

**ST. MARY'S COLLEGE (AUTONOMOUS), THOOTHUKUDI**

**Master of Science ( Zoology )**

**Course Structure (w.e.f 2017-18 )**

**Semester – I**

Subject	Subject Code	Title of the Paper	Contact Hours / Week	Credits	Max .Marks		
					CIA	ESE	Total
Core I	17PZOC11	Biochemistry	6	5	40	60	100
Core II	17PZOC12	Genetics and Evolution	6	5	40	60	100
Core-III	17PZOC13	Cell and Molecular Biology	6	5	40	60	100
Elective I	17PZOE11	Environmental Biology and Resource Management / Parasitology	6	5	40	60	100
Practical I	17PZO CR1	17PZOC11, 17PZOC12, 17PZOC13	6	3	40	60	100
			<b>30</b>	<b>23</b>	<b>200</b>	<b>300</b>	<b>500</b>

**Semester – II**

Subjects	Subject Code	Title of the Paper	Contact Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core IV	17PZOC21	Animal Physiology	6	5	40	60	100
Core V	17PZOC22	Techniques in Biology	6	5	40	60	100
Core-VI	17PZOC23	Developmental Biology	6	5	40	60	100
Elective II	17PBOE21	Ecotourism and Wildlife Management /Plant Cell and Tissue Culture	6	4	40	60	100
Practical II	17PZO CR2	17PZOC21, 17PZOC22, 17PZOC23	6	3	40	60	100
Self Study Course (Compulsory)	17PZOSS1	Zoology for Competitive Examinations.		+2		100	100
			<b>30</b>	<b>22+2</b>	<b>200</b>	<b>400</b>	<b>600</b>

**Semester – III**

Subject	Subject Code	Title of the Paper	Contact Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core VII	17PZOC31	Computational Biology	6	5	40	60	100
Core VIII	17PZOC32	Biotechnology	6	5	40	60	100
Core-IX	17PZOC33	Aqua culture Biotechnology	6	5	40	60	100
Practical III	17PZOCR3	17PZOC31, 17PZOC32, 17PZOC33	6	3	40	60	100
Project	17PZOP31		6	5	40	60	100
Self Study Course (Optional)	17PZOSS2	Women and Health care		+2		100	100
			<b>30</b>	<b>23+2</b>	<b>200</b>	<b>300+100</b>	<b>500+100</b>

**Semester – IV**

Subject	Subject Code	Title of the Paper	Contact Hours / Week	Credits	Max. Marks		
					CIA	ESE	Total
Core X	17PBCC41	Marine Biology	6	5	40	60	100
Core XI	17PZOC42	Immunology	6	5	40	60	100
Core-XII	17PZOC43	Applied Microbiology	6	5	40	60	100
Elective III	17PZOE41	Applied Entomology / Endocrinology	6	4	40	60	100
Practical IV	17PZOCR4	17PZOC42 17PZOC43	4	2	20	30	50
Practical V	17PBCCRI	17PBCC41	2	1	20	30	50
			<b>30</b>	<b>22</b>	<b>200</b>	<b>300</b>	<b>500</b>

## Master of Science (Zoology)

Components	Credit per Semester	No. of Courses	Total
Core	5	12	60
Practical	3	3	9
	2	1	2
	1	1	1
Core Elective	5	1	5
Core Elective	4	2	8
Project	5	1	5
			90
Self Study Course (Compulsory)	+2	1	+2
Self Study Course (optional)	+2	1	+2
			90+2+2

SEMESTER I			
Core I : Biochemistry			
Code: 17PZOC11	Hrs/Week: 6	Hrs/Sem: 90	Credits: 5

## Objectives

- To present and relate the biochemical events at metabolic levels
- To exemplify the relationship between the conformation of proteins, carbohydrates, lipids, nucleic acids, enzymes and their biological activity.
- To know the generation and storage of metabolic energy and biosynthesis

### Unit I Atoms and Molecules

Structure of an atom, chemical bonds (ionic, covalent and hydrogen). Structure and properties of water. Vanderwaals interaction, role of water in life. pH and buffers- Weak acids and alkalies, Henderson and Hasselbalch's equation- Biological buffer system

### Unit II Carbohydrates

Classification – structure – properties and functions of carbohydrates. Metabolism: glycolysis – TCA cycle – glycogenolysis – glycogenesis – gluconeogenesis – HMP shunt pathway -Cori cycle.

### Unit III Protein

Classification – structure – properties and functions of amino acids – classification – properties and functions of proteins – metabolism of proteins – metabolism of tryptophan – phenylalanine – tyrosine.

### Unit IV Lipid

Classification – Biological importance of simple lipids (Triglycerides and Wax), compound lipids (phospholipids and glycolipids) and derived lipids (saturated, unsaturated and cholesterol) –  **$\beta$  oxidation, ketogenesis** – biosynthesis of fatty acids – disorders of fat metabolism (xanthomatosis, atherosclerosis). Role of liver in fat metabolism.

### Unit V Enzymes and Nucleic acids

Nomenclature – classification – properties – functions and mechanism of enzyme action and its regulation – coenzyme, isoenzyme. Nucleic acids - chemistry of nucleic acids, structure, biosynthesis and degradation, purine and pyrimidine nucleotides and disorders of their metabolism.

## Books for Reference

1. Jain.J.L, Sunjay Jain, Nitin Jain.2007. Fundamentals of Biochemistry, S.Chand & Company. New Delhi.
2. Lehninger, A.1993. Principles of Biochemistry, CBS Publishers & Distributers, New Delhi.
3. AmbikaShanmugam, 1997. Fundamentals of Biochemistry for Medical Students,Navabharat Printers and Traders, Madras.
4. Styer.L.W.H.1995. Biochemistry, Freeman & Company, Sanfrancisco.
5. Murray.R.K. Gaaner.D.K, Mayer.P.A, Rodwell.V.W.1996. **Harper's Biochemistry**, 24<sup>th</sup> edition. Prentice Hall of Japan, Inc, Tokyo.
6. Rastogi.S.C. 2003. Biochemistry, Second edition. Tata McGraw Hill Publishing Company Ltd.
7. Satyanarayana.U and U.Chakrapani,2013. Biochemistry,Fourth edition. Elsevier & Allied. Haryana andKolkata.
8. Edward Staunton West, Wilbert,R. Todd. Howard S.Mason, John .T.Van. Bruggen. 1966. Biochemistry, Fourth edition. Oxford and IBH Publishing Co. New Delhi.
9. **Bernard L. Oser. 1965. Hawk's Physiological Chemistry**, 14<sup>th</sup> edition.Tata McGraw Hill Publishing Company Ltd.New Delhi.
10. Chattergia.M.N. A textbook of Biochemistry. Jaypee Brothers, Medical Publishers PvtLtd.New Delhi.

## PRACTICALS

### Hrs/Week: 2

1. Effect of pH on salivary amylase activity.
2. Effect of salivary amylase activity on substrate concentration.
3. Salivary amylase activity in relation to enzyme concentration.
4. Preparation of standard graph for carbohydrate
5. Preparation of standard graph for protein
6. Quantitative estimation of muscle protein
7. Determination of iodine number of an edible oil
8. Separation of lipids by TLC -Demonstration only
9. Separation of amino acids by paper chromatography / Ninhydrin method
10. Preparation of buffers : acetic acid and acetate buffers

<b>SEMESTER I</b>			
<b>Core II : Genetics and Evolution</b>			
<b>Code: 17PZOC12</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits: 5</b>

### Objectives

- To provide a deeper meaning and conceptual framework to heredity.
- To establish comprehensive knowledge of genetics and human welfare.
- To comprehend the scientific concepts of animal evolution through the process and theories in evolutionary biology

### Unit I **Chromosomes and Genetic Recombination.**

Introduction –human karyotype analysis – chromosome banding technique and its significance – linkage – comparison of complete and incomplete linkage – **Morgan’s** experiments – theories and molecular mechanism of crossing over – construction of chromosome map – three point test cross (*Drosophila*), tetrad analysis (*Neurospora*) and somatic cell hybridization (human)

### Unit II **Microbial Genetics**

Recombination in bacteria – conjugation – transformation – transduction – sexduction – transposons – mobile DNA elements in prokaryotes – retroviruses and retrotransposans- modes of transposition – genetic and clinical significance.

### Unit III **Population Genetics and Human Genetics**

Gene pool concept – gene and genotype frequencies – Hardy – Weinberg equilibrium – algebraic proof- estimation of equilibrium gene frequencies for complete dominance, co-dominance, multiple alleles and sex linked inheritance Human genetic diseases – Alzheimer’s – Huntington’s disease – glycogen storage diseases– genes in pedigree – Pharmacogenetics – drug metabolism – genetic variation in the effect of drugs.

### Unit IV **Evolutionary Concepts**

Neo- Lamarckism, Neo- Darwinism - stabilizing, directional and diversifying selection, experimental evidences - Modern concepts of recapitulation theory, genetic and non-genetic variations, origin and evolutionary significance.

## Unit V      Speciation

Species - modes of speciation. Genetic drift- evolutionary significance - isolating mechanisms and their significance – **Simpson's adaptive grid concept** – micro, macro, and mega evolution - evolutionary rates-evolution of man -cultural evolution

### Books for Reference

1. Strickberger, M.W.1985. Genetics 3<sup>rd</sup> edition, Maxwell Macmillan International Edition, New York.
2. Gardner, Simmons and Snustad, 1991, Principles of Genetics , 6<sup>th</sup> edition Prentice Hall. inc.New york.
3. Klug, W.S.and Cummings M.R.2000. Concepts of Genetics. 6<sup>th</sup> edition Prentice Hall. Inc.New york
4. Emmanuel, C., Ignacimuthu, S. and S. Vincent, 2009. Applied Genetics – Recent Trends and Techniques. MJP Publishers, Chennai.
5. Amita Sarkar, 2011. A Text Book of Human Genetics, Wisdom Press, New Delhi.
6. Krebs, J.E., Goldstein, S.and T Kilpatrick, 2011. Genes X 10<sup>th</sup> edition. Jones Bartlett Publishers, USA.
7. William D. Stansfield, 1977. The Science of Evolution .MacMillan Publishing Co. New York .
8. Ledyard Stebbins,1970. Processes of Organic Evolution . Prentice Hall of India.
9. Ernst Mayr,1970. Populations, Species and Evolution .An Abridgment of Animal Species and Evolution. The Belknap Press of Harvard University
10. Dobzhansky, Francis J. Ayala, G. Ledyard Stebbins James W. Valentine Evolution,1973.Surjeet Publications. Delhi .

### PRACTICALS

#### Hours/Week : 2

1. Construction of genetic map for a given three point test cross.
2. Preparation of culture medium of Drosophila
3. Tracing the stages in the life cycle of Drosophila.
4. Observation of common mutants of Drosophila
5. Survey of simple Mendelian traits and ABO blood group in the class population and estimation of gene and genotype frequencies based on Hardy – Weinberg law.
6. Demonstration of role of random genetic drift in small populations using simulation (beads)
7. Analysis of dermatoglyphic data (finger print) of the class population.
8. Construction of pedigree
9. Bacterial conjugation (chart).
10. Industrial melanism- Peppered moth

<b>EMESTER I</b>			
<b>Core III : Cell and Molecular Biology</b>			
<b>Code: 17PZOC13</b>	<b>Hrs/Week: 6</b>	<b>Hrs/Sem: 90</b>	<b>Credits: 5</b>

### **Objectives**

- To appreciate the interrelation and interdependence of different cell structures and functions
- To impart comprehensive knowledge on molecular mechanisms of cellular events and their control.

#### **Unit I Cell and Transport Across Cell Membranes**

Molecular organization of cell membrane – molecular models (Unit membrane, Trilaminar and Fluid Mosaic). Types of transport -diffusion –membrane transport proteins – uniportercatalysed transport – membrane electrical potential. Active transport by ATP powered pumps. Co -transport by symporters and antiporters –intercellular junctions.

#### **Unit II Cell Signaling**

Cell- cell signaling - cell surface receptors – types - G protein coupled receptors- ion channel receptors- second messengers (DAG, Ryanodine receptors, Ca<sup>2+</sup>Calmodulin complex and cGMP) - signaling from plasma membrane to nucleus.

#### **Unit III Protein Synthesis and Processing**

Ultrastructure of ribosome – endoplasmic reticulum – golgi complex. Protein synthesis- translational proof – reading. Post translational modification (disulfide bond formation, correct folding, assembly into multimeric proteins and protein glycosylation in endoplasmic reticulum).

#### **Unit IV Chromosome and Genes**

Chromosome- types - organization of genes in chromosomes – introns and exons – simple , complex, split and overlapping genes – molecular basis of mutation – transition- transversion – frame shift – induction of mutation – repair systems to counteract DNA damage and mutation.

#### **Unit V Cell Division**

Mitosis - meiosis – molecular mechanisms for regulating mitotic events – cyclins and their kinases (cdks) –cell death and its regulations - characteristics of cancer cells – causes and onset of cancer.



## **Books for Reference**

1. De Robertis, E.D.P. and Robertis, E.M.F. 1988. Cell and Molecular Biology 9<sup>th</sup> International Edition, K.M. Varghese Company, Mumbai.
2. NeolO.Thorpe. 1984. Cell Biology. John Wiley & Sons.
3. David M.Prescott. 1988. Cells – Principles of Molecular Structure and Function. Jones and Bartlett Publishers.
4. Lodish, H., Baltimore D. and J. Darnell. 1999. Molecular Cell Biology. Scientific American Book, Inc, USA.
5. Ajoy Paul. 2007. Text Book of Cell and Molecular Biology. Books and Allied (P) Ltd. Kolkata.
6. Bhamrah, H.S. 1995. Molecular Cell biology. Anmoi Publications Pvt Ltd, New Delhi.
7. David Freifelder.1995. Essentials of Molecular Biology. Narosa Publishing House, New Delhi.
8. SivaramaSastry, K., Padmanaban G. and C. Subramanyam. 1994. Text Book of Molecular Biology. MacMillan India Limited, New Delhi.
9. Gerald Karp. 1984. Cell Biology. Second Edition McGraw Hill.
10. Prakash S. Lohar. 2007. Cell and Molecular Biology. MJP Publishers, Chennai.

## **PRACTICALS**

### **Hrs / Week : 2**

1. Preparation of squamous epithelial cells.
2. Preparation of human blood smear.
3. Preparation of cockroach haemolymph smear.
4. Mitotic cell division in onion root tip.
5. Meiotic cell division in grasshopper testis.
6. Giant chromosome in chironomus larva.
7. Observation of blood smear of frog.
8. Observation of sarcomere, columnar epithelial cells and ciliated epithelial cells.
9. Observation of different types of tissues : bone, hyaline cartilage, liver, kidney and nervous tissue.

SEMESTER I			
Elective I : Environmental Biology and Resource Management			
Code: 17PZOE11	Hrs / Week:6	Hrs/Sem :90	Credits : 5

### Objectives

- To create environmental awareness among students.
- To inculcate knowledge about the natural resources, their conservation and efforts towards their sustainability.
- To generate concepts of prediction, prospecting, promotion, preservation and vision about restoration and resuscitation of dwindling natural resources.

### Unit I Environment and Social Issues

From unsustainable to sustainable development - environmental ethics, issues - possible solutions – urban problems related to energy - consumerism and waste products - climate change - global warming – ozone depletion - acid rain.

### Unit II Human Population & Environment

Population growth – population explosion – family welfare programmes - environment and human health – human rights – value education – women and child welfare – Role of IT in environmental and human health.

### Unit III Natural Resources

- Forest resources: Use and over exploitation- deforestation- timber extraction- mining- dams and forests – tribes.
- Water resources: Use and over exploitation of ground water – surface water – conflicts over water- dams - benefits and problems - conservation of water.
- Land resources: Land as a resource- land degradation- soil erosion and desertification - conservation of soil
- Energy resources: Growing energy needs – renewable and non-renewable energy sources – use of alternate energy source.

### Unit IV Biodiversity and Conservation

Biodiversity – values of biodiversity - threats to biodiversity, *in-situ* conservation, *ex-situ* conservation- role of individual in conservation of natural resources - role of organizations - NB PGR, BSI, ZSI, WWF, IUCN and Convention on Biological diversity - Ramsar Convention, National Action Plan on Conservation of Biodiversity. Environmental Protection Act (1986) – Forest Conservation Act (1980).

## **Unit V          Disaster Management**

Flood warning system - earthquakes, droughts, famines and heat waves – cyclone - wild fires – land slide – Disaster Management Information System (DMIS) – A guideline for disaster management.

### **Books for Reference**

1. DhulasiBrindha, V. 2004. Environmental Studies. Allied Publishers Pvt. Ltd., New Delhi.
2. Veer BalaRastogi and M.S. Jayaraj. 2009. Animal Ecology and Distribution of Animals KedarnathRamnath, Meerut – Delhi.
3. Agarwal, A.C. 1999. Environmental Biology, Agro Botanical, Bikaner.
4. Anjaneyalu, Y.B. 2004. Introduction to Environmental Science, SPBS. Publications. Hyderabad.
5. Kormondy Edward J. 1994. Concepts of Ecology - Prentice Hall of India, Pvt. Ltd.
6. Odum, E.P. 1983. Basic Ecology - CBS College Publishing, Saunder.
7. Anubhakaushik and C.P. Kaushik. 2007. Environmental Science & Engineering, Newage International (p) Publishers. New Delhi.
8. Ravikrishnan, A. 2010. Environmental Science & Engineering. Sri Krishna Publications, Chennai.
9. Saha, T.K. 2008. Ecology & Environmental Biology, Books and Allied (P) Ltd.

SEMESTER I			
Elective I : Parasitology			
<b>Code: 17PZOE11</b>	<b>Hrs/Week: 6</b>	<b>Hrs /Sem:90</b>	<b>Credits:5</b>

### Objectives

- To know the different kinds of parasites, their harmful effects, mode of infection and preventive measures.
- To learn the varied applications of the diagnostic tools in parasite control

#### Unit I **Parasites and Hosts**

Introduction – parasitism in perspective – symbiotic relationship, kinds of parasites and hosts – ecology and host parasite relationship – parasitology in cyberspace

#### Unit II **Protozoan Parasites**

Morphology, Immunology, life cycle, mode of infection, pathogenicity, treatment and prophylaxis of protozoan parasites – examples – Balantidium, Entamoeba, Giardia, Leishmania and Trypanosoma

#### Unit III **Helminth Parasites**

Morphology, life cycle and portals of entry of helminth parasites – examples Schistosoma, Echinococcus, Hymenolepis, Wuchereria, Ancylostoma, Trichinella, Trichiuris and Dracunculus – their pathogenicity, diagnosis, treatment and prophylaxis.

#### Unit IV **Arthropod Parasites**

Arthropods of medical importance – epidemiology and biology of the casual agents of Pediculosis – Myiasis – Dermatitis (caused by Acarids) – origin and evolution of parasitism – phylogenetic relationship of Platyhelminthes.

#### Unit V **Parasitic Adaptations**

Parasitic mode of life – adaptations- morphological, biochemical and ethological adaptation – immune responses of host and self – defense mechanism – molecular characterization of stage specific antigens – nucleotide probes for diagnosis of protozoan diseases.

## **Books for Reference**

1. Kochhar S.K. 2004. A Text Book of Parasitology. Dominant Publishers and Distributors – New Delhi.
2. Veer Singh Rathore and Yogesh Singh Sengar 2005. Diagnosis parasitology. Pointer Publishers Jaipur – India.
3. Prakash Malhotra 2008. Applied Parasitology – Adhyayan Publishers and Distributors – New Delhi.
4. Jordan E.L. and P.S. Verma 2009 Invertebrate Zoology 14th Edition. Chand and Company Ltd. Ram Nagar, New Delhi.

<b>SEMESTER II</b>			
<b>Core IV : Animal Physiology</b>			
<b>Code: 17PZOC21</b>	<b>Hrs/Week:6</b>	<b>Hrs/Sem:90</b>	<b>Credits : 4</b>

### **Objectives**

- To derive an unified knowledge of the physiological functions of animals
- To know about the uniqueness and complexity of different systems of the body.

### **Unit I Digestive and Circulatory Systems**

General organization of gastrointestinal tract-. gastrointestinal secretory functions and the glands-physiology of absorption - role of GI hormones. Structure of mammalian heart-cardiac cycle - ECG-cardiac output- control of heart beat, hemodynamics, blood pressure and its regulation – related diseases. ( hypertension , hypotension ,stroke)

### **Unit II Respiratory System**

Types of respiratory mechanisms

Human respiration: Physiology and anatomy of the respiratory tract- transport of oxygen and carbon-dioxide regulation of respiration. artificial respiration- physiological response to oxygen deficient stress(diving, high altitude) and exercise.

### **Unit III Excretory System**

Excretion in relation to different environments-.organs of excretion in different animals. Human: kidney –nephron – mechanism of urine formation- regulation of ionic and osmo regulation in invertebrates with reference to Protozoa, crustaceans and insects- osmo-ionic regulation in fishes, birds and mammals - endocrine regulation of water and mineral balance

### **Unit IV Neuromuscular and Sensory System**

Nervous system: neurons –structure and types- nerve impulse propagation – concept of synapse- transmission of electrical and chemical synapse- reflex arc-- reflex action.

Muscular system: Structural basis of contraction sliding filament theory – mechanism and energetics of muscle contraction.

Sensory system; Sense organs – physiology of vision, hearing and equilibrium maintenance.

## **Unit V            Endocrinology**

Basic mechanism of hormone action – neuroendocrine integration –endocrine glands in mammal hormones and functions-hormonal disorders- reproductive cycles- hormonal control-. hormones and neoplastic growth.

### **Books for Reference**

1. Hoar 1975. General and Comparative Physiology. Prentice. Hall of India Pvt Ltd .New Delhi.
2. Sembulingam K, and PremaSembulingam 2006-Essentials of Medical Physiology Jay Pee Brothers New Delhi.
3. KuntSchmidt-Nielsen.K.1985AnimalPhysiology.Adaptation and Environment CambridgeUniversity Press, Cambridge.
4. Ladd Prosser. C. 1984.Comparative Animal Physiology, Third edition. Satish Book Enterprise Book Sellers and Publishers Agra.
5. Malcolm S. Gordon 1984. Animal Physiology Principles and Adaptations. Third edition. Collier MacMillan International edition.
6. Nagabhushanam, R and M.S. Kodarkar.1978 Textbook of Animal Physiology Oxford and IBH Publishing Co. New Delhi.
7. Aubrey Gorbman and Howard A.Bern. 1962. A Textbook of Comparative Endocrinology . First edition John Wiley & Sons Inc, New York.
8. Bentley.P.J. Comparative Vertebrate Endocrinology, 1980 First edition Chand& Company Ltd, Delhi.
9. Constance R.Martin1985. Endocrine Physiology, First edition. Oxford University Press, New York
10. Prakash S Lohar, 2005. Endocrinology – Hormones and Human Health, MJP Publishers, Chennai.

### **PRACTICALS**

#### **Hrs / Week : 2**

1. Estimation of haemoglobin.
2. Determination of erythrocyte sedimentation rate (ESR)
3. Detection of haemin crystals of blood.
4. Salt loss/salt gain in a fish
5. Effect of temperature on oxygen consumption of fish.
6. Urine analysis for sugar, albumin and sediments.
7. Urine analysis for creatinine and urea.
8. Assay of acid / alkaline phosphatase enzyme.
9. Study of endocrine glands in chick/rat/- chart
10. Chart/ slide/, photograph
  - a) ECG
  - b) Conditional reflex
  - c) Transverse section of pituitary, thyroid, pancreas, adrenal, ovary and testis
  - d) Reproductive cycles-( oestrus and menstrual cycle)

<b>SEMESTER II</b>			
<b>Core V : Techniques in Biology</b>			
<b>Code: 17PZOC22</b>	<b>Hrs/Week: 6</b>	<b>Hrs /Sem:90</b>	<b>Credits:4</b>

### **Objectives**

- To inculcate research aptitude in students
- To introduce the principles and applications of various instruments used in Biology and to prepare them to use these techniques in their own research

#### **Unit I            Research Designing**

Introduction – types, preparation of index cards, literature collection-sources – literature citation – manuscript preparation of research report, Internet and e-journals- thesis formating and typing – laboratory safety – biosafety levels – biohazardous wastes – safety measures in a laboratory

#### **Unit II            Microscopy Types**

Principle, construction and applications of Phase contrast- Polarization –Electron microscope– types-fixation and staining techniques for EM ( freeze –etching and freeze fracture), fluorescence - flow cytometry - atomic force and magnetic force microscope – micrometry.

#### **Unit III           Spectroscopic Techniques**

Absorption and emission principles – construction and applications of UV-visible spectrophotometer-spectrofluorometer-flame photometer-atomic absorption and emission spectrophotometer -NMR and Mass spectrometer in Biology

#### **Unit IV           Centrifugation and Chromatographic Techniques**

Principles of centrifugation— ultra centrifuge, differential centrifugation- density gradient – isopycnic - Principle, instrumentation and application of chromatography – column - gas - liquid - HPLC – ion exchange-affinity- gel filtration.

#### **Unit V            Electrophoresis & Radioactive Techniques**

Principle and applications of electrophoresis -agarose -PAGE- SDS-PAGE- isoelectric focusing- radioisotopes used in Biology. GMcounter, solid and liquid scintillation counters – sample preparation for radioactive counting, autoradiography-calorimetry – bomb calorimeter , calorific value- applications.



## **Books for Reference**

1. Palanichamy S. and M. Shanmugavelu. 1997. Research Methods in Biological Sciences. Palani Paramount Publication, Palani.
2. Keithwilson and John Walker, 2010 Principles and Techniques of Biochemistry and
3. Gurumani 2011. Research Methodology for Biological Sciences. M.J.P. Publishers, Chennai.
4. Palanivelu. P. Analytical Biochemistry and Separation Techniques. IV Edition 21<sup>st</sup> century Publications Palkalai Nagar, Madurai
5. Veerakumari. L 2007. Bioinstrumentation. M.J.P Publishers, Chennai.
6. Aparna Mathur 2013. Laboratory Instrumentation. Black Prints .New Delhi
7. Chinmoy Goswami, Abhijit Paintal and Rabindra Narain. 2011 Hand Book of Bioinstrumentation. South Anarkali Delhi.
8. Debbie Holmes Peter Moody and Diana Dine, 2006. Research Methods for the Biosciences
9. Rabindra Narain ,2012. Practical Immunology. Wisdom Press New Delhi

## **PRACTICALS**

### **Hrs / Week - 2**

1. Sub – cellular fractionation of rat liver ( centrifugation)
2. Measurement of cell size by micrometry
3. Phase contrast microscopic observation of living cells
4. Estimation of lipids (Bragdon method)
5. Absorption spectra of proteins/ pigments
6. Column chromatographic separation of plant pigments.
7. Use of different instruments in research methodology.
  - a. Electron microscope
  - b. Spectrophotometer
  - c. Chromatography
  - d. HPLC
  - e. PAGE Unit

<b>SEMESTER II</b>			
<b>Core VI: Developmental Biology</b>			
<b>Code: 17PZOC23</b>	<b>Hrs/Week: 6</b>	<b>Hrs /Sem:90</b>	<b>Credits: 5</b>

### **Objectives**

- To understand the sequential changes in the organization of embryo
- To have a knowledge about post embryonic development
- To know the role of genes in development.

#### **Unit I Gametogenesis and Fertilization**

Basic concepts of development – gametogenesis – spermatogenesis – oogenesis. Structure of gametes - sperm and egg of sea urchin and mammal. Fertilization (biochemical, molecular aspects) - prevention of polyspermy .Parthenogenesis.

#### **Unit II Cleavage and Blastulation**

Planes of cleavage - Patterns of cleavage – role of yolk in cleavage.Mechanisms and regulation of cleavage cycles. Cleavage and blastulation in sea urchin, frog, bird and mammal. Fate map of sea urchin and frog.

#### **Unit III Gastrulation and Organogenesis**

Gastrulation – Morphogenetic movements - gastrulation in sea urchin and frog. Organogenesis in vertebrates - CNS, eye, skin and its derivatives, heart, kidney, digestive tube and its derivatives.

#### **Unit IV Role of Genes in Development**

Genomic equivalence – differential gene expression – amplified genes – selective gene transcription – control of gene expression.  
Congenital abnormalities – teratogenic agents - programmed cell death in development. Stem cells.

#### **Unit V Metamorphosis and Regeneration**

Amphibian metamorphosis – morphological, physiological, biochemical changes and causation of metamorphosis.

Regeneration – patterns – morphollaxis - epimorphosis and heteromorphosis – regeneration ability in different group of organisms - blastema formation- regeneration of amphibian limb – Wolffian regeneration - polarity and gradient in regeneration.

## **Books for Reference**

1. Philip Grant. 1985. Biology of Developing Systems. Hall – Saunders International edition.
2. Scott F. Gilbert. 1994. Developmental Biology. Sinamer Associates Inc Publishers, Sunderland, Massachusetts.
3. N.J Berrill. 1982. Developmental Biology. Tata McGraw – Hill Publishing Co.Ltd, New Delhi.
4. Balinsky.B.I.1981. Introduction to Embryology. Saunders College Publishing Ltd.
5. Wendell Smith.C.P, Williams.P.L, Sylvia Tread Gold. 1996. Basic Human Embryology. ELBS Edition. Pitman Publishing Ltd.
6. Banerjee S. 2005. A Text Book of Developmental Biology. Dominant Publishers and Distributors, New Delhi.
7. Lewis Wolpert, Cheryll Tickle. 2010. Principles of Development. Fourth edition. Oxford University Press, New Delhi.
8. Verma P.S, V.K. Agarwal and B.S. Tyagi. 1980. Chordate Embryology. S. Chand & Company Ltd, New Delhi.

## **PRACTICALS**

### **Hrs / Week : 2**

1. Spermatogenesis and oogenesis (vertebrate) - chart
2. Study of different types of eggs - frog, chick, man - slides/ model
3. Study of different types of sperms - frog, chick, man - slides
4. Frog developmental stages - cleavage, blastula, gastrula, external gill stage – slides
5. Observation of T. S. of testis and T.S. of ovary of frog and Mammal- slides.
6. Temporary mounting of chick blastoderm.
7. Observation of chick embryos – 24 hrs, 48 hrs, 72 hrs, 96 hrs.
8. Study of any two congenital abnormalities – Phocomelia, Cyclopic lamb (Chart).
9. Effect of thyroxine in amphibian metamorphosis
10. Regeneration in the tail of tadpoles

<b>SEMESTER II</b>			
<b>Elective II : Ecotourism and Wildlife Management</b>			
<b>Code: 17PBOE21</b>	<b>Hrs/Week: 6</b>	<b>Hrs /Sem:90</b>	<b>Credits:4</b>

## Objectives

- To develop and communicate basic framework and conceptual heritage of the discipline of Tourism.
- To evaluate the role of various organizations of tourism.
- To discuss current wildlife management issues.

### **Unit I Introduction to Ecotourism**

Concepts of tourism, classification of tourism- religion tourism, cultural tourism, heritage tourism, monumental tourism, adventure tourism, mass tourism, sustainable tourism, consumptive and non- consumptive tourism, and ecotourism. Ecotourism – history, principle, objectives and types.

### **Unit II Interesting Ecotourism**

Places of interest for ecotourism- global, national, regional destination (any five in each category). Ecocircuit of Western Ghats. Infra structural facilities for ecotourism. Maintenance of ecological centers- important biosphere reserve ecotourism and conservation- rain forest ecotourism, mountain tourism, polar, island and coastal ecotourism.

### **Unit III Impact of Ecotourism**

Economical, socio-cultural and environmental impacts. Ecotourism and education. Ecotourism related organizations. Ecotourism research. Disasters and ecotourism. Need for sustainable tourism.

### **Unit IV Wildlife Conservation**

Values of wildlife. Planning and management of wildlife. Factors influencing wildlife management – habitat, population, behavior, food- habits and health. Role of zoos, parks and sanctuaries for conservation of wildlife. Tools for data collection and analysis.

### **Unit V Wildlife Management:**

Important projects for the conservation of wildlife in India. Role of local communities in wildlife management. Man-wildlife conflicts, poaching of wildlife, wildlife conservation laws- The Wildlife (Protection) Act, 1972. World Ecotourism Summit Quebec, 2002.

### **Reference Books**

1. Dasman RF (1968) Environmental Conservation: John Wiley and Sons, New York.
2. Jadhav and Bhosale. Environmental Protection and Laws, V.M. Himalaya publishing House.
3. Mukherjee N (2008) Ecotourim and sustainable Development. Cybetech Publications, NewDelhi
4. Prabhas Chandra (2003) Global Ecotourism, Kaniskha Publishers, New Delhi.
5. Sinha, P.C (2003) Encyclopedia of Ecotourism, Volume I, II and III, Anmol Publications Pvt. Ltd., New Delhi.
6. Weaver DB (2001) The Encyclopedia of Ecotourism, CABI Publishing, U.K.

### **Web References**

1. [www.incredibleindia.org/newsite/cms\\_page.asp?pageid=994](http://www.incredibleindia.org/newsite/cms_page.asp?pageid=994)
2. [www.nativescience.org/html/eco-tourism.html](http://www.nativescience.org/html/eco-tourism.html)
3. [www.wcsindia.org/](http://www.wcsindia.org/)
4. [envfor.nic.in/divisions/9-10.pdf](http://envfor.nic.in/divisions/9-10.pdf)

SEMESTER II			
Elective II : Plant Cell and Tissue Culture			
Code: 17PBOE21	Hrs/Week: 6	Hrs /Sem:90	Credits: 4

### Objective

- To acquire knowledge on basic plant tissue culture techniques

### Unit I

Basic concept and scope of plant *in vitro* technology: History of *in vitro* plant biology, organization of a tissue culture laboratory, equipment, basic techniques, medium components, medium preparation- MS **medium** and **White's medium**.

### Unit II

Differentiation/ regeneration- organogenesis-process, mechanism of action of plant hormones, multiple hormonal controls on organogenesis. Embryogenesis: Major processes in embryonic development, role of phyto-hormones in embryogenesis. Somatic embryogenesis- physiological, biochemical and molecular aspects of somatic embryogenesis. Synthetic seeds and its applications.

### Unit III

Haploid and triploid culture: androgenesis, gynogenesis, endosperm culture. Techniques and applications in crop improvement. Protoplast culture -isolation, purification and culture of protoplasts, protoplast fusion and somatic hybridization. Selection of hybrids, regeneration, applications and limitations.

### Unit IV

Micropropagation: methods and stages of clonal propagation. Strategies for virus-free plant production. Assessment of clonal fidelity using different types of markers. Field evaluation, packaging technology and transport methods. Soma clonal variation- genotypic and phenotypic variations in cell cultures and in regenerated plants. Chromosomal mutation in cultured plants. Applications in crop improvement.

## Unit V

Production of secondary metabolites by cell and organ cultures. Germplasm preservation- *in-situ* and *ex-situ* conservations of germplasms. Cryopreservation: principle, techniques and applications

### Books for Reference

1. HarinderChaddha 2011 Tissue culture and non-gene biotechnology, Dominant publishers and distributors Delhi.
2. Sharp, W.R., D.A.Evans, P.V.Ammirato and Yamada, 1984 hand book of plant cell culture volume II, Library of congress Macmillian publishing Co New York.
3. Narayanaswamy, S.1994 Plant cell and tissue culture. Tata McGraw- Hill publishing limited New Delhi
4. Green, C.E., D.A. Somers , W.P. Hackett and D.D. Biesboer 1987, Plant biology Volume 3 Plant and cell culture Alan R. Liss, Inc., New York.
5. Kumar, H.D. 1998 A text book of Biotechnology Affiliated east- west private limited, New Delhi.

<b>SEMESTER II</b>	
<b>Self Study Course: Zoology for Competitive Examinations</b>	
<b>Code: 17PZOSS1</b>	<b>Credit:1</b>

### **Objective**

- To make students competent to face competitive examinations effectively

### **Unit I**

Concepts of species and hierarchical taxa, classical and quantitative methods of taxonomy of animals. Classification of invertebrates upto classes and chordates upto order – diagnostic features and examples.

### **UNIT II**

Physiology of digestion and absorption, respiration, transport of oxygen, carbon – di-oxide, structure of kidney and nephron, urine formation in man.-structure, composition and functions of blood of man, types of muscle, structure of neuron, nerve impulse conduction – physiology of vision and hearing in man. Structure and functions of pituitary, Islets of Langerhans, human reproductive systems – menstrual cycle.

### **UNIT III**

Modern concept of gene, split gene, genetic regulation, genetic code. Sex chromosomes and their evolution, Sex determination in Drosophila and man. **Mendel's law of inheritance**, recombination, linkage, multiple alleles, genetics of blood groups, pedigree analysis, hereditary diseases in man – Inborn errors of metabolism- mutations and mutagenesis-theories of evolution- natural selection, role of mutation in evolution, evolutionary patterns, molecular drive, mimicry, variation, isolation and speciation.



## UNIT IV

Structure and function of cell and its organelles (nucleus, plasma membrane, mitochondria, golgi bodies, endoplasmic reticulum, ribosomes and lysosomes), cell division (mitosis and meiosis), mitotic spindle and mitotic apparatus, chromosome movement, chromosome type – polytene and lamp brush, organization of chromatin, heterochromatin, cell cycle regulation. Protein synthesis, structure of DNA, RNA, replication of DNA. Nucleic acid topology, DNA motif, transcription, RNA processing, translation, protein folding and transport.

## UNIT V

Transgenic animals, bioremediation and phytoremediation. Tissue culture, Genomics and its applications to health – gene therapy – recombinant vaccines. Major infectious and communicable diseases (malaria, filaria, tuberculosis, cholera and AIDS ) their vectors, pathogens and prevention.

### Books for Reference

1. Jordan.K.C.andVerma .P.S.2009. Invertebrate Zoology. S.Chand& Company Ltd, Ram Nagar, New Delhi.
2. Jordan E.L.andVerma. P.S.1965. Chordate Zoology. S.Chand& Company Ltd, Ram Nagar, New Delhi.
3. Shembulingam. K. and PremaShembulingam. 2005. Essentials of Medical physiology. Jaypee Brothers, Medical Publishers Ltd. New Delhi.
4. Verma. P.S and Agarwal. V.K.2013. Cell Biology, Genetics, Molecular Biology, Evolution &Ecology, S.Chand& Company Ltd, Ram Nagar, New Delhi.
5. Kumaresan. V. 2009. Biotechnology. Saras Publication, Kottar, Nagercoil.

SEMESTER - III			
Core VII: Computational Biology			
Code : 17PZOC31	Hrs/Week : 6	Hrs/Sem : 90	Credits : 5

### Objectives

- To provide mathematical foundation to build analytical skills.
- To make the student competent in the applications of information science in bioscience.
- To gain an insight about the molecular databases

### Unit I      **Biostatistics –Descriptive Statistics**

Introduction – measures of central tendency - arithmetic mean, geometric mean, harmonic mean, median and mode – measures of dispersion – range, quartiles, mean deviation, standard deviation, standard error and coefficient of variation – measures of skewness and kurtosis – stem and leaf diagram - box plot.

### Unit II      **Inferential Statistics**

Theoretical probability distributions - binomial - Poisson – normal distribution – hypothesis testing procedure – **student’s t-** test – chi – square test – goodness of fit and contingency tables – ANOVA – assumptions - types - one way and two way.

### Unit III      **Correlation and Regression**

Computation and interpretation of correlation coefficient – **Karl Pearson’s** correlation coefficient – **Spearman’s rank correlation coefficient** – regression – types – regression lines and their properties – fitting linear regression equations and forecasting – relationship between correlation and regression coefficients.

### Unit IV      **Computer Applications**

Graphical presentation of statistical data – MS Excel – spread sheet – data entry and creation of graphs – statistical packages –GENSTAT STATISTICA and SIGMAPLOT – statistical calculation –SPSS package – Principal Component Analysis(PCA).

## Unit V      **Bioinformatics**

Basic concepts and scope - nucleic acid database - GENBANK and EMBL – protein sequence database - NBRF – PIR and SWISSPROT - database similarity searches – BLAST and PSI – BLAST algorithms – derivation and searching molecular phylogenetic analysis – basic and functional genomics of bacteria and human.

### **Books for Reference**

1. Jerrold H.Zar.1984 Biostatistical Analysis, 2<sup>nd</sup> edition, Prentice -Hall International Edition. USA
2. Snedecor, G.W. and Cochran, 1989. W.G. Statistical Methods,(8<sup>th</sup> edition) Affiliated East West Press, New Delhi,.
3. Gurumani, N.2005. An Introduction to Biostatistics, MJP Publishers,2<sup>nd</sup> edition, Triplicane, Chennai-5
4. Agarwal, S.K.2008. Bioinformatics, APH Publishing Corporation, New Delhi.
5. Peter Norton 2009. Introduction to Computers, 6<sup>th</sup> edition, Tata McGraw Hill, New Delhi.
6. Thiagarajan, B.andPa.Rajalakshmi 2009. Computational Biology, MJP publishers, Chennai .
7. Rajadurai, M.2010. Bioinformatics – A Practical Manual, PSB Book Enterprises, Chennai.

### **PRACTICALS**

#### **Hrs/ Week : 2**

1. Computation of mean, median, mode, variance, standard deviation, standard error and coefficient of variation for biological variables.
2. Display of data through stem and leaf diagram.
3. Test of significance **using student's t – test**.
4. Test of goodness of fit of data with the aid of chi- square test.
5. Analysis of variance of molluscan shells
6. Correlation coefficient between height and weight of students and length and width of leaves.
7. Fitting regression equations for two variables and prediction of values.
8. Creation of graphs using MS-Excel
9. Statistical calculation using SPSS software package.
10. EMBL database - Print out.

<b>SEMESTER – III</b>			
<b>Core VIII: Biotechnology</b>			
<b>Code : 17PZOC32</b>	<b>Hrs / week : 6</b>	<b>Hrs / sem : 90</b>	<b>Credits : 5</b>

### Objectives

- To study the potential benefits of biotechnology
- To familiarize with basic concepts of nanotechnology
- To understand the application of biotechnology in industries

### Unit I Cloning and Screening

Definition – scope – vectors - properties of good vector-cloning and expression vectors - *E.coli* vector- screening of recombinants - pBR 322 - bacteriophage – Lambdaphage - M13 – cosmid – plasmid- shuttle and yeast. - Integration of DNA insert with the vector-Introduction of vector into suitable host.

### Unit II Animal Cell and Organ Culture

Cell culture - culture media - initiation of cell culture - evolution of continuous cell lines – large scale culture of cell lines- stem cell culture – organ culture - somatic cell fusion- hybridoma technology – *in-vitro* fertilization- embryo transfer - transgenic animals- fish, sheep and mice.

### Unit III Microbial Biotechnology and Human Welfare

Microbial biotechnology- Isolation and improvement of microbial strains – micro organism used in alcohol production –alcoholic beverages-wine, beer, whisky-uses of alcohols. Cloned genes and production of chemicals-human peptide hormones - insulin–vaccine for hepatitis B – rabies – polio - small pox – malaria - foot and mouth disease viruses - disease prevention - gene therapy - DNA finger printing.

### Unit IV Enzyme and Industrial Biotechnology

Methods of enzyme production – immobilization of enzymes - enzyme engineering - application of enzymes. Single cell protein- mushroom culture – techniques-advantages and nutritive value. Bio gas production – anaerobic digestion-solubilization-acidogenesis-methanogenesis- mechanism of methane production

## **Unit V      Nanotechnology**

Nanomaterials, synthesis of nanoparticles: RF plasma, chemical methods, thermolysis, nanobiosensor, nanofluids, nanocrystals in biological detection - synthesis of nanodrugs - nanomedicine.

### **Books for Reference**

1. Dubey.R.C. 2006. A Text Book of Biotechnology, 4<sup>th</sup> edition S.Chand & Company Ltd, New Delhi.
2. Singh.B.D.2005. Biotechnology. Revised edition. KalyaniPublishers, New Delhi.
3. Kumaresan V. 2009 Biotechnology. Saras Publication
4. Rema.L.P. 2007.Applied Biotechnology. MJP Publishers, Chennai.
5. Satyanarayana U. 2006. Biotechnology, Books and Allied (P) Ltd. Kolkatta
6. Robert Preidt, LauraCostlow and Peter. 2007. Introductory Nanotecnology. Dominant Publishers and Distributors, Delhi
7. Suhas Bhattacharya, 2013. Introduction to Nanotechnology. Wisdom Press. Delhi

### **PRACTICALS**

#### **Hrs/week : 2**

1. Isolation of DNA from goat liver.
2. Isolation of RNA from yeast
3. PCR amplification.
4. Western blotting analysis.
5. Biogas production
6. Wine preparation
7. Mushroom culture
8. Charts and models pertaining to theory for spotters
9. Report of visit to Biotechnology lab

<b>SEMESTER – III</b>			
<b>Core IX : Aquaculture Biotechnology</b>			
<b>Code : 17PZOC33</b>	<b>Hrs / week : 6</b>	<b>Hrs / sem : 90</b>	<b>Credits : 5</b>

### **Objectives**

- To familiarize and perceive the importance of aquacultural potentials
- To understand the various techniques of seed production and health management
- To acquaint with the techniques in biotechnology as applied to aquaculture industry

### **Unit I Aquaculture Basics and Management**

Scope of aquaculture, aquaculture in India. Farm engineering and equipments: selection of site, lay out , construction ,mechanical and biological filters - aeration in culture ponds.

Management of culture ponds - fertilization, water quality management, control of predatory and weed fishes, aquatic weeds.

### **Unit II Aquaculture for Stable Environment**

Sewage - fed fish culture, sewage treatment, sewage- cum fish culture in India. Recent developments in integrated fish farming - animal husbandry- cum fish culture , paddy cum fish culture, fish culture in cages and pens, race-way fish culture, culture of air breathing fishes.

### **Unit III Seed Production and Culture Techniques**

Brooders care and management, bundh breeding, hypophysation, *in-vitro* fertilization, application of synthetic hormones, transport of fish seed and brooders ,culture of shrimp, edible and pearl oysters.

### **Unit IV Nutrition and Health management**

Culture of fish feed organisms: diatoms, cladocerans, rotifers, artemia, tubifex, blood worm. artificial feed formulation and management, probiotics in formulated feeds.

Bacterial, viral and fungal diseases, nutritional deficiency diseases, ectoparasites, endoparasites, principles of fish health management, fish vaccines.

## **Unit V      Aquaculture Biotechnology and Economics**

Genetic improvement of stock: selective breeding, hybridization, transgenic fishes, chromosomal manipulation: polyploidy, gynogenesis, androgenesis, production of monosex and sterile fishes, cryopreservation of gametes. Aquaculture economics, fish marketing, involvement of Government organizations in marketing.

### **Books for Reference**

1. Jhingran, U.G. 1997 Fish and Fisheries of India. Hindustan Publ. New Delhi
2. Dubey S. K. and BandandGhosh 2012. Fish Biotechnology. Published by Wisdom Press, New Delhi
3. AmitaSaxena 2011. Fisheries Economics. Daya Publishing House, New Delhi.
4. Schonder, S. L. 1980 Hypophysation in Indian Major Carps. Sathish Book Enterprises Agra.
5. Santhanam R., SukumaranN.and P. Natarajan 1990. A Manual of Fresh Water Aquaculture. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
6. Pandian I.D., Abhinandan Kumar and Rajbhushan Prasad. 2009 Aquaculture and Biotechnology. A. K. Publ. New Delhi.
7. Agnihotri S. B. 2013 Aquaculture Management and Technology. Swastik Publication, Delhi.
8. Felix S. 2010. Marine and Aquaculture Biotechnology. Published by Agrobios, Jodhpur, India
9. Santhanam R., Ramanathan N. and G. Jegathesan 1990. Coastal Aquaculture in India 1<sup>st</sup>edn. CBS Publishers, Delhi.

### **PRACTICALS**

#### **Hrs / Week : 2**

1. Estimation of dissolved ammonia in water samples
2. Estimation of alkalinity in water samples.
3. Identification of cultivable food fishes
4. Identification of aquatic weeds, predatory fishes and insects.
5. Study of fish parasites and diseases.
6. Decapsulation technique and hatching of artemia cysts
7. Preparation of artificial feed.
8. Report on field visit to aquaculture farm
9. Report on visit to CMFRI / Fisheries Institute.

SEMESTER – IV			
Core X : Marine Biology			
Code: 17PBCC41	Hrs /Week : 6	Hrs / Sem: 90	Credits : 5

## Objectives

- To make the students realize the potentiality of marine environment
- To understand the marine ecosystem threats and conservation

### Unit I Marine Environment – Zonation and Biota

Sea as a biological environment. Classification of marine environment.– Plankton – classification (size, life, habitat) and adaptations. Inter-tidal, rocky, sandy and muddy shores –features of the flora, fauna and adaptations. Role of marine micro-organisms (bacteria and fungi) in nutrient cycles (nitrate, phosphate and sulphate)

### Unit II Characteristics of Sea Water

Physical properties: waves, tides, currents- types, causes, and their impact on marine organisms. Illumination, temperature, pressure,. Chemical properties: nutrients, (major, minor, and trace elements), salinity, pH, density, dissolved gases (oxygen, carbon-di-oxide).

### Unit III Marine Ecosystems

Estuaries, saltmarshes, mangroves. Coral reef - ecology and types, species interaction, adaptations and importance. Threats and conservation of coastal ecosystems (coral reef and mangroves)

### Unit I V Marine Pollution

Sources, effects and control measures of heavy metals, radioactive, oil, and thermal pollutions. Algal blooms-sources and effects. Microbial indicators of pollution. Role of microbes in pollution abatement.

### Unit V Wealth of the sea

Living resources: Fishery products- fish meal and fish oil. Natural pearls: formation, ornamental and medicinal importance. Non-living resources: mineral wealth (manganese nodules, beach placers, glauconite and garnet). Bioactive compounds from marine organisms (bacteria, fungi, macro algae and sponges).Phycocolloids: agar-agar and algin.

## Books for Reference

1. Tait, R.V. and Dipper F.A (1998) Elements of marine ecology.- 4 the d. British Library Cataloguing in Publication Data.



2. Gross, G., 1993. Oceanography: A view of the Earth. Sixth edition. Prentice Hall Inc., New Jersey.
3. McCormick, J.M. and J.V. Thiruvathaakal, 1976. Elements of Oceanography. W.B. Saunders Company, Philadelphia.
4. Nybakken, J.W. 1997. Marine Biology – An Ecological Approach. Addison Wesley Longman, Inc. California, 477pp.
5. Olivia J. Fernando 1999. Sea water-Properties and dynamics, Dhanesh Publications, Ponnagam, Thanjavur
6. Russel 1970. Marine Ecology, Academic Press- London and New York
7. Nelson and Smith 1973, Oil pollution and Marine Ecology-Plenum press
8. Benjamin- Cummings, Menlo Park, California. Vijaya Ramesh, K. (2004). Environmental Microbiology. MJP Publishers Chennai.
9. Moshrafuddin Ahamed and Basumatary. S.K. (2006). Applied Microbiology. MJP Publishers Chennai
10. Daws, C.J. 1981. Marine Botany John Wiley and Sons, New York.

## PRACTICALS

### Hrs / Week : 2

1. Determination of acidity
2. Determination of salinity
3. Determination of alkalinity
4. Determination of total hardness
5. Determination of nitrite
6. Determination of phosphate
7. Biochemical test for micro-organisms-IMViC
8. Collection and identification of marine plankton ( any three phyto and zooplanktons )
9. Identification and remarks of the following
  - i. Plankton net
  - ii. Inter-tidal organisms
    - a. Rocky shore : Sea anemone, *Chiton*
    - b. Muddy shore: *Uca*, *Cerithidia*
    - c. Sandy shore: *Arenicola*, *Murex*
  - iii. Food fishes: *Cybium*, *Sardinella*
  - iv Sea weeds: *Gracilaria*, *Sargassum*,
10. Submission: Record Note Book

<b>SEMESTER IV</b>			
<b>Core XI: Immunology</b>			
<b>Code: 17PZOC42</b>	<b>Hrs /Week : 6</b>	<b>Hrs / Sem: 90</b>	<b>Credits : 5</b>

### **Objectives**

- To analyze the genetic basis of antibody diversity and organization and arrangement of Ig genes.
- To learn about defense mechanisms with recent views on MHC and HLA.
- To familiarize the modern laboratory techniques applicable in the diagnosis and monitoring of diseases involving the immune system.

### **Unit I Immunoglobulin Genes- Organisation and Expression**

Scope- structure of Immunoglobulin (IgG)-Genetic model for Immunoglobulin structure -germ line and somatic variation – Dryer and Bennett two gene model Organization of Immunoglobulin (Ig) genes. Gene rearrangements in variable region - Mechanism of variable region DNA rearrangements - generation of diversity – class switching- theories of antibody synthesis- Applications of monoclonal and polyclonal antibodies.

### **Unit II Antigen- Antibody Responses**

Antigen - Antibody reactions: Salient features of antigen antibody reaction. Detection of antigen antibody reaction - precipitation - single radial immunodiffusion -doubleimmunodiffusion - immunoelectrophoresis – rocket immunoelectrophoresis- Immunofluorescence. Agglutination: haemagglutination- bacterial agglutination- passive agglutination- - agglutination inhibition test - **Coomb's test**- Complement fixation- ELISA.

### **Unit III Immunobiology**

Hypersensitivity: - Types – Type I Anaphylaxis – Type II Antibody dependent cytotoxicity – Type III Immune complex mediated disease – Type IV Delayed type hypersensitivity and Type V Stimulatory hypersensitivity - Factors causing hypersensitivity - Major Histocompatibility Complex - MHC products – structure, distribution and functions - Clinical importance of HLA - HLA typing - HLA paternity testing - HLA and diseases.

#### **Unit IV Tumour Immunology and Autoimmunity**

Immune responsiveness to tumours - tumour associated Ag - natural immunity to tumours – T cell mediated immunity to tumours - tumour markers - hormones useful as tumour markers - therapeutic approaches to cancer - immune surveillance- Autoimmunity: characteristics and cause of autoimmune diseases - classification of autoimmune diseases - diagnosis and treatment of autoimmune diseases.

#### **Unit V Clinical Immunology and Immunoprophylaxis**

Transplantation immunology - types of grafts - mechanism of graft rejection - graft versus host reaction - tissue typing - immunosuppression - prevention of graft rejection – Immunodeficiency diseases - phagocytic deficiencies, defective phagocytic function, humoral deficiencies, cell mediated deficiencies and combined immunodeficiencies- vaccines.

#### **Books for Reference**

1. Catherine Sheehan., 1997. Clinical Immunology. Principles and Laboratory Diagnosis. Wolterskluwer Company, Philadelphia, Newyork, London.
2. David Male, Brian Champian& Annie Cooke, 1987. Advanced Immunology, J.B. Lippincott Company, Philadelphia, Gower Medical Publishing, London&N.York.
3. Emil R. Unanue and Baruj Benacerraf, 1984. Text Book of Immunology. II Edition. Williams and Wilkins, Baltimore, London, Los Angels, Sydney.
4. Ivan M. Roitt, 1994. Essential Immunology. Blackwell Scientific Publications.
5. Joshi, K.R., Osamo, N.O., 1994. Immunology. Agro Botanical Publishers, India.
6. Mary S. Leftfell., Albert D. Donnenberg and Noel R. Rose., 1997 Hand Book of Human Immunology, CPC Press, Boca Raton, New York.
7. Rao, C.V., 2005. An Introduction to Immunology. Narosa Publishing House, New Delhi.
8. Rastogi, S.C., 2002. Essentials of Immunology. CBS Publishers and Distributors, New Delhi.
9. Talwar G.P. and Gupta, S.K., 1993 A Hand Book of Practical and Clinical Immunology, CBS Publishers and Distributors, Delhi.
10. Yadav P.R., 2004. Immunology. Discovery Publishing House, New Delhi.
11. Surendra Naha 2012. Fundamentals of Immunology. Dominant Publishers Pvt. Ltd. New Delhi.

## **PRACTICALS**

### **Hrs/Week - 2**

1. Lymphoid organs in rat (chart)
2. Radial Immunodiffusion.
3. Double Immunodiffusion.
4. Direct Agglutination - ABO blood grouping.
5. Rh - Typing.
6. Immunoelectrophoresis.
7. ELISA - Demonstration.
8. Isolation of lymphocytes and enumeration.
9. HLA typing.
10. Haem-agglutination.

<b>SEMESTER IV</b>			
<b>Core XII: Applied Microbiology</b>			
<b>Code: 17PZOC43</b>	<b>Hrs/ Week :6</b>	<b>Hrs/sem : 90</b>	<b>Credits : 5</b>

### Objectives

- To know the basic principles of food, industrial and environmental Microbiology.
- To concentrate on the economic aspects and to make use of or combat the activities of microorganisms.
- To understand the interaction of microorganisms with their environments and the practical consequences of these interactions.

#### Unit I      **Microbial Classification**

Definition – scope, history of Microbiology - **Bergey's classification**-recent status of classification- Five kingdom concept. Distinctive features of the major groups of microorganism- bacteria, fungi and virus

#### Unit II      **Food Microbiology**

Microbiology of food -growth of microorganisms in food - food spoilage - food poisoning - food infections – food preservation – microbiology of fermented foods - detection of food - borne pathogens.

#### Unit III      **Industrial Microbiology**

Choosing microorganism for industrial microbiology – bioreactors - types of bioreactors - major products of industrial microbiology – antibiotics – organic acids - biopolymers – biosurfactants - bioconversion process and biofuels. Beverages – wine, beer.

#### Unit IV      **Medical Microbiology**

Microbial diseases - Protozoan diseases; Plasmodium, Entamoeba. Fungal diseases: mycotoxicosis, aspergillosis. Bacterial diseases: meningitis and streptococcal pneumonia. Food and waterborne diseases: cholera, typhoid. STD and contact diseases: gonorrhoea and syphilis. Viral diseases: influenza, hepatitis B

## **Unit V            Environmental Microbiology**

Biodegradation using microbial communities - leaching of metals, hydrocarbon degradation in water and soil. Waste as a resource - microbes in composting, sewage treatment, biofertilizers, symbiotic -asymbiotic nitrogen fixation.

### **Books for Reference**

1. Dubey R. C. and D.K Maheswari, 2006. A Text Book of Microbiology. S. Chand & Co, New Delhi.
2. Rogar & Stainer, John I. Ingraham, Mark I. Wheelis & Page R. Painter, 1992. General Microbiology. Mac Millan India Ltd.
3. Kannan, N. 1996. Laboratory Manual in General Microbiology. Palani Paramount Publications.
4. James Cappuccino and Natalie Sherman, 1999. Microbiology - A Laboratory Manual. Addison-Wesley - Hyman Inc. Tokyo.
5. Pelzer, Chan and Krieg, Microbiology 1998. 2<sup>nd</sup> edn. Tata Mc Graw Hill Publishing Company.
6. Prescott, Harley and Klein. 2005 Microbiology, WCB Mc Graw Hill Co. New York.
7. Purohit S. S., 1991. Microbiology – Fundamentals and Application. M/S Sarawathi Purohit for Student edition, India

### **PRACTICALS**

#### **Hrs / Week : 2**

1. Sterilization technique
2. Sample handling for microbial studies.
3. Preparation of culture media for microorganisms.
4. Counting of viable cells (CFU / ml) by serial dilution & spread plate or pour plate.
5. Dye reduction test in milk.
6. Gram staining
7. Capsular staining.
8. Test for antibiotic sensitivity.
9. Isolation of nitrogen fixing symbiotic bacteria from root nodule.
10. Observation of algae, fungi and blue green algae
11. Industrial visit/ Institutional visit and submission of report

<b>SEMESTER –IV</b>			
<b>Elective III : Applied Entomology</b>			
<b>Code :17PZOE41</b>	<b>Hrs/Week : 6</b>	<b>Hrs/Sem : 90</b>	<b>Credits : 4</b>

### **Objectives**

- To explore the rich diversity of insects.
- To impart knowledge about the beneficial services and harmful effects rendered by insects.
- To familiarize with effective control measures.

#### **Unit I Insect Taxonomy**

Introduction – principles of classification – **Imm’s classification down to orders** with their diagnostic characters, familiar and important examples – methods of collection, killing and preservation of insects.

#### **Unit II Beneficial Insects**

Productive insects – economic value of products of honey bee, silk worm and lac insect-helpful insects – insect pollinators, scavengers - insects as protein sources of human and animal feeds, medicinal uses of insects ,Forensic entomology .

#### **Unit III Harmful Insects**

Insect pests of crops – general characters, bionomics and control measures of any four important pests of paddy, sugarcane and coconut – pests of stored products – internal and external feeders.

#### **Unit IV Medical Entomology**

Insects in relation to public health –Biology, mode of transmission of diseases and control: housefly, sand fly, human body louse and head louse and mosquito (special reference to dengue, chikungunya and filariasis)

#### **Unit V Pest Management**

Assessment of pest population and pest damage. Methods of pest control: natural, cultural, mechanical, legal, biological and chemical (organic and inorganic compounds – synthetic pyrethroids). Classification of insecticides: based on mode of entry, mode of action and chemical nature – Recent trends in pest control: chemosterilants, hormones, pheromones, anti-feedants, Integrated Pest Management

## Books for Reference

1. Fenemore, P.G.andB.Prakash 1997. Applied Entomology, Wiley Eastern Ltd., New Delhi.
2. Tembhare. D.B. 1997. Modern Entomology, Himalaya Publishing House, New Delhi,
3. Nayar, K.K., Vasantharaj David, B, and T.N.Ananthkrishnan 2004. General and Applied Entomology Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. NalinaSundari, M.S.andR.Shanthi 2006. Entomology MJP Publishers, Chennai.
5. AbishekShukla 2008, Entomology Daya Publishing House, New Delhi.
6. SandhyaAgrawal 2009 Applied Entomology Oxford Book Company, Jaipur, India.
7. Ravindran K.R.2013. A Text Book of Economic Zoology, Wisdom Press , New Delhi
8. T.V.Sathe,A.TSatha, and Jagtap, Mahendra, 2011. Mosquito Borne Diseases. Mangalam Publishers & Distributers.



<b>SEMESTER IV</b>			
<b>Elective III : Endocrinology</b>			
<b>Code: 17PZOE41</b>	<b>Hrs / Week: 6</b>	<b>Hrs/ Sem : 90</b>	<b>Credits:5</b>

### **Objectives**

- To give an insight about the endocrine function
- To signify the hormonal action in synchronization of the internal life processes and to emphasize the role of endocrinology in human health and welfare.

#### **Unit I            Hormones and their Assay**

Scope of endocrinology – types of chemical messengers – hormone as a messenger – feedback control of hormone production. neuro – endocrine integration – prohormones -prehormones – chalcones. Types of hormones-peptide, steroid .assays of hormones.

#### **Unit II            Mechanism of Hormone Action**

The concept of neurosecretion – neuro endocrine mechanism in insects and crustaceans – pheromones-mechanism of hormone action –receptors- cell signaling-second messengers- cAMP – calcium calmodulin - receptor properties – disorders due to receptor defects.

#### **Unit III            Structure and Function of Endocrine Glands**

Structure and functional integration of endocrine glands – pituitary, pancreas, adrenals, thyroid and parathyroid. Endocrinology of ovary and testis-hormonal disorders.

#### **Unit IV            Hormones and Metabolism**

Hormonal regulation of carbohydrate, protein and lipid metabolism. Hormonal regulation of growth and development-gastro-intestinal hormones-hormones and osmo regulation-hormones and behaviour.

#### **Unit V            Endocrine Integration**

Diffuse effects of hormones-reproductive cycle and pregnancy-development and function of mammary gland and analogous structures-hormones and neoplastic growth-hormonal regulation of migration in birds and fishes – hibernation-hormonal control of colour change in vertebrates.

## Books for Reference

1. Aubrey Gorbman and Howard A. Bern. A Textbook of Comparative Endocrinology, 1962 First Edition John Wiley & Sons Inc, New York.
2. Bentley.P.J. Comparative Vertebrate Endocrinology, 1980 First edition Chand&
3. Constance R.Martin. Endocrine Physiology,1985 First edition. Oxford University Press, New York.
4. Richard N.Hardy Endocrine Physiology,1981, First edition. Edward Arnold Ltd
5. Prakash S Lohar. Endocrinology – Hormones and Human Health,2005 MJP Publishers, Chennai.
6. John F. Laycock, Peter H.Wise. Essential Endocrinology,1986 ELBS- Oxford University Press.
7. Frye B. E. Hormonal Control in Vertebrates,1971, Third edition. Macmillan Company, London.
8. Charles Ralph, Introductory Animal Physiology,1978,First edition. M.C Graw Hill Book Company. Colorado State University
9. Ladd Prosser C. Comparative Animal Physiology 1984, First edition Satish Book Enterprise Book Sellers & Publishers, MoliKatra, Agra.