
8. Stool culture for hook worm
9. Stool culture for amoeba.

Text Books:

1. SC Parija (2004). Text Book of Medical Parasitology . Protozoology & Helminthology . All India Publishers & Distributors .New Delhi .
2. Easwari Nayar (1994). Hand Book on Medical Entomology, Kalpana Printing House, Delhi.
3. LS Garcia, DA Bruckner. Diagnostic Medical Parasitology. American Society for Parasitology, Washington DC , 2004 .

Further Readings:

1. Jc Colle, JP Duguid, A.c. Fraser and B.P. Marimon (2004). Mackie and McCartney's Practical Medical Microbiology. 14th Edition, Churchill Livingstone.

ALLIED PAPER - III

ALLIED BIOLOGICAL SCIENCE PAPER I

Unit I (10 Hours)

General classification of Plants and Animals, Concept of Species, Overview of Kingdom Animalia and Plantae, General characteristics of each group up to class level with an example.

UNIT II (12 Hours)

Structure and function of plants tissues: parenchyma, collenchyma, sclerenchyma. Different types of xylem and phloem.

Structure and functions of animal tissues: simple epithelial tissue, connective tissues, muscle tissues and nervous tissue (Neuron).

Unit III (15 Hours)

Autotrophic nutrition, Photosynthesis, micro- and macro-nutrients, overview of mineral element deficiencies in plants. Different types of heterotrophic nutrition.

Methods of treatments and preventions of diseases – Malaria, Typhoid, HIV.

UNIT IV (18 Hours)

Brief account of plant-water relations, types of transpiration and stomatal mechanism, ascent of water in xylem and translocation of organic solutes in phloem, Anaerobic and aerobic respiration, Nitrogen fixation, Vegetative and asexual propagation of plants, sexual reproduction in plants (algae to angiosperm), pollination, fertilization.

UNIT V (15 Hours)

Digestion of food in various regions of the alimentary canal; General characteristics of blood vascular system, composition of blood, structure and functions of heart and blood clotting; structure and functions of brain, nerve impulse; General view of endocrine system.

Allied Biological Science – I

Practicals

1. Mounting of salivary gland chromosomes in chironomous larvae.
2. Transpiration – Gannong's Potometer
3. Estimation of photosynthetic pigments in plants.
4. Estimation of ascorbic acid in plant tissues.
5. Study of transverse section of stem/ root
6. Study of transverse section of dicot leaf.
7. Study of morphological adaptations of Xerophytes and Hydrophytes.
8. Display and identification of endocrine glands of rat.
9. Biology of *Drosophila* and its life cycle

Text Books

- Biological Science (Third Edition) – D.J. Taylor, N.P.O. Green, G.W. Stout, Edited By R. Soper
- Animal Physiology- Schmidt and Nielson
- Plant Physiology (Second Edition)- Taiz

Further Readings:

- Analysis of Vertebrate Structure (Fourth Edition)- Hildebrand
- Perspective in Biological Sciences- Rai. V
- Principles of Plant Nutrition (Fourth Edition)- K. Mengel
- Molecular Genetics of Photosynthesis- B. Anderson
- Introduction to Plant Physiology (Second Edition)- W. G. Hopkins

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER VII

IMMUNOLOGY

Unit I: (14 hours)

History of Immunology: Host parasitic relationships, Microbial infections, virulence and host resistance. Immunity. Innate immunity, Acquired immunity: Structures. Composition and functions of cells and organ involved immune system.

Unit II: (14 hours)

Antigens and antibodies : Types, properties, Haptens, adjuvants – vaccine types. Toxoids - antitoxins. Immunoglobulin- structure, types and properties. Theories of antibody production. Complement system: structure, properties, function of complement component and pathways.

Unit III: (14 hours)

Antigen and antibody reactions: *In-vitro* methods: Agglutination, precipitations, complement fixation. Immunofluorescence, ELISA. RIA. *In-vivo* methods: Skin tests, immune complex tissue demonstrations.

Unit IV: (14 hours)

Hypersensitivity reactions: Type I, II, III and IV hypersensitivity reactions. B and T lymphocytes, maturation and selection of T and B cells, T cell B cell interaction, Memory cells, Immune expression, Cytokines-Classification, Definition and Function.

Unit V: (14 hours)

Transplantation immunology: Graft versus host reaction structure and function of class I and Class II MHC molecules Major histocompatibility complex. Tumor immunology...Immunodeficiency and Auto immune diseases.

Immunology

Practicals:

1. Purification of antigens
2. Raising polyclonal antibodies
3. Purification of antibodies
4. Conjugation and labeling of antibodies
5. ELISA and Western Blotting
6. Immunodiffusion analysis
7. Assessment of DTH – Skin Test
8. Diagnosis of an infectious disease by an immunoassay
9. Antigen-antibody reactions-agglutination-precipitation ring test, immuno-diffusion, immuno-electrophoresis.

Text Books:

1. Kuby Immunology. Richard A.Goldsby, Thomas J.Kindt. Barbara A.Osborne, (2000). 4th edition. W.H. Freeman and Company. New York.
2. Roitt, LM. Brostoff, J.J. and Male, O.K. (1996). Immunology 4th Ed. 51. Louis CoV. Mosby.
3. Abbas, A., A-H. Lichtman, and J.S. Pober, (1994). Cellular and molecular Immunology 2nd Ed. WB Saunders Company.

Further Readings:

1. Coleman R.M. Lombard, M.F. and Sicard, RE. (1992). Fundamental Immunology 2nd Ed. Dubuque lower WID. C. Brown.
2. Baron EJ et al. (1994). Bailey and Scott's diagnostic Microbiology (9th Ed.) Mosby Publications. '

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER VIII

GENETIC ENGINEERING

Unit I (10 hours)

Introduction, Definition, Basic steps in gene cloning, Restriction enzymes, Ligases, DNA polymerase, Polynucleotide Kinase, Phosphatase, Restriction and Ligation of DNA.

Unit II (15 hours)

Cloning vectors, Basic design of cloning vectors for use in prokaryotic and eukaryotic systems, plasmid vectors, Bacteriophage- λ , λ ZAP, λ gt11, Charon16A, Cosmids, Artificial chromosomes (BACs, YACs, MACs), Cloning BST gene in *E.coli*.

Unit III (15 hours)

Gene transfer techniques: Electroporation, Particle gun bombardment, Microinjection, Protoplast fusion, CaCl_2 mediated, Lipofection.
Selection methods of recombinants – Blue/White screening and plus and minus screening

Unit IV (15 hours)

Construction of genomic and cDNA library, Analysis of cloned foreign genes: Hybridization, Nucleic acid and Immuno probes, concept and application of PCR.

Unit V (15 hours)

Applications of genetic engineering in Industry, Medicine, Agriculture and pharmacy. Stem cell research – Reproductive cloning and Therapeutic cloning, Bioethics and Biosafety.

Genetic Engineering

Practicals:

1. Agarose gel electrophoresis
2. Isolation of total Bacterial DNA
3. Isolation of Plasmid DNA
4. Restriction analysis of plasmid
5. PAGE
6. PCR
7. Production of competent *E.coli*
8. Transformation of bacteria and isolation of transformants
9. Rapid Isolation of mammalian DNA from blood.

Text Books:

- R.W. Old & S. B. Primrose, Principles of gene manipulation – An introduction to genetic engineering (Fifth Edition), Blackwell Science.
- T. A Brown, Gene cloning-An introduction.
- D.S.T. Nicholl, Genetic Engineering- An introduction.

Further Readings

- Joseph Sambrook and David. W. Russell., Molecular cloning: A laboratory manual, (Third Edition).
- Helen Kreuzer and Adrienne Massey, Recombinant DNA and Biotechnology (Second edition).

DEPARTMENT OF BIOTECHNOLOGY

ALLIED PAPER - IV

ALLIED BIOLOGICAL SCIENCE - II

UNIT I (10 Hours)

Mendelian genetics, monohybrid and dihybrid cross, test cross, back cross, chromosomal basis of inheritance, Chromosomal aberrations, Epistasis, Hypostasis, Codominance, Incomplete dominance

UNIT II (15 Hours)

Linkage and crossing over, Recombination, sex determination, sex linked Inheritance (Autosomal and Allosomal), blood groups, lethal gene, mutation and variations.

UNIT III (20 Hours)

Abiotic and biotic factor, ecosystem, energy transfers, ecological pyramids, biogeochemical cycles and community ecology (seral changes), population ecology, human impacts on ecosystem.

Extinction, genetic resources for human use, Adaptation of plants and animals in different environmental conditions, extremophiles.

UNIT IV (15 Hours)

Theories of the origin of life, evidence for the theory of evolution, paleontology, comparative anatomy, embryology and biochemistry. Adaptive radiation, modern views on evolution.

Evolution of Human (*Homo sapiens*)

UNIT V (10 Hours)

Mechanism of speciation, population genetics, gene pool, allele frequency, genotype frequency, genetic polymorphism, Hardy-Weinberg equation.

Allied Biological Science – II

Practicals:

10. Mounting of squamous epithelium from the buccal mucosa of man.
11. Preparation of blood smear of man.
12. Identification of blood groups.
13. Enumeration of RBC and WBC using Hemocytometer.
14. Differential counts of WBC.
15. Estimation of hemoglobin using Hemometer.
16. Biological Oxygen Demand
17. Carbon dioxide Demand
18. Estimation of salinity in water samples.

Text Books:

- Biological Science (Third Edition) – D.J. Taylor, N.P.O. Green, G.W. Stout, Edited by R. Soper, Cambridge university press.
- Ecology- Chapman and Reiss
- Introductory Ecology- Peter Cotgreave and Irwin Forseth

Further Readings:

- Essential of Ecology- Colin R. Townsend John and L. Harper Michael Begon
- Plant Physiology (Second Edition)- lincon Taiz, eduardo, zeiger 1998 sinauer associates publishing, Inc copy rights, second edition, pages 792.
- Genetics (Third Edition)- Weaver, McGrawhill college,division, third edition, 1997, pages 638.
- Fundamentals Of Genetics – B.D. Singh, Kalyani publishers 1998 pages 702.
- Ecology and Environment- P.D. Sharma, Rastogi publication
- Perspective in Biological Sciences- Rai. V

MAJOR PAPER IX

ENVIRONMENTAL BIOTECHNOLOGY

UNIT I (12 hours)

Introduction and scope of environmental biotechnology- Renewable and non-renewable resources, Biofuels-firewood, plant and animal wastes, Animal oils, Coal, Gas, Petroleum.

UNIT II (12 hours)

Environmental impact of conventional fuels - Modern Fuels and their environmental impacts- solar energy converters-Petrocrops - Biogas—Cellulose as a source of energy – energy and fuel using micro organisms.

UNIT III (12 hours)

Biodiversity - Types, Values and industrial uses – Biotechnology in conservation of biodiversity - Gene banks - *in situ* and *ex situ* conservation.
Introduction to GM Foods – advantages and disadvantages.

UNIT IV (17 hours)

Environmental Pollution – Types and source of Pollution, Eutrophication- Oil, Heavy metals and Pesticide Pollutions.
Solid waste pollution and management - Land filling, Composting (Vermitechnology), Recycling process of organic wastes.

UNIT V (17 hours)

Biodegradation - Organisms Involved - Biodegradation of oil, heavy metals and pesticides – Bioremediation, Bioremediation of wastelands - Biomonitoring and applications of Biosensor

Environmental Biotechnology

Practicals:

1. Microbiological Examination of water
2. Microbial population in soil
3. Isolation of Nitrogen fixing microorganisms
4. Bacteriological testing of milk
5. Microbial population of water
6. Isolation of Phage from sewage
7. Observation of Mycorrhizal fungi.
8. Preparation of phage stock
9. Rhizosphere of Mangroves

Text Books:

- Introductory Ecology - Peter Cotgreave and Irwin Forseth, Black well publishing 2002, pages 288.
- Essential of Ecology - Colin R. Townsend, John L. Harper and Michael Begon
- Environmental Microbiology – Varanam

Further Readings:

- Environmental Chemistry – Willams John willey &sons, 2001.
- Waste Water Microbiology (2nd edition)- Bitton, John willey &sons, 2001, Inc copy rights
- Manual of Environmental Microbiology – Hrust, American society microbiology second edition 2002, pages 1138
- Environmental Biotechnology – S. N. Jogdand, Himalaya publishing.

MAJOR PAPER X

Marine Biotechnology

UNIT I (14 HOURS)

Sea as a biological habitat, pelagic and benthic habitats, major groups of marine organisms, phyto and zoo planktons, Mangroves ,coral reefs and hydrothermal vents. Marine biodiversity

UNIT II (14 HOURS)

Aquaculture: culture of shrimp, edible mollus ,oysters, pearl oysters, culture of cucumbers. Culture of live feed organism -brine shrimp, rotifers , marine algae.

UNIT III (14 HOURS)

Culture of sea weeds.Marine hydrocolloids –Agar,Agarose,Chitosan and Chitin. Marine enzymes- Trypsinase,Applications of enzymes for sea food processing . Marine lipid- PUFFA, Application of lipases for modification of fats and oils.Marine Flavourants-Astaxanthine and Flavanoids.

UNIT IV(14 HOURS)

Aquaculture Biotechnology - Hormonal manipulation of sex, Chromosomal manipulation of sex fish.Cryopreservation of fish gametes and embryo. Transgenic fishes :Antifreeze and metalothionine gene. Methods of diagnosis of SEMBV , MBV and Vibrio diagnosis.

UNIT V (14 HOURS)

Therapeutics of marine realms : Zinconotide , Dolastatin , Bryostatin .Biofouling and their control . Control of oil spills and bioremediation .

MARINE BIOTECHNOLOGY

Practicals:

1. Biochemical test for identification of Marine bacteria – Five test
2. Evaluation of antimicrobial agents
3. Measurement of growth of microorganisms
4. Plankton analysis
5. Isolation, Characterization and Antagonistic effect of probiotic bacteria against fish pathogen.
6. Estimation of dissolved oxygen from marine water bodies.
7. Estimation of Ammonia from shrimp pond
8. Disease identification in shrimp and fish.
9. Karyotyping of fish chromosome.

Text Books:

- Comprehensive Biotechnology (Vol IV) – M.Moo-Young
- Manual on research methods for chromosome manipulation in fish, T. J. Pandian and J. Muthukrishnan
- Microbial Ecology – Fundamentals and Applications – R. M. Atlas and R. Baltha

References:

- Waste water engineering: Treatment, Disposal and reuse – Metcalf and Eddy
- Introduction of Biodeterioration – D. Allsopp and K. J. Seal
- Thermophilic Microorganisms a high temperature – T. D. Brook
- Microbiology in Extreme Environments – Edwards
- Microbiology Practical Manual – A. Purushothaman and K.Sathyamoorthy
- Laboratory manual on methodologies for assessing Biodiversity in estuaries mangroves and coastal water – Annamalai University.

MAJOR PAPER XI

Animal Biotechnology

UNIT I

Conventional technologies in animal improvement (Cryopreservation and artificial insemination). Animal breeding for traits. Integrated pest management- Definition, Control – Red hairy caterpillar, rhinoceros battle

UNIT II

Transformation of animal cells, Maintenance of animal cell culture –HeLa cells and lymphocytes proliferation assay. Products through animal cells – Vaccines – Organ culture. Stem cells and their applications. Biology of cloning vectors and expression vectors - yeast vectors and animal viral vectors. Genetic engineering as applied to production of vaccines and hormones.

UNIT III

***In vitro* fertilization and embryo transfer technique, transgenic animals (rodents, avian, Ruminants) and its applications. Production of useful proteins in transgenic animals**

UNIT IV

Gene Therapy: Definitions, e.g., ADA deficiency, Cystic fibrosis, Muscular dystrophy, Sickle cell anemia. DNA Finger printings – RFLP, RAPD, RFLP Applications in forensic science. Molecular diagnosis of genetic disorders.

UNIT V

Introduction to Sericulture - Cultivation of mulberry. Silkworm life cycle, Rearing of larvae, Spinning and reeling of silk worm diseases-Pebrine , Muscardine, Grasserie, Uzi fly. Production of non-silk proteins using baculovirus in silk worm.

Animal Biotechnology

Practicals:

1. **Introducing cloned genes into cultured mammalian cells - Calcium Phosphate mediated**
2. **Isolation of high molecular – weight DNA from mammalian cells - Using formamide**
3. **RFLP**
4. **Southern Blotting**
5. **Western Blotting**
6. **Feulgen – Giemsa staining**
7. **Bacteriophage experiments**
8. **Luciferase assay**
9. **Rearing of silk worms**

Text Books:

- **Bernard R.Glick and Jack J.Peternak : Molecular biotechnology-principles and Applications of Recombinant DNA (2nd edition),ASM press Washington DC,2001,pp.479-505,253-276, 145-169,555-590**
- **Ganga. G & Slochanachetty, An introduction to sericulture, 2nd edition, Oxford and IBH publishers Pvt.Ltd.Delhi, P: 302**
- **S.B. Primrose, R.M. Twyman and R.W Old, Principles of gene manipulation, Sixth edition, Blackwell science publishers, Page .390.**

Further Reading:

- **Sericulture Manual 1- Mulberry Cultivation, Sericulture Manual2- Silk worm Rearing, Mohan Prilani for Oxford & IBH publishing Co.Pvt.Ltd.66 Janpath road,New Delhi – 110001**
- **Tom Strachan & Andrew P. Read, Human Molecular Genetics, 2nd edition..**
- **J.P Maule , The Semen of Animals and Artificial Insemination**
- **Human Molecular Genetics, 2nd edition - Tom Strachan & Andrew P. Read**
- **Animal Cell Culture, 3rd edition - John R.W. Masters**
- **Principles of Gene manipulation (6th edition) R.W. Old, S.B. Primrose, R. M Twyman**
- **Microinjection – Lal. J. C**
- **Basic human Genetics (2nd edition) – E. J. Manje**
- **The Semen of Animals and Artificial Insemination – J. P Maule**

MAJOR PAPER XII

BIOPROCESS TECHNOLOGY AND DOWNSTREAM PROCESSING

UNIT I (20 Hours)

Principles of bioprocess technology – Introduction and history of traditional and modern bioprocesses. General concepts of fermentation technology – Outline of an integrated bioprocess and various unit operations. Maintenance of industrially important microorganisms. Kinetics of microbial growth and death; media for industrial fermentation.

UNIT II (10 Hours)

Fermentor design and types of fermentors – Analysis of batch, solid state, fed batch and continuous bioreactors. Specialized bioreactors – pulsed, fluidized and photo bioreactors. Measurement of bioprocess parameters.

UNIT III (10 Hours)

Scale up of microbial bioreactors – various approaches to scale up and scale down methods – scale up and scale down methods. Air lift, recycled and immobilized bioreactors. Bioprocess control measures.

UNIT IV (14 Hours)

Industrial Production of chemicals – alcohol (ethanol), acids (citric acid and acetic acid), solvents (Acetone and Butanol), antibiotics (Penicillin and Streptomycin), amino acids (Lysine and Glutamic acid)and Enzymes (Amylase and Protease). Vitamins (B₁₂).

UNIT V (16 Hours)

Down- stream processing: Removal of microbial cells and solid matter –Precipitation, Filtration, Centrifugation, liquid – liquid extraction, chromatography and membrane processes. BOD and COD measurements and disposal of industrial wastes.

Bioprocess Technology And Downstream Processing:

Practical:

1. Oyster Mushroom cultivation.
2. Mother spawn preparation
3. Isolation of yeasts from Hops.
4. Isolation of lactic acid bacteria from curd
5. Isolation of lipolytic organisms from Butter / cheese.
6. Continuous culture.
7. Estimation of organic carbon in industrial effluent.
8. Estimation of COD.
9. Immobilized bacterial cells for the production of hydrolytic enzymes.

Text Books:

- Anthons Moses - Bioprocess Technology -Kinetics and Reactors
- J. Krijgsman Product Recovery in Bioprocess Technology-
- McNeil & L.M. Harvey Fermentation -a practical approach

Further Reading :

- W. Crueger & Crueger A. Biotechnology (2nd edition) A textbook of industrial microbiology
- L. Demain & E. Davies Manual of Industrial Microbiology and Biotechnology (2nd edition).
- M.J. Waites, N.L. Morgan, J.S. Rockey Industrial Microbiology.

MAJOR PAPER XIII
GENOMICS AND PROTEOMICS

Unit I (13 Hours)

Definition: Genome organizations, Principles of gene expression - C value paradox - Genome mapping – Physical mapping and molecular mapping, insitu hybridization, FISH, FACS.

Unit II (12 hours)

Introduction – SNP's and Population genomics – Pharmacogenomics – Linking drugs to genes – Genome based search for mutations – Comparative genomics – genome annotation and analysis.

Unit III (15 hours)

Functional genomics, Molecular Phylogenetics Pharmacogenetics EST – Microarrays – Sequencing – gene therapy - Role of animal models in identification of genes for disorders knockout mice.

Unit IV (15 hours)

Protein detection and purification by chromatography- types of chromatography – Protein characterization and sequencing techniques – Identification of protein by charge and isoelectric points – isoelectric focusing – 2D gel electrophoresis

Unit V (15 hours)

Oligonucleotide arrays, Protein arrays; MALDI – TOF Method of Analysis of Proteins – Peptide mass finger printing - Browser enabled tools for Genomics and Proteomics – proteomics in drug discovery.

Genomics and Proteomics:

Text Books:

- R.W. Old & S. B. Primrose, Principles of gene manipulation – An introduction to genetic engineering (Fifth Edition).
- Helen Kreuzer and Adrienne Massey, Recombinant DNA and Biotechnology (Second edition).
- Richard J.Simpson , 2002. Proteins and Proteomics: A laboratory manual.

Further Readings:

- S.B.Primrose and R.M.Twyman. 2003. Principles of Genome Analysis and Genomics (3rd ed.) Blackwell publishing.
- Mike Bailey and Keith Hirst, 2000, Advance Molecular Biology 2nd ed., Haeper Collins Publisher Limited

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER XIV

PLANT BIOTECHNOLOGY

UNIT I

Conventional breeding for crop improvement (Introduction, Domestication, Mutation, Hybridization, Selection, Evaluation), improved varieties, introduced genes, advantages and disadvantages.

UNIT II

Plant genome organization, organization of chloroplast genome, cytoplasmic male sterility, genetic male sterility, cytoplasmic and genetic male sterility. Plant Tissue Culture - Medium (MS), Micropropagation, Anther-Poolen Culture, Embryo Culture.

UNIT III

Techniques for gene transfer: Gene gun method, Microinjection, *Agrobacterium* mediated gene transfer methods. Genetic engineering in plants: Genetic engineering of plants for pest resistance, resistance to fungi, bacteria and virus, delay of fruit ripening, salt and drought tolerance.

UNIT IV

Gene expression: Tissue specific gene expression, Heat-Shock Protein Genes, Wound Responsive Genes and Pathogenesis-related (PR) protein genes.

UNIT V

Biochemistry and molecular biology of nitrogen fixation in legumes by *Rhizobium*. Structure and function of Ti plasmid, Biofertilizer (*Azolla*, BGA), Biopesticides (*Pseudomonas* and *Bacillus*)

Plant Biotechnology

Practicals:

1. **Rapid Isolation of Plant DNA**
2. **Isolation of total genomic DNA from leaves.**
3. **Extraction of total protein from leaves and PAGE analysis.**
4. **Isolation of total RNA from plant sample**
5. **Amplification of a plant gene by polymerase chain reaction**
6. **Cloning of a plant gene in plasmid vectors**
7. **Quantitative and Qualitative analysis of total DNA. – Agarose gel electrophoresis and Spectrophotometric analysis of plant DNA.**
8. **Restriction Enzyme Digestion analysis of total genomic DNA.**
9. **RAPD**

Text Books:

- Plant Biotechnology; Recent Advances - P. C. Trivedi
- Applied plant biotechnology - Rev. Fr. Dr.S. Ignacimuthu S.J
- Plant Biochemistry- P. M. Dey & J. B. Harborne

References :

- Plant Breeding Systems (2nd Edition) A. J. Richards
- Practical applications of plant molecular biology – R. J. Henry
- Plant breeding and *in vitro* culture - Bahar A. Siddique & Salimullah Khan
- Principles of Gene manipulation (6th edition) R.W. Old, S.B. Primrose,
R. M Tqyman
- Plant Biochemistry and Molecular Biology (2nd Edition). Peter J. lea and
R. C. Leegood

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER XV

Medical Biotechnology

UNIT I (10 HOURS)

Introduction to the origin and significance of medical biotechnology, classification and impact of genetic diseases.

UNIT II (20 HOURS)

Down syndrome, Translocations, sex chromosome errors, sex determination, klinefelter's and Turner's syndromes.

Human genome project – Ethical, Legal and Social Issues.

UNIT III (24 HOURS)

Metabolic disorders and inherited diseases, Inborn Errors of metabolism, disorders of amino acid, carbohydrate and lipid metabolism- phenylketonuria (PKU), G_{M2}-gangliosidosis, Gaucher's disease, Mucopolysaccharidoses, Homocystinuria; inherited diseases-Diabetes, haemophilia, sickle cell anemia.

UNIT IV (8 HOURS)

Immunogenetics - genetic basis of antibody diversity; hybridoma technique and development of monoclonal antibodies; antibodies and therapy.

Plants of medicinal Importance – *Phyllanthus neruri*, *Vitex negundo*, *Vinca rosea*.

UNIT V (8 HOURS)

Diagnosis and treatment of genetic diseases, methods for prenatal diagnosis of Chromosome disorders, impact of chromosome errors upon human health, human reproductive loss.

MEDICAL BIOTECHNOLOGY

Practicals:

1. Preparation of medicinal plant extract
2. Antibacterial property testing
3. Biochemical test for identification of bacteria
4. Antifungal test
5. Column chromatography fractionation of plant extracts
6. Estimation of serum amylase - colorimetry
7. Separation of serum amylase – SDS - PAGE
8. Protein extraction from liver tissue
9. Diagnosis of infectious diseases - HbsAg

Text Books:

- Medical Biotechnology – S. N. Jogdand
- Medical genetics-robert F. Mueller, Ian D. Young
- Human Genetic diseases- A practical approach-K.E. Davier

Further Reading:

- Molecular Biotechnology- Therapeutic application strategies. Maulik. S and Patel. S.D.
- Molecular biotechnology – Principle and Applications of Recombinant DNA- Glick B.R and Pasurank. J.I
- Human Molecular Genetics – Sudbury
- Kuby Immunology – Goldsby
- Using Anti bodies: A laboratory manual - Ed Harlow, David lane

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER XVI

PHARMACEUTICAL BIOTECHNOLOGY

Unit I

Introduction – Overview of products, classification of pharmacologic agents based on chemistry and source. Phytopharmaceuticals: Screening tests for phyto constituents – alkaloids and terpenoids. Three examples of commercial natural products from marine and terrestrial organisms.

Unit II

Drug development: Biology guided fractionation methods : *in vitro* assay systems based on enzymes, tissue, organ or growth inhibition.

Antimicrobial activity studies (antibacterial, antiviral, antifungal and antiparasitic activities).

Unit III

Gene therapy: General introduction, ex vivo and in vivo gene therapy, potential targets for gene therapy, inherited disorders.

Vaccine design and production, classification, recombinant vaccines, Advantages and disadvantages – examples – Hepatitis B vaccines, Cholera vaccines, Edible vaccines, DNA vaccines..

Unit IV

Immunologicals: Antisera – hyper immune gamma globulin – monoclonal antibodies – uses.

Recombinant proteins: strategies and genetic manipulations for over production of biomolecules –interferons and insulin.

Other biomolecules; Probiotics and Neutraceuticals.

Unit V

Economic and legal considerations in Pharmaceutical biotechnology, ICMR guidelines for design and conduct of clinical trials, licensing and drug control.

Pharmaceutical Biotechnology

Practicals:

1. Sterility testing of vaccines and injections
2. Preparation of medicinal plant extracts
3. Antibacterial activity of antibiotic preparations
4. Antifungal tests
5. Estimation of thiamine, riboflavin, ascorbic acid content of multivitamin formulations
6. Proteolytic digestion of antibodies
7. Analysis of digested fragments
8. Florescent Antibody techniques
9. Purification of IgG from serum

Text Books:

- P.K. Mukherjee, Quality control in Herbal drugs – An approach to evaluation of botanicals. Business Horizons
- J.B. Harborne. 1998 Phytochemical methods – A guide to modern techniques of plant analysis. 3rd ed. Chapman & Hall.
- R.J.P. Cannell 1998 Natural products isolation Humana press.

Further Readings;

- A. J. Winfield, R.M.E. Richards, Churchill Livingstone (1990), Pharmaceutical Practice (Second Edition)
- Rang and Dale, Pharmacology
- K. D. Tripathy, Essentials of Medical Pharmacology.

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER XVII

BIOINFORMATICS

UNIT I (15 Hours)

Introduction to bioinformatics, scope, and applications – Information retrieval: Information systems in India (BTISNET and NICNET)- Internet-Basics-Information access (online, CD-ROM, e-mail)- Accessing- Information resources from International Databases.

UNIT II (16 Hours)

Application of bioinformatics in Medicine- Agriculture-Microbial Genomics-Marine-Meteorology.

UNIT III (12 Hours)

C: C character set, constants, variables and keywords. Declarations, Control structures: if, switch-Case-Looping Structures: while-do,While, for, break and continue- Arrays: Single and Two dimensional, strings .

Structure: Declaration and accessing structure variables. Files: Concepts, Usage, Text files. (All Concepts supported by theory and programmes)

UNIT IV (15 Hours)

Sequence Analysis, Introduction - Sequence file formats, Sequence symbols , Sequence alignments- Pairwise Alignment, Dot Blots, Nucleotide sequence databases –gen Bank, EMBL,DDBJ, Protein sequence databases –Swissprot,PIR,TrEMBL,Protien structure databases-PDB,CATH,SCOP,ICSU-CODATA recommendations.

UNIT V (12 Hours)

Introduction of presently available biological software programmes used in bioinformatics –BLAST-FastA-Phyllip.

Bioinformatics

Practicals:

1. Check for palindrome (String Reverse)
2. Fibonacci Series, Pascal's triangle
3. Matrix – addition, Subtraction, Multiplication, Transpose
4. File handling – Open and close, read and write
5. Database manipulation – creation, deletion, Updation, Editing a Record
6. Biological data banks, sequence databases, structure databases, specialized databases.
7. Data retrieval tools and methods, Database file formats
8. Gene structure and function prediction (using GenScan, Gene Mark)
9. Sequence similarity searching (NCBI BLAST), Molecular phylogeny (PHYLIP)

Text Books:

- Andrequas D. Baxebanis,, B.F. Francis Quellette, Bioinformatics: A pratical guide to the analysis of genes and proteins. John Wiley & sons, New york (1998)
- S.C.Rastogi, Namita Mendiratta, Parag Rastogi. Bioinformatics – Concepts, Skills, Applications.
- Richard Durbin, Sean Eddy, Anders krogn and Graceme Mitchison. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic acids Cambridge University press, 1998.

Further Reading:

- Bishop M.J., Rawlings C.J. (Eds) DNA and protein sequence analysis. A practical approach IRL Press, Oxford (1997).
- Teresa K Attwood and David J Parry – Smith. Introduction to Bioinformatics.

DEPARTMENT OF BIOTECHNOLOGY

MAJOR PAPER XVIII

ENTREPRENEURIAL DEVELOPMENT, BIOSAFETY, BIOETHICS AND IPRs

Unit I

Enterprise, Inculcating the spirit – Demand survey of a product – Identifying a product a line – Design and Developing the process – Economics of scale – Factors to be considered for selecting a project, Essentials of a project report of a business.

Unit II

Resources – Choice of location – Energy requirement – skilled man power government interface / laws exercise duty sales tax – Labour, Factories / industries Department compliance – Licenses – Permissions – rules and regulation of export – import, Environmental, Fire, Health and Hygiene issues.

Unit III

Bioethics – social, legal issues governing human genome project. Biosafety – GMO acceptance by public / scientists, environmental fallout. Principles and practices – containment facilities.

Unit IV

IPRs convention on Biological Diversity (DBD) Geographical Indicators, post GATT scenario, WTO, GATS Intellectual property Rights on products / procedures. Biodiversity Protection Act 2003(GOI).

Unit V

Indian Patenting Act 2003 Patent Registration procedure. Information and services Patent Application US /EU patent procedures International Cooperative Treaty and patents WIPO.

Entrepreneurial Development, Biosafety, Bio-Ethics and IPRs

Text Books:

- P.Saravanavel, Entrepreneurship Development.
- Francis Cheriumilam, International Business.
- P.Narayanan, IPR laws.

Further Reading:

- Dr.G.B.Reddy, IPR laws.
- Poles Apart (Vol. I & II), CSE Publication, New Delhi,2002.