

ST. MARY'S COLLEGE (Autonomous)

(Re-accredited with 'A' Grade by NAAC)

Thoothukudi – 628001, Tamil Nadu

(Affiliated to Manonmaniam Sundaranar University)



Syllabus

M.Sc. ZOOLOGY

(Choice Based Credit System)

(w.e.f. 2017)

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 & 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	17PZOCCR1	17PZOC11, 17PZOC12, 17PZOC13	6	3	40	60	100
			30	23	200	300	500

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	17PZOE21	Applied Biology/ Nutrition and Health	6	4	40	60	100
Practical II	17PZOCCR2	17PZOC21, 17PZOC22, 17PZOC23	6	3	40	60	100
Self Study Course (Compulsory)	17PZOSS1	Zoology for Competitive Examinations.		+1			100
			30	22+1	200	300	600

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		+1			100
			30	23+1	200	300	500+100

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	17PBCC41	2	1	20	30	50
Practical V	17PZOCR5	17PZOC42 17PZOC43	4	2	20	30	50
			30	22	200	300	500

Master of Science (Zoology)

Components	Credit per Semester	No. of Courses	Total
Core	5	12	60
Practical	4	3	12
Core Elective	5	1	5
Core Elective	4	2	8
Project	5	1	5
			90
Self Study Course (Compulsory)	1	1	1
Self Study Course (optional)	+1	1	1
			91+1

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 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) – β 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, 24th 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 and Kolkata.
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, 14thedition.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

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

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 3rd edition, Maxwell Macmillan International Edition, New York.
2. Gardner, Simmons and Snustad, 1991, Principles of Genetics , 6th edition Prentice Hall. inc.New york.
3. Klug, W.S.and Cummings M.R.2000. Concepts of Genetics. 6th 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. Kreb, J.E., Goldstein, S.and T Kilpatrick.2011 Genes X 10th 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

SEMESTER - I			
Core III: Cell and Molecular Biology			
Code: 17PZOC13	Hrs/week : 6	Hrs/sem: 90	Credits: 5

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 – uniporter catalysed 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, Ca²⁺ 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 9th 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 chironomous 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			
Code: 17PZOE11	Hrs/Week: 6	Hrs /Sem:90	Credits:5

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 parasitic 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.

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

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 of vision and physiological optics hearing and equilibrium maintenance.

Unit IV 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. Sembulingmam 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)

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

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 – 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 – agrose-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 Molecular Biology. 7th Edition Cambridge University Press
3. Gurumani 2011. Research Methodology for Biological Sciences. M.J.P. Publishers, Chennai.
4. Palanivelu. P. Analytical Biochemistry and Separation Techniques. IV Edition 21st 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

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

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 change and causation of metamorphosis.

Regeneration – patterns – morphallaxis - 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.
9. Effect of thyroxine in amphibian metamorphosis
10. Regeneration in the tail of tadpoles

SEMESTER - II			
Elective II Applied Biology			
Code : 17PZOE21	Hrs/Week : 6	Hrs/Sem : 90	Credits : 5

Objectives

- To explore the scope for self employment opportunity adopting Apiculture, Poultry and Sericulture after their graduation.
- To acquire knowledge on mushroom cultivation.
- To learn the art of culturing earthworm and production of bio-fertilizer through vermi-composting.

Unit I Apiculture

Scope and economics of Apiculture - Bees suitable for bee keeping - bee keeping equipments. Artificial hive - Langstroth hive - Newton's hive. Products of bee keeping - honey, wax, pollen and venom. Relationship between bees and plants. Diseases: Foul brood disease - septicemia, nosema, acarine disease.

Unit II Poultry keeping

Scope - commercial breeds, management of chicks, growers, layers and broilers. Summer management and winter management, Debeaking, Feed stuffs for poultry. Poultry diseases – fowl cholera , ranikhet , aflatoxicosis and coccidiosis.

Unit III Vermicomposting

Scope and importance of vermitechnology – worms suitable for composting. Vermiculture -Vermicomposting process– vermicomposting materials-construction of vermi bed -indoor and outdoor vermicomposting-application of vermicompost -predators and parasites of earthworm. Economics of vermicomposting

Unit IV Mushroom Cultivation

Introduction. Nutritional and medicinal value of edible mushrooms. Poisonous mushrooms. Types of edible mushrooms available in India. Cultivation of oyster mushroom. Post harvesting technology: Freezing, dry freezing, drying, canning and entrepreneurship. Disease management.

Unit V Sericulture

Scope of sericulture - Role of Central Silk Board. Mulberry cultivation - mulberry silkworm - silk gland. Rearing of silkworm - mounting - silk reeling - uses of silk. Diseases of silkworm: pebrine, muscardine, flacherie - grasserie.

Books for Reference

1. Mishra.R.C and Rajesh Grag.1998 Perspectives in Indian Apiculture, Agro Botanica, New Delhi.
2. Root.A.I.1985 Encyclopedia of Bee Culture, International Books and Periodicals Supply Service.
3. Raja Justus.E. 1994 Economics of Bee Keeping Industry, Rawat Publications, New Delhi.
4. Gnanamani.M.R. 2010 Profitable Poultry Farming, J.Hiltone Publication Madurai.
5. Gupta.P.K. 2003 Vermi Composting for Sustainable Culture, Agrobios .
6. Ranganathan.L.S.2006 Vermibiotechnology from Soil Health to Human Health. AGROBIOS (India) Jodhpur.
7. Ganga, G. and J. Sulochana Chetty, 1998. An introduction to Sericulture, Oxford and IBH Publishing Co.Pvt.Ltd., New Delhi.
8. Dubey, R.C. 2008. A text book of Biotechnology, S. Chand & Co Ltd; New Delhi.
9. Kumaresan. V. 2004. A Text Book of Biotechnology, Saras Publication, Nagercoil.

SEMESTER – II			
Elective II: Nutrition and Health			
Code: 17PZOE21	Hrs/week : 6	Hrs/sem: 90	Credits: 5

Objectives

- To introduce the students to fundamentals of nutrition, food and health.
- To familiarize them with importance of nutrition during various stages of life.
- To impart knowledge regarding etiology and management of nutritional disorders.

Unit – I Basics of Nutrition

Basic food groups –carbohydrate, protein, lipids, vitamins and minerals - calcium and potassium. Concept of balanced diet –Protein Energy Malnutrition- Iron and iodine deficiency Recommended dietary allowances for Indians — Sedentary, Moderate and Heavy meal- Meal planning – food pyramid.

Unit II Food groups

Selection and nutritional contribution of the following food groups - pulses, cereals, fruits and vegetables, milk and milk products, egg, meat, fish, poultry.

Unit III Nutrition during life cycle

Physiological considerations and nutritional concerns for the following life stages
- Infant, Pre school, adolescent, pregnant women, nursing, adult men/ women - old age.

Unit IV Nutrition and fitness

Definition of fitness and health - Nutritional guidelines for health and fitness - diet and benefits of physical activity. Etiology and health complications of over weight and obesity - Weight management.

Unit V Therapeutic Nutrition

Etiology, clinical features and nutritional management of the following - Type I and Type II Diabetes - Hypertension, coronary heart disease -Peptic ulcer and Diarrhoea - Infective hepatitis – B.

Books for Reference

1. B. Srilakshmi, Human Nutrition New Age International (p) Ltd. 2009.
2. M.Swaminathan, Essential of Food & Nutrition Vol.I &II, Bappco, Bangalore.1974
3. B.Srilakshmi, Dietetics, New Age International Pvt. Ltd, 2009.
4. Mudambi SR and Rajagopal MY, Fundamentals of Foods, Nutrition and Diet Therapy, New Age International Pvt. Ltd, 2009.
5. Sherman H.C. Chemistry of Food and Nutrition, Agrobios 2010.
6. Blank F.C. A Hand book of Foods and Nutrition Agrobios 2010.

SEMESTER II	
Self Study Course: Zoology for Competitive Examinations	
Code: 17PZOSS1	Credit:1

Objective

- To make students competent to face competitive examinations effectively

Unit I

Concepts of species and hierarchial 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 Drosophilla 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.and Verma .P.S.2009. Invertebrate Zoology. S.Chand& Company Ltd, Ram Nagar, New Delhi.
2. Jordan E.L.and Verma. P.S.1965. Chordate Zoology. S.Chand& Company Ltd, Ram Nagar, New Delhi.
3. Shembulingam. K. and Prema Shembulingam. 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, 2nd edition, Prentice -Hall International Edition. USA
2. Snedecor, G.W. and Cochran, 1989. W.G. Statistical Methods ,(8th edition) Affiliated East West Press, New Delhi,.
3. Gurumani, N.2005. An Introduction to Biostatistics, MJP Publishers,2nd edition, Triplicane, Chennai-5
4. Agarwal, S.K.2008. Bioinformatics, APH Publishing Corporation, New Delhi.
5. Peter Norton 2009. Introduction to Computers, 6th 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.

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

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, 4th 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.MJPPublishers,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

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

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 - role of 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 1stedn. 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-dioxide).

Unit III Marine Ecosystems

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

Unit IV Marine Pollution

Sources, effects and control measures of heavy metal, 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 and 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.-4th ed. 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. MoshrafuddinAhamed 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: *Cybbium*,*Sardinella*
 - iv Sea weeds: *Gracilaria*,*Sargassum*,
10. Submission: Record Note Book

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

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.

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

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 micro organisms 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: gonorrhea 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 l.ingrahan, Mark l. 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-Wesly - Hyman Inc. Tokyo.
5. Pelzer, Chan and Krieg, Microbiology 1998. 2ndedn. Tata MC Grow Hill Publishing Company.
6. Presscott, Harley and Klein. 2005 Microbiology, WCB MC Graw Hill Co. New York.
7. Purohit S. S.,1991. Microbiology – Fundamentals and Application. M/S SarawathiPurohit 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

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

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.Ananthakrishnan 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.T Satha, and Jagtap,2011. Mahendra. Mosquito Borne Diseases. Mangalam Publishers & Distributers.

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

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 – chalone. 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.

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 & Company Ltd, Delhi.
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, Moli Khatra, Agra.