

Pondicherry University

**B. Sc (Applied Microbiology)**  
**Course Structure (with effect from 2006-2007 academic year)**

Year	Semester	Course	Hours per week			Max. Marks
			Theory	Practical	Total	
First	First	Language	6	0	6	100
		English	6	0	6	100
		Major Paper I : <b>Cell Biology</b>	4	2	6	100
		Major Paper II : <b>Fundamentals of Microbiology</b>	4	2	6	100
		Allied Paper I : <b>Allied Biochemistry , Paper I</b>	4	2	6	75
		Major Practical - I				50
		Allied Biochemistry practical - I				25
Total Marks : 550						
First	Second	Language	6	0	6	100
		English	6	0	6	100
		Major Paper III : <b>Molecular Biology</b>	4	2	6	100
		Major Paper IV : <b>Immunology</b>	4	2	6	100
		Allied Paper II : <b>Allied Biochemistry, Paper II</b>	4	2	6	75
		Major Practical - II				50
		Allied Biochemistry Practical - II				25
Total Marks : 550						
Second	Third	Language	6	0	6	100
		English	6	0	6	100
		Major Paper V : <b>Genetic Engineering</b>	4	2	6	100
		Major Paper VI : <b>Microbial Physiology</b>	4	2	6	100
		Allied Paper III : <b>Allied Biological Science, Paper I (General Biology)</b>	4	2	6	75
		Major Practical - III				50
		Allied Biological Science Practical - I				25
Total Marks : 550						

Year	Semester	Course	Hours per week			Max. Marks
			Theory	Practical	Total	
Second	Fourth	Language	6	0	6	100
		English	6	0	6	100
		Major Paper VII : <b>Biostatistics</b>	4	2	6	100
		Major Paper VIII : <b>Virology</b>	4	2	6	100
		Allied Paper IV : <b>Allied Biological Science, Paper II (Parasitology and Entomology)</b>	4	2	6	75
		Major Practical - IV				50
		Allied Biological Science Practical - II				25
Total Marks : 550						
Third	Fifth	Major Paper IX : <b>Bioprocess Technology</b>	4	2	6	100
		Major Paper X : <b>Food and Dairy Microbiology</b>	4	2	6	100
		Major Paper XI : <b>Pharmaceutical Microbiology</b>	4	2	6	100
		Major Paper XII : <b>Introduction to Bioinformatics</b>	4	2	6	100
		Major Paper XIII : <b>Genomics and Proteomics</b>	6	0	6	100
		Major Practical – V (Major Paper IX and Major Paper X)				50
		Major Practical – VI (Major Paper XI and Major Paper XII)				50
Total Marks : 600						
Third	Sixth	Major Paper XIV : <b>Medical Microbiology</b>	4	2	6	100
		Major Paper XV : <b>Environmental Microbiology</b>	4	2	6	100
		Major Paper XVI : <b>Agricultural Microbiology</b>	4	2	6	100
		Major Paper XVII : <b>Biological Databases and their uses</b>	4	2	6	100
		Major Paper XVIII: <b>Entrepreneurial Development, Biosafety, Bio-ethics and IPRs</b>	6	0	6	100
		Major Practical – VII (Major Paper XIV and Major Paper XV)				50
		Major Practical – VIII (Major Paper XVI and Major Paper XVII)				50
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 microbial pathogens.

#### **UNIT II ( 14 Hours )**

Structure and functions 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). Reproduction: Gametogenesis, Fertilization.

#### **UNIT V ( 15 Hours )**

Molecular Mechanism of Signal transduction (specificity, amplification, desensitization, integration), General Types of signal transducers (Gated ion channel, Receptor enzyme, Serpentine receptor, Receptor with no intrinsic Adhesion receptor Steroid receptor), Signal Amplification.

## 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- The haemocytometer and finding 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

### Reference:

- 📖 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.
- 📖 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.
- 📖 P.S. Verma and V.K. Agarwal, Concepts of Cell Biology.
- 📖 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**

### **FUNDAMENTALS OF MICROBIOLOGY**

#### **Unit I**

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 ( 9<sup>th</sup> edition) – Basic understanding of classification of Viruses, Algae, Fungi and Protozoa.

#### **Unit II**

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**

Principles and Methods of Sterilization: Physical – Moist heat, Dry heat , Filtration, Pasteurization, Tyndalization, Radiations- Chemical – Alcohols, Aldehydes, Phenols, Halogens and Hypochlorites.  
General characteristics and nature of Archaeobacteria, Eubacteria, Cyanobacteria. Preservation and maintenance of microorganisms

#### **Unit IV**

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**








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

## Fundamentals of 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.

### Reference:

-  M.J. Pelczar Jr. E.C.S. Chan and N.R. Kreig , Microbiology.
-  R. Ananthanarayanan. and C.K.Jayaram Panickar, Text book of Microbiology
-  P. Chakraborty, A Text book of Microbiology.
-  Hans G. Schlegel (seventh edition), General Microbiology.
-  Lansing M. Prescott, John. P. Harley, Donald A. Klein, Microbiology ( fourth edition)
-  Barry L. Batzing, Microbiology an Introduction
-  Ronald M Atlas Principles of Microbiology

## **DEPARTMENT OF APPLIED MICROBIOLOGY**

### **MAJOR THEORY: III**

### **MOLECULAR BIOLOGY**

#### **UNIT I**

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**

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, Gyrases, Single Strand Binding Protein, Replisome / Primosome).

#### **UNIT III**

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**

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**

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.

### **Reference:**

- 📖 Benjamin Lewin Genes VII
- 📖 David Freifelder Essentials of Molecular Biology
- 📖 P.S. Verma and V.K. Agarwal Concepts of Molecular of Molecular Biology-
- 📖 Nelson and Cox, Lehninger. Principles of Biochemistry (Third Edition).
- 📖 Harvey Lodish, Arnold Berk, S. Lawrence Zipursky, Paul Matsudaira, David Baltimore and James Darnell Molecular Cell Biology (Fourth Edition)



## DEPARTMENT OF APPLIED MICROBIOLOGY

### MAJOR PAPER: IV

### IMMUNOLOGY

#### Unit I:

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:

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:

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:

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.

#### Unit V:

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. Precipitation reaction : Ouchterlony double immunodiffusion test (ODDI)
2. Counter immunoelectrophoresis (CIE).
3. VDRL test.
4. Agglutination reaction – Widal test
5. RIA test
6. ASLO test
7. CRP
8. Complement fixation test
9. ELISA – HbsAg and HIV 1 and 2 (demonstration only)

### REFERENCES:

1. Kuby Immunology. Richard A.Goldsby, Thomas J.Kindt. Barbara A.Osborne, (2000). 4<sup>th</sup> edition. W.H. Freeman and Company. New York.
2. Roitt, LM. Brostoff, J.J. and Male, O.K. (1996). Immunology 4<sup>th</sup> 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.
4. Coleman R.M. Lombard, M.F. and Sicard, RE. (1992). Fundamental Immunology 2nd Ed. Dubuque lower WID. C. Brown.
5. Baron EJ et al. (1994). Bailey and Scott's diagnostic Microbiology (9<sup>th</sup> Ed.) Mosby Publications. '

**DEPARTMENT OF APPLIED MICROBIOLOGY**

**DEPARTMENT OF MICROBIOLOGY**

**ALLIED BIOCHEMISTRY – PAPER II**

**UNIT I**

Carbohydrates: Glycolysis, Citric acid cycle, HMP pathway, ET chain, Uronic acid pathway, Glucogenesis, Gluconeogenesis, Glycogenesis, Glycogenolysis, Utilization of galactose, fructose.

**UNIT II**

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**

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

**UNIT IV**

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

**UNIT V**







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

## Allied Biochemistry – Paper II

### Practicals

1. Separation of Blood plasma or Serum from blood cells by centrifugation technique.
2. Preparation of acetate buffer.
3. Beer's and Lambert's law.
4. Column Chromatography.
5. TLC.
6. Estimation of proteins
7. Estimation of Glucose
8. Estimation of Cholesterol
9. Influence of Temperature, substrate and pH on enzyme activity.

### Reference:

-  Nelson and Cox, Lehninger. Principles of Biochemistry (Third Edition).
-  Roy Tasker, Carl Rhodes. Stryr's Biochemistry (Fourth Edition).
-  Voet. D. Biochemistry (Second Edition).
-  Zubey. G. Principles of Biochemistry.
-  Devlin T.M. Text Book of Biochemistry. With Clinical Correlations (Fourth edition).
-  Wilson and Walker, Principles and Techniques of practical Biochemistry.

## DEPARTMENT OF APPLIED MICROBIOLOGY

### MAJOR PAPER: V

### GENETIC ENGINEERING

#### Unit I

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

#### Unit II

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

#### Unit III

Transfer of recombinant DNA molecules into bacteria, plant and animal cells, electroporation, Introduction of DNA- particle gun bombardment, microinjection, *Agrobacterium* mediated transfer. Selection methods of recombinants – Blue/White screening and Plus and minus screening

#### Unit IV

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

#### Unit V

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 mammalian DNA from blood

### Reference:

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

### **MAJOR PAPER: VI**

#### **MICROBIAL PHYSIOLOGY**

##### **UNIT I**

Microbial nutrition – Heterotrophs, Autotrophs, Uptake of nutrients, Enrichment culture techniques. Transformation of elements : Carbon, Nitrogen, Phosphorous and sulphur.

##### **UNIT II**

Microbial growth – Growth curve – Measurement of microbial growth – gravimetry, turbidometry and nephelometry. Continuous culture – Synchronous culture – Sporulation.

##### **UNIT III**

Mobility of bacteria, Transport of nutrients – Uptake of nutrients – Passive diffusion, Facilitated diffusion, Active transport, Group translocation. Role of osmoregulatory proteins

##### **UNIT IV**

Photosynthesis – characteristics and metabolism of Autotrophs, Photosynthetic bacteria and cyanobacteria – CO<sub>2</sub> fixation and mechanism of photosynthesis – Hydrogen bacteria – Nitrifying bacteria, Sulphur bacteria, iron bacteria \_ Methylotrophs – Methanogens.

##### **UNIT V**

Microbial metabolism – Role of ATP \_ electron carriers \_ HMP Pathway, ED Pathway, Fermentations – Anaerobic respirations –Nitrogen fixation.- symbiotic and asymbiotic.

## **Microbial Physiology**

### **Practical**

1. Determination of growth curve of bacteria
2. Bacterial population count by turbidity method.
3. Microbial growth by gravimetric estimation.
4. Effect of antimicrobials on the growth of bacteria.
5. Effect of temperature on bacterial growth.
6. Effect of pH on bacterial growth.
7. Synchronous culture.
8. Cultivation of anaerobic bacteria.
9. Characterization of microbial cultures: Catalase, Urease, Oxidase and Sugar fermentation.

### **Reference:**

1. A G. Moat and J.W. Foster, Microbial physiology, 2<sup>nd</sup> edition John wiley and sons.
2. D.R. Caldwell, Microbial physiology and Metabolism. Wm. C. Brown publishers, England.
3. D.O. Hall and K.K. Rao, Photosynthesis, Cambridge University Press.
4. A.H. Rose, Chemical Microbiology-An introduction to Microbial Physiology, 3<sup>rd</sup> edition. New York; Plenum.
5. M.J. Pelczar Jr. E.C.S Chan and N.R. Kreig, Microbiology, McGraw Hill Inc. New York.
6. R.Y.Stanier, J.L.Ingraham, M.L.Wheelis and P.R.Painter, General Microbiology – MacMillan Education Ltd. London.



## DEPARTMENT OF APPLIED MICROBIOLOGY

### ALLIED PAPER: III

#### ALLIED BIOLOGICAL SCIENCE

##### Unit I :

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 :

Structure and function of plant tissues : parenchyma collenchyma, sclerenchyma. Different types of xylem and phloem. Vegetative and sexual propagation of plants, sexual reproduction in plants (algae to angiosperm), pollination, fertilization.

Plant movements, plant growth substances, Vernalisation and flowering. Brief account of plant – water relations, types of transpiration and stomatal mechanism, ascent of water in xylem and translocation of organic solutes in phloem.

##### Unit III :

General characteristics of blood vascular system, composition of blood – functions of mammalian blood.

The nervous system – types of nerve cells – the nerve impulse – resting and action potentials – the synapse – the peripheral nervous system – reflex action – Central and autonomous nervous system.

The endocrine system - Mechanism of hormone action – Hypothalamus and Pituitary glands. Basic idea of the function of hormones of thyroid, parathyroid, adrenal, pancreatic islets, testes and ovary.

##### Unit IV :

Ecosystem, Food web, community / population ecology, human impact on ecosystem. Extinction, biodiversity, conservation of rare (extinct species) and endangered species, genetic resources for human use. Adaptation of Plants and Animals in different environmental conditions.

## **Unit V :**

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

## **ALLIED BIOLOGICAL SCIENCE**

### **PRACTICALS**

1. Mounting of Squamous epithelium from the buccal mucosa.
2. Enumeration of RBC and WBC using hemocytometer.
3. Differential counts of WBC
4. Estimation of hemoglobin using hemometer.
5. Study of transverse section of stem and root
6. Study of transverse section of dicot leaf.
7. Display and identification of endocrine glands of rat.
8. Display and identification of mouth parts of cockroach appendages of prawn.
9. Display and identification of appendages of prawn.

### **Reference:**

1. D.J. Taylor., N.P.O. Green., G.W. Stout, Edited by R. Soper, Biological Science (3<sup>rd</sup> edition).
2. W.G. Hopkins, Introduction to plant physiology (Second Edition).
3. P.D. Sharma, Ecology and Environmental.
4. Colin R. Town send John and L. Harper Michael Begon, Essential of Ecology.
5. V.Rai, Perspective in Biological Sciences.

# **DEPARTMENT OF APPLIED MICROBIOLOGY**

## **MAJOR PAPER VII**

### **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.
9. Chi-square test for independence of attributes.

### **Reference:**

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

# DEPARTMENT OF APPLIED MICROBIOLOGY

## MAJOR PAPER VIII

### VIROLOGY

#### Unit I

Introduction to virus; virus classification; Morphology; Animal viruses, plant viruses, Bacterial, algal and fungal viruses and insect viruses.

#### Unit II

Influenza, Herpes and Papilloma, Viral Hepatitis, HIV, Ebola, Rabies, Polio, Pox viruses. Teven and Todd phages, virioids and prions.

#### Unit III

Viral replication : Eukaryotic DNA virus replication, Eukaryotic RNA virus replication. Viral propagation – chick embryo and cell lines. Purification and assay. Laboratory diagnosis of viral diseases. Viral vaccines; Interferons, Interleukins. Viral vectors. Mechanism of viral oncogenesis - virus induced changes in cells.

#### Unit IV

Viral infections: Viral neutralization by humoral antibody; cell - mediated antiviral mechanisms, viral evasion of host-defense mechanism: influenza-properties of influenza virus, Host response to influenza infections.

#### Unit V








Morphology. classifications, characteristics pathogenicity, Laboratory diagnosis, prevention. and control of infections produced by the following group of viruses. Pox viruses, Herpes viruses, Picorna viruses, Hepatitis viruses, Rhabdo viruses and HIV virus.

## **Virology**

### **Practicals:**

1. Isolation of bacteriophage from sewage
2. Preparation of bacteriophage stock
3. Titration of bacteriophage
4. One step growth of bacteriophage
5. Plaque assay
6. Chick embryo inoculation
7. Study of plant viral symptoms
8. Viruses associated with cultivation of mushroom.
9. RT-PCR

### **Reference:**

-  M.J. Pelczar Jr. E.C.S. Chan and N.R. Kreig , Microbiology.
-  R. Ananthanarayanan. and C.K.Jayaram Panickar, Text book of Microbiology
-  P. Chakraborty, A Text book of Microbiology.
-  Hans G. Schlegel, General Microbiology. (seventh edition)
-  Lansing M. Prescott, John. P. Harley, Donald A. Klein, Microbiology ( fourth edition) –
-  Barry L. Batzing, Microbiology an Introduction
-  Principles of Microbiology – Ronald M Atlas

**DEPARTMENT OF APPLIED MICROBIOLOGY**

**ALLIED PAPER: IV**

**ALLIED 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.

### **Reference:**

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 .
4. Jc Colle, JP Duguid, A.c. Fraser and B.P. Marimon (2004). Mackie and McCartney's Practical Medical Microbiology. i4th Edition, Churchill Livingstone.



## DEPARTMENT OF APPLIED MICROBIOLOGY

### MAJOR PAPER –IX

#### BIOPROCESS TECHNOLOGY

##### UNIT I

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

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

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

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 (B<sub>12</sub>).

##### UNIT V

**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

### **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.

### **REFERENCE:**

1. Anthons Moses - Bioprocess Technology -Kinetics and Reactors
2. J. Krijgsman Product Recovery in Bioprocess Technology-
3. McNeil & L.M. Harvey Fermentation -a practical approach
4. W. Crueger & Crueger A. Biotechnology (2<sup>nd</sup> edition) A textbook of industrial microbiology
5. L. Demain & E. Davies Manual of Industrial Microbiology and Biotechnology (2<sup>nd</sup> edition) -
6. M.J. Waites, N.L. Morgan, J.S. Rockey Industrial Microbiology

## **MAJOR PAPER: X**

### **FOOD AND DAIRY MICROBIOLOGY**

#### **Unit I**

Food as substrate for growth of microbes, role of microbes (mold, yeast, bacteria) in food – Factors affecting the growth of microorganisms in food, feed and fodder.

#### **Unit II**

Principles of food preservation – Asepsis – removal of microorganisms, anaerobic conditions – High temperature, low temperature – drying – food additives.

#### **Unit III**

Spoilage of food, cereals, vegetables, eggs, milk and milk products, meat and meat products, fish and sea food and canned foods, botulism. Microbiological examination of food.

#### **Unit IV**

Fermented foods – Bread, Cheese, Vinegar, fermented vegetables, fermented dairy products. Spoilage and defects of fermented dairy products.

#### **Unit V**

Food borne diseases – Microbial and non-microbial food borne diseases, including pesticide residues and biomagnification – laboratory testing – prevention measures – food sanitation –employee health standards – Quality control.

## FOOD AND DAIRY MICROBIOLOGY

### **PRACTICALS:**

1. Quantitative analysis of milk by standard plate count method.
2. Test of quality of milk by Methylene blue reduction test.
3. Detection of mastitis through milk test.
4. Fat hydrolysis (Lipase activity) by a bacterial culture.
5. Microbial populations in fruit juices, soft drinks and ice cream.
6. Enumerations of bacteria in milk and presumptive test for coliforms.
7. Isolation of halophilic bacteria from pickles.
8. Effect of preservation of quality maintenance of fruit juices.
9. Detection of aflatoxin.

### **REFERENCES:**

1. W.C. Frazier and D.C. Westhoff (1988). Food Microbiology, 4<sup>th</sup> Edition, McGraw-Hill, NY
2. M.R. Adams and M.O.Moss (1995) Food Microbiology. New Age International (P) Limited Publishers.
3. B.C. Hobbs and D. Roberts (1993). Food poisoning and food hygiene . Edward Arnold (A division of Hodder and Stoughton), London.
4. P.F. Stanbury, A.Whiteker, and S.J.Hall (1995). Principles of Fermentation Technology, 2<sup>nd</sup> Edition, Pergamon Press.
5. R.K.Robinson(1990) Dairy Microbiology, Elsevier Applied Science, London.

## DEPARTMENT OF APPLIED MICROBIOLOGY

### MAJOR PAPER – XI

#### PHARMACEUTICAL MICROBIOLOGY

##### 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.  
Animal models: cell lines, transgenic animals  
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, genetically recombinant vaccines, Advantages and disadvantages – examples – Hepatitis B vaccines, Cholera vaccines, Edible vaccines, DNA vaccines – Principles and Mechanism.

##### Unit IV

Immunologicals: Antisera – hyper immune gamma globulin – monoclonal antibodies – uses.  
Recombinant proteins: strategies and genetic manipulations for over production of biomolecules – insulin production, production of interferons, interleukins.

##### Unit V

Other biomolecules : Probiotics and Nutraceuticals  
Economic and legal considerations in Pharmaceutical biotechnology: FDA guide lines – preclinical trials, acute, sub acute, chronic and teratogenic studies. Clinical trials – Phases I, II and III; ICMR guidelines for design and conduct of clinical trials, licensing and drug control.

## **PHARMACEUTICAL MICROBIOLOGY**

### **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. Western blotting
7. Southern blotting
8. Proteolytic digestion of antibodies
9. Analysis of digested fragments.

### **References:**

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

**MAJOR PAPER: XII**  
**INTRODUCTION TO BIOINFORMATICS**

**UNIT I**

Principles of computing – computer hardware – system software – application software – algorithm design and analysis – flow charts – structured and object oriented programming

**UNIT II**

Database management systems ; Data processing – Introduction to database management systems – database designs  
Telecommunication : Introduction to telecommunications – computer networks – communication systems – Distributed systems.

**UNIT III**

Internet and Intranet; Internet and world wide web – Electronic mail intranets; Multimedia and virtual reality.  
Introduction to multimedia –multimedia tools -Introduction to virtual reality.

**UNIT IV**

New technologies in IT – electronic commerce –hypermedia –data warehouses and marts – data mining online analytical processing-geographic information systems.  
Application of IT- computer in business and industry-computers in home – computers in education and training –computer in entertaining, science, medicine and engineering.

**UNIT V**

Computer networking – use of computer networking.  
LAN, WAN, MODEM, Fiber optics network.  
Introduction to internet, WWW , NICNET, ERNET, VSNL, ISDN.

## INTRODUCTION TO BIOINFORMATICS

### Practical:

1. Various browsers, search engines, email
2. Text document with images with multiple formatting options using a specified office package.
3. Spreadsheet using a specified office package
4. Presentation on a specified topic using the specified office package
5. Files and directories in windows and Linux in the specified locations
6. C program – functions
7. C program – file handling
8. C program demonstrating the usage of user defined variables.
9. Shell programming – parameters
10. Shell program – regular expressions

### Reference:

1. Leon, A. and Leon , M. Fundamentals of Information Technology, Leon Tech world, 1999.
2. Bb Breedlove et al, Web programming unleashed, Sams Net Publishing, 1996.
3. Powell. HTML, The complete reference, Tata McGraw Hill, 1998.
4. Hanery Korth and Abraham Silberschatz., Database system Concepts, Tata McGraw Hill publications.
5. Wilteach et al., Parallel and Distributed databases
6. C.J.Date., Introduction to database systems
7. J.M.Martin and Princeton-Hall, Database systems organization.



## **MAJOR PAPER – XIII**

### **GENOMICS AND PROTEOMICS**

#### Unit I

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

#### Unit II

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

#### Unit III

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

#### Unit IV

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

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.

References:

1. R.W. Old & S. B. Primrose, Principles of gene manipulation – An introduction to genetic engineering (Fifth Edition).
2. Helen Kreuzer and Adrienne Massey, Recombinant DNA and Biotechnology (Second edition).
3. Richard J.Simpson , 2002. Proteins and Proteomics: A laboratory manual.
4. S.B.Primrose and R.M.Twyman. 2003. Principles of Genome Analysis and Genomics (3<sup>rd</sup> ed.) Blackwell publishing.
5. Mike Bailey and Keith Hirst, 2000, Advance Molecular Biology 2<sup>nd</sup> ed., Haeper Collins Publisher Limited

## **DEPARTMENT OF APPLIED MICROBIOLOGY**

### **MAJOR PAPER: XIV**

#### **MEDICAL MICROBIOLOGY**

##### **Unit I**

General attributes and virulence factors of bacteria and fungi causing infections.

##### **Unit II**

Morphology, classification, cultural characteristics, pathogenicity, Laboratory diagnosis and prevention of infections caused by the following organisms. Staphylococci, Streptococci, Neisseriae. Mycobacteria, Corynebacteria, Escherichia, Salmonella, Shigella, Vibrios, Clostridia and Pseudomonas.

##### **Unit III**

Morphology, classification, cultural characteristics, pathogenicity, Laboratory diagnosis and prevention of infections caused by the following organisms: zoonotic bacterial diseases such as Plaque, Anthrax, Leptospirosis, Brucellosis; Rumen Microbiology.

##### **Unit IV**

Detection and recovery of fungi from clinical specimens. Dermatophytes and agents of superficial mycoses. Yeasts of medical importance - Dimorphic fungi causing systemic mycosis – Fungi causing Eumycotic mycetomas.

##### **Unit V**

Clinical diagnosis of sexually transmitted diseases , urinary tract infections , hospital acquired infection , meningitis, diarrhoea and pyrexia of unknown origin. Collection and transport of specimens for microbiologic examination. Disposal of biological waste.

## MEDICAL MICROBIOLOGY

### **PRACTICAL:**

1. Isolation of microflora from human throat.
2. Differential test of *Staphylococci* through growth on agar plates.
3. Antimicrobial sensitivity testing and determination of MIC
4. Quantitative Urine culture.
5. Simple, Differential and Special staining of clinical specimens.
6. Isolation and identification of bacterial pathogens from clinical specimens.
7. KOH & Lactophenol preparation for skin scrapings for fungi.
8. KOH & Lactophenol preparation for skin scrapings for scabies mites.
9. Identification of ectoparasites (Mosquitoes, fleas, lice, mites, ticks, Cyclops etc) spotters only.

### **REFERENCES:**

1. D.Greenwood, Richard C.B. Slack. John Forest Peutherer (2004 ). Medical Microbiology, 17<sup>th</sup> Edn. ELBS with Churchill Livingstone
2. R Ananthanarayanan and C.K. Jayaram Panicker. (2004 ). Text Book of Microbiology - Orient Longman
3. JC Collee, , JP Duguid, A.C Fraser., B.P. Marimon ( 203 ) Mackie and McCartney Practical Medical Microbiology. Churchill Livingstone:
4. E.Jawetz,; J.L., Melnic and E.A. Adelberg, (2004). Review of Medical Microbiology. Lange Medical Pub. USA.
5. P. Chakraborty, (2004). A Text book *or* Microbiology .New CentralBook Agency (P) Ltd., Calcutta.

## **DEPARTMENT OF APPLIED MICROBIOLOGY**

### **MAJOR PAPER: XV**

#### **ENVIRONMENTAL MICROBIOLOGY**

##### **Unit I**

Environment ecosystems, food chain – niche, soil, water and air environment Microbial interactions – Symbiosis, Neutralism, Commensalism, Synergism, Mutualism, Ammensalism, Competition, Parasitism and Predation.

##### **Unit II**

Aero biology – Microbes in aerosol, Allergens – Assessment of quality of air – Air borne diseases caused by bacteria, spores and viruses – symptoms and preventive measures.

##### **Unit III**

Microbiology of water – Determination of water quality – bacteriological examination of water – indicator organisms – water borne pathogens. Microbiology of sewage – chemical and biochemical characteristics of sewage – sewage treatment and disposal of wastes.

##### **Unit IV**

Biodegradation of oil, pesticide degradation, Biodeterioration of materials – Paint, paper, Wood and Leather; Xenobiotic degradation. Bioaccumulations – Biomagnifications.

##### **Unit V**

Composting – water pollution –BOD – COD –Bioremediation, Bioamelioration – Biofilm formation – impact on the environment. Environmental protection laws.

## ENVIRONMENTAL MICROBIOLOGY

### PRACTICALS

1. Presumptive test for coliform group of bacteria
2. Confirmed test of coliform bacteria
3. Complete test for coliform bacteria.
4. Water analysis for total bacterial population by Standard Plate Count Method.
5. Determination of total alkalinity of water
6. Isolation of pectinolytic bacteria.
7. Estimation of oxygen by Winkler's method.
8. Isolation of decolourizing microbes.
9. Isolation of bacteriophage from the sewage.

### REFERENCES:

1. M Alexander 1977. Introduction to soil microbiology, John Wiley & sons, Inc., New York.
2. K.H. Baker, and D.S. Herson, 1994. Bioremediation, McGraw Hill Inc, New York.
3. M Alexander 1977. Microbial Ecology, John Wiley & sons, Inc., New York.
4. R.N. Atlas, and R. Bartha (1992). Microbial Ecology : Fundamentals and applications, 3<sup>rd</sup> Ed. Redwood City. CA.Benjamin/Cummings.
5. R. Campbell (1983) Microbial ecology. 2<sup>nd</sup> Ed. Blackwell Scientific Publications London.
6. R. Mitcheli (1992). Environmental Microbiology. John Wiley & sons, Inc., New York.

## **DEPARTMENT OF APPLIED MICROBIOLOGY**

### **MAJOR PAPER: XVI**

#### **AGRICULTURAL MICROBIOLOGY**

##### **Unit I**

Introduction to soil microorganisms – bacteria, algae, fungi, actinomycetes, protozoans, nematodes and viruses – Role of microbes in soil fertility.

##### **Unit II**

Soil microbiology – microbes in soil – Rhizosphere – Phyllosphere and Mycorrhiza; Organic matter decomposition – humus formation – biodegradation of pesticides and pollutants in soil.

##### **Unit III**

Biogeochemical cycles – carbon, nitrogen, phosphorus, sulphur cycles; Nitrogen fixation – plant growth promoting bacteria – Root nodule formation – Nitrogen fixers – Nitrogenase, Hydrogenase – Biochemistry of Nitrogen fixation.

##### **Unit IV**

Plant pathology (Symptoms, Disease cycle and control measures). Bacterial diseases – Blight of rice, Citrus canker, Wilt of potato; Fungal diseases – Blast of rice, Late blight of potato, Rust of wheat, Smut of sugar cane, Wilt of cotton, Tikka leaf spot of ground nut.

##### **Unit V**

Economically important agricultural microbes: Biofertilizer – Rhizobium, Azospirillum, Azotobacter, Cyanobacteria, Azolla – mass multiplication, field applications and crop response. Biopesticide – Bacterial, Fungal and Viral.

## AGRICULTURAL MICROBIOLOGY

### **PRACTICALS:**

1. Isolation of Bacteria, fungi and actinomycetes from soil / diseased plants
2. Isolation of Nitrogen fixing bacteria from root nodules of legumes.
3. Isolation of Azotobacter from garden soil
4. Isolation of antagonistic actinomycetes from soil
5. Microscopic observations of root colonization by VAM fungi.
6. Enumeration of bacterial spore formers from soil.
7. Isolation of lignocellulolytic bacteria by enrichment culture technique.
8. Isolation of microbes from rhizosphere and rhizoplane of plant.
9. Biodegradation of recalcitrant chemicals.

### **REFERENCES:**

1. M. Alexander 1977. Introduction to soil microbiology, John Wiley & sons, Inc., New York.
2. E.A. Paul, and F.E. Clark (1986). Soil microbiology and Biochemistry, New York, Academic Press.
3. Robert, L.tate (1995). Soil microbiology.First Edition, John Wiley & sons, Inc., New York.
4. N.S.Subba Rao, , (1995) Biofertilizers in Agriculture and Forestry. 3<sup>rd</sup> Edition. Oxford and IBH Pub.Co.Pvt.Ltd., New Delhi.
5. N.S.Subba Rao, (1995) Soil microorganisms and plant growth. Oxford and IBH Pub.Co.Pvt.Ltd., New Delhi.



**DEPARTMENT OF APPLIED MICROBIOLOGY**

**MAJOR PAPER – XVII**

**BIOLOGICAL DATABASES AND THEIR USES**

Unit I

Analysis of DNA and protein sequences – Codon distributions, Frequency statistics, Pattern and Motif searches – Randomization.

Unit II

Sequence alignments: Scoring matrices – PAM and BLOSUM – Local and Global alignment concepts – Dynamic programming methodology – Needleman and Wunsch Algorithm, Smith – Waterman Algorithm – Statistics of alignment Score – Multiple sequence alignment – Progressive alignment – Database searches for homologous sequences – Fasta and Blast versions.

Unit III

Evolutionary analysis: Distances – Clustering methods – Rooted and unrooted tree representations – Bootstrapping strategies

Unit IV

Fragment assembly – Genome sequence assembly. Gene finding methods: Content and signal methods, Gene prediction – analysis and prediction of regulatory regions.

Unit V

Neural network – Concepts and secondary structure prediction – Probabilistic models: Markov chain – Random walk – Hidden Markov models – Gene identification and other applications

## BIOLOGICAL DATABASES AND THEIR USES

Practicals:

<b>Mr. Moushmi Priya</b>						
	1	2	3	4	5	6
	9.30 - 10.30	10.30 - 11.30	11.40 - 12.40	1.20 - 2.10	2.10 - 3.00	3.10 - 4.00
<b>Mon</b>						
<b>Tue</b>			BIO.DATA			BIO.DATA
<b>Wed</b>				BIO.DATA		BIO.DATA
<b>Thu</b>		<b>BIO.DATA</b>	<b>BIO.DATA</b>		EVS	
<b>Fri</b>					EVS	

1. Biological data banks, sequence databases, structure databases, specialized databases.
2. Data retrieval tools and methods
3. Database file formats
4. Molecular visualization
5. Gene structure and function prediction ( using GenScan, Gene Mark)
6. Sequence similarity searching (NCBI BLAST)
7. Protein sequence analysis (ExPASy Proteomics tools)
8. Multiple sequence alignment (Clustal)
9. Molecular phylogeny (PHYLIP)

References:

1. Andrequas D. Baxebanis,, B.F. Francis Quellette, Bioinformatics: A pratical guide to the analysis of genes and proteins. John Wiley & sons, New york (1998)
2. S.C.Rastogi, Namita Mendiratta, Parag Rastogi. Bioinformatics – Concepts, Skills, applications.
3. Richard Durbin , Sean Eddy, Anders krogn and Graceme Mitchison. Biological Sequence Analysis: Probabillistic Models of Proteins and Nucleic acids Cambridge University press, 1998.
4. Bishop M.J., Rawlings C.J. (Eds) DNA and protein sequence analysis. A practical approach IRL Press, Oxford (1997).
5. Teresa K Attwood and David J parry – Smith. Introduction to Bioinorfmatcs.

## **DEPARTMENT OF APPLIED MICROBIOLOGY**

### **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 1970 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**

##### **REFERENCE:**

1. Entrepreneurship Development - P.Saravanavel
2. International Business - Francis Cheriumilam
3. IPR laws - P.Narayanan.
4. IPR laws - Dr.G.B.Reddy
5. Poles Apart (Vol. I & II) - CSE Publication,New Delhi,2002



## **DEPARTMENT OF MICROBIOLOGY**

### **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 Amino Acids
3. Qualitative Analysis of Carbohydrates
4. Qualitative Analysis of Fats
5. Preparation of Starch from Potatoes
6. Preparation of Ovalbumin from Egg
7. Preparation of Lactalbumin from Milk
8. Acid – base titration curve
9. Qualitative analysis of food mixture

### **Text Books:**

- A. Nelson and Cox, Lehninger. Principles of Biochemistry (Third Edition).
- B. Roy Tasker, Carl Rhodes. Stryr's Biochemistry (Fourth Edition).
- c. Voet. D. Biochemistry (Second Edition).

### **Reference:**

- Zubey. G. Principles of Biochemistry.
- Devlin T.M. Text Book of Biochemistry. With Clinical Correlations (Fourth edition).