

OUTLINE OF TEST  
M. Phil. (BOTANY) FIRST SEMESTER

COURSE I: Techniques in Biological Research	100 Marks
COURSE II: Any one of the following options	100 Marks
(i) Advanced topics in Mycology	
(ii) Advanced topics in Plant Pathology	
(iii) Advanced topics in Microbiology & Biotechnology	
(iv) Wood Science, Forest Biodiversity and Plant Resources	
(v) Advanced topics in Plant Physiology	
(vi) Advanced Topics in Biodiversity, Bioprospecting, Ethnobotany and Sustainable Utilisation of Plant Resources.	

SECOND SEMESTER:

COURSE III: Dissertation	100 Marks
(i) Evaluation of Dissertation	75 Marks
(ii) Viva Voce	25 Marks

M.Phil. (Zoology) : I Semester

COURSE I : Techniques in Biological Research	100 Marks
COURSE II: Any one of the following special papers	100 Marks
(i) Microbial Physiology and Genetics	
(ii) Advanced topics in Muscle physiology	
(iii) Special Topics in Biochemistry	
(iv) Cytogenetics and Molecular Genetics	
(v) Advanced topics in Radiation Biology	
(vi) Advanced topics in Entomology	
(vii) Advanced topics in Parasitology	

SECOND SEMESTER:

COURSE III: Dissertation	100 marks
(i) Evaluation of Dissertation	75 Marks
(ii) Viva voce	25 Marks

**M.PHIL. BOTANY/ZOOLOGY****PAPER I - TECHNIQUES IN BIOLOGICAL RESEARCH**

TOTAL MARKS: 100

**PRINCIPLES AND APPLICATIONS OF THE FOLLOWING TECHNIQUES IN BIOLOGICAL RESEARCH:****1. Spectrophotometry**

Laws of photometry

Kinds of photometers- colorimeters

- spectrophotometers
- single /double beam instrument
- Biological application

Uses and types of

- a) light sources
- b) filters, monochromators
- c) Sample holders
- d) photoelectric devices etc.

Extraction and estimation procedure for proteins, amino acids, carbohydrates etc.

**2. Electrophoresis:**

Principle of electrophoresis, Agarose gel electrophoresis and its limitations, Cellulose acetate membrane electrophoresis, Polyacrylamide gel electrophoresis, Disgel electrophoresis, Polyacrylamide gel electrophoresis, Determination of molecular weights by electrophoresis, Isoelectric focusing (IEF) and 2-D gel electrophoresis, Western blotting, Northern blotting, Southern blotting and pulse Field Electrophoresis

**3. Chromatography:**

Principles of adsorption, Partition, ion exchange and molecular sieve chromatography. Techniques and instrumentation involved in paper chromatography, thin layer chromatography, column chromatography, gas chromatography, high performance liquid chromatography, ion exchange chromatography. Their analytical uses and applications.

#### 4. Centrifugation:

Principle of Centrifugation

Types of centrifuges (low speed, high speed and ultra centrifuges)

Types of centrifugations (Rate, Density gradient-Isopycnic centrifugation)

Preparative and analytical ultracentrifugations.

#### 5. Radiotracer techniques and autoradiography

Radiotracers, isotopes and applications of tracer techniques

Autoradiography: Principle, techniques and applications of autoradiography.

#### 5. Histochemistry:

Principle, types of EM & Biological applications

Importance of histochemistry in Biological research, Historical perspective, Principles of fixation; type of fixative and their application; Principles and methods of histochemical localization of carbohydrates, lipids, proteins, nucleic acids and some enzymes (phosphorase, aldolase, SDH, LDH-ases and lipase).

#### 6. Electron Microscopy

Differences between light and Electron Microscope

Specimen block preparation for Transmission Electron Microscopy

Staining for ultrathin sections

Specimen preparation for scanning Electron Microscopy

Negative staining

Freeze-fracture Etching technique.

#### 7. Immunological techniques:

Radial immunodiffusion

Double diffusion

Immunoelectrophoresis

Radioimmuno assay

Haemagglutination

Enzyme linked immunosorbent assay (ELISA)

Immunofluorescence, Western blotting, Migration inhibition factor assay.

## COURSE II (BOTANY)

### ADVANCED TOPICS IN MYCOLOGY

1. Concepts in microbial ecology, microbe-microbe interactions, microbe-plant interactions, microbe-animal interactions, carbon cycle, nitrogen cycle, sulphur cycle, phosphorous cycle, transformation of other ions, degradation of man made compounds.
2. Fungi in fermentation technology, in the production of antibiotics, immunoregulators, antitumor and antiviral agents, in transformation, in mineral biotechnology, in coal solubilization and paper industry, biosorption, bioremediation, detoxification of pesticides, in treatment of industrial effluents.
3. Type, structure, function of mycorrhizae, role in agriculture, horticulture and forestry
4. Bioconversion of waste material : through cultivation of fungi
5. Effect of plant parasitic and other fungi on man.

#### Suggested Books:

1. Ainsworth, G.C. and Sussman, A. S. The fungi Academic Press, New York 1968.
2. Alexopoulos, C.J. and Mims, C.W. 1979. And Blackwell, M. Introductory Mycology. Wiley Eastern Limited, New Delhi.
3. Burnett, J. H. 1976. Fundamentals of Mycology. Edw and Arnold, London.
4. Alexopoulos, C. J., Mims, C. W. and Blackwell, M. Introductory Mycology. John Wiley and Sons.
5. Deacon, J.W. Introduction to Modern Mycology. ELBS.
6. Horsfall, J.G. and Cowling, E.B. Plant Disease Vol. I-V. Academic Press, New York.

## ADVANCED TOPICS IN PLANT PATHOLOGY

1. Nature, origin and evolution of parasitism.
2. Parasitic and phanerogamic diseases of plants, effect of atmospheric impurity and lightening; diseases due to unfavourable temperature and light, soil moisture disturbances and nutritional deficiency diseases due to excess of nutrients.
3. Molecular plant pathology: Molecular diagnosis; identification of genes and specific molecules in disease development; molecular manipulation of resistance.
4. Application of information technology in plant pathology: Simulation of epidemics, program for diagnosis, remote sensing and image analysis for ecosystem level effects, prediction of disease control decisions.
5. Mechanism of action of fungicides, antiviral agents and chemotherapy.

### Suggested Books:

1. Agrios, G.N. Plant Pathology, Academic Press, 1988.
2. Baker, F. and Cook, R.J. 1974. Biological Control of Plant Pathogens. W.H. Freeman & Co. San Francisco.
3. Bilgrami, K.S. and Dubey, H.C. text Book of Modern Plant pathology. Vikas, New Delhi; 1980.
4. Horsfall, J.G. and Dimond, A.E. Plant Pathology - An Advanced Treatise. Vol-III Academic Press, New York.
5. Horsfall, J.G. and Cowling, E.B. Plant Disease Vol. I-V. Academic Press, New York.

## ADVANCED TOPICS IN MICROBIOLOGY AND BIOTECHNOLOGY

### 1. Biocatalyst Technology:

- i. Starilization of Biocatalysts.
- ii. Immobilization of Biocatalysts.
- iii. Biocatalysts in organic synthesis.
- iv. Enzyme reactions in organic solvents.
- v. Enzymes as biosensors.

### 2. Genetic Engineering:

- i. Expression of foreign DNA in *E. coli*.
- ii. Gene cloning and expression in Yeast.
- iii. Gene cloning in animal cells.
- iv. Techniques in plant genetic engineering.
- v. Site detected mutagenesis.

### 3. Fermentation Technology:

- i. Microbial growth kinetics.
- ii. Design and analysis of bioreactors.
- iii. Operation of fermentation processes.
- iv. Energy and food from industrial and forest wastes.
- v. Techniques of product recovery.

### 4. Cell and Tissue Culture:

- i. Products from animal and plant tissue culture.
- ii. Animal and plant reactor technology.

### 5. Immunology and Medical Microbiology:

- i. Interferons, interferon like substances and vaccines.
- ii. Oncogenes.
- iii. Tissue organ transplantation.
- iv. Mechanism of drug resistance in microorganisms.

**Suggested Books:**

1. Jay, J.M. 1987. Modern Food Microbiology. CBS Publishers and Distributors, New Delhi.
2. Casida, L.E. 1968. Industrial Microbiology. Wiley & Mc Millan Publishers.
3. Joshi, K.R. and Osamo, N.O. 1992. Immunology, Agrobotanical publishers, (India) Bikaner.
4. Walker, J. M. and Gungold, E.B. Molecular Biology and Biotechnology. Royal Society of Chemistry, Cambridge, 1990.
5. Kumar, H.D. A text Book of Biotechnology. East West Pvt. Ltd. New Delhi 1993.
6. Kuby, J. Immunology. W.H. Freeman and Company, New Delhi.
7. Frazier, W.C. and Wsthoff, D.C. Food Merobiology Company Ltd. New delhi, 1995.
8. Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology - An Introduction. Addison Wesley Longman, Inc. California.

## WOOD SCIENCE, FOREST BIODIVERSITY AND PLANT RESOURCES

1. General characteristics and Anatomical Features of Normal and Compression Wood of Gymnosperms
2. General Characteristics and Anatomical Features of Normal and Tension Wood of Angiosperms.
3. Differences between Manoxylic and Pycnoxylic Woods; normal and Polyxylic Woods; Sapwood and Heartwood; Storied and Nonstoried Woods; Porous and Nonporous Woods; Ring porous and Diffuse porous Woods, and between Compression Wood and Tension Wood.
4. Some important physical properties of woods namely moisture content, specific gravity, wood density and fuel value of wood.
5. A general account of the properties of wood in relation to its structure.
6. Phytogeography and Biodiversity: A general concept of phytogeography and biodiversity; an outline of the classification of the types of climatic zones, vegetation zones and forest types of India with particular reference to Himalayas and Himachal Pradesh (DETAILS ARE NOT REQUIRED AT THE LEVEL OF INDIA, BUT ONLY AT THE LEVEL OF HIMACHAL PRADESH).
7. Wild Plant Resources: A LIST of economically important wild plants of Himachal Pradesh (Emphasis is not to be placed on the study of individual plants)
8. Plant Resources for pulp and Paper: A general account of plant fibers with particular reference to the effect of fibre morphology, chemical composition and wood properties on pulp and paper.
9. Plant resources for the sericulture: A LIST of important food plants of mulberry, tassar, oak tassar, eri, muga and wild silkworms (Emphasis is not to be placed on the study of individual plants). Status of sericulture industry in Himachal Pradesh.
10. Causes and Remedies for the Loss of Forest Genetic Materials.
11. Conservation through law: A LIST of important acts and bills passed with reference to Environment, Forest, Wild Life, Biodiversity, Conservation and Patents in India and Himachal Pradesh. Legal provisions regarding duties of the State and Citizens to protect the Environment. Sovereign Rights and Intellectual Property Rights.

## SUGGESTED READINGS:

- Agrawal, H.O. and Seth, M.K. 2000. Sericulture in India. Vols.I-IV. Bishen Singh Mahendra Pal Singh, Dehradun, 984 pp.
- Bawa, R and Khosla, P.K. 1998. Biodiversity of Forest Species (A Community Forestry Approach). Bishen Singh Mahendra Pal Singh, Dehradun, 218pp.
- Carlquist, S. 1988. Comparative Wood Anatomy-Systematic, Ecological and Evolutionary Aspects of Dicotyledonous Woods, Springer Verlag, Berlin.
- Dhar,U(Ed.). 1993. Himalayan Biodiversity. HimVikas Publication No.3, Gyanodya Prakashan, Nainital, 543pp.
- Heywood,V.H. and Watson, R.T. 1995. Global Biodiversity Assessment, UNEP, Cambridge University Press, Cambridge, U.K.
- Jane, F.W. 1970. The Structure of Wood, Adair and Charles Blanck, London.
- Kothari, A. 1997. Understanding Biodiversity: Life Sustainability and Equity. Orient Longman.
- Krattiger, A.F. et al. (Eds.). 1994. Widening Perspectives on Biodiversity. Natraj Publishers, Dehradun, 473pp.
- Nair, M.N.B. 1998. Wood Anatomy and Major Uses of Woods. Faculty of Forestry, Universiti Putra, Malaysia, 434 PM Serdang, Selangor, Malaysia.
- Nair, M.N.B et al. (Eds.) 1998. Sustainable Management of Nonwood Forest Products. Faculty, Universiti Putra Malaysia, 434004 PM Serdang, Selangor, Malaysia.
- Panahin, A.J. and deZeeuw, C. Textbook of Wood Technology. Vol. I. McGraw Hill Book Co., New York.
- Rao, R.R. 1994. Biodiversity in India (Floristic Aspect). Bishen Singh Mahendra Pal Singh, Dehradun, 315pp.
- Seth, M.K. 2002. Trees and Their Economic Importance.
- Seth, M.K., Kumari, A., Thakur, R. and Khullar, S.P. 2002. Pictorial Guide to Common Himalayan Pteridophytes. Vol. I. Pteridophytes of Shimla.
- Seth, M.K., Chandel, S and Thakur, R. 2002. Pictorial Guide to Some Common Ornamental Plants in the Himalaya, Vol. I.
- Seth, M.K., Sharma, S. and Chandel, S. 2002. Shrubs and Their Economic Importance. Prof. S.P.Khullar's Festschrift Volume.
- Seth, M.K., Sharma, S. and Thakur, R. 2002. Pictorial Guide to Some Common Shrubs of the Himalaya. Vol. I.
- Timell, T.E. 1986. Compression Wood in Gymnosperms. Vols. I-III. Springer-Verlag, Berlin, Heidelberg, New York, Tokyo.

## ADVANCED TOPICS IN BIODIVERSITY, BIO PROSPECTING, ETHNOBOTANY AND SUSTAINABLE UTILISATION OF PLANT RESOURCES

1. Ethnobotany  
Definition, What makes a good ethnobotanist?  
Its scope and various subdisciplines  
Interdisciplinary approaches in ethnobotany
2. Ethnobotany: mindsets, externalities and challenges
3. Ethnic groups of India ; distinctive features of the various tribes
4. Ethnoagriculture: Use of plants by tribals as food and fodder
5. Ethnobotany in Modern India
6. Ethnobotany in development and conservation of resources
7. Traditional Phytochemistry
8. Plants in folk religion and mythology
9. Plants in material culture
10. Biodiversity Hot Spots
11. Role of satellites in the mapping of plant resources
12. Information systems and databases for the conservation of medicinal plants

### Suggested readings:

- Baker, H.G. 1978. *Plant and Civilization*. Wadsworth, Belmont.
- Chrispoels, M. J. & Sadava, D. 1977. *Plants, Food and People*. Freeman, San Francisco
- Frankel, O. H., Brown, A.H.D. & Burden, J. J. 1995. *The Conservation of Plants diversity*. Cambridge Univ. Press, Cambridge.
- Gadgil, M. & Guha, R. 1996. *Ecology and Equity : Use and abuse of nature in Contemporary India*. Penguin, New Delhi.
- Pimentel, D. & Hall, C. W. (eds.) 1989. *Food and Natural Resources*. Acad. Press
- Schery, R.W. 1972. *Plants for Man*. Englewood, Prentice Hall.
- Walter, K.S. & Gillett, H.J. 1998. *IUCN Red List of Threatened Plants*. IUCN, the World Conservation Union, Switzerland, U. K.

## ADVANCED TOPICS IN PLANT PHYSIOLOGY

### 1) Plant growth, regulators and elicitors :

- a) Auxins- Structure-activity relationship; bioassays and chemical methods of estimation; metabolism; IAA transport; mechanism of rapid and long term responses; synthetic auxins - application in agriculture and horticulture.
- b) Gibberellins- Structure-activity relationship; biosynthesis, bioassays and outlines of methods of quantification; molecular mechanism of amylase induction in aleurone tissue.
- c) Abscisic acid- Structure; various biosynthetic pathways ; catabolism and conjugation ; bioassays and chemical estimation; mechanism of action of rapid responses (stomatal closure) including the role of calcium ions as second messenger and of long term responses; role of ABA in drought tolerance and in the regulation of seed germination and dormancy- evidences from mutants.
- d) Physiological effects and mechanism of action of ethylene, polyamines, brassinosteroids, jasmonic acid, salicylic acid and phenolics.

### 2. Nitrogen fixation, protein synthesis:

Range of nitrogen fixing organisms; molecular mechanism of nitrogen fixation; protein synthesis- transcription and translation.

### 3. Signal transduction:

Overview, receptors and G- proteins, phospholipid signaling, role of cyclic nucleotides, calcium- calmodulin cascade, diversity in protein kinases and phosphatases, sucrose-sensing mechanism.

### 4. Stress physiology:

Concept of biological stress and strain; plant responses to abiotic stresses, mechanisms of abiotic stress tolerance - water deficit and drought resistance, salinity stress, freezing and heat stress, oxidative stress.

5. **Heavy metals-Toxicity** ; detoxification methods, phytochelatins and related peptides- their structure, synthesis and role in metal tolerance.

### **Suggested Readings**

1. Annual Reviews of Plant Physiology
2. Annual Reviews of Biochemistry
3. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of plants. American Society of Plant Physiologists, Maryland, USA.
4. Leopold. A.C. Plant growth and Development
5. Levitt, J. Responses of plants of environmental stresses, Academic Press, N.Y.
6. Moore, T.C. 1989. Biochemistry and physiology of plant hormones (2<sup>nd</sup> ed), Springer-Verlag, New York, USA
7. Paleg, L.G. & Aspinall, D. 1981. Physiology and Biochemistry of drought resistance in plants. Academic press, N.Y.
8. Purohit, S.S. (ed.). Hormonal regulation of plant growth and development vol I- IV, Agro Botanical Publ. India.
9. Singh, R. & Sawhney, S.K. Advances in frontier areas of plant biochemistry, Prentice Hall, India.
10. Taiz, L. & Zeiger, E. 1998. Plant Physiology (2<sup>nd</sup> ed.). Sinauer Associates Inc. Publishers, Massachusetts, USA.
11. Wilkins, M.B. (ed.) 1984. Advanced Plant Physiology. ELBS, Longman, UK.

**COURSE II; ZOOLOGY**

**MICROBIAL PHYSIOLOGY AND GENETICS**

**I. Nutrition and Environmental Influence:**

1. Principles of Microbial nutrition, approximate elementary composition of microbial cells, requirements of Carbon, Nitrogen, Phosphorus, Sulphur, Oxygen and Principal micronutrients (elements). Nutritional categories of Microbes, glucose and amino acid transport in microbes.  
6 hrs

2. Composition of culture media, complex media, selective media, Minimal media, enrichment media, defined media, Isolation of pure line cultures, Maintenance & Preservation of microbes, Microbial growth, phases of growth and measurement of growth.  
3 hrs

**II. Energy and Metabolism:**

3. Concept of Energy, Pathways involving substrate level phosphorylation, oxidative phosphorylation. Photosynthesis, carbohydrate metabolism.  
6 hrs

4. Protein metabolism, lipid metabolism, purine and pyrimidine metabolism.  
6 hrs

**IV. Bacterial genetics:**

5. Mutations & Mutagenesis: Types of mutagenesis, Biochemical basis of mutations, spontaneous and induced mutations. Isolation of mutants, Replica plating, site directed mutagenesis. Conditional mutants, Reversion of mutations.  
3 hrs

6. Recombination: General Recombination, site specific, recombinations, composite transposons, the tri-3-type transposons, transposable, Replication of transposable phage by transposition, transposable phage.  
3 hrs

7. DNA repair mechanisms: DNA repair mechanism DNA damage in bacteria, photoreactivation, excision (dark repair, recombinations, post replication repair, SOS repair system).  
3 hrs

8. Structure of plasmid, Functions of plasmid, Replication of Plasmids, Plasmid incompatibility, Conjugative plasmids, conjugation, DNA transfer, Integration and Hfr strains and F' factors.  
3 hrs

9. Structure of bacteriophage, a typical phage life cycle, lysogenic life cycle, growth & assay for phage, RNA phage, single stranded DNA phage, double standard DNA phage, Mn-whole mechanism of phage replication.  
3 hrs

10. Transfer of genetic material: Conjugation, transduction, transformation, Natural transformation, competence and uptake of DNA, Ames test, Activation of carcinogens, treatment of *Salmonella typhimurium* cells with activated carcinogens, Reversion of mutants for histidine.  
3 hrs

11. Transduction: Generalised and specialized transduction.  
3 hrs

12. Types of transposons, detection of transposition in bacteria, Insertion sequences, Excision of transposons, Genetic phenomena mediated by transposons in bacteria.  
4 hrs

Basic texts:

1. Daniel Lim; Microbiology; 2<sup>nd</sup> edition, WCB McGraw Hill, 1998.
2. J. Nicklin: Instant notes on Microbiology, viva books Pvt. Ltd. 1999.

## SPECIAL TOPICS IN BIOCHEMISTRY

### 1. Covalent properties of Proteins

- 1.1 Protein sequencing
- 1.2 Protein splicing
- 1.3 Covalent modifications.

### 2. Protein structure and folding.

- 2.1 Protein tertiary structure and folding.
- 2.2 Folding overview.
- 2.3 Condensation and molten globules.
- 2.4 Amino acid sequence variations and membrane proteins folding.
- 2.5 Chaperonin-assisted protein folding.

### 3. Enzyme

- 3.1 Enzyme-substrate complementarity and the use of binding energy in catalysis.
- 3.2 The factors associated with catalytic, proximity and orientation distortion.
- 3.3 Enzyme purification by various methods and establishment of homogeneity of purified enzymes.
- 3.4 Enzyme characterization
- 3.5 Allosteric enzymes, properties, Kinetics and co-operativity, hill and scatchard plot.

### 4. Medical Biochemistry and Molecular Biology

- 4.1 Digestive disorders, diseases of kidney and diseases of respiratory system
- 4.2 Diseases of cardiovascular system and diseases of respiratory system
- 4.3 Infectious diseases.
- 4.4 Important prophylactic enzymes involve in various diseases.
- 4.5 Free radicals and antioxidant enzymes in various diseases with special reference to parasitic diseases.
- 4.6 Molecular markers in genome analysis; RFLP, RAPD and AFLP analysis.

4.7 Application of RFLP in forensic disease prognosis.

4.8 DNA probes in diagnostic.

**Suggested Readings:**

1. Clinical Biochemistry Hawks
2. Enzymology, Dixon
3. Segel, I.H.: Enzyme Kinetics, Wiley, New York 1995.
4. White and Smith, Principals of Biochemistry. McGraw-Hill; New York, 1978.
5. Molecular Biology and Biotechnology, A Comprehensive desk references, R.A. Meyers, VCH Publishers, New- York.

## MUSCLE PHYSIOLOGY

1. **Skeletal Muscle Development:**  
Stem Cells in myogenesis, Molecular signalling of myogenesis, Myogenesis and motor innervation.
2. **Skeletal Muscle Biochemistry :**  
Metabolic fuels, Effects of exercise, training, Muscle and amino acid metabolism. Anapleurosis in muscle, Muscle glutamine and oxidative stress.
3. **Excitation contraction coupling:**  
Calcium as a chemical link between excitation and contraction, characteristics of muscle activation, mechanism of ATP hydrolysis, Structure and function of troponin, Regulation of muscle force, stiffness and shortening velocity.
4. **Contractile apparatus of smooth muscle:**  
Organization of contractile material, Thick, Thin and Skeletin filaments, Dense bodies and attachment plaques, contractile proteins ( myosin, actin, troponin) additional proteins(C- Protein,  $\alpha$ - actinin, Filamin).
5. **Calcium activation of contractile mechanism in vertebrate smooth muscle:**  
Calmodulin and myosin light-chain Kinase activation, Myosin phosphorylation and dephosphorylation as a regulatory mechanism of contraction in vertebrate smooth muscle. An introductory idea about 'catch' and 'latch' phenomenon.
6. **Modulation of calcium activation of vertebrate smooth muscle by cyclic nucleotides:**  
 $\beta$  adrenergic relaxation of vascular smooth muscle by cyclic AMP, Role of cyclic GMP in vascular smooth muscle relaxation, Role of cyclic GMP dependent protein kinase in mediating cyclic AMP evoked relaxation.

**7. Muscle Diseases:**

Classification of muscle diseases, An introductory idea of the following diseases:

Dystrophinopathies, muscular dystrophies, Myasthenia gravis, Botulism.

**8. Muscle regeneration**

**Books:**

1. Muscle Regeneration by Alexander Mauro. Raven Press: 1979.
2. A Text Book of Medical Physiology by A C Guyton and Hall
3. Disorders of voluntary Muscle By Karpati, Hilton-Jones and Griggs. Harcourt India Pvt Ltd. New Delhi 2001.

## ADVANCED TOPICS IN CYTOGENETICS AND MOLECULAR GENETICS

### 1. Genomics:

- i. Structural Genomics: Sequence Organization, Assigning Loci to Specific Chromosomes, High Resolution Chromosome Maps, Physical Mapping of Genomes, Genome Sequencing, Use of Genome Maps in Genetic Analysis.
- ii. Functional genomics: Characterization of Proteome by Open Reading Frame Analysis, DNA Microarrays.

### 2. Cytogenetic Techniques:

- i. Karyotyping: Centromeric Index, Arm Ratio, Relative Length, Idiogram.
- ii. Chromosome Mapping.
- iii. Banding Techniques: Giemsa staining, Giemsa C banding, Giemsa-G banding, Quinacrine (Q) banding, R banding and Silver staining.
- iv. Measuring nuclear DNA: Microdensitometry, The Feulgen Reaction
- v. Human Pedigree Analysis

### 3. Molecular Tools:

- i. Molecular Probes.
- ii. Florescence *in situ* Hybridization
- iii. Discrete Genetic Markers as Probes for Studying Populations.
- iv. Use of PCR as a Tool to Study Races.

### 4. Evolutionary Genetics:

- i. Evolution of Multigene Families.
- ii. Neutrality.
- iii. Molecular Clocks.
- iv. Use of mt DNA in Studying Genetic Relationships.
- v. Human Evolution: The Origin of Major Human Groups.

**Suggested Readings:**

1. Gardener, E.J.; Simmons, M.J. and Snustad, D.P. Principles of Genetics. John Wiley & Sons.
2. Griffiths, A.J.F.; Gelbart, W.M.; Miller, J.H. and Lewontin, R.C. Modern Genetic Analysis. W.H. Freeman & Company.
3. McGregor, H.C. and Varley, J.M. Working With Animal Chromosomes. John Wiley & Sons.
4. Mitra, S. Genetics-A Blueprint of Life. Tata McGraw-Hill Publishing Company.
5. Dover, G.A. and Flavell, R.B. Genome Evolution. Academic Press.

ADVANCED TOPICS IN RADIATION BIOLOGY

1. Histopathological studies on effects of radiation:  
Early lethal effects, Prodromal radiation syndrome,  
Gastrointestinal tract with associated glands, haemopoietic system and blood,  
reproductive system, Life-shortening and cataractogenesis
2. Cell population kinetics, techniques of cell population kinetics and analysis of cell survival curves.
3. Imaging, tomography, magnetic resonance imaging, radioimmunoassay.
4. Uses of various radioisotopes in therapy and diagnosis.
5. Clinical radiotherapy- teletherapy, particle therapy, dose fractionation, oxygen effect, hyperthermia and chemicals in radiotherapy.
6. Application of Radioimmunoscinigraphy and Radioimmunotherapy in the management of cancer.
7. Design of Radioisotope Laboratory: Floor and room plans, hood and glove box, remote handling of equipment, isotope storage, isotope waste disposal, radiation monitoring equipment, and control of contamination.

## ADVANCED TOPICS IN ENTOMOLOGY

### 1. Insect Sociobiology

Forms of social life. The organisation of higher social communities of insects. Mutual communication in search of food. Social homeostasis and superorganism.

### 2. Insect pheromones and Socio Chemicals:

Diversity of communication systems. Primers and releasers. Socio-chemicals of bees and ants. Allomones.

### 3. Insect Toxicology

Chemistry and mode of action of organophosphates and carbamates. Physiology of insecticidal resistance. Insecticides and environmental pollution.

### 4. Behavioural Physiology

The physiological causes of behaviour. Hormonal releasers of behaviour. Hormonal switches of behavioural states. Higher control of hormonal causes of behaviour. Effects of behaviour on physiology.

### 5. Bio-chemistry of Insect Flight:

Pathways for the utilization of carbohydrates, amino acids and fats in flight muscle. The control of flight muscle mitochondrial metabolism. Respiratory fuels - carbohydrates, lipids and their metabolism.

### 6. Nervous system and synaptic Transmission:

Nervous integrity and transmission of Bioelectrical events. Chemically mediated transmission-synaptic transmission and chemical transmitters at neuromuscular junctions. Nervous system control.

### 7. Insect Thermoregulation:

Behavioural and physiological mechanisms of thermoregulation. Regulation of temperature in the nests of social insects.

### 8. Diapause:

Endocrine mediation of diapause. Morphological, Physiological and behavioural expression diapauses. Significance of diapause.

#### Suggested Readings:

1. Fundamentals of Insect Physiology-Murray L. Blum. John Wiley & sons. New York.
2. The Physiology of Insecta-Morris Rockstein (Vol-I-IV) Academic Press, New York and London.
3. Insect Biochemistry and Function-D.L.Candy and B.A.Kilby. Chapman and Hall London.
4. The Biochemistry of Insects-Darcy Gilmour. Academic press, New York and London.
5. An Introduction to insect Physiology- s Bursell Academic Press New York and London.
6. The Principles of Insect Physiology- V.B.Wigglesworth, English Language book Society and Chapman and Hall, London.
7. The Insects structure and Function -R-F Chapman. The English Language book society and The English University Press, London.
8. Introductory Insect Physiology-Robert L. Patton,(Saunders. Toppan Publishers)
9. Insect Physiology-N.C. Pant and Ghai, SICAR Publishers, New Delhi.
10. Introduction to Insect biology and Diversity - Howell V Daly Mc Grew Hills Ltd., London.

#### ADVANCED TOPICS IN PARASITOLOGY

1. Pathogenesis due to protozoan and helminth parasites.
2. In vitro culture of protozoan and helminth parasites
3. Physiology of helminth parasites:
  - (a) feeding, nutrition, (b) carbohydrate, lipid and protein metabolism (c) electron transport.
4. Biology of egg and larval forms in helminthes
5. Exhatching and hatching mechanisms in helminth parasites.
6. Ecology of parasites
7. Immunity to protozoan and helminth parasites.
8. Identification of helminth parasites.
  - (i) characters of taxonomic importance
  - (ii) Problems in speciation in dioecious parasites
  - (iii) rules of zoological nomenclature.

Note: Eight questions to be set, Four to be attempted.