

**Madras Christian College(Autonomous)
East Tambaram, Chennai 600059
Department of Zoology
M.Sc. ZOOLOGY - Syllabus**

(CBCS Curriculum for students admitted from 2014- 2015 onwards)

Revised New Curriculum 2014

MADRAS CHRISTIAN COLLEGE (Autonomous) M. Sc. (vi) Zoology CBCS Curriculum for students admitted from 2014- 2015 onwards

Sem	Paper	Title	Hrs	Credit	CA	ESE	Sem	Paper	Title	Hrs	Credit	CA	ESE
MAJOR – CORE							MAJOR - CORE						
I	1	Animal Phylogeny	6	4	50	50	II	7	Bioinformatics, Biostatistics	5	4	50	50
	2	Biophysics	4	2	50	50		8	General & Applied	6	4	50	50
	3	Molecular Biology & Molecular Genetics	7	4	50	50		9	Entomology Research	4	4	50	50
	4	Nanoscience	5	3	50	50		10	Methodology	5	4	50	50
	5	Pra I – Animal Phylogeny	4	3	50	50		11	Developmental Biology	3	2	50	50
	6	Pra II Molecular Biology, Molecular Genetics	2+2	2	50	50		12	Pra III Bioinformatics & Biostatistics Pra IV Developmental Biology, Entomology	2+3	3	50	50
MAJOR - CORE							MAJOR - CORE						
III	13	Animal Physiology & Biochemistry	6	4	50	50	IV	19	Biotechnology	6	4	50	50
	14	Microbiology & Immunology	6	4	50	50		20	Molecular Endocrinology	5	4	50	50
	15	Environmental Biology & Biodiversity	6	4	50	50		21	Pra VII – Biotechnology & Endocrinology	3+3	4	50	50
	16	Pra V - Animal Physiology, Biochemistry, Immunology	2+2	3	50	50							
	17	Pra VI Environmental Biology Biodiversity, Microbiology,	2+2	2	50	50							
		Soft Skill	2										
MAJOR - CORE							MAJOR-ELECTIVES						
							22	Animal Behavior / Aquaculture	4	5	50	50	
							23	Teaching Zoology / Medical Lab Technique	4	5	50	50	
							24	Pra VIII Animal Behavior / Aquaculture	2	5	50	50	

18	Dissertation	3	100	25	Pra IX Teaching Zoology / Medical LabTechnique	3	5	50	50
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MAJOR ELECTIVES – 2 theory + 2 practical

13 hrs – 20 credits - Semester IV

MAJOR CORE – 13 theory + 7 practical + 1 dissertation

103 hrs – 70 credits - Semester I, II, III, IV

Soft Skill

4 hrs

120 hrs - 90 credits.

M.Sc. (vi) - SEMESTER I - PAPER 1 : MAJOR CORE

ANIMAL PHYLOGENY

6 Hours / week

4

Credits

(for students admitted from 2008-'09 onwards)

Unit I : Principles of animal taxonomy. Terminology - systematics - nomenclature -taxonomy - classification - identification - taxon - phenon - cladon and siblings - biological species concepts - definition of species, genus, variety, race, strain and breed - Naming of species, sub-species, genera, Zoological commission and Congress - International code of Zoological nomenclature. Keys - definition and types. Atlas, check list, catalogue. Biosystematics - definitions - Classical and Experimental taxonomy and Numerical taxonomy.

Unit II: Geological time scale

Unit III: Phylogenetic trees and their significance: Protozoan inter-relationships - Origin of Metazoa – theories - Inter-relationships of Coelenterates and their symmetry.

Unit IV: Origin of Bilateria - Evolution of Turbellaria and their importance - Rhabdocoela as a stem group.

Unit V : Origin and evolution of coelom.

Unit VI: Origin of metamerism and Annelidan inter-relationship.

Unit VII: Arthropod phylogeny.

Unit VIII: Molluscan evolution – Monoplacophora

Unit IX: Echinoderm larvae and evolutionary significance.

Unit X: Evolutionary trends among minor phyla (Rotifera, Acanthocephala, Pogonophora, Sipunculida, Entoprocta, Ectoprocta, Brachiopoda and Chaetognatha).

Unit XI: Phylogenetic importance of Prochordates

Unit XII: Theories of origin and evolution of Chordates

Unit XIII: Fossil history of fishes (origin and early evolution) and of Amphibians, Reptiles, (major groups) and of Birds and Mammals (origin and evolution of the three sub classes).

Reference Books:

The Invertebrates (Vol I to Vol) – Hyman, L.H.

Arthropod Phylogeny – Gupta, A.P.

The Evolution of metazoa – Hadzi

Lower Metazoa: comparative Biology and phylogeny – Dougherty, E.C.

Evolution of Vertebrates – Colbert

Life of Vertebrates – Young

Vertebrate Paleontology – Romer.

M.Sc. (vi) - SEMESTER I - PAPER 2: MAJOR CORE

BIOPHYSICS

4 hours / week

2 Credits

(for students admitted from 2014-'15 onwards)

Biophysics

Objectives and Scope: Physics to explain life system – physics affects life system – physics helps life system.

Unit I Theoretical biophysics

Thermodynamics: Laws of thermodynamics, thermodynamics related to chemical reactions – internal free and bond energy. Animal mechanics Motion – kinetics, kinematics, friction, stress, strain and torques.

Unit II Molecular Biophysics

Atoms and molecules, Biopolymer, polymerization of organic molecules.
Structure of molecules : Methods and principles of determining molecular weight. Physical principles involved in centrifugation, Chromatography, Electron microscopy, spectrophotometry and NMR – spectroscopy, Optical principles of Fluorescence, Polarizing, Phase contrast and interference Microscope colloids sol/gel changes – emulsions – Tyndall effect.

Unit III Membrane biophysics

Structure and function of bio-membranes – ion channels – Gates – Pores and Pumps.

Unit IV Radiation Biophysics

Isotopes, Isobars, Radioactivity and Properties of α β and γ rays, detection of Radiation, Hazards of Radiation, and tracer techniques. Non-Ionizing radiation, UV and infrared – definition and properties of Laser.

Unit V: Physiological Biophysics

Biophysical aspects of vision and its Aberrations. Biophysical aspects of nerve impulse transmission, Action potential. Biophysical aspects of muscle contraction. Biophysical aspects of hearing.

Unit VI Clinical biophysics

Biopotential recording ECG, EEG and EMG
Imaging techniques. Photography, X-ray and Ultrasound.
Therapeutic applications Diathermy, Radiotherapy and Laser
Principles of CT scan and MRI scan.

Reference

Life Science Physics – Joseph W Kane and Morton M. Sternheim, John Wiley and Sons, New York.

Biophysics – Caesey

Biophysical Science – Eugene Ackerman.

M.Sc. (vi) - SEMESTER I – Paper 4: Major Core

NANOSCIENCE

5 hours / week

3 Credits

Unit I: Basics of Nanoscience

History of Nanoscience - Definition of nanometer, Nanomaterials and Nanotechnology – Scientific Revolutions – Types of Nanotechnology and Nanomachines – the Periodic table – Atomic Structure - Molecular and atomic size – Surfaces and dimensional space – top down and bottom up - Opportunity at the nanoscale.

Unit II: Quantum Mechanics

Limitation of classical physics - Introduction to quantum physics - Factors affecting to particle size - Quantum confinement - Quantum dots - particle in a box, Quantum wires and wells

Unit-II: Properties and types of Nanomaterials

Mechanical, Thermal, Electrical, Magnetic and Structural. Size effect on shape, electronic magnetic properties of nanomaterials - Carbon nanostructures- electrical and mechanical properties - Carbon nanotubes (CNTs)- Single walled carbon nanotubes (SWNTs), Multiwalled carbon nanotubes (MWNTs) - graphenes, fullerenes.

Unit III: Bionanotechnology

Biology inspired concepts – biological networks - biological neurons - Quantum dot biolabeling - fabrication of biosensors - DNA based biosensors – Protein based biosensors – Bionanostructures- Micelles, vesicles, multilayer films, biological interactions - future potential.

Unit IV: Nanotechnology in Health Care

Nanotechnology in pharmaceutical applications - micro and nano immunosensors and use of gold and silver nanoparticles - DNA and antibodies, DNA Profiling - Prosthetic and Medical Implants - Nanodiagnostics using nanorobots, *in vivo* imaging capability to detect tumors and genetic defects and other diseases.

Reference Books:

1. Nanoscience and Nanotechnology – Fundamentals to Frontiers – Rao & Singh
Principles of nanoscience and Nanotechnology – Shah & Ahmed

M.Sc. (vi) - SEMESTER I – PAPER 3 : MAJOR CORE

MOLECULAR BIOLOGY AND MOLECULAR GENETICS

3+4 Hours / week

4

Credits

(for students admitted from 2008-'09 onwards)

Molecular Biology

Objective : To make the students understand the molecular basis of genes

Unit I Nucleic Acids (DNA and RNA)

Structures of DNA – (Willkins's and Watson's Model) – Types of DNA, Complimentary bases in DNA, Properties of DNA, denaturation and renaturation kinetics. Types of RNA – structure of tRNA, DNA – RNA differences.

Unit II Synthesis of DNA

Origin of replication – DNA polymerases – 5'-3' replication – proteins involved in replication – the end replication problem – telomerase – proof reading – methylation of DNA – brief comparison of eukaryotic and prokaryotic replication.

Unit III DNA repair

Fidelity of DNA sequences – different types of DNA repair systems with special reference to SOS response.

Unit IV DNA Recombination

Homologous genetic recombination – enzymes involved in recombination – Holliday model – site specific recombination – prerequisites for recombination – transposons.

Unit V Transcription and Translation

RNA polymerase in Eukaryotes – initiation and termination of transcription, transcription factors – splicing of RNA – Eukaryotic mRNA processing – transport of RNA from nucleus to cytoplasm – tRNA and rRNA synthesis – transcription inhibitors, translation.

Unit VI Cell Proliferation

Significance of cell cycle in cancer – abnormal cell growth (Neoplastic growth) concept of oncogenes and anti-oncogenes.

Reference Books:

Molecular Biology of the Gene Watson et al.

Biochemistry, Voet, D and Voet, J. John Wiley and Sons, Inc. 1995.

Text of Biochemistry Lehninger et al, CBS publishers and distributors, 1993.

Molecular Genetics

Unit I: Genetic code

Characteristics of the code - Triplet nature – degeneracy – universality – decoding of DNA - tRNAs translation into peptides, polypeptides, initiation, lengthening, molecular basis of degeneracy of DNA into RNA (copies).

Unit II: Genetic control of hormone regulation

Analysis of gene control, structure of a gene encoding a polypeptide hormone, housekeeping genes, levels of gene control, Examples of housekeeping genes and homeotic gene.

Unit III: Gene expression and regulation: Operon concept. Constitutive versus inductive control. Positive and negative regulation of gene expression.

Examples: Lac, tryptophan

Unit III: Mutation

Classification of mutations, types of chromosomal, gene (transition, transversion, addition, deletion), tautomerisation, deamination and base analogues, alkylating and other mutagenic agents, molecular effects of mutation, mutagen and antimutagens, mutator and antimutator polymerases.

Unit IV: Microbial genetics

Molecular model for transformation, recombination maps and transformation, generalized genetic transduction, bacterial conjugation, sex factor, F-episome, conjugation and mapping, F'-episomes plasmid.

Unit V: r DNA technology

Types of vectors, plasmids, cosmids, YAC's, bacteriophages etc. Restriction enzymes - classification, Cloning, expression of cloned genes, gene therapy.

Unit VI: Ethics

Ethical issues that have arisen due to cloning, ART

Reference Books:

1. Molecular Biology of the Gene. (Fifth edition)

James D Watson, Tania A. Baker, Stephen P. Bell, Alexander Gana, Michael Levini, Richard

Lorick 2006

M.Sc. (vi) – SEMESTER I - PAPER 4: MAJOR CORE PRACTICAL – I

MOLECULAR BIOLOGY AND MOLECULAR GENETICS

2+2 hours / week

2 Credits

(for students admitted from 2014-'15 onwards)

1. Basic techniques identification of DNA by feulgen reaction
2. Identification of RNA by Methyl green and pyromine staining.
3. Identification of proteins by MBPB.
4. DNA extraction.
5. PCR (Demonstration)
6. Squashes and smears of chromatin and chromosomes. Sex chromatin – human buccal smear.
7. Orange G and Aniline blue staining for heterochromatin.
8. Study of mitotic chromosomes using onion root tip and bone marrow aspirate.
9. Mitotic indices in Onion root tip and Grasshopper testis.
- 10.** Meiotic indices in Grasshopper testis.
11. Drosophila Genetics, Preparation of culture medium and culture of Drosophila handling and maintenance – study of the life history – mutant forms. Chromatographic studies of eye pigments of various eye mutants.
12. Population genetics Location of tasters and non-tasters by PTC tests in a random sample.
13. Multiple factor inheritance studies in a random sample of student population with reference to their height.
14. Case studies – family histories and pedigree charts.
15. Dermatoglyphics
16. Karyotyping.
17. Study of various syndromes with the help of metaphasic plate.

Bioinformatics**Unit I Introduction to Bioinformatics**

Aims, Tasks and Applications of Bioinformatics. Information Retrieval System, Data submission Tools, Data Analysis and Prediction Tools.

Unit II Biological Databases

Nucleic acid sequence data banks. Databases of patterns, motifs and profiles: Metabolic Pathway Databases. Literature Databases. Database Similarity Searches: BLAST, FASTA, PSI-BLAST algorithms; Pair wise sequence alignment - NEEDLEMAN and Wunsch, Smith Waterman algorithms; Multiple sequence alignments - CLUSTAL, PRAS; Patterns, motifs and Profiles in sequences.

Unit II. Genomics.

Central Dogma hypothesis. Gene structure. Recombinant DNA technology. Gel Electrophoresis, DNA Sequencing. Single Nucleotide Polymorphism. Genome analysis, Genome mapping, Comparative genomics - Paralogs and orthologs, Phylogenetic profiling. Genome Projects.

Unit III Proteomics

Introduction to basic Proteomics technology, Protein structure and Functions- amino acids and peptides; primary, secondary, tertiary and quaternary structures; protein identification and characterization; protein structure and function prediction; Protein Sequencing. Protein prediction from DNA sequence.

Unit IV Homology, Phylogeny and Evolutionary Trees

Sequence Analysis. Alignment and Phylogenetic Trees. Homology and similarity, Phylogeny and relationships, Approaches used in Phylogenetic analysis, Molecular approaches to Phylogeny, Phylogenetic Analysis databases, Hidden Markov Models for homology modeling.

Unit V. Microarray Technology

Introduction to basic microarray technology, - concept of gene expression.

Unit VI. Drug Discovery and Pharmacoinformatics

Overview of the Drug Discovery process and the role of computational methods. Review of basic biological concepts, Characteristics of a drug compound, Elements of molecular pharmacology. Concept of receptor and target. Receptor binding and activation. Ligand-receptor interaction, non-covalent bonds. Ligand into the binding site. Concepts of pharmacophore, bioactive conformation and Active Analog Approach. Molecular docking

Reference Books:

1. Basic Bioinformatics 2005, S.Ignacimuthu, s.j.
Narosa Publishing House
2. Introduction to Bioinformatics (Fourth Edition) - 2003
T.K. Attwood & D.J. Parry- Smith, Pearson Education (Singapore) Pvt. Ltd.
3. Introduction to Bioinformatics 2003
Arthur M. Lesk , Oxford University Press
4. Bioinformatics- Methods and Applications- Genomics, Proteomics & Drug Discovery- 2005
S.C. Rastogi, N. Mendiratta & P. Rastogi , Prentice Hall of India Private Ltd.
5. Bioinformatics- Databases and Algorithms - 2006
N. Gautham - Narosa Publishing House
6. Discovering Genomics, Proteomics & Bioinformatics- 2003
A. Malcolm Campbell & Laurie J. Heyer, Pearson Education (Singapore) Pvt. Ltd.
7. Bioinformatics- Managing Scientific Data- 2003
Zoe Lacroix & Terence Critchlow, Morgan Kaufmann Publishers.

Biostatistics

Unit I

Collection and classification of data – Representation of data –Tabulation of data –Diagrammatic representation of data – differences between diagrams and graphs. Graphic representation of data –frequency distribution.

Unit II

Elements of probability – sample space, sample point, sample event and venn diagram.Theoretical distributions – fundamentals of Binomial, Poisson and Normal distribution – Central Limit Theorem. Student's t-distribution – characteristics. Use of t-test for small samples. Chi-square test.

Unit III

Correlation – characteristics. Types, methods of study of correlation – scatter diagram method, graphic method, Karl Pearson's coefficient of correlation – rank correlation – concurrent deviation method – significance. Regression – characteristics, dependent and independent variables – slope and intercept – method of least squares.

Unit IV

Analysis of variance (ANOVA) characteristics – F-distribution, types and concepts of ANOVA – simple classification (one-way) of ANOVA and Two way ANOVA.

Unit V

Computer Applications in Biology.

Reference Books:

- R.C. Campbell, 1973, Statistics for Biologists
N.T.J. Bailey, 1985, Statistical Methods in Biology
W.C. Shester, 1982, Statistics for biological Sciences
S.N. Schneider 1980, Statistical Methods in biology
Lewis, A.W., 1974, Biostatistics.

General Entomology

Unit I Reason for insects as a successful group

Unit II: Insect classification

Outline classification of insects with examples.

Unit III: Basic knowledge of the following orders of insects with special reference to Indian examples: Apterygota: Thysanura, Protura, Collembola, Dipleura. Pterigota:

Exopterygota – Ephemeroptera, Odonata, Orthoptera, Thysanoptera, Mallophaga, Anopleura, Hemiptera. Endopterygota: Lepidoptera, Coleoptera, Diptera, Hymenoptera.

Unit IV : Morphology of head Sulci-tentorium – types of mouth parts – type of antenna
Morphology of wing hearing segment – wing venation of generalized insect region of wings – wing coupling mechanism – legs and external genitalia types of larvae and pupae.

Unit V: Morphology of internal organs: Elementary histology of alimentary canal - respiratory structure - circulatory organs - Brain and sub-oesophageal ganglia. - Internal organs of reproduction.

Unit VI: Structure and composition of integument – moulting

Metamorphosis and role of hormones in metamorphosis

Insect digestion – digestion of carbohydrates, fats, proteins – role of micro organisms in digestion

Elimination of nitrogenous wastes

Mechanism of respiration

Composition of Haemolymph and its function – Course of circulation - heartbeat

Reference Books:

Chapman, R.F. The Insects structure and function

Nayar, K.K. and David, General and applied entomology

Wigglesworth, V.B. The principles of insect physiology

B. Vasanthraj David, T. Elements of economic entomology

Snodgrass, G.E. Insect morphology

Snodgrass, Principles of insect morphology.

Richard O.W. and Davies, R.G. Imms' General Text books of Entomology, Vol. I

Richard O.W., and Davies, R.G. General Text Book of Entomology, Vol. II

Mani, M.S. General Entomology.

Applied Entomology

Unit I: Economic Importance of Insects: Insect pests – types – causes for insects attaining pest status – Types of damages to plants

Unit II: Agricultural Entomology: Biology, Nature, extent of damage and control of pests of Paddy, Brinjal, Mango, Cotton

Unit III: Storage of Entomology: Nature of damage and control of external and internal feeders of stored product

Unit IV: Veterinary Entomology: Nature of damage and control of insect pests of cattle, fowl, sheep and goat

Unit V: Medical Entomology: Nature of damage and control of insects associated with human beings – mosquito, house fly, fleas and head louse

Unit VI: Basic knowledge of forensic entomology

Unit VII: Beneficial insects: Kinds of honey bees – bee keeping – care and maintenance of an apiary- Types of silk worms and silk – mulberry varieties – Biology and behaviour of lac insect and lac cultivation

Unit VIII: Pest control: Methods and principles of insect pest control – Natural control (Climate, topographic features and natural enemies) – Artificial / Applied control (prophylactic, curative measures, cultural, mechanical, physical, biological, legal and chemical methods) – recent trends in pest control- IPM

Unit IX: Insecticides: Classification based on mode of entry, mode of action, chemical nature, hazards of insecticides, resurgence and outbreak, plant protection appliances.

Unit X: Integrated pest management programme, plant quarantine and pesticides registration in India.

Reference Books:

Chapman, R.F. The Insects structure and function

Nayar, K.K. and David, General and applied entomology

Wigglesworth, V.B. The principles of insect physiology

B. Vasanthraj David, T. Elements of economic entomology

Snodgrass, G.E. Insect morphology

Snodgrass, Principles of insect morphology.

Richard O.W. and Davies, R.G. Imms' General Text books of Entomology, Vol. I

Richard O.W., and Davies, R.G. General Text Book of Entomology, Vol. II

Mani, M.S. General Entomology.

(for students admitted from 2008-'09 onwards)

Unit I – Introduction to Research Methodology

Research: Meaning, Objectives, types and significance – Research process.

Research problem: Selection, selection criteria, necessity techniques in selecting a problem.

Unit II – Research Design

Research design: meaning need, research designs – Basics of experimental designs – Developing research plan.

Unit III – Literature Survey

Source of literature – INSDOC, MEDLINE, Biological abstracts, Current Contents, Pubmed and Online Journals – Types of literature: reviews, abstracts, short notes, journal articles, magazines, periodicals, books and proceedings – Reprint requisition cards and reprint requesting – Organization of collected information – index cards and style of indexing

Unit IV –Data collection

Methods of data collection- Questionnaires/schedule, Selection of appropriate method for data collection – Guidelines for constructing questionnaires – Guidelines for interviewing – Sample questionnaires – Data Analysis and interpretation – Dissertation /Reporting – Steps in report writing – How to critique an article.

Unit V – Publication

Preparation of research reports, project reports, scientific report writing – Documentation: Library cataloguing, definition, need, objectives and function of catalogue (Colon Classification, Dewey, ISBS, ISSN, Bar Coding and Accession Number) – Internet Resources: What is Internet, World Wide Web, Navigating the Internet, Electronic mail, and Electronic publication, Online Journals – Structure and ethics of Scientific presentations.

Unit VI – Funding resources and designing research proposals

World Health organization (WHO), Department of Science and Technology (DST), Indian Council for Medical Research (ICMR) – Structure of Research Proposals: Origin, Objectives, Existing Knowledge of the problem, Current status of the problem, Methodology, Budget and expected outcome.

Reference Books:

1. Doing Your Masters Dissertation, Chris H, 1st edition , Vistaar publications, 2005
2. Research Methodology, Palaniswamy and Shanmugavel.
3. Research Methodology Methods & Techniques, C. R. Kothari.

M.Sc. (vi) - SEMESTER II - PAPER 8 : MAJOR CORE

DEVELOPMENTAL BIOLOGY

5 Hours / week

4 credits

(for students admitted from 2008-'09 onwards)

(Objective: To elaborate the Scope of development biology and its development as science and a technology)

Unit I

Gametogenesis Spermatogenesis and Oogenesis – role of Hypothalamo hypophyseal Gonadal axis. Types of gametes in animals – the developing egg and its environment – sexual cycles (estrus and menstrual) – role of hormones in gametogenesis.

Unit II

Fertilization and Cleavage – physico-chemical events related to fertilization and cleavage – morphological aspects of gastrulation and primary organ formation – physiology of gastrulation.

Unit III

Determination of primary organ rudiments. Embryonic adaptations.

Unit V

Organogenesis – morphogenetic process – development of central nervous system, heart and alimentary canal.

Unit VI

Differentiation and growth – general considerations.

Unit VII

Metamorphosis – regeneration and sexual reproduction

Unit VIII

Reproductive technology: Synchronisation of estrus – control of ovulation embryo transplantation and storage – diagnosis of pregnancy – induction of parturition – out of season and prepuberal breeding – selection technique and sex pre determination – cloning.

Reference Books:

Introduction to Embryology, Balinsky
Developmental Physiology, Raven
Reproduction in farm animals – Hafez
Reproduction in Farm animals, R.H.F. Hunter.

(for students admitted from 2014-15 onwards)

Bioinformatics

1. Basics of Bioinformatics, types of data base, Online sequence retrieval- NCBI.
2. Literature database- Pub Med, Medline, OMIM.
3. Sequence database- Protein- UniProt, Prosite, Pfam, Nucleotide- Gen Bank.
4. Homology study- Basic alignment- BLAST & FASTA.
5. DNA & protein sequence analysis, pair wise (Emboss) alignment techniques.
6. Multiple alignment techniques -Clustal W.
7. Structural Database: - PDB, Protein structure Visualization- PyMol, SPDV.
8. Secondary databases -SCOP, CATH.
9. Metabolic pathway database- KEGG.
10. Docking- Argus lab.
11. Protein Modeller.
12. SAVS (Ramachandran plot validation)

Biostatistics

1. Representation of data in one, two, three dimensional diagrams and pictograms.
2. Graphic representation of data through graphs of time series and frequency distribution.
3. Statistical software package SPSS- Descriptive Statistics, Correlation and regression, ANOVA- one way and two way

(for students admitted from 2014-'15 onwards)

Developmental Biology

1. Semen collection from Bull.
2. Sperm count.
3. Egg diameter measurement, volume and density of microscopic eggs.
4. Mounting of chick embryos.
5. Study of the developmental stages of chick embryo-24,36,48,60,72,84,96 hours.(any5)
6. Observation of developmental stages of frog and Amphioxus (slides)
7. Dissection of tadpoles to show the anatomical peculiarities and transitions.
8. Regeneration studies in tadpoles/house lizard.
9. Study of placentation in goat/pig and human.
10. Oviparity, ovoviviparity and parental care (spotters)

General Entomology

Dissection of digestive nervous and reproductive systems. Mounting of mouth parts and other special morphological modifications of the following species: *Lepisma*, Earwig, Ant lion, Naiad of Dragon fly, Adult Dragon fly, *Anthia*, *Laccotrephes* or *Ranatra*, Calliphora, *Apis*, *Polistes*, Butterfly

- a. Collection, pinning and preservation of Insects
- b. Identification of some common insects or or their damages on MCC (ATLEAST 20 insects)
- c. Submission of record and insect box

Applied Entomology

- a. Collection, identification and study of any four insect pests of crops grown in MCC farm – Paddy, vegetables – Brinjal and Okra
- b. Identification of four insect pests of mango
- c. Identification of any four stored product insect pests.
- d. Identification of beneficial insects: Honey bee, Silk worm larval stage and cocoon, chandraki
- e. Insects of medical importance – mosquito, housefly and headlouse
- f. Insecticides : Knowledge of any organochlorine- DDT/HCH, Organophosphorous – Monocrotophos/ Chloropyriphos, Carbamate – Carbofuran, Synthetic pyretheroid – Fenvalerate / Cypermethrin
- g. Knowledge of field layout to study the efficacy of insecticides.
- h. Visit to a biological control laboratory to study the rearing of biocontrol agents
Submission of record

Animal Physiology

Unit- I Osmotic and ionic regulation (aquatic & terrestrial) :

Maintenance of osmotic and ionic balance in animals living in hypo, hyper and iso-osmotic environment.

Unit- II Body fluids and their circulation:

Plasma proteins and regulation of fluid volume.

Cardiac rhythm- Open and closed system- Vascular pump- chambered heart and booster pumps- Pattern of circulation of Vertebrates- The lymph hearts of Vertebrates- Pace makers of myogenic hearts- The rhythm of neurogenic heart- Blood pressure and Haemodynamics.

Unit- III Neuromuscular and neuroendocrine integration and regulation:

Myoneuronal junctions- Patterns of efferent innervation of muscles- Motor units in vertebrate muscle- Fast and slow contractions- peripheral inhibition- Neuromuscular transmitters.

Neurosecretory system- Mechanism of hormone actions (Steroid hormones and cascade amplification system).

Unit- IV

Electric organs: Morphology- physiology

Bioluminescence: Luminescent organs- distribution of bioluminescence- biochemistry of luminescence (firefly- cypridina - coelenterate). Bacterial, extracellular and intracellular luminescence- functional significance of bioluminescence. Sound Production and reception – Communication- Echo-orientation.

Reference Books:

1. Hoar- General and Comparative Physiology
2. Wilson- Animal Physiology
3. Prosser and Brown- Animal Physiology
4. Tuttle & Schottelius – Text book of Physiology
5. Kunt and Schmidt Nielson - Animal Physiology
6. Potts and Parry – Osmotic and Ionic regulation.
7. Lehninger – Principles of Biochemistry.

Biochemistry

Unit I: Enzymes: Classification, mechanism of enzyme action, Michaelis-Menton reaction, enzyme inhibitors.

Unit II: Anabolism – biosynthesis: Carbohydrates: central pathway, bypass reactions, gluconeogenesis, glycogenesis. Lipids – Mitochondrial synthesis of fatty acids, non-mitochondrial synthesis of fatty acids, synthesis of triglycerides, synthesis of phospholipids, synthesis of cholesterol, errors in lipid metabolism.

Unit III: Catabolism: Carbohydrates – glycolysis, TCA cycle, HMP pathway, glycogenolysis, energetics of the cycles. Proteins – overview of protein catabolism – Transamination, deamination, fate of ammonia and carbon skeleton, urea cycle. Lipids – mobilization of fats from dietary intake. Break down of fatty acid and cholesterol.

Unit IV: Integration of biomolecules - intermediary metabolites – phosphorylation, types, biological oxidation, energy rich compounds – oxidative phosphorylation.

Reference Books:

Lehninger, Albert L. 1970. Biochemistry Worth Publishers, Inc., New York, pp.833.

Jain, L.L. Sunjay Jain & Nitin Jain 2005. Fundamental of biochemistry, S. Chand and Company Ltd., New Delhi, pp.1230.

Ambika Shanmugam 1974. Fundamentals of Biochemistry for Medical Studies. Second Edition (Revised), Aries Agencies, Chennai, pp.647.

West, Edward Staunton, Todd Wilbert R. Mason Howard, S. and Bruggen John T. Van. 1974. Textbook of biochemistry Amerind Publishing Co. Pvt. Ltd, New Delhi, pp.1595.

Wilson, Jean, D. Foster Daniel W., Kronenberg Henry M and Larsen Reed, P. 1998. Williams Test book of Endocrinology. W.B. Saunders Company, London, p.1819.

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Microbiology

Objective: To expose the students to various micro-organisms and their applied aspects.

UNIT I

History of Microbiology. Discovery of the microbial world.

UNIT II

Bacterial identification. nomenclature and classification, New approaches to bacterial taxonomy / classification including ribotyping and ribosomal RNA sequencing

UNIT III

General structure and features, brief account of all group of bacteria and cyanobacteria, Rickettsia, Chlamydia and Mycoplasma

Archaea : Archaeobacteria and extremophilic microbes – their biotechnological potentials

UNIT IV

The definition of growth, growth curve, measurement of growth and growth yields, Culture collection and maintenance of cultures. Isolation, pure culture techniques, Methods of sterilization.

UNIT V

Different modes of nutrition in bacteria, Sulfate reduction, Nitrogen metabolism – nitrate reduction, nitrifying and denitrifying bacteria, Nitrogen fixation and Microbes used as biofertilizer

UNIT VI

Viruses : Classification, morphology and composition of viruses in general, Bacteriophages : ϕ X 174, cyanophages and retroviruses, Viroids and Prions

UNIT VII

Applications in Microbiology:- Industrial Microbiology: Microbes in the production of alcohol and antibiotics.

UNIT VIII

Dairy microbiology: Microbiology of milk and milk products,

UNIT IX

Agricultural microbiology: Nitrogen cycle, phosphorous cycle, nitrogen fixation, soil fertility and biogas. Medical Microbiology – study of common bacterial (10), fungal (5) and viral (5) diseases of man and their preventive measures.

UNIT X

Microbiology of drinking water. Methodology of bacterial analysis of water- water borne diseases- Sewage- biological sewage purification methods- Chlorination of water and its implication.

Reference Books:

Microbiology – Anna K. Joshua
Microbiology – Norton C.F.
Microbiology – Pelcazar, Reid and Chan
Text Book of Microbiology – Ananthanarayanan and Jayaram
Food Microbiology – Frazier
Industrial Microbiology – Casida L.F
Micro biology of water and Sewage Geinyl and lord
General Microbiology – Boyd
Microbiology – Atlas – Biology of Microorganisms – Brock and Madigan
General Microbiology – Stainer, John, Mark
Microbiology - Zinsser

Immunology

Unit I : Introduction to immunology

History of development of immunology and scope. Classification of immunity – natural, induced, innate, acquired, specific, non-specific. Immune response-primary and secondary and Heideberger-Kendall reaction.

Unit II: Lymphoidal organs

Primary bone marrow, thymus, Bursa of fabricius, secondary spleen GALT, MALT. Peyer's patches, Kupffer cells, etc. – Theory locations structure and function.

Unit III: Principles of classification

Stem cells and differentiation and classification of lymphoid cells.

Unit IV: Fundamentals of immunity

Immunoglobulins – structure, classification, theories of formations and functions. Separation of T and B lymphocytes. Antibody-mediated and cell-mediated immunity. Cytokines. Antigen presentation. Compliment system. Major histocompatibility complex. Phagocytosis. Tolerance.

Unit V: Immunity of viral, bacterial, fungal, protozoan, and helminth infections

Natural response and immunological mechanism against such infectious agents; immune mechanisms of host.

Unit VI: Primary and secondary immunodeficiency states

Occurrence of primary and secondary immunodeficiencies with examples.

Unit VII: Hypersensitivity Reaction

Types I, II, III, IV and V. Roll of immunoglobulins in various types of reactions; Reactions and responses of the system and tests; specific examples for each type. Disease manifestation and modern treatment methods.

Unit VIII: Transplantation and Rejection

Tissue typing and HLA system: (Genetics); grafting and classification of grafts; graft rejection and prevention and role of T. Lymphocytes; immunosuppression, immunomodulators.

Unit IX: Autoimmunity

Types of autoimmune diseases, antibodies, occurrence, genetic factors and pathogenicity diagnostic and prognostic values.

Unit X: Modern trends of immunology

Biotechnological trends in organ / tissue grafting technology, vaccinology; Bispecific antibodies; monoclonal antibodies, vaccines through food. Role of natural research laboratories and institutes.

Reference Books:

Immunology by Roitt.

Basic immunology by Gupta

Fundamentals of immunology by Weir

Immunology by Barrett.

M.Sc. (vi) - SEMESTER III - PAPER 12: MAJOR CORE

ENVIRONMENTAL BIOLOGY & BIODIVERSITY

4+2 Hours / week

4

Credits

(for students admitted from 2008-'09 onwards)

Environmental Biology

UNIT I - ECOSYSTEM ECOLOGY: Ecosystem components; concept (Aquatic, Terrestrial, Deep Sea, Polar, Micro and Space ecosystem): Biological control of the chemical environment: Production and decomposition in nature: Homeostasis.

UNIT II - ENERGY in ECOSYSTEM : Energy and Environment : Concept of productivity.

UNIT III - SPECIES in ECOSYSTEM : Concepts of habitat and ecological niche; ecological equivalents; natural selection and speciation: Biological clocks: Ecosystem development and succession.

UNIT IV - RESOURCES : Forest, grass land and agriculture; capture and culture fisheries; Land, soil and water; fossil fuel; minerals; wild life; energy of biological origin and non-conventional energy resources.

UNIT V- RESOURCE MANAGEMENT : Conservation of biodiversity; renewable and non-renewable; deforestation and afforestation; wild life conservation; land use; desalination and weather modifications; national programmes on conservation.

UNIT VI - POLLUTION and ENVIRONMENTAL HEALTH : Air, water and soil pollution; special emphasis on CO₂, CO, pesticides and heavy metals (lead, mercury, chromium): Solid wastes and their management; Agro-industries, Thermal, Tanneries pollution: Noise pollution: Pollution as it relates to meteorology and climatology; el-nino: Sewage treatment: Environmental laws to monitor pollution.

UNIT VII - ENVIRONMENTAL EDUCATION AND ORGANIZATIONS : Goals, objectives and guiding principles; various programmes in India; Environmental organization and agencies: Environmental issues:- silent valley, Narmadha: International bodies: Man and the biosphere programme: National organization:- Department of environment, forest and wild life; Important abbreviations/acronyms.(AEC, BSI, CFC, CPCB, CRZ, DNES, DST, EIA, ENVIS, EPA, EPC, FAO, GEMS, IUCN, MAB, NEERI, NEPA, SPCB, UNESCO, WHO, WWF-INDIA).

UNIT VIII - BIOREMEDIATION : Definition; Need and scope; Environmental application; Future outlook; Phytoremediation:- biotechnology of cleaning up the environment by plants.

UNIT IX - SPACE ECOLOGY : Types of life support systems in space; exobiology; hazards of space travel.

UNIT X - ENVIRONMENT AND FUTURE OF BIOSPHERE

A. GLOBAL WARMING : Causes:- CO₂, Methane, Chlorofluorocarbons, Nitrous oxide, Ozone. Consequences:- climatic change, human diseases. Impact:- on forests, Agriculture.

B. POPULATION GROWTH AND FOOD PRODUCTION : World population:- growth, regulation, modern technology and population explosion, future of world population, population growth in India.

World food production:- Green revolution, towards second green revolution.

C. URBANIZATION AND ITS IMPACT ON SOCIETY : Population growth and urbanization: Factors contributing urbanization:- migration, industrialization, transportation, socio-economic changes: Impact on environment, health, society: Management of urbanization.

D. ENVIRONMENTAL IMPACT ASSESMENT : Process and preparation of environmental impact statement, cost benefit analysis, current status EIA in developed countries(U.S.A.,Canada, Germany, U.K., Japan), and developing countries (India, Indonesia, Philippines). GIS; remote sensing.

E. ENVIRONMENT AND SUSTAINABLE DEVELOPMENT : Sustainable growth in the context of Population growth, Urbanisation, Industrial growth, global warming, military conflicts and nuclear war. Biotechnology and nature management as a way to sustainable development: People's participation: Future Scenario.

Reference Books:

Fundamentals of Ecology – Eugene P Odum 1991.W.B.Saunders Company.

Fundamentals of Environmental Sciences – G.S.Dhalival, G.S.Sangha, P.K.Ralhan. 2000
Kalyani Publishers.

Ecology and Environment – P.D.Sharma 1999, Rastogi Publications.

Animal Ecology and Environmental Biology – H.R.singh 2001, Shoban Lal Nagin Chad & co

Biodiversity

UNIT – I

Defining Biodiversity Concept, Convention on Biological diversity – role, goals, functions and perspectives. Global biodiversity assessment

UNIT – II

Biodiversity from taxonomic and evolutionary perspectives; Origin of scientific taxonomy, basis of taxonomic characterisation, characterizing species (the morphological species concept, biological species concept, phylogenetic species concept) Phylocode classification. Taxonomic measures of species diversity, modern developments (database and expert identification systems).

UNIT - III

Types of diversity – Ecosystem diversity (Variety and habitat), Species diversity, Genetic diversity, Methods of measuring species diversity and genetic diversity, Causes of biodiversity loss, Effects of biodiversity loss.

UNIT-IV

Human Society and biodiversity- Cultural diversity, Values of biodiversity, People's movement, Climate Change, Conservation – Approaches and Sustainable development.

UNIT V

Mega diverse nations, Hot Spots of biodiversity, IUCN categories of threat, Biosphere Reserves and Conserved areas of India, Projects to Save Threatened species.

UNIT VI

National Biodiversity Act- policy and action, Wild life Regulation Acts, National and International Treaties and Conventions, Intellectual Property Rights over Biological products

Reference Books:

1. Ferguson. C. 1980. Biochemical Systematics and Evolution.
2. Mayor. E. 1994. Principles of Systematic Zoology.
3. Agarwal. K.C. 2000. Biodiversity.
4. A.B.Choudhari and D.D.Sarkar 2002. Biodiversity Endangered.
5. Kumar.V. 2003. Biodiversity Principles and Conservation.
6. Kotwal P.C. 2003. Biodiversity Conservation in Managed Forests and Protected Area.
7. Trivedi. P.C. 2004. Biodiversity Assessment and Conservation.
8. India 2006: Ministry of Information and Broadcasting, Government of India, New Delhi.

(for students admitted from 2014-'15 onwards)

Animal Physiology

1. Preparation of Maltose standard graph
2. Human Salivary Amylase activity in relation to Temperature
3. Rate of activity in relation to body mass / weight in an aquatic organism (Fish)
4. Estimation of Haemoglobin
5. Estimation of ESR

Biochemistry

1. Paper Chromatography.
2. Thin layer chromatography.
3. Quantitative Estimation of Blood Glucose.
4. Quantitative Estimation of Total Protein.
5. Quantitative Estimation of HDL, LDL (Triglycerides).
6. Quantitative Estimation of Creatinine in urine.
7. Quantitative Estimation of Creatinine in serum.
8. Quantitative Estimation of Urea in serum.
9. Quantitative Estimation of Urea in urine.
10. Quantitative Estimation of Serum cholesterol.
11. Quantitative Estimation of Alkaline phosphate

Immunology

1. Precipitin Test
2. Dissection to locate primary and secondary lymphoid organs (any vertebrate)
3. Vaccination Schedule and vaccines used.
4. Demonstration of immunization (Intravenous, Intraperitoneal, cutaneous, ocular, oral)
5. Observation of permanent slides of lymphoid organs / tissues.
6. Radial Immunodiffusion and Ouchterlony double diffusion using Agarose, Aleiver's.
7. Fluorescent staining of blood for observation of lymphoid cells.
8. ELISA-demo.
9. Report of survey of awareness of HIV/AIDS amongst students.

Visit to Institute and departments related to immunology and vaccine producing laboratories-Diagnostic centre.

M.Sc. (vi) - SEMESTER III - PAPER 13: MAJOR CORE PRACTICAL – III ENVIRONMENTAL BIOLOGY & BIODIVERSITY AND MICROBIOLOGY 2+2 Hours / week 2 Credits

Environmental Biology and Biodiversity

1. Qualitative and quantitative analysis of plankton sample.
2. Determination of hardness of water – calcium, magnesium.
3. Estimation of BOD in pond water and polluted water.
4. Study of soil characteristics:- colour, texture, moisture, PH, carbonate and nitrate.
5. Study of terrestrial community by quadrat method :- determining frequency, density and abundance of different species present in the community.
6. Measurement of particulate air pollutants - dust fall and suspended particulate matter from different areas.
7. Visit to sandy shore, muddy shore and rocky shore to collect and study the organisms and their adaptation to the environment.
8. Study of pond / estuarine ecosystem (Estuarine Biological Laboratory, Pulicat): Plankton collection, estimation of primary productivity, PH, salinity, dissolved oxygen content, free carbon dioxide content, analysis of biotic community and construction of food chain and food web.
9. To Study the biodiversity of fauna of the scrub jungle of MCC campus and to estimate Absolute density - Relative dominance - Relative density - Relative frequency - Simpson, Index of dominance - Community dominance index - Community similarities - Coefficient of community - Species diversity index - Index of frequency of occurrence together and Species association test
10. Students may be exposed to the following areas (not for assessment)- sewage treatment plants; drinking water treatment plants; atomic power plants; refineries and tanneries.

Microbiology

1. Commercial kits-based diagnosis.
2. Antibiotic sensitivity(bacterial).
3. Bacterial culture
4. Agar gel diffusion
5. ELISA
6. Preparation of axenic cultures
7. Laboratory Safety, Microscopy, Aseptic Technique
8. Bacterial Cultures, Slide Preparation, Staining, Streaking
9. Streaking, Pour Plates
10. Bacterial Characteristics
11. Differential and Selective Media
12. Bacterial Identification
13. Litmus Milk, Carbohydrate Fermentation, Hydrogen Sulfide and Agglutination Tests

M.Sc. (vi) - SEMESTER IV - PAPER 14 : MAJOR CORE

BIOTECHNOLOGY

6 Hours / week

4

Credits

(for students admitted from 2008-'09 onwards)

Unit – 1: Introduction: Historical perspective; definitions; scope of biotechnology; commercialization of biotechnology. Fundamentals of molecular biology. 5 hrs.

Unit – 2: Gene technology: Restriction endonucleases as tools for DNA fragment generation; linkers and adaptors; expression of cloned genes; P.C.R.; vectors; rDNA technology; transgenics; cloning; DNA sequencing; gene libraries; human genome project 10 hrs..

Unit – 3: Protein engineering and design: Protein structure and function; methods in protein engineering and design; production of foreign proteins. Gene therapy. 8 hrs.

Unit – 4: Enzyme technology: Traditional uses of enzymes; immobilization – methods and uses; biosensors. 5 hrs.

Unit – 5: Bioprocess technology: Exploitation of micro-organisms and cells; S.C.P.; mining; over-exploitation in various fields of biotechnology. 8 hrs.

Unit – 6: Human health and biotechnology: Application of biotechnology in the field of biotechnology – diagnostics and therapy; human protein replacements; vaccines; A.R.T.; monoclonal antibody technology; immunotechnology; human gene banks; related ethical issues. 12 hrs.

Unit – 7: Agricultural biotechnology: tissue culture; micropropagation; somatic hybridization; transgenic plants. 4 hrs.

Unit – 8: Animal biotechnology: transgenic animals; high yielding and disease resistant animals; A.R.T. in animal husbandry; cloning and transgenic animals; animals as models and related ethical issues. Fishery biotechnology. 10 hrs.

Unit – 9: Environmental biotechnology: environment and human health; biomonitoring of pollution; waste treatment; bioremediation; global environmental problems. Bioethics. I.P.R. and patents. 8 hrs.

Reference Books:

1. Molecular biology of the gene. Watson, et al.
2. Concepts of Biotechnology. Balasubramanian, et al.
3. Biotechnology. U. Sathyamurthy.
4. Animal Biotechnology. Ramadas.
5. Introduction to Biotechnology. Gupta.
6. Basics in Biotechnology – Springer Verlag

(for students admitted from 2008-'09 onwards)

Unit I: Role of Hormones

1. Hormone biosynthesis and secretion
2. Transport of hormones
3. Mechanism of hormone action: Peptide and steroids
4. Receptor types and its mode of action

Unit II: Endocrine manipulation of Reproduction in Mammals

1. Overview of hormonal control of reproduction in mammals
2. Manipulation of the estrous cycle
3. Induction and synchronization of estrus
4. Superovulation and embryo transfer
5. Hormones in maintenance of pregnancy
6. Induction of Parturition
7. Inducing puberty

Unit III: Gonads and fertility disorder

1. Amenorrhea
2. Polycystic ovary
3. Hirsutism
4. Cryptorchism
5. Varicocele
6. Sertoli cell syndrome

Unit IV : Gamete Preservation in Fish & Mammals

1. Sperm motility and metabolism
2. Gamete quality
3. Short-term preservation of spermatozoa
4. Short-term preservation of ova
5. Cryopreservation of gametes

Unit V: Anabolic steroids and Analogues

1. Direct and indirect effects
2. Delivery systems
3. Effects of sex steroids on meat quality
4. Safety issues

Unit VI: Hormonal response to stress

1. Sympatho-adrenal system
2. Hypothalamic – Pituitary axis
3. Role of various hormones in stress responses
4. Effects of stress on reproduction

5. Effects on growth performance

Unit VII: Obesity

1. Cause and Consequences
2. Outline of hormonal involvement
3. Leptin: synthesis, secretion and its role in adipogenesis

Unit VIII: Thyroid disorders and management

1. Antithyroid drugs, dietary goitrogens
2. Goiter
3. Myxedema
4. Cretinism

Unit IX : Insulin and Glucose balance

1. Glucose homeostasis
2. Insulin resistance & Management
3. Diabetes mellitus & Management

Reference Books:

1. G. M. Besser & M. O. Thorner. Comprehensive Clinical Endocrinology, IIIrd Ed. (2002), Mosby.
2. E. Knobil & D. Niell. Encyclopedia of Reproduction (1998), Academic press.
3. P. J. Bentley. Comparative Vertebrate Endocrinology, IIIrd (1998), Cambridge University Press
4. E. J. Squires. Applied Animal Endocrinology (2003), CABI Publications UK.
5. Mac E. Hadley. Endocrinology, V Ed. (2000), Prentice Hall International Inc.
6. Norris. Vertebrate Endocrinology, IIIrd ed. (1998). Lea & Febiger.
7. P. R. Larsson et.al., Williams Text Book of Endocrinology, Xth Ed. (2002), W.B. Saunders, Philadelphia.



M.Sc. (vi) – SEMESTER IV - PAPER 16: MAJOR CORE PRACTICAL - IV

BIOTECHNOLOGY AND ENDOCRINOLOGY

3+3 Hours / week

4Credits

(for students admitted from 2008-'09 onwards)

Biotechnology

1. Design of bioreactor.
2. Electrophoretic separation of proteins (PAGE)
3. Genomic DNA isolation from animal tissues.
4. Detection of DNA.
5. Quantitative estimation of DNA.
6. Enzyme immobilization.
7. Chromatographic techniques – Column Chromatography
8. P.C.R.
9. Principles of animal cell culture.
10. ELISA.
11. Immunoblotting.

Endocrinology

1. Dissection to see various endocrine glands in mice/Rat, frog / Wall lizard
2. Observation of histological slides: Pituitary, Thyroid, Adrenal, Pancreas, Thymus, Ovary, Testis and Epididymis
3. Ectomy experiments: Adrenalectomy, Castration, Ovaryectomy in lab mice (any one)
4. GTT experiments
5. Thyroxin test in Tadpoles
6. Estrous cycle study by vaginal smears in mice
7. hCG based pregnancy test

Credits

(for students admitted from 2008-'09 onwards)

Unit I Introduction: Definition (ethology, instinct –learning, Altruism, agnostic behaviour, derive, displacement behaviour, territorial behaviour, communication, hierarchy, FAP, stimuli, ethogram, Time budgets) Lorenz's and tinbergen's models for release of FAP, modern methods in the study of behaviour.

Unit II Describing behaviour: Description by form and function, Advantages and disadvantages, methods of data collection – field observations, capture, recapture, camera tagging, radioelemetry, lab experiments, activity recordings.

Unit III: Living groups: Costs and benefits, communication (types, design of signals, variability in signals – bees, birds and bats), behaviour expressed in a group (territorial, altruism, courtship and mating, agnostic hierarchy).

Unit IV: Rhythmic behaviour: Kinds of biological rhythms (circadian, tidal, lunar and annual). Characteristics of circadian rhythms, terminology used (Zeitgeber, phase, phase shifts, phase angle difference, entrainment, freerunning rhythm, CT, PRC, Actogram), biological clocks.

Unit V: Behavioural Genetics: Single genes and behaviour, chromosomal mutations affecting behaviour, polygenic inheritance of behaviour, behaviour of inbred, recombinant strains, molecular basis of circadian rhythms, phylogeny of behaviour.

Unit VI: Neural control of Behaviour: Language of the nervous system, brain centers and their functions, learning and memory, hormones and behaviour.

Unit VII: Applied Ethology: Pest control, managing population size, improving productivity promoting the welfare of farm and captive animals, wildlife management.

Unit VIII: Human behaviour

Human actions (innate, discovered, absorbed, trained and mixed), gestures (primary and secondary), greeting signals, baron signals.

Reference Books:

McFarland, D. Companion to Animal Behaviour

Manning, Introduction to Animal Behaviour

Desmond Morris, Manwatching.

(for students admitted from 2008-'09 onwards)

Objectives: To introduce the knowledge of aquaculture potential and practices in India, and to realize the need for augmenting food production from the aquatic resources through aquaculture

Unit I

Scope and definition. Nature and socio-economic basis. Biological and technological basis. History of aquaculture and its present status at the National and Global level. National and International research and development organizations.

Unit II

Classification of cultivable aquatic organisms of India (taxonomic and ecological) pre-requisites for cultivable organisms.

Unit III

Basic considerations in aquaculture. Definition of traditional extensive and intensive, semi-intensive culture practices; preparation and management of ponds – construction, fertilization, control of aquatic insects, weeds and predatory and weed fishes. Estimation of live-feed organisms. Procurement of seed and its transportation natural and artificial feeds, nutritional ecology (Energy budgets). Spawning and breeding, parasites and diseases.

Unit IV

Productivity and plankton. Methods of productivity studies in an aquatic environment; qualitative and quantitative studies of plankton; culture techniques of phyto and zooplankters.

Unit V

Culture Techniques : Sea-weed culture. Resources and utilization; culture techniques.

Unit VI

Shell fish culture: Crustacean culture. Shrimp culture, pattern of life-cycles of penaeids and non-penaeids , induced maturation and breeding of cultivable shrimps- Formulated feeds of shrimps and prawns and lobsters. Recent breakthroughs in the induced breeding of shrimp, prawns and crabs. Biology and culture techniques.

Unit VII

Fin-fish culture

Patterns of life cycles of brackishwater cultivable fin fishes. Techniques of induced breeding of cultivable fin-fishes. Monoculture, polyculture, special culture techniques of various freshwater, brackishwater, marine finfishes viz., pond, cage, pen, race-way, recirculatory, paddy-cum-fish culture, sewage-fed fishculture, sustainable aquaculture, culture based fisheries of small reservoirs, flood plain wetland culture fisheries close to jheels. Lab- to -land programmes.

Unit VIII

Constraints of aquaculture (i) low quality and costly feed ingredients, (ii) weak extension network, (iii) lack of field exposure, (iv) insufficient R & D support (v) lack of proper database (vi) non-availability of proper insurance schemes (vii) lack of policy for aquaculture.

Reference Books:

Reay, R.J. 1979, Aquaculture. Edward Arnold (Publishers) Ltd., pp.56.

T.V.R. Pillai, 1993. Aquaculture – principles and practices fishing news publication, pp.578.

Sinha, V.R.P. 1993. A compendium of aquaculture technologies for developing countries, Oxford I.B.P. Publishing Co. Pvt. Ltd., pp.115.

Annon, 1995, Freshwater fishes Hand Book on aquaculture, MPEDA, Cochin, pp.102.

T.J.Pandian (ed.) 2001. Sustainable fisheries. National academy of agriculture sciences, pp.327.

(for students admitted from 2008-'09 onwards)

UNIT I : Introduction

Nature and scope of Life Sciences in Modern times – trends in teaching life sciences – aims and objectives with reference to Bloom's taxonomy – teaching life sciences at different levels.

UNIT II: Microteaching:

Teaching skills – demonstration – explaining – Black board writing – skills of stimulus variation – questioning – uses of aids and reinforcement.

UNIT III: Lesson Planning:

Principles of lesson planning – its importance – approach to lesson plan – planning for specific behavioural changes – Herbartian steps – its merits and demerits.

UNIT IV : Education Technology:

Traditional: importance of aids in teaching – principles and preparation of charts, pictures, models, objects, specimen, transparencies, audio and video tapes – magnifying equipments like microscopes – preservation of biological specimens including herbarium, cultures, aquarium, vivarium, aviary, museum – setting up a lab – accidents and first aid.

Modern Technology: Flow chart – computer aided learning – internet search – use of multimedia.

UNIT V: Methods of teaching:

Inductive and deductive approach – Importance of formulation and verification of hypothesis – General methods of Teaching: lecture – Lecture cum demonstration – practical project – PowerPoint presentation – Seminars – group discussion – field trip – organizing seminars and symposia.

UNIT VI: Evaluation:

Achievement tools – preparation of question paper – essay type, objective and short answer – blue print of question paper – construction and use of tests – statistical analysis of results and performance – diagnostic tests – remedial measures – teaching and student evaluation.

Reference Books:

Secondary School Teaching Methods

By Leonard H. Clark, Irving S. Starr

Exercises for "Methods of Teaching in High Schools":

Samuel Chester Parker

Science Teaching Methods

Harold R. Hungerford, A. Tomera

A Method of Teaching Zoology

By Elliot Whipple

M.Sc. (vi) – SEMESTER IV- MAJOR ELECTIVE : PAPER 18**MEDICAL LABORATORY TECHNIQUES****4 Hours / week****5****Credits**

(for students admitted from 2008-'09 onwards)

UNIT I: Human Anatomy and Physiology:

Organs and organ systems – levels of organization – study of the following systems in detail: circulation – digestion – urinary – endocrine.

UNIT II: Lab organization, maintenance and instrumentation:

Code of ethics – organization of Laboratory - laboratory administration - maintenance of records and reporting – construction – care and use of the following equipments: photoelectric colorimeter, spectrophotometer, ECG apparatus, electrophoresis, Biochemical analysers and ELISA Reader.

UNIT III: Medical parasitology:

Morphology, life cycle, mode of infection, pathogenesis, prophylaxis and treatment of the following parasites found in human.

Protozoology: Rhizopoda – *Entamoeba histolytica*, *Entamoeba coli*, Sporozoa – *Plasmodium* sp., Ciliata – *Blantidium coli* and flagellates – *Trichomonas*, *Trypanosoma*, *Giardia lamblia*.

Helminthology: Nematodes – *Ascaris*, Hookworm, *Enterobius*, *Trichuris*, *Wuchereria*.

Cestodes – *Taenia saginata*, *Taenia solium*, *Hymenolepis nana*, *Diphyllobothrium latum*.

Trematodes – Common Blood flukes, Intestinal and Lung flukes and Liver flukes.

UNIT IV: Clinical immunology

Cell mediated and humoral immunity; Immuno diagnostic test.

UNIT V : Biochemistry and techniques in Histopathology:

Enzymes: Basic concepts, clinically important enzymes – metabolic disorders.

Use of enzymes, immobilization of enzymes and their application in biotechnology.

Preparation and processing of tissues – Fixation / dehydration / impregnation with paraffin wax / embedding / block making / section cutting / mounting and staining.

UNIT VI: Haematology and Clinical pathology

Blood – composition – functions – production of cells – Types of anaemias – clotting mechanisms and disorders. Blood groups and blood banking – study of body fluids – sputum. Faeces, semen, gastro and duodenal contents – cerebrospinal fluid, transudates and exudates – basic information of commitment.

Reference Books:

A text book of physiological chemistry, Harold Harper.

A text book of biotechnology, Kumar

Anatomy and Physiology for Nurses, Evelyn and Pearce

Biochemistry, Ambika Shanmugam

Biotechnology – The biological principles: Treven, et al.

Cell biology: De Robertis

Essential Immunology: Roit

Human Anatomy and Physiology: Best and Taylor

Immunology: Weir

Instrumentation techniques: Griffith

Introduction to Human Anatomy and Physiology: Eldra Pearl Solomon

Language of Medicine: David Ellen Chabner

Manual on Medical Lab Technology: CMC Medical Foundation

Medical Parasitology: Jayaram Panicker

Medical Physiology: Guyton

Medical Microbiology: Anantanarayanan and Panicker

Notes on Clinical Lab Techniques: K.M. Samuel

Practical Clinical Biochemistry: Herold Varley

Textbook of Medical Laboratory Technology: Ramnik Sood

Textbook of Medical Laboratory Technology: Kanai Mukherjee

Textbook of Biochemistry: Lehninger

M.Sc. (vi) – SEMESTER IV- MAJOR ELECTIVE : PAPER 19 PRACTICAL V		
ANIMAL BEHAVIOUR	2 Hours / week	5
Credits		

(for students admitted from 2008-'09 onwards)

1. Study of birds in MCC campus.
2. Orientation of animals (cockroach, ant-lion larvae, maggots, earthworm, grasshopper and butterfly).
3. Mounting of the legs and sting of honey bees.
4. Study of *Drosophila* eclosion rhythms.
5. Study of mouth parts in insects and their feeding strategies.
6. Study of learning in mice and cockroach.
7. Establishment of the relation between brain and behaviour.
8. Human actions and gestures
9. Study of animals in captivity – visit to the zoo.

M.Sc. (vi) – SEMESTER IV- MAJOR ELECTIVE : PAPER 19 PRACTICAL V		
AQUACULTURE	2 Hours / week	5 Credits

(for students admitted from 2008-'09 onwards)

1. Identification of cultivable organisms and weed and predatory fishes
 - i. Fishes (10) b) Shrimps (3) c) Prawns (3) d) Molluscs (5)
2. Identification of aquatic insects (5)
3. Identification of live-feed organisms (field training)
4. Identification / field visit to identify parasites and diseases of fish/shrimp, utility of PCR & ELISA techniques, medicines and probiotics
5. Water quality analysis and estimation of primary productivity in fish/shrimp farm.
6. Qualitative and quantitative analysis of Planktons.
7. Compulsory visits to 1. Fish farm, 2. Fish Hatchery, 3. Shrimp Farm, 4. Shrimp Hatchery, 5. Visits to CIBA and CMFRI – Kovalam lab and NIOT)

M.Sc. (vi) SEMESTER IV - PAPER 20 : MAJOR ELECTIVE PRACTICAL - VI		
TEACHING ZOOLOGY	3 Hours /week	5
<i>credits</i>		

(for students admitted from 2008-'09 onwards)

1. Preparation of Teaching aids: a) Wet mount b) Dry mount (insect/crab)
c) skeleton preparation.
2. Preparation of charts and Herbarium sheets
4. Question paper writing – assessment – evaluation.
blue print preparation
5. Lesson plan
6. Power point preparation & presentations
7. Teaching practice in the Zoology Department, MCC.

M.Sc. (vi) SEMESTER IV - PAPER 20 : MAJOR ELECTIVE PRACTICAL - VI		
MEDICAL LABORATORY TECHNIQUES	3 Hours /week	5
<i>credits</i>		

(for students admitted from 2008-'09 onwards)

I. Analysis of Body fluids and Medical Microbiology

Preparation of reagents.

chemical tests – qualitative

Microscopical examination of deposits

Pregnancy tests.

Faeces: routine examination, microscopical examination for ova and parasites. Culture and sensitivity, sputum for AFB, semen analysis. Collection of sample for culture of microorganisms; different staining techniques, culture and sensitivity test, test for typhoid - Widal / VDRL test, HIV test, HBSAg (Hepatitis B Surface Antigen) and Mantoux test.

II. Practical Clinical Biochemistry

Determination of the following parameters in blood – Blood sugar, urea, creatinine – cholesterol – alkaline and acid phosphatase – SGOT and SGPT – total proteins.

III. Haematology and Blood Banking

Collection of blood - Blood cell counts - TC, TRBC – haemoglobin. Haematological indices, coagulation tests – ESR tests – peripheral smear study. Blood for malaria and microfilaria – ABO grouping and Rh.