

**Semester 1**  
**Core Course I**

**Hours: 6**  
**Credits: 5**

## **ANIMAL DIVERSITY AND CONSERVATION**

### **Unit I**

Basic concept of biodiversity – Elements of biodiversity – Ecosystem diversity, Genetic diversity, and Species diversity. Biogeographical classification of India. Patterns of biodiversity- alpha, beta and gamma. Measurement of species abundance, species richness, diversity - Shannen index and Simpson index. Dominance and evenness. Biogeography,

### **Unit II**

Biodiversity & Conservation: Threats to living species- habitat loss - its causes and consequences. Protection of critical habitat and conservation plans. Poaching of wildlife and man- wildlife conflicts. Hot spots of biodiversity. India a mega diversity nation. Methods of conservation –In situ and Ex situ methods. Cryopreservation and germplasm conservation. Needs for biodiversity conservation.

### **Unit III**

Exotic animal species from Invertebrates (any 5) – phylum Porifera, Coelenterate, Annelida, Arthropoda, Mollusca and Echinodermata. Exotic animal species from Vertebrates (any 5) - Fishes, Amphibians, Reptiles, Birds and Mammals. Detrimental effects of exotic species. Biosphere reserves and its conservation. National parks and wildlife sanctuaries in India and Tamilnadu.

### **Unit IV**

IUCN Classification: Rare and endangered animals, endemic animals, extinct animals (schedule I–V). Conservation of endangered animals. Project tiger, project elephant and project crocodile. Factors threatening animals – trade, season and urbanization.

### **Unit V**

Ethics of Conservation – Values of biodiversity, biopiracy and economic values of biodiversity. Legal, Ethical and Conservation issues related to biodiversity. Global Conservation Issues. NGO Organizations in India. Role of CITIES and ICUN. RAMSAR convention.

### **TextBook:**

Kumar, U. and M.J Asija.2006. Biodiversity, Principle and Conservation. Student Edition, Jodhpur.

### **Reference Books:**

1. Biodiversity – CPR – Environmental Education center 2003, Chennai.
2. Biodiversity and Ecosystem Conservation, Ashish Dutta, Kalpaz Pub. New Delhi.
3. Environment – The Science behind the stories (II Edition) by Withgott and Brennan, Pearson Publ. Inc.,
4. Environmental Science & Engineering, T. Meenambal. MJP Publishers, Chennai
5. An advanced book on Biodiversity – Principles and Practice by K.V.Krishnamurthy, 2003 – Oxford SIBH publishing Co, Pvt. Ltd., New Delhi.

**Semester I**  
**Core Course II**

**Hours 6**  
**Credits 5**

## **CELL BIOLOGY**

### **Unit I**

Introduction - Cell Theory - Ultrastructure of prokaryotic and eukaryotic cell. Plasma Membrane: ultra structure chemical composition. Models of membrane structure and Properties. Intracellular junctions - tight junctions, gap junctions, plasmodesmata, desmosomes and hemidesmosomes. Cell Cycle: Chromosomal events during mitosis and meiosis.

### **Unit II**

Protoplasm – chemical composition and properties. Microtubules and microfilaments- dynamics, regulation and functions. Endoplasmic Reticulum: ultrastructure and composition. Intracellular compartments - transport and vesicular trafficking. Trans-Golgi Network (TGN) and protein sorting. Golgi Complex: ultra structure and composition. Protein synthesis and secretion in pancreatic cell.

### **Unit III**

Mitochondria: ultrastructure, composition and functions. Energy transduction. Ribosomes: ultrastructure composition and functions in prokaryotic and eukaryotic cells. Assembly of ribosomes during protein synthesis. Lysosome: ultra structure , composition - enzymatic content and functions.

### **Unit IV**

Nucleus: General structure of interphase nucleus - Chromonema cycle. Nuclear envelope structure , nuclear pore complex and functions. Nuclear matrix and nuclear proteins. Nucleosome : ultra structure and functions. Nucleolus - ultrastructure and its role in RNA processing. Metaphase Chromosomes- ultra structure, types and functions. Giant chromosomes - Polytene and Lamp-brush chromosomes.

### **Unit V**

Cancer Biology: Genetic rearrangements in progenitor cells, Characteristics of Cancer Cells, types of tumours. Therapeutic intervention of uncontrolled cell growth. Apoptosis and its relevance in cancer biology. Cytology of Aging: Factors for ageing and cellular changes. Role of free radicals in ageing.

### **Text Books:**

- 1.Gupta, P.K. Cell and Molecular Biology, Rastogi Publications, India.
- 2.Verma Agarwall. Cell Biology, Himalaya Publishing House, Bombay.

### **References:**

1. De Roberties, E.D.P and E.M.F. De Roberties. 1998. Cell and Molecular Biology. 8<sup>th</sup> Edn.
2. Gerald Karp, 1996. Cell and Molecular Biology, John Wiley and sons, USA.
- 3.Powar, C.B. 1997. Cell Biology. Himalaya Publishing House, Bombay.
- 4.Ajoy Paul, 1960. Cell and Molecular Biology, India.
- 5.Kuttikan, A.M. 1987.Cell Biology. Fourth Edition. JAC Publications, Kanyakumari.

## **MICROBIOLOGY**

### **Unit I**

History and Scope of microbiology - Classification based on cellularity - Structure of *E.coli* Bacterial respiration and reproduction – Bacteriophage - multiplication and life cycle; Fungi - Penicillium.

### **Unit II**

Bacterial nutrition and Growth- Nutritional types of bacteria-Growth factors- culture media- Isolation of pure culture –Colony morphology and growth- Growth curve and Growth kinetics.

### **Unit III**

Microbial ecology-Fresh water environment- water purifications- Microbiological analysis of lentic and lotic system(MPN analysis) and marine environment – Microorganism and formation of different soils-Soil microorganisms, interactions with the atmosphere- Extreme environments – Thermophiles and Halophiles.

### **Unit IV**

Food Microbiology - Food borne infections and intoxications: Bacterial with example of infective and toxic types- Clostridium, Salmonella, and Staphylococcus –micro toxins in food with reference to Aspergillus species- Quality assurance- microbiological quality standards of food, government regulatory practices and policies- FDA, EPA.

### **Unit V**

Medical Microbiology - Morphological characteristics, Pathogenesis, laboratory diagnosis and treatment – Pathogenic bacteria - *Streptococcus pneumoniae*, *Shigella dysenteriae*. Pathogenic fungi - *Candida albicans*, Microsporium, Pathogenic Virus – Rabies, AIDS- Parasitic Protozoans- *Leishmania donovani*, *Entamoeba histolytica*, *Plasmodium vivox*.

### **Text Books**

1. A Text book of microbiology. R.C. Dubey, D.U. Maheshwari, S.Chand and company Ltd 2005.
2. Sharma, P.D. 1998: Microbiology, Rastogi Publ. Meerut, India
3. Vijaya Ramesh, 2005: Environmental Microbiology, MJP.Publ., Chennai, India

### **References**

1. Medical Microbiology, Rajan,S. 2007, MJP.Publ. Chennai, India.
2. Pelczer, M.J., Reid, R.D. and Chan, E.C.S. (1996), Microbiology, V Ed., Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Ananthanarayanan, T and Jayaram Paniker, C.K. (2000), Text Book of Microbiology, VI Ed., Orient Longman Ltd., Madras.
4. Talaro, Park.,Kathelee, N and Talaro,Arthur. 2002, Foundations of Microbiology. McGraw Hill Higher Education, NY.

**Semester I**  
**Core Course IV**

**Hours 6**  
**Credits 4**

## **BIOPHYSICS AND BIOCHEMISTRY**

### **Unit – I**

Scope of Biophysics – Colloids – Description, types and properties , Tyndall effect, Surface tension, Viscosity, Brownian movement, Filtration, Osmosis, Dialysis and Absorption. LASER

### **Unit -II**

Structure of atoms, molecules and chemical bond: Covalent bond ,hydrogen bond, disulphide bond, peptide bond, Vander waals bond ,Electrostatic bond, hydrophobic, hydrophilic interactions. Laws of Thermodynamics: Concepts of free energy, entropy, enthalpy, exergonic and endergonic reaction - high energy phosphate (ATP).

### **Unit-III**

Water: Electrolytic dissociation-acid-base balance; Buffer-Biological importance; pH-Acidosis-alkalosis; Electromagnetic spectrum visible-invisible regions; Effects of UV in biological system-DNA-proteins. Bioluminescence- types -mechanisms.

### **Unit-IV**

Biomolecules; structures- classification - properties and functions of proteins, lipids, carbohydrates and vitamins. Metabolism; proteins, lipids, carbohydrates and nucleic acids.

### **Unit-V**

Enzymes-Classification-characteristics-functions. Enzymes actions; Application of Michaelis-Menten equation. Factors affecting enzyme action- Enzyme inhibitors

### **Text Book:**

1. M.P.Arora, 2004. Biophysics, Himalaya Publishing, House. Delhi, India.
2. Rastogi.S.C. (2003) Biochemistry. Tata McGraw-Hill publishing company limited, New Delhi.

### **References:**

1. Thiravia Raj, S.(2001) Biophysics .Saras Publications ,Kanyakumari,India.
2. Palanichamy,S and Shunmugavelu, M.(2002)Principles of Biophysics. Palani Paramount Publications, Tamil Nadu.
3. Albert,L Lehinger, D.L.Nelson& Michael M Cox(1993).Principles of Biochemistry. CBS Publishers & Distributors, New Delhi India.
4. Singh ,S.P.2007. A Text book of Biochemistry. Third Edition.CBS , Publishers, New Delhi.

**Semester 1**  
**Core Practical V**

**Hours 6**  
**Credits 4**

**ANIMAL DIVERSITY AND CONSERVATION, CELL BIOLOGY, MICROBIOLOGY  
AND BIOPHYSICS & BIOCHEMISTRY**

**Animal Diversity**

1. Using world and Indian map mark Biodiversitically important regions, countries and centres.
2. Measuring Biodiversity- Quadrature method using various indices and calculate dominance and evenness.
3. Collection of endemic animals photos with information by using websites, journals, newspapers etc.

**Spotters :**

Two animals from each phylum from invertebrates and vertebrates.

**Cell biology:**

Cytological techniques

Micrometry - Measuring the diameter of microorganisms using ocular and stage micrometers.

Micro techniques: Tissue Fixation - processing - sectioning - spreading - staining.

Study of different types of cells: Blood cells - Differential count in man.

**Spotters:** Epithelial, connective, blood, muscle, bone, nerve and germ cells.

**Microbiology:**

Staining and identification of Protozoa, Bacteria, Fungi and Algae.

Demonstration of isolation of single bacterial colony: Streak plate method. Enumeration of bacteria in a sample- Viable plate count - Spread plate and pour plate methods.

Hanging drop preparation of Lactic acid bacteria.

Preparation of bacterial growth curve.

**Spotters:** Microorganisms relevant to theory syllabus.

**Biophysics and Biochemistry:**

1. Determination of pH using pH meter.
2. Salivary amylase activity in relation to pH.
3. Quantitative analysis of Protein, Glucose and Lipid.
4. Determination of Viscosity.

**Field Work:**

A visit to any protected area and submit the report on the observation .

**Record to be submitted for the Practical Examination**

**Semester II**  
**Core Course VI**

**Hours 6**  
**Credits 5**

## **ANIMAL PHYSIOLOGY**

### **Unit I**

Gastrointestinal physiology:- Digestion, Absorption and Assimilation in man - Digestive Enzymes - Digestion and Absorption of Carbohydrates, Lipids and Proteins – Defecation, regulation by gastrointestinal hormones. Intermediary metabolism. Respiration; External respiration - Internal respiration -Neural control of respiration, Respiratory pigments - Structure and functions of Haemoglobin - Lung-tissue gaseous exchange - regulation of breathing in mammal. Gill and cutaneous respiration.

### **Unit II**

Cardio Vascular Physiology: - Heart structure and function; Cardiac cycle - Cardiac rate - cardiac rhythm, ECG - Conduction and regulation of heart beat - heart block. Haemodynamics; Cardiac output -Venous return - blood pressure - normal 'hypo and hyper tension. Composition of blood - Properties and function of corpuscles and plasma - Erythropoiesis and haemopoiesis. Blood groups. Renal physiology; Structure of Kidney, Nephron - Formation of urine - Glomerular filtration and clearance- acid-base balance.

### **Unit III**

Neuromuscular Physiology; Muscles; Structure of skeletal, smooth and cardiac muscles, chemistry of muscle proteins -mechanism of muscle contraction - theories of contraction. Brain and spinal cord: structural organization, functions, Reflex action- conditional reflex, Autonomous nervous system - Cerebrospinal fluid. Neurons - structure and types - neuro transmitters- conduction and transmission of nerve impulse and synaptic transmission.

### **Unit IV**

Receptor physiology: Vision: Visual system structural organization - structure of retina- light and optics of eye, Biophysical phenomenon- chemistry of vision-colour vision- common defects of vision. Hearing and balance: Ear - structural organization - Auditory pathways - ear ossicles, structure of Cochlea, Organ of corti- Physiology of hearing and common cause of hearing impairment-membranous labyrinth- cristae and maculae - maintenance of equilibrium, sense organ of olfaction, touch and taste.

### **Unit V**

Reproductive physiology: Structural organization of male reproductive organ. Structural organization of female reproductive organs: Growth and maturation of graffian follicles, its hormonal control- Ovulation- Corpus luteum- phases of menstrual cycle-hormonal regulation- synchrony of ovarian and menstrual cycle-menarche menopause. Fertilization, pregnancy, parturition and lactation. Endocrine Physiology: Structure and function of pituitary, thyroid, parathyroid, pancreatic islets and adrenals.

### **Text Book**

Verma, P.S and V.K Agarwal, 1992. Animal Physiology, S. Chand and Co, New Delhi.

### **References:**

1. Mariakuttikan and N Arumugam, 2002. Animal Physiology, Saras publications, Nagercoil
2. Rastogi, S.L., 1997. Essential of Animal Physiology, New Age International Publisher, New Delhi.
3. Parameswaran, R., Ananthakrishnan T.N., 1999 Outlines of Animal Physiology. Viswanathan pvt. Ltd, Chennai.
4. William .S. Hoar. 1995. General and comparative physiology, 3<sup>rd</sup> Edition, Prentice Hall of India Pvt. Ltd, New Delhi.

**Semester II**  
**Core Course VII**

**Hours 6**  
**Credits 5**

## **DEVELOPMENTAL BIOLOGY**

### **UNIT-I**

Gametogenesis- Structure of gametes- egg and sperm, maturation, motility, semen secretion and composition. Fertilization: Recognition of egg and sperm, gamete fusion, activation of egg metabolism, rearrangement of egg cytoplasm. Cellular differentiation- morphological and physiological -Chemodifferentiation and cytodifferentiation.

### **UNIT-II**

Cleavage: Blastulation, Patterns of embryonic cleavage, mechanism and control of cleavage. Reorganising the embryonic cells: amphibian gastrulation; totipotency and pluripotency. Morphogenic movements. – Fate map.

### **UNIT-III**

Organiser or Induction. Differentiation: Organogenesis- ectoderm- formation of central nervous system- neurulation- neural tube, neural crest and development of brain- development of vertebrate eye. Mesoderm - development of heart : Endoderm- development of lungs, liver and pancreas.

### **UNIT-IV**

Regeneration:- Stimulus and suppression of regeneration. Types of regeneration- amphibian limb regeneration. Metamorphosis- types- amphibian metamorphosis; events and hormonal control of metamorphosis. Insect metamorphosis: moulting, growth and hormonal control.

### **UNIT-V**

Polarity and gradient: dorsal and ventral polarity – homeobox concept. Formation of extra embryonic membranes in Chick. Placentation in Mammals. Teratogenesis- Developmental mechanism of teratogenesis. Contributions of teratology to developmental biology. Stem cells and applications in animal reproduction.

### **Text Book**

Verma , P.S. Agarwal, V.K. and Tyagi, B.S. 1980. Chordate Embryology,  
SChand and Company Ltd. New Delhi.

### **References:**

1. Developmental biology- Scott F. Gilbert, 5<sup>th</sup> Edition., SA,
- 2 .Principles of Animal Developmental Biology-Suresh C.Goel, HPH Rastogi, V.B. and Jayaraj, M.S. 2002.
3. Berill N.J, 1992. Developmental biology, Tata McGraw Hill Publishing company ltd. New Delhi.
4. Twymann, R.M.2003. Developmental biology, Viva Books Private ltd. New Delhi.
5. Arora, M.P. 1992. Embryology, Himalaya Publishing House , New Delhi.
6. Berry, A.K.2013. An introduction to Embryology, EMKAY Publications, New Delhi.

## **GENE TECHNOLOGY**

### **Unit-I**

Introduction to Gene Technology. Scope. Overview of recombinant DNA technology. Deoxyribonucleic acid- molecular architecture. Chemical synthesis of DNA. Applications of Gene technology with reference to personalized medicine.

### **Unit-II**

Tools for DNA technology: Enzymes - Restriction endonuclease, ligases, SI nucleases, DNA polymerases, Ribonucleases, Deoxyribonuclease, Reverse transcriptase. Vectors: plasmid vectors – pBR 322, Ti plasmids– cosmid, phagemids viral vectors, transposons. Specialized vectors, Expression vectors, Binary and shuttle vectors. Klenow fragment, linkers, adaptors and homopolymers.

### **Unit –III**

Steps involved in Genetic Engineering: Methods of plasmid, DNA and gene isolation. Insertion of desired DNA fragment into vector - Cutting and joining of DNA strands - Construction of rDNA - Examples for chimeric DNA - creating and screening of DNA library - DNA hybridization. Methods of introducing DNA into bacteria-Ca mediated transfection, particle bombardment, microinjection, electroporation, sperm mediated transfer and lipofection.

### **Unit –IV**

Gene cloning in prokaryotes - identification and selection of recombinants by- insertional inactivation, colony hybridization and plaque hybridization. Chromosome walking, chromosome jumping. Cloning. DNA synthesis that encodes eukaryotic proteins. Genetic transformation and Recombinant gene expression in prokaryotes and eukaryotes.

### **Unit-V**

Gene amplification-PCR different schemes and applications. Molecular Markers: Restriction Fragment Length Polymorphism (RFLP) -Random Amplified Polymorphic DNA (RAPD) - application of RAPD. Minisatellite or Variable Number of Tandem Repeats (VNTRs). Microsatellite or Simple Sequence Repeats (SSRs). Reporter, marker and promoter genes. DNA chip technology, micro arrays-production and applications of DNA chips.

### **Text book:**

Dubey, R.C. 2007. A Text book of Biotechnology. S. Chand and Company Ltd, New Delhi.

### **References :**

1. Ignacimuthu, S.J. 2002. Basic Biotechnology. Tata Mc Graw- Hill Publishing Company, Ltd., New Delhi.
2. Arora, P.M.2003. Biotechnology. First Edition. Himalaya Publishing House, Mumbai. Gupta, P.K.2001. Elements of Biotechnology and Genomics (I edition) Rastogi Publication, Meerut.
3. Gupta, P.K. 2004. Biotechnology and genomics (I edition) Rastogi Publication, Meerut.
4. Trevan, M.D., Boffey, Goulding, K.H. and Standbury, P. 1987. Biotechnology: The Biological Principals. Tata Mc Graw – Hill Publishing Company Ltd., New Delhi.



**Semester II**  
**Course Core IX**

**Hours 6**  
**Credits 4**

## **BIostatistics AND STATISTICAL PACKAGES**

### **Unit I**

Biostatistics Descriptive statistics: Measures of central tendency: Mean, Median, Mode. Measures of dispersion: range, variance, Standard deviation, standard error, coefficient of variation. Graphical representation –histogram, frequency curve and polygon, Ogive.

### **Unit II**

Concept of probability, Characteristic features and functions of Binomial, Poisson and Normal distributions. Basics of Skewness and kurtosis, Pearson's correlation, Rank correlation and Regression.

### **Unit III**

Hypothesis testing – tests of significances, 95% confidences interval: Chi- square test, Student's t-test (paired Two independent samples, population mean Vs sample mean). one way. Definition of Two- way Analysis of variance (ANOVA) Post hoc tests: Duncan's multiple range tests, Turkey, SNK tests.

### **Unit IV**

Multivariate analysis: Multivariate analysis: Classification and organization of variable – arrays solving simultaneous equations for more than three variables (Gauss- DOO Little methods): Theoretical, basics and applications of steps involved and output of results in SPSS for: Multiple regression, Cluster analysis –Dendrogram, Principal Component and factor Analysis.

### **Unit V**

Statistical packages: Introduction to MS-Excel. SPSS spreadsheet -data editor-Creating, coding variables. Output viewer, Exploring data with SPSS-Graphics and diagrammatic representations with SPSS, Application of SPSS in biological Sciences.

### **Text book :**

1. Gurumani. N. 2004. An introduction to biostatistics. MJP Publishers, Chennai.
2. Rajathi. A. An introduction to SPSS. MJP publishers, Chennai.

### **References**

1. Sokal, R.R and F.J. Rohlf, 1981. Introduction of Biostatistics, WH freeman and co, USA.
2. Veer Bala Rosrogi. 2007. Fundamental of biostatistics. Ane Books India. Chennai.
3. Ramakrishnan, P. 1995. Biostatistics, Saras Publications, kanyakumari.
4. Prasad, S. 2001. Elements of Biostatistics. Rastogi Publication, Meerut.
5. Statistics in Biology. Bliss GI, 1970. Mc Graw Hill Book Company, Vol I and II. New Delhi.

**ANIMAL PHYSIOLOGY, DEVELOPMENTAL BIOLOGY, GENE TECHNOLOGY  
AND BIOSTATISTICS & STATISTICAL PACKAGES**

**Animal physiology:**

1. Estimation of RQ in fish with reference to light and temperature.
2. O<sub>2</sub> consumption in aquatic animal (fish).
3. Salt loss and salt gain in fish.
4. Separation of amino acids in the tissues (liver/muscle) of fish (Paper Chromatography).
5. Estimation of blood glucose level (GOD kit).
6. Estimation of blood urea (DAM method) using commercially available kits.

**Spotters:** Principles and applications of the following instruments: Kymograph, Spectrophotometer/Colorimeter, Sphygmomanometer, Chromatographic assembly, ECG and Retinogram.

**Slides :** T.S of Thyroid, T.S of Pancreas, T.S of Ovary, T.S of Testes, Muscles (striated, non-striated and cardiac).

**Developmental Biology:**

1. Chick embryo - blastoderm mounting,
2. The oestrus cycles in a mammal (Rat).
3. Pregnancy test using kit.

**Spotters:** Frog egg, cleavage, blastula, gastrula, Yolk plug stage. Chick developmental stages 13, 24, 36, 48, 72 and 96 hours.

**Gene Technology:**

1. Separation of insect tissue by SDS-poly acrylamide gel electrophoresis (SDS-PAGE) – Demonstration.
2. Standard graph preparation for DNA and RNA
3. Quantitative estimation of DNA
4. Quantitative estimation of RNA
5. Isolation of DNA from human saliva
6. Restriction digestion of lambda DNA ( Demo)
7. Agarose gel electrophoresis of DNA using Horizontal Submarine Gel System - Demonstration.
8. Demonstration of PCR, Western Blot.

**Spotters**

Vector pBR 322, electroporation, microinjection, Sanger's Dideoxy sequencing, Automated gene sequencer.

**Bio Statistics and statistical packages:**

1. Descriptive measures and calculation of mean, median, mode, standard deviation, standard error and coefficient of variation for individual series.
2. Testing the correlation coefficient and regression.
3. Testing the significance – Non – parametric - Chi- square test  
Parametric - Student T test
4. Demonstration: Statistical packages – problem solving with SPSS.

**Record to be submitted for the Practical Examination**

**Semester III**  
**Core Course XI**

**Hours 6**  
**Credits 5**

## **IMMUNOLOGY AND IMMUNOTECHNOLOGY**

### **Unit I**

Introduction to immune system. Innate and Adaptive immunity – Lymphoid system: Primary and secondary lymphoid organs, tissues. Cells of immune system: lymphoid lineage, myeloid lineage. Molecules- complement, acute phase proteins, interferon, lymphokines and cytokines.

### **Unit II**

Antigens: Types of antigens – factors of antigenicity. T cell and B cell epitopes, haptens, adjuvants and carriers. Antibodies: Ultra structure of immunoglobulin, types, paratopes, characteristics and functions. Monoclonal and polyclonal antibodies. Antibody receptors- T cell receptors (TCR), Genes for TCR, TCR diversity. Immune response- Humoral and cell mediated immune response.

### **Unit III**

Hypersensitivity: Definition and classification; Types- I, II, III, IV and V. Major Histocompatibility Complex (MHC): Genomic organization, MHC molecules, peptide binding. Complement activation: Classical and Alternate pathway. Transplantation immunology: Types of grafts- Allograft rejection- Prevention of graft rejection.

### **Unit IV**

Vaccination: Principle, antigen as vaccines, subunit vaccines, recombinant vaccines, anti idiotypic antibodies as vaccines, Vaccination schedule. Tumour immunology: Tumour antigens- Immune response to tumours- Immunotherapy to tumours- Tumour vaccines. Autoimmune diseases. Immunodeficiency- inherited and acquired.

### **Unit V**

**IMMUNOTECHNOLOGY:** Clinical methods for detection of antigens and antibodies: Immunodiffusion: Ouchterlony analysis (Single radial diffusion), Double immunodiffusion. Immunoelectrophoresis: Immunocontraception. Binder- Ligand assays: RIA, ELISA, EMIT. Histocompatibility testing: HLA typing. Autoimmune disease detection: Rheumatoid arthritis, Hepatitis – B virus test. Immune complex detection: Rossette Forming Array, Plaque Forming Array.

### **Text books:**

1. Rao, C.V. 2006. Immunology. Narosa Publishing House, New Delhi.
2. Kannan, I. 2007 Immunology, MJP Publishers, Chennai.
3. Arumugam, N. *et al.*, 2005. Immunology and Microbiology, Saras Publications, Kanyakumari.

### **References:**

1. Janis Kuby. 1997. Immunology. W.H. Freeman & company, New York.
2. Ivan M. Roitt *et al.*, Essential Immunology. XII Edition, Wiley- Blackwell Publishers. UK.
3. Shetty, N. 2006. Immunology. New Age International (P) Limited, Publishers. New Delhi.

**Semester III**  
**Core Course XII**

**Hours 6**  
**Credits 5**

## **MOLECULAR GENETICS**

### **Unit I**

The birth of Molecular genetics. Nucleic acids: Structure and chemical nature of DNA and RNA, types and properties. Denaturation and renaturation of double helix. The Gene – cistron. Gene – protein relations - Globin gene. Constitutive Genes and Inducible Genes, Interrupted genes and gene families. Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids. Prokaryotic and Eukaryotic genome- human genome.

### **Unit II**

DNA replication, repair and recombination: Watson and Cricks's model for DNA Replication, The Meselson and Sthal explanation- replication units, replication origin and replication fork, fidelity of replication, extra-chromosomal replicons and Enzymatic DNA synthesis. Models of DNA Replication, Termination of Replication. DNA damage and repair mechanisms. Mechanism of DNA Replication in Prokaryotes and in Eukaryotes.

### **Unit III**

RNA synthesis and processing in prokaryotes: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation. RNA synthesis and processing in Eukaryotes: Enzymatic Synthesis of RNA. Binding of RNA Polymerase to Promoter, Initiation, Elongation and Termination phase, Anti-termination and attenuation. Initiation of transcription in eukaryotes,

### **Unit IV**

Protein synthesis and processing and Regulation: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination. Characteristics of genetic code and Wobble Hypothesis. Aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, translational proof-reading, translational inhibitors, post-translational modification of proteins.

### **Unit V**

Control of gene expression at transcription and translation level: Regulation of prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing. Hormonal control of gene expression.

Regulation of gene action in prokaryotes: Transcriptional Control mechanisms, Translational Control mechanisms -The operon model (lac, trp operons). Regulation of gene action in Eukaryotes.

### **Text book**

1. Gupta. P.K.2003. Genetics. Rastogi Publishers. Meerut.
2. G.S. Stent and Richard Calendar., Molecular Genetics (Second edition) CBS. !986.

### **References:**

1. Gardner, E J. 1984. Principles of Genetics. Jhon Wiley and Sons Ltd. New York.
2. Levin B, Gene IX. 2014. Jones and Bartlett Publishers
3. Tom Strachan and Andrew P Read. Human Molecular genetics 4th Edition, Tailor and Francis Group, New York;
4. Singh BD.2006. Fundamentals of genetics. Kalyani Publishers. Lucknow.

**Semester III**  
**Core Practical XIII**

**Hours 6**  
**Credits 5**

**IMMUNOLOGY & IMMUNOTECHNOLOGY, MOLECULAR GENETICS, APPLIED BIOTECHNOLOGY & BIOINFORMATICS**

**Immunology and Immunotechnology;**

1. WIDAL test for typhoid detection
2. RPR test for Syphilis detection
3. Mancini's Single Radial immunodiffusion
4. Ouchterlony's Double immunodiffusion
5. Demonstration of Ig G by precipitation ring test
6. Demonstration for haemagglutination
7. Demonstration Immuno- electrophoresis

**Spotters:**

**Immunology and Immunotechnology**

Lymphoid organs in Mouse, Lymph node, Lymphocytes, Vaccine, ELISA, RIA.

**Molecular Genetics:**

Human Karyotypes - normal male and female and Syndromes (Sickle Cell Anaemia), DNA, RNA- types.

**Applied Biotechnology:**

Monoclonal antibodies, DNA finger printing, DNA chip, Cell line, Knockout mouse

Biofuels, Probiotics, Bioremediation, SCP, GM Food.

**Bioinformatics**

**Spotters:** Gen Bank EMBL, DDBJ, SWISS PROT, PIR, BLAST, FASTA, PHYLIP, Gen Bank and Dendrogram.

**Semester III**  
**CBE I**

**Hours 6**  
**Credits 4**

## **APPLIED BIOTECHNOLOGY**

### **Unit – I**

Medical Biotechnology – Applications of r-DNA technology in human health - Recombinant DNA proteins and their uses: i) Interferon, ii) Interleukin, iii) Factor VIII, iv) Urokinase and v) Tissue plasminogen activator – Recombinant vaccines: Hepatitis-B, Rabies and FMD Vaccine - Commercial production of penicillin – DNA finger printing and its use in Forensic science

### **Unit – II**

Hybridoma technology: Production and Application of monoclonal and polyclonal antibodies – Gene Therapy — Cell bank – Animal bioreactor and molecular pharming. Historical background and value of transgenic animals – transgenic animal model development – Transgenic mouse – embryonic stem cell method and pronucleus method – Transgenic fish and sheep. Bioethics in animal genetic engineering.

### **Unit – III**

Agricultural Biotechnology: Genetically Modified Microorganism – Phytoremediation . Biofertilizers – Bacterial, Rhizobial, Azatobacter, Azospirillum inoculants– Nitrogen , Phosphate and sulphate fixing mechanism, Green manuring – Cyanobacterial inoculants – Mycorrhizal fungi. Benefits of biofertilizers. Biopesticides in pest management.

### **Unit - IV**

Industrial and Microbial Biotechnology – Fermentation technology: Fermenters, Selection of microbes, Fermentation medium – Production of Penicillin, Vitamin B12, Amino acids and Proteases – Production of organic compounds by microbial fermentation – Ethanol and acetone production of Antibiotics – microbes used – commercial production of antibiotics – Single Cell Protein (SCP) from microorganism – SCP process.

### **Unit – V**

Environmental Biotechnology – Bioremediation – *In-situ*, and *Ex-situ* Bioremediation – Use of genetically engineered bacterial strains – Bioremediation of dyes – Bioremediation in paper and pulp industry. Immobilized culture – Bioremediation of heavy metals: Mechanism of metal removal – Bioremediation of coal waste through VAM fungi – Bioremediation of xenobiotics.

### **Text book :**

Gupta, P.K. Biotechnology and genomics (Edition, 2009) Rastogi Publication, Meerut, India

### **References**

1. Dubey, R.C. A Textbook of Biotechnology (Edition, 2006) S. Chand & Co. Ltd. Ram Nagar, New Delhi, India
2. Das, H.K. Textbook of Biotechnology (Edition, 2006) Wiley Dream Tech, India Pvt. Ltd. New Delhi, India
3. Ramawat, K.G and Shaily Goyal. Comprehensive Biotechnology (Edition, 2009), S.Chand & Co. Ltd. Ram Nagar, New Delhi, India

**Semester III**  
**CBE - II**

**Hours 6**  
**Credits 4**

## **BIOINFORMATICS**

### **Unit I**

Bioinformatics : Need for Bioinformatics technologies. Biological databases-Primary, composite and Secondary databases. Specialised databases- flybase.

### **Unit II**

Genomics: Structural , functional and Comparative genomics. DNA sequencing. techniques- Sanger method, Automated method. DNA microarrays- applications, gene chips, levels of gene expression, capturing expression profile.

### **Unit III**

Proteomics- Protein sequencing- Determination of structure of protein –NMR and X-ray crystallography. Protein structure prediction. Protein expression analysis. Isoelectric focussing, Structural databases- SCOP,CATH.

### **Unit IV**

Pattern matching: PSA and MSA, Local and global sequence alignment . Phylogenetic Tree - phenetic and cladistic approach, clade, Taxon, Mode. Dendogram, Cladogram, Phylogram. Monophyletic, Paraphyletic and polyphyletic. Root and unrooted trees.

### **Unit V**

Drug discovery- Approaches-Target, Identification and validation identification and optimisation of the lead compound, molecular docking .Personalised medicine.

### **Text Book:**

1. Ignacimuthu. S.J 2013. Basic Bioinformatics Narosa publishing House, New Delhi, India.
2. Attwood T.K and Parry-Smith D J 2004. Introduction to Bioinformatics. Pearson Education ( Singapore).

### **References**

1. Zoe Lacroix and Terence Critchlow. 2003. Bioinformatics. Morgan Kaufmann publishers, San Francisco.
2. Yi-Ping Phoebe chen ( Ed.) 2007.Bioinformatics technologies – Springer publications
3. Pavel A Pevzner.2000.Computational Molecular Biology – an algorithmic approach. MIT Press, Cambridge, USA.



**Semester IV**  
**Core Course XIV**

**Hours 6**  
**Credits 5**

## **APPLIED ECOLOGY**

### **Unit I**

Types of toxins, Toxicological methods: Acute, Sub-acute, chronic and special tests. Lethal doses. Pollution: Atmospheric, water, land, thermal, noise and radiation pollution, biological and molecular indicators and their role in environmental monitoring.

### **Unit II**

Ecology of Space Travel – Introduction - Environmental problems of space travel: Physiological Changes during space travel, oxygen equipment, pressure suits, Life support system-Storage or non regenerating system, partial regenerating system, complete regenerating system, mechanism of regenerating system, mechanical, Chemo regeneration, Bio-regenerating system - Exobiology - The Extrabiospheric Environment.

### **Unit III**

Remote sensing- Physical basis for remote sensing- Energy and Plant relationships - Energy and Animal Relationships - Process of information extraction - interpretation- The nature of tone and texture - Photogrammetry – Role of remote sensing in ecological research - Inventory and mapping - Quantitating the environment - Flow of matter and energy - Evaluating change and alternative solutions.

### **Unit IV**

Environmental monitoring - Objectives- benefits – classifications ; occupational and general environment monitoring – Biological monitoring : types of monitoring - Ecological effects of monitoring- Biological indications; concepts, advantages and disadvantages - Biological indicators of pollution ; saprobic system - biotic indices – chemical monitor species ; vertebrates, invertebrates, plants – advantages of chemical monitor species - chemical methods of monitoring .

### **Unit V**

Bio remediation- Scope and merits – approaches to bioremediations - ecology of bioremediation - technology of bioremediation – FOCI of R & D for bioremediation ; Complex organic pollutants ; metal polluted soil and sediments – Current status - Phytoremediation - remediation of contaminated sites using plants - Field scale applications.

### **Text Books**

1. Ecology and Environment- by P.D.Sharma, Rastogi Publicaitons, X edition, 2009.
2. Fundamentals of Environmental Pollution- by Krishnan Kannan , Chand & Co ., 1997.
3. Concepts of Ecology\_by N. Arumugam. Saras publications.1983
4. Fundamentals of Ecology – by Eugene P. Odum, III rd Edition, Toppan Company , 1985.

**Reference:**

1. Claude, F., Christiane, F., Paul, M. and Jean, D. 1998. Ecology Science and Practice. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Verma P.S, and V.K Agarwal 1996. Principles of Ecology S. Chand and Co, New Delhi.
3. Arumugam, N. 1992. Concepts of ecology. Saras publication, Nagercoil.
4. Kumar, U. and M.J Asija.2006. Biodiversity, Principle and Conservation. Student Edition, Jodhpur.

**Semester IV**  
**Core Practical XV**

**Hours 6**  
**Credits 5**

**APPLIED ECOLOGY, AQUACULTURE & RESEARCH METHODOLOGY**

**Applied Ecology**

1. Estimation of dissolved oxygen,
2. Estimation of dissolved BOD
3. Estimation of dissolved COD
4. Estimation of salinity, Alkalinity, Calcium in water samples.
5. Analysis of industrial effluent for TS, TDS, TSS.
6. Estimations of LC 50 and LD 50

**Spotters:**

Pollution – Air, water, land, thermal, noise and radiation pollution.

**Aquaculture:**

1. Measurement of fish / prawn.
2. Measurement of pond ecosystem.
3. Water quality parameters- turbidity,
4. Estimation of nitrites and phosphates,

**Spotters :**

Catla, Rohu, Mirigal, *Penaeus monodon*, *Macrobrachium rosenbergii*, Transgenic fishes, aquarium fishes, MPEDA

**Research methodology**

Centrifuge, Autoradiography, paper chromatography, Agarose and SDS-PAGE Electrophoresis

Indexing and abstracting services, Bibliographic databases, abstract model for a paper.

**Field Work:**

Visit to a Fish Farm or Laboratory / Instrumentation Centre.

**Record to be submitted for the Practical Examination**

**Semester IV**  
**CBE III**

**Hours 6**  
**Credits 4**

## **AQUACULTURE**

### **UNIT I**

Present status of aquaculture in India. Culture systems: freshwater, brackish water and coastal aquaculture. Present status and importance of Mariculture in India. Biological characteristics of culturable species. Economically important freshwater (Indian major carps-Cat fishes-live fishes-exotic fishes) and marine water fishes (Sea bass).

### **UNIT II**

Fresh water aquaculture - Culture of Indian Major carps–pond construction–pond preparation–stocking– fish feeds – natural feeds – plankton; artificial feed–pellets – encapsulated feed – live feed – Artemia, Rotifer. Feeding management–water quality management – O<sub>2</sub>, temperature, CO<sub>2</sub>, NH<sub>3</sub> –water exchange–aerators. Diseases-fungal (Saprolegnia and Achlya); Bacterial (Fish tuberculosis, dropsy and fin rot disease) and prophylaxis. Monoculture and Polyculture.

### **UNIT III**

Fish breeding techniques: Fish seed from natural sources- Bundh breeding–Induced breeding – hypophysation – hybridization – transport of fish seed – hatchery techniques. Monosex culture (Tilapia), waste water fish farming (sewage fed fish culture) – Ornamental fish culture.

### **UNIT IV**

Economically important freshwater and marine shrimps. Shrimp farming–freshwater farm culture – *Macrobrachium malcomsonii*, marine shrimp farming – *Penaeus monodon* – pond construction – seed collection – nursery management – feeding – diseases – Viral (White spot syndrome baculovirus - WSBV); Bacterial (Black spot disease); Fungal (Yeast infection) and prophylaxis of shrimps and prawns.

### **UNIT V**

Integrated fish farming: Paddy cum fish culture; duck cum fish culture; fish cum fish culture; fish cum cattle farming. Harvest and post harvest technology: Harvesting – crafts and gears used in fish harvest; Harvesting methods, handling, preservation and transport of fishes and prawns. Fish by- products, marketability and economics–MPEDA, CMFRI, CIBA and CIFRI.

### **Text book :**

Aquaculture- Principles and Practices (II Edition). Pillai TVR, Kutty MN.

### **References :**

1. Jhingran VG, 1982. Fish and fisheries of India, Hindustan Publishing Corp.
2. Rath RK. Freshwater aquaculture, 1993. Scientific Publishers.
3. Pandey and Shukla, 2007. Fish and fisheries (II Edition), Rastogi Publishers.
4. Santhanam.P, Ramanathan. N and Jegatheesan. G, 1990. Coastal Aquaculture in India.
5. Aquaculture: Dr. N. Arumugam, Saras Publications.

**Semester IV**  
**CBE IV**

**Hours 6**  
**Credits 4**

## **RESEARCH METHODOLOGY**

### **UNIT I**

Library and Research Documentation: Methods of literature collection, preparation of index card and reference cards - Data collection and data interpretation for project work. Preparation of Research papers, Technical papers (Articles for News papers and Telecasting) and Monographs. Preparation of dissertation and thesis. Impact factors, citation index and copyright. Preparation and presentation of research paper for Symposia, Seminar and Conferences.

### **UNIT II**

Principles of Microtechniques-Fixative and Histological stains-Fixation, Tissue processing and staining-freezing Microtomy (Cryostat), Histochemical stains of Carbohydrates, Proteins, Lipids, Enzymes and DNA. Chromatography-Paper, Column, Ion-exchange, HPLC, TLC, GLC, GC.

### **UNIT III**

Principles, Types and application of Electrophoresis - Agar Gel, PAGE, SDS-PAGE, Gel Documentation, 2D Electrophoresis; Principles and applications: pH meter, Colorimeter, Spectrophotometer –UV visible, UV Atomic Absorption Spectrophotometer, NMR, Flame photometer.

### **UNIT IV**

Centrifuge: Types of centrifuges: Analytical Centrifuge – Ultra Centrifuge – Differential Centrifuge – Cell fractionation –Application of Centrifugation - Cell culture techniques: Tissue culture laboratory- cell proliferation measurements, cell viability testing, culture media preparation and cell harvesting methods.

### **UNIT V**

Radioisotope and mass isotope techniques in biology: Sample preparation for radioactive counting, autoradiography and Magnetic Resonance Imaging (MRI)- Geiger Muller Counter, Scintillation Counter. Energy value of biological material: wet combustion,. Bomb calorimeter - estimation of calorific value.

### **Text books;**

1. Guramani. N. (2009). Research methodology for biological sciences. MJP publishers, Chennai.
2. Kothari CR, 1990. Second edition. Research Methodology – Methods and Techniques. Wiley Eastern,Ltd., New Delhi.

### **REFERENCES**

1. Laboratory Experiments in Microbiology. Case CL and Johnson TR, 1984. The Benjamin Cummings Pub. Co., London.
2. Environmental Instrumentation. Fritschen LJ and Gay LW, 1979. Springer Verlag, New York.
3. Animal Tissue Techniques. IV Edition, Humason GL, 1979, Freeman WH and Co., San Francisco.
4. Methods of Protein and Nucleic acid Research. Osterman A, 1984. Springer Verlag, New York.
5. An Introduction to Practical Biochemistry. Plumber DT, 1971, Tata Mc Graw Hill Co.,