POOMPUHAR COOLEGE (AUTONOMUS)

(HR&CE Admin. Dept. Tamil Nadu)

MELAIYUR-609107

P.G. & Research Department of Zoology

M.Sc., Zoology- Course structure under CBCS

(Applicable to the candidates admitted from the academic year 2016-2017 onwards)

Semester	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
I	Core Course – I (CC)	Functional Morphology & paleontology of Invertebrates & Chordates	6	5	3	25	75	100
	Core Course – II (CC)	Genetics	6	5	3	25	75	100
	Core Course – III (CC)	Evolution	6	5	3	25	75	100
	Core Course – IV (CC)	Cell & Molecular Biology	6	5	3	25	75	100
	Core Course – V (CC)	Practical I	6	4	3	40	60	100
		Total	30	24				500
II	Core Course – VI (CC)	Biochemistry & Biophysics	6	5	3	25	75	100
	Core Course – VII (CC)	Microbiology	6	5	3	25	75	100
	Core Course – VIII (CC)	Biotechnology	6	5	3	25	75	100
	Core Course – IX (CC)	Practical II	6	4	3	40	60	100
	Elective – I	Endocrinology/Toxicology/Research Methodology and Bioinformatics	6	4	3	25	75	100
		Total	30	23				500
III	Core Course – X (CC)	Developmental Biology & Immunology	6	5	3	25	75	100
	Core Course – XI (CC)	Animal Physiology	6	5	3	25	75	100
	Core Course – XII (CC)	Practical III	6	4	3	40	60	100

	Elective II	Bioinstrumentation/Poultry Science/Environment and Health	6	4	3	25	75	100
	Elective – III	Vermitechnology/Animal Behavior	6	4	3	25	75	100
		Total	30	22				500
IV	Core Course – XIII (CC)	Environmental Biology	6	5	3	25	75	100
	Core Course – XIV	Practical IV	4	4	3	40	60	100
	Project Work	Dissertation 80 Marks [2 reviews – 20+20=40 marks Report Valuation =40 marks] Viva 20 Marks	8	4				100
	Elective IV	General and applied Entomology/Wildlife Biology	6	4	3	25	75	100
	Elective V	Fishery Biology/Cancer Biology	6	4	3	25	75	100
		Total	30	21				500
		Grand Total	120	90				2000

The Department of Zoology will offer the following Major Elective Courses

1. Poultry Science
2. Vermitechnology
3. Entomology
4. Fishery Biology

The Department of Zoology will offer the following Non Major Elective Courses

1. Inherited Diseases and Genetic Counseling
2. Freshwater Fish culture
3. Bio resources
4. Toxicology

Note:

Core Courses include Theory, Practical & Project

No. of Courses	15 - 4
Credit per Course	10 + 5
Total Credits	70

Elective Courses

(Major based / Non Major / Internship)

No. of Courses	4 – 5
Credit per Course	4 – 6
Total Credits	20

	Internal	External
Theory	25	75
Practical	40	60

Project

Dissertation	80 Marks [2 reviews – 20+20 = 40 marks Report Valuation =	40 marks]
Viva	20 Marks	20 marks

Passing Minimum in a Subject

CIA	40%	
UE	40%	Aggregate 50%

CORE COURSE I FUNCTIONAL MORPHOLOGY & PALAENTOLOGY OF INVERTEBRATES AND CHORDATES

SUB CODE:16:P08M1

A. INVERTEBRATES

Unit - I

Organization

Symmetry in animal organization – Asymmetry, radial, biradial and bilateral symmetry – Significance.

Coelom – Evolution of coelom. Acoelomate, pseudocoelomate, coelomate groups (Schizocoel, Enterocoeel, mesenchyme) – Significance.

Metamerism – Evolution of metemerism – Pseudometemerism, cyclo metamerism, corm theory, embryological theory – Significance.

Locomotion

Movement in Annelids, Molluscs and Echinoderms.

Nutrition

Filter feeding in Polychaetes, Molluscs and Prochordates.

Respiration

Gills and trachea in Arthropods – Respiration in Molluscs.

Circulation

Circulation in Arthropods and Molluscs.

Unit - II

Excretion

Different types of excretory organs in invertebrates – their structure and function.

Nervous System

Primitive types – Coelenterates and nerve net; advanced types – Nervous system in Annelids, Molluscs and Arthropods.

Chemical Coordination

Endocrine glands in Crustaceans and Insects – Pheromones and allelochemicals.

Unit - III

Reproduction

Pattern of sexual and asexual reproduction – Invertebrate larval forms and their phylogenic significance.

Invertebrate Fossils

Evolutionary trends and phylogenetic importance of Trilobites, Ammonoids, Belemnoids, Nautiloids, Echinoderm fossils.

Minor Phyla

Organisation and affinites of 1. Chaetognatha, 2. Rotifera, 3. Sipunculida, 4. Phoronida.

B. CHORDATES

A. Comparative study and functional Morphology of vertebrates.

Unit – IV

Integumentary System

Exoskeletal structures and their modifications.

Digestive System

Alimentary canal and associated glands

Respiratory System

Gill respiration in cyclostomes and fishes – Pulmonary respiration in tetrapods.

Circulatory System

Types & evolution of heart and aortic arches.

Excretory System

Types & evolution of kidneys.

Unit – V

Nervous System

Brain and spinal cord – cranial nerves, spinal nerves and visceral nerves – Autonomic nervous systems – Sympathetic – Parasympathetic.

Reproductive system

Reproductive systems, Male and Female – Accessory reproductive glands.

Vertebrate Fossils

Evolutionary significance of Ostracoderms, Placoderms, Crossopterygians, Labyrinthodonts, Dinosaurs, Archaeopteryx and Mesozoic mammals.

Recommended Text Books

INVERTEBRATES

1. BARNES, R.D. (1982), Invertebrate Zoology, IV Ed., Holt Saunders International Edition.
2. BARRINGTON, E.J.W. (1979), Invertebrate Structure and Functions, II Ed., ELBS and Nelson.
3. MOORE, R.C., LOLICKER and FISCHER, A.G. (1952), Invertebrate Paleontology, McGraw Hill Book Co., Inc., N.Y.

CHORDATES

1. WATERMAN, A.J. (1971), Chordate Structure and Function, The Macmillan Company.

REFERENCES

INVERTEBRATES

1. HIGHNAM, K.C. and HILL, L. (1979), the Comparative Endocrinology of Invertebrates, ELBS & Edward Arnold (Publishers) Ltd., London.
2. HYMAN, G.H., the Invertebrates, Vol. I to VII, McGraw Hill Book Co., Inc., N.Y.
3. VASANTIKA KASHYAP (1997), Life of Invertebrates, Vikas Publishing House Pvt. Ltd., New Delhi.
4. KOTPAL, R.L., Minor Phyla, Rastogi Publication, Meerut.

CHORDATES

1. COLBERT, H. EDWIN (1989), Evolution of the Vertebrates, II Ed., Wiley Eastern Limited, New Delhi.
2. HARREY POUGH, JOHN B. HEISHER, WILLIAM N. McFARLAND (1990), Vertebrate Life, Macmillan Publishing Co., N.Y.
3. JOLLIE, M. (1962), Chordate Morphology, Reinholt Publishing Corporation, N.Y.
4. KENT, G.C. (1976), Comparative anatomy of the Vertebrates, McGraw Hill Book Co., Inc., New York.
5. ROMER, A.S. (1974), the Vertebrate Body, W.B. Saunders, London.
6. ROMER, A.S. (1979), HYMAN's Comparative Vertebrate Anatomy, III Ed., The

University of Chicogo Press, London.

7. WEICHERT, C.K. (1965), Anatomy of the Chordates, McGraw Hill Book Co., N.Y.
8. NEWMAN, N.H. (1961), Phylum Chordate, The University of Chicago Press, Chicago.

CORE COURSE II GENETICS

SUB CODE:16:P08M2

Unit I

Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance.

Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests.

Unit II

Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

Unit III

Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes, maternal inheritance.

Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.

Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

Unit IV

Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping.

Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.

Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications.

Unit V

Recombination: Homologous and non-homologous recombination, including transposition, site-specific recombination .

DNA Repair – types of DNA repair, - Chromosomal aberrations- Genetic disorders.

RECOMMENDED TEXT BOOKS

GENETICS

1. JENKINS, J.B. (1983), Human Genetics, the Benjamin Cummings Publishing Co.
2. URSULA GOODENOUGH (1984), Genetics, Saunders College Publishing Co., London.
3. Verma, V. K. and Agarwal, Genetics.
4. A text book of Genetics by V.B. Rostogi.
5. A text book of Evolution, V.B. Rostogi.

REFERENCES

GENETICS

1. BENJAMIN LEWIN (2000), Genes VII, Oxford University Press, New York.
2. DANIEL L. HARTL (1994), Genetics, III Ed., Jones and Bartlett Publishers, Boston.
3. JOHN D. HAWKINS (1996), Gene Structure and Expression, III Ed., Cambridge University Press.
4. ROBERT H. TAMARIN (1996), Principles of Genetics, WCB Publishers.

   Munro.W. Also,

   www.catchword.com

   www.fruitfly.org

CORE COURCE – III EVOLUTION

SUB CODE:16:P08M3

UNIT I

Emergence of evolutionary thoughts: Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; the evolutionary synthesis.

UNIT II

Origin of cells and unicellular evolution: Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.

UNIT III

Evolutionary history: The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multicellular organisms; major groups of plants and animals; stages in primate evolution including Homo.

UNIT IV

Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence.

The Mechanisms: Population genetics – populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; adaptive radiation and modifications; isolating mechanisms; speciation; allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution.

UNIT V

Brain, Behavior and Evolution: Approaches and methods in study of behavior; proximate and ultimate causation; altruism and evolution-group selection, kin selection, reciprocal altruism; neural basis of learning, memory, cognition, sleep and arousal; biological clocks; development of behavior; social communication; social dominance; use of space and territoriality; mating systems, parental investment and reproductive success; parental care; aggressive behavior; habitat selection and optimality in foraging; migration, orientation and navigation; domestication and behavioral changes.

RECOMMENDED TEXT BOOKS EVOLUTION

1. STRICKBERGER, M.W. (1996). Evolution. Jones and Barlett publishers Inc., London.
2. DOBZHANSKY, T., AYALA, F.J., STEBBINS, G.L. and VALENTINE, J.W. (1975).

Evolution. Surjeet Publications. .

REFERENCES

1. DODSON, E.O. and DODSON, P. (1976). Evolution: Process and Product (II Edn), Van Nostrand Company, New York.
2. DOWDESWELL, W.H. (1963). The Mechanism of Evolution, ArnoldHeinmann India, Delhi.
3. JOHA, A.P. (1992). Gene and evolution, The Macmillan Co., New Delhi.
4. MERREL, D.P. (1962). Evolution and Genetics: The Modern theory of Evolution. Holt, Rinehart and Winston Inc., New York.

CORE COURSE IV CELL & MOLECULAR BIOLOGY

SUB CODE:16P08M4

Unit - I

Cell Membrane

Molecular organization – molecular models – cell permeability – cell surface differentiations and cell – cell communication – membrane receptors and signal transduction pathways.

Cytoskeleton and Cell Motility

Microtubules, microfilaments and Cell intermediate filaments – role in cell organization, division and motility.

Methods of Cell Study

Micrometry – cell culture methods – cell fractionation technique – cytochemical staining methods – cytophotometry – immunocytochemistry and autoradiography.

Unit – II

Mitochondria and Energy Transduction

Molecular organization of mitochondria and their role in oxidative phosphorylation .

Nucleus and Chromosomes

Nuclear envelope – Nuclear pore – Nuclear proteins – Nucleosome – exons – introns – extrachromosomal DNA overlapping genes Transposable elements Gene amplifications.

Unit - III

Nucleic Acids and Their Functions

DNA and RNA – Structure, types and functions – Replication of DNA – DNA repair mechanism.

Ribosomes

Morphology, ultrastructure, biochemistry and functions.

Unit – IV

Cell Cycle

Phases of cell cycle – role of cyclin and other molecules – molecular organization and functional significance of mitotic apparatus in cell division.

Protein Synthesis

Mechanism of transcription – role of transcription factors – transcription regulators – Genetic code, Processing of mRNA – translation – post translational modifications and control mechanism.

Unit - V

Protein Transport

Intracellular compartments and protein sorting Vesicular traffic in secretary and endocytic pathways transport from ER through Golgi to lysosome, endosome.

Biology of Cancer Cells

Characteristics of Cancer Cells, types of tumours. Apoptosis and its relevance in cancer biology.

RECOMMENDED TEXT BOOKS

CELL AND MOLECULAR BIOLOGY

1. De ROBERTIS, E.D.P. and De ROBERTIS, E.M.F. (1987), Cell and Molecular Biology, VIII Ed., Lea and Febiger, Philadelphia.
2. DAVID FREIFELDER (1998), Molecular Biology, II Ed., Narosa Publishing House, New Delhi.

REFERENCES

CELL AND MOLECULAR BIOLOGY

1. LEWIS, KELEINSMITH and VALERIS M. KISH (1988), Principles of Cell Biology, Harper and Row Publications, New York.
2. POWAR, C.B. (1983), Cell Biology, Himalaya Publishing House, Bombay.
3. WATSON *et al*., (1987), Molecular Biology of the Gene, the Benjamin Cummings Publishing Co., Inc., California.
4. Dupraw, cell and molecular Biology.

CORE COURSE V PRACTICAL – I

FUNCTIONAL MORPHOLOGY & PALAENTOLOGY OF INVERTEBRATES AND CHORDATES, GENETICS, EVOLUTION AND CELL AND MOLECULAR BIOLOGY

SUB CODE:16P08M5P

A. INVERTEBRATES and CHORDATS

1. Taxonomy

A list of atleast 50 representative animals belonging to major classes of eight invertebrate phyla and major orders of 5 classes of Chordata can be prepared by the college and the animals shown to the students. A student has to identify and describe the salient features and assign them to the order, class and phylum to which they belong.

2. Mounting

Nereis – Parapodium

Lepas – Mouthparts

Sea urchin – Pedicellaria

Teleost – Scales

Honeybee – Sting

Earthworm – Body setae and penial setae

Pila – Radula

Freshwater muscle - Ganglia

3. Spotters

Invertebrate larval forms. Invertebrate fossils – Ammonoids, Belemnoids, Nautiloids and Echinoderm fossils. Minor Phyla – Chaetognatha, Rotifera, Phoronida and Sipunculida.

4. Dissections

Video clipping of dissection of shark, frog, calotes and rat can be shown to the students. A student can make use of material available in any search web site for online dissection of Shark, Frog, Calotes, and Rat using Apple quick time software.

5. Culturing of Animals

A visit to atleast any 2 of following: Vermiculture, Apiculture, Sericulture, Ornamental fish culture, Poultry or Dairy farm or Biofertilizer or Biopesticide Industry in order to evoke interest in self employement.

B. GENETICS

Drosophila culture – Identifications of mutants & sexes.

Blood groups ABO & Rh their genetic significance.

Pedigree analysis.

Human karyotyping & Chromosomal abnormalities.

Hardy Weinberg law & Calculation of gene frequencies for dominant, recessive & co-dominant traits and multiple alleles.

C. MICROBIOLOGY

Culture techniques – culture of bacteria. Bacterial growth curve – Counting and Antibiotic susceptibility test. Measurement of bacteria – Preparation of smears and simple staining. Specific staining – negative staining & Gram staining.

D.CELL AND MOLECULAR BIOLOGY

Micrometry

Camera Lucida Drawings

Human Buccal Smear

Blood Smear – Cockroach, Man

Cytochemical detection of Carbohydrates, Proteins, Lipids, DNA and RNA.

Record of Laboratory work shall be submitted at the time of practical examination.

REFERENCES

Biology course

www.cleverrodgehog.com.

CORE COURSE VI BIOCHEMISTRY AND BIOPHYSICS

A. BIOCHEMISTRY

SUB CODE16:P08M6

Unit - I

Introduction to Biochemistry: Scope of biochemistry – Physical and chemical processes of living systems – Water and it functions – Dissolved gases and their properties – pH and buffer.

Amino Acids

Structure and classification – Ketogenic and glucogenic amino acids – Catabolism of Tyrosine and Tryptophan.

Proteins

Classification – Globular and fibrous proteins – Structure and functions.

Enzymes

Classification – Properties – 3D structure of an enzyme – Enzyme kinetics – Michelis menden equation – Mechanism of action of enzymes – Active sites – Coenzymes – Activators and inhibitors – Isoenzymes – Allosteric enzymes – Regulation of enzymatic activity.

Unit - II

Carbohydrates

Mono, oligo and polysaccharides – Structure, properties and functions.

Lipids

Classification, structure, properties and functions. Prostaglandins – their classes, functions and Pharmacological uses.

Vitamins

Source, properties and functions of water soluble and fat soluble vitamins.

Unit – III

Respiratory pigments

Structure of Hemoglobin and Cytochrome.

Biological Oxidation

Nucleotides, Flavoproteins, Cytochromes – Redox potential – Oxidative phosphorylation.

Energy relation, energy rich compounds, their roles.

Hypothalamic and hypophyseal factors – Chemistry and function – Mechanism of hormone

action – Peptide hormone – Adenylate cyclase – Cyclic AMP mechanism – Ca^{++} - Phosphoinositol, steroid hormone and transcriptional control.

B. BIOPHYSICS

Unit - IV

Scope of Biophysics in Biology – structure and properties of atoms and molecules – Formation of molecules form atoms – Bonds – types – properties – strength – atomic and molecular orbital – X-Ray diffraction – Polymerization of organic molecules.

Energy sources – Principle and application of thermodynamic laws – Free energy from electromagnetic waves.

Natural radiations – Properties of natural light. Photoelectric effect – Photodynamic sensitization – LASER – Concept of spectroscopy. Visible, NMR and ESR spectroscopy ;Atomic absorption and plasma emission spectroscopy.

Effect of UV light and ionizing radiations – Detection – Disintegration – Measurement of radio activity – Gieger Muller counter – Isotopes as tracers.

Unit - V

Microscopy – principles of optics in light, phase contrast, polarizing, fluorescence, scanning and transmission electron microscopes.

Principles of Centrifuge – sedimentation velocity – sedimentation equilibrium and density gradient centrifugation.

Principles and application of chromatography – Paper – Thin layer – Column – Ion – exchange – Gel filtration – Gas liquid – HPLC and Affinity.

Principles and applications of electrophoresis – Paper electrophoresis – Ager gel electrophoresis – PAGE – SDSPAGE – Immunoelectrophoresis – Isoelectric focussing.

RECOMMENDED TEXT BOOKS

BIOCHEMISTRY

1. LEHNINGER L. ALBERT, DAVID. L. NELSON, MICHAEL M. COX. (1993), Principles of Biochemistry, CBS Publishers and Distributors, Delhi.
2. STRYER, L. (1988), Biochemistry, W.H. Freeman and Company, New York.
3. COOPER, T.G. (1977), the Tools of Biochemistry, Wiley Inter science Publication, John Wiley and Sons, New York.

BIOPHYSICS

1. CASEY, E.J. (1962), Biophysics – Concepts and Mechanisms, East West Press Pvt. Ltd., New Delhi.

REFERENCES

BIOCHEMISTRY

1. ROBERT K. MURAY, DARYL K. GRANNER, PETER A. NAYES, VICTOR W.RODWELL (1993), Harper's Biochemistry (24th Edition), Prentice Hall International Inc., London.
2. SMITH *et al.*, (1985), Principles of Biochemistry, McGraw Hill (Mammalian Biochemistry).
3. VOET, D. and VOET, J. (1995), Biochemistry, John Wiley and Sons, New York.

BIOPHYSICS

1. DANIEL, M. (1989), Basic Biophysics for Biologists, Agro Botanical Publishers, Bikaner, India.
2. De ROBERTIS, E.D.P. and De ROBERTIS E.M.F. (1987), Cell and Molecular Biology, VIII Edition, Lea and Febiger, Philadelphia.
3. DOG, A., DOUGLAS and JAMES J. LEARY (1992), Principles of Instrumental Analysis, Under Golden Sunberst Series.

CORE COURSE VII MICROBIOLOGY

SUB CODE:16P08M7

Unit - I

Introduction to Microbes:

Scope of microbiology – three domain system of classification : Microbial diversity. Morphology and fine structure of bacteria, cyanobacteria, fungi, virus, viroids and prions and T4 phage; Reproduction of bacteria, fungi and virus – lytic and lysogenic cycles.

Unit - II

Methods in microbiology:

Microbial cultures: Physical conditions for growth – chemical methods – biological methods; Methods of culturing aerobic bacteria and anerobes; Isolation and maintenance of pure culture methods; Cultural characteristics. Microbial Growth: continuous culture, batch culture, synchronous culture; Cultural media: Characteristics, types and preparation; Gram's Staining and smearing.

Unit – III

Soil microbiology:

Role of microorganisms in an organic matter decomposition and production of Biogas; Symbiotic nitrogen fixating; Mechanism of nitrogen fixation.

Water microbiology:

Microbiological analysis of water purity – MPN Technique; Biosensor; Purification of drinking water and Sewage (waste) water treatment.

Aeromicrobiology:

Indoor Aeromicrobiology – Aeroallergens and Aeroallergy; Phylloplane microflora and its characteristics.

Unit - IV

Fermentation and Production.

Food microbiology:

Microbial contamination foods – spoilage of food – food poisoning – food preservative methods.

Unit – V

Medical microbiology:

Microorganisms and infectious diseases – Epidemiology, clinical types and therapy of bacterial disease – Diptheria, Gonorrhoea & Typhoid; viral diseases – AIDS, Chicken pox & Rabis; Fungal diseases – Mycoses and Mycotoxicosis.

REFERENCES

1. S. Rajan, 2007. Medical microbiology. MJP Publishers Chennai.
2. Mashrafuddin Ahmed and S.V. Basumatary, 2006. Applied Microbiology. MJP Publishers Chennai.
3. Powar, C.B. and Daginwala, 2005. General Microbiology. Himalaya publishing house.
4. Prescott & Donald, 2003. Microbiology 5th Edition. Mc Graw Hill Publishing House.
5. Dubey, R.C., and Maheswari. K., 2000. A text Book of Microbiology, S. Chand & Company, New Delhi.
6. Roger. Y. Stainer, John. L. Ingraham, Mark. L. Wheelis, Page R. Painter., 1987. General microbiology, Macmillan education Ltd. (V).
7. L.E. Casida J.R. 1984. Industrial Microbiology. Wiley International Ltd.

CORE COURSE VIII BIOTECHNOLOGY

SUB CODE:16:P08M8

Unit - I

Basic Biotechnology: Definition – Scope – Achievements of Biotechnology – Restriction Enzymes, DNA ligases, polymerase etc. Cloning vehicles – Plasmids Bactriophage, Cosmids, Yeast plasmids – Genomic DNA libraries, cDNA libraries.

Unit - II

Techniques in Biotechnology: Southern blotting, Northern blotting, Western blotting, In-situ hybridization DNA sequencing PCR, DNA finger printing, DNA probes, site – directed mutagenesis, particle gun, microinjection, electroporation.

Unit - III

Medicinal Biotechnology: Insulin, Somatotrophin, somatostatin, hormone production, vaccines, interferons, gene theraphy, monoclonal antibodies, Antenatal diagnosis, Invitro fertilization technology, Human genome project, Test tube baby.

Unit - IV

Agricultural Biotechnology: Micropropagation, protoplast culture, Encapsulated seed, Symbiotic and Non symbiotic nitrogen fixation, Biofertilizers – Mass – production of BGA, VAM Rhizobium culture. Biopesticides – single cell protein – transgenic plants and animals, mushroom culture.

Unit - V

Microbial and Environmental Biotechnology: Bioreactor, Growth curve, primary metabolites – vitamins, alcohols, secondary metabolites – Antibiotics and Toxins, Microbial enzyme production – amylase. Biomass as a source of energy. Biogas production, vermicomposting, Microbial leachning. Ethical issues and biosafety regulations, Intelluctual Property Right (IPR) and Protection (IPP).

Text Books:

1. Dubey R.C. 2004. A text book of Biotechnology. S. Chand & Co. Ltd. New Delhi.

2. Gupta. R.K. 1996. Elements of Biotechnology. Rastogi & Company, Meerut.

Reference Books:

1. Kumar. H.D. 1998. A text book of biotechnology. Affiliatiated East – west press pvt. New Delhi.
2. Purohit. S.S 2000. Biotechnology, Fundamentals and Application. Agrobios Jodhpur.
3. Primrose. S.B. 1991. Molecular Biotechnology. 2nd Edition Blackwell, Oxford.
4. Meyers. R.A. 1995. Molecular Biology and Biotechnology. VCH publishers.

CORE COURSE IX – PRACTICAL II BIOCHEMISTRY AND BIOPHYSICS, MICROBIOLOGY AND BIOTECHNOLOGY

SUB CODE:P08M9P

A. BIOCHEMISTRY

Quantitative estimation of amino acids, protein, carbohydrate and lipids in tissue samples. Preparation of solutions – Molarity, Normality, Percentage.

Calculation of moles, millimoles, micromoles and nanomoles. Buffer preparation – determination of pH using pH meter.

B. BIOPHYSICS

Colorimeter

Determination of Optical Density of samples using Standards.

Centrifuge

Preparation of samples using low and high speed centrifuges.

Chromatography

Separation of free sugars in different samples (Paper). Separation of neutral lipids (TLC).

Electrophoresis

Separation of human serum proteins (Demonstration only).

C. MICROBILOGY

Culture techniques- Culture of Bacteria. Bacterial growth curve – Counting and Antibiotics susceptibility test. Measurement of Bacteria – Preparsation of smears and simplr staining. Specific staining – Negative staining&Gram staining.

D. BIOTECHNOLOGY

Isolation of genomic DNA Plasmid isolation Agarose gel electrophoresis of DNA DNA fragmentation using restriction enzymes (Demonstration) Blotting technique (southern and western) Demonstration only.

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ELECTIVE – I – TOXICOLOGY

SUB CODE:16:P08E1

UNIT – I

Absorption Distribution and Excretion of toxicants:

Definition and scope of toxicology – Chemical interaction – Membrane permeability – Diffusion, filtration and engulfing by cells – absorption – distribution – excretion.

UNIT – II

Bio-Transformation of Toxicants:

Definition – general principles – receptors site – degradation reaction – conjugation – bioactivation – complex nature of bio-transformation – Antidotes – mechanism of antidotal action – assessment of antidotal efficacy.

UNIT – III

Bio-chemical basis of Toxicology:

Mechanism of Toxicity – receptor mediated events – disturbance of excitable membrane function, biochemical process – Ca+ homeostasis – covalent binding – genotoxicity – Tissue – specificity – Target organs – mechanism of action.

UNIT – IV

Methods of Toxicology:

Bio-assay test – single species test – multi species test – acute toxicity test – subacute toxicity test – chronic toxicity test – determination of LC_{50} value – pathological techniques – autopsy and histology – histopathology – cytochemistry – morphometric methods.

UNIT – V

Chemical and Immuno toxicology:

Toxic chemicals: Pesticides – automobile emission – heavy metals – fertilizers – food additives – animal, plant and mushroom toxins.

Immunotoxicology – General concepts – lymphocytes – Natural killer cells – macrophages – hypersensitivity reaction – immunosuppression – molecular immunotoxicology.

Text Books:

1. Sharma, P.D. 1996: Environmental Biology and Toxicology. Rastrogi publication, meerut, India.

2. L.U., F.C. 1985, Basic Toxicology. Hemisphere publication. Corporation, Washington, N.Y. London.
3. Gupta,P.K. and Salunka, D.K. 1985. Modern toxicology. Vol. I and II, Metropolitan, New Delhi.
4. Sood, A. 1999 Toxicology. Sarup & sons, New Delhi.

Reference Books:

1. Butler, G.C. 1978. The Principles of Ecotoxicology Scope. 12, ICSO Scope John Wiley and sons, Chicheater.
2. Finner D.J. 1971. Probit Analysis, Cambridge University Press.
3. Adrien Albert 1981. Selective Toxicity. University press Cambridge.
4. Gupta, P.K. and V. Raviprakash, 1988. Advance in toxicology and Environmental Health. Jagmandar Book Agency, New Delhi.

CORE COURSE X DEVELOPMENTAL BIOLOGY AND IMMUNOLOGY

SUB CODE:16:P08M10

DEVELOPMENTAL BIOLOGY

Unit I

Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.

Unit II

Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals;

Unit III

Morphogenesis and organogenesis in animals: Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia and chick; organogenesis – vulva formation in *Caenorhabditis elegans;* eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.

UNIT IV

Innate and adaptive immune system:

Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation.

Unit V

Activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

Histochemical and immunotechniques: Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, floweytometry and immunofluorescence microscopy, detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH.

Recommended Text Books for Reference

Developmental Biology

1. BALINSKY, B.L., (1981). An Introduction to Embryology, V Ed., Saunders Co., Philadelphia.
2. BERRILL, N.J., (1986) Developmental Biology, Tata McGraw Hill, New Delhi.

Immunology

1. Sells, S. (1987). Basic Immunology, Elsevier Science Publishing Co., New York.
2. TIZARD, I.R., (1995). Immunology – An Introduction, IV Ed., Saunders College Publications, Philadelphia.

Reference Books :

Developmental Biology

1. BERRILL, N.J., and KARP, G. (1976) Developmental Biology, McGraw Hill Inc. New York.
2. BROWDER, L.N. (1980) Developmental Biology, Saunders College, Philadelphia.
3. DEUCHAR, E.M., (1976) Cellular interaction in Animal Development, Chapman and Hall, London.
4. Govindaraju : Immunology.
5. GILBERT, S.F. (1995) Developmental Biology, II Edn., Sinamer Associates Inc., Publishers, Saunderland, Massachusetts, USA.
6. SAUNDERS, A.W., (1982) Developmental Biology : Patterns / Principles / Problems. Macmillan Publishing Co., NewYork.
7. STEVAN, B. and OPPENHEIMER (1980) Introduction to Embryonic Development, Alley and

Bern.
8. TIMIRAS, P.S. (1972) Developmental Physiology and Aging. The Macmillan Company, New York.
9. WILLER, B.H. and OPPENHEIMER, J.M., (1964) Fundamentals of Experimental Embryology, Prentice Hall.

Immunology

1. ABBAS A.K., LICHMAN A.K., JORDAN S. POBER J.S. (1997). Cellular and Molecular Immunology, Harcourt Brace and Co., Asia Pvt. Ltd., Singapore.
2. CHAMPION, M.D., and COOKE, A. (1987) Advanced Immunology, J.B. Lippincott Philadelphia.
3. CHAM CLARK, W.R. (1983). The Experimental Foundations of Modern Immunology, John Wiley & Sons, New York.
4. COLEMAN, LOMBARD and SICARD (1992). Fundamentals Immunology, W.M.C. Brown Publishers.
5. STITES D.P. and ABBA I.TERR A.I. (1991). Basic and Clinical Immunology, Prentice Hall International Inc.,
6. KUBY, J. (1994). Immunology. W.H. Freeman and Co., New York.
7. NANDHINI SHETTY (1996). Immunology: Introductory Text Book. New age International Pvt. Ltd. New Delhi
8. PAUL, W.E.M. (1989). Fundamentals Immunology, Raven Press, New York.
9. RAMAKRISHNAN, S and RAJI SWAMY (1995). Text Book of Clinical Biochemistry and Immunology, T.R. Publications, Madras.
10. ROITT, M.I. (1994). Essential Immunology, Blackwell Science Ltd., U.K. ROITT, M.I., BROSTOFF & D.K.MALE (1996). Immunology, IV Edn., Mosby, London.
11. SRIVASTAVA, R., RAM, B.P. and TYLE, P. (1991). Molecular Mechanisms of Immune

CORE COURSE XI – ANIMAL PHYSIOLOGY

SUB CODE:16:P08M11

Unit I

Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.

Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.

Unit II

Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

Nervous system: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture.

Unit III

Sense organs: Vision, hearing and tactile response.

Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

Unit IV

Thermoregulation: Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization.

Digestive system: Digestion, absorption, energy balance, BMR.

Unit V

Endocrinology and reproduction: Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, neuroendocrine regulation.

Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT .

Recommended Text Books :

1. HOAR W.S. (1987) General and Comparative Physiology, Prentice Hall.
2. TURNER, C.D. and BAGNARA, J.T. (1976) General Endocrinology, 6th Edn., WB Saunders Co., Philadelphia.

Reference Books

1. BALDWIN, E. (1964). An Introduction to Comparative Biochemistry, CUP, London.
2. BECK, W.S. (1971). Human Design, Harcourt Brace Joranorich Inc.,
3. DAWSON, H. (1964) General Physiology, Little Brown Co., Boston.
4. ECHERT, R. and RANDALL, D. (1987) Animal Physiology, CBS Publishers and Distributors.
5. GIESE, A.C. (1979) Cell physiology and Biochemistry, Prentice Hall.
6. GORDON, M.S., BARTHOLOMEW, G.A., GRILNELL, A.D., JORGENSEN, C.B., and WHITE.
7. F.N. (1971) Animal Function, Principles and Adaptation, Macmillan Co., London.
8. McFARLAND, D. (1986) Animal Behaviour – Psychobiology, Ethology and Evolution, English Language Boosk Society, Longman.
9. ROBERT M. BERINE and M.N. LEVY (1988) Physiology, III Edn., St;Louis, Baltimore, Boston, Lodon.
10. SCHMIDT NEILSSEN, K. (1985) Animal Physiology – Adaptation and Environment, CUP, London.
11. TEDESCHI, H. (1993) Cell Physiology, Molecular Dynamics, II Edn., Won C. Brown publishers, Oxford, England
12. WILSON, J.A. (1979) Principles of Animal Physiology.
13. WOOD, W.S. (1968) Principles of Animal Physiology, Edward Arnold, London.

CORE COURSE XII PRACTICAL – III DEVELOPMENTAL BIOLOGY, IMMUNOLOGYAND ANIMAL PHYSIOLOGY

SUB CODE:16:P08M12P

Developmental Biology

Preparation of sperm suspension in frog/bull and observation of the spermatozoa. Observation of live spermatozoa and study of rate of motility of sperm in frog /bull semen.

Effect of thyroxin or iodine on metamorphosis of frog. Vaginal smear preparation in rat / mouse to study the stages of oestrous cycle.

Immunology

Identification of lymphoid organs in rat / mouse.

Preparation of antigen and raising of antibody – RBC and sperm proteins. Determination of human blood group by haemagglutination test and assessment of specificity of antigen – antibody reactions.

Detection of the presence of precipitating antibody (IgG) with soluble antigen by precipitin ring test.

Detection of the specific reactivity of precipitating antibody (IgG) with soluble antigens by double immunodiffusion (Ouchterlony) test.

Detection of the specific reactivity of precipitating antibody (Igg) with fractionated antigens by immunoelectrophoresis.

Animal Physiology

Quantitative estimation of amylase activity.

Quantitative estimation of ammonia and urea.

Rate of salt loss and salt gain in fish using different experimental media.

Estimation of blood chloride.

Microtechnique

Fixing, embedding, sectioning, spreading, staining, and mounting of tissues and embryos

Candidates are expected to study the ecology of chosen habitats and make observations of ecological interest during field studies. Visits to national laboratories and research institutes are recommended.

A record of field work and laboratory work and twenty five slides containing serial sections (Tissue – 10 slides; Embryos – 10 slides) shall be submitted at the time of practical examination.

ELECTIVE II POULTRY SCIENCE

SUB CODE:16:P08E2

Unit - I

Introduction to poultry science – Historical review and problems of poultry growing in India. Annual egg production in India.

Nomenclature of breeds of fowl, classification of fowls, selection of breed – Natural and artificial brooding.

Housing and equipment – General principles of building poultry sheds, deep litter system, laying cages.

Unit - II

Brooding and rearing – Methods of brooding brood temperature, space and duration; fed, water and space allowance, debeaking – vaccination.

Management of growers, layers, broilens – lighting of chicks, growers and layers. Summer and winter management.

Poultry manure – volume, composition, value and disposal.

Unit - III

Feed additives – Names, allowance and usage of Food additive – the impact on human health.

Food stuffs for poultry in relation to protein, amino acids, minerals (Ca and P), vitamins and fibre content.

Feed formulations for chicks, growers, phase I to phase III layers and broilers.

Unit - IV

Short account on cause symptoms, prevention, control and treatment of viral, bacterial, fungal, protozoan and worm infection, ticks, mites and lice affecting fowl.

Unit - V

Nutritive value of egg, factors affecting egg size, storage and preservation of egg, marketing, incubation ahd hatching of eggs.

Economics of poultry production units to examine first hand rearing and business operation.

TEXT BOOK:

Sunil Kumar Das (1994) – Poultry production, CBC Publishers and Distributors, Delhi – 110032.

REFERENCE BOOKS:

1. Banerjee G.C. (1992) A textbook of animal husbandary, Oxford and IBM Publishing Co., New Delhi.
2. Shukula, G.S. and Upadhyay V.B. (1997) Economic Zoology, Rakesh Rastogi Meenit.
3. Indian Poultry Industry year book 1975 – 76. By Sakuntbak B.Gupta, C34, New Bactak Road, New Delhi – 110 005.
4. Intensive Poultry Management for egg production. Bulletin NO. 152, her majesty stationery office, London.

ELECTIVE III VERMITECHNOLOGY

SUB CODE:16:P08E3

UNIT - I

Earthworms and their environment, diversity, distribution and biology.

The nature of earthworms soil environment – basic environmental requirements.

Food and digestive capabilities, respiratory requirements and adaptation.

Systematic affinities and evolutionary descent, Families, genera and species.

Geographical distribution - Life style, behaviour patterns, water relationships, regeneration and transpiration.

UNIT - II

Role of earthworms in soil structure, fertility and productivity.

Earthworms burrows and casts.

Effect earthworms in soil structure – carbon, nitrogen and phosphorous, Transformations.

Earthworms as bioindicators of soil types.

Effect of earthworms on plant productivity.

Earthworms in land amelioration and reclamation.

Earthworms as indicators of environmental contamination.

UNIT - III

Earthworms in organic waste management.

Management of sewage sludge by earthworms.

Management of animal, vegetable and industrial organic waste by earthworms.

Earthworm composts as plant growth media and its marketing.

The use of earthworm as food protein source for animals

Engineering of waste management.

Role of earthworms in processing organic wastes applied to agricultural and other land

UNIT – IV

Effects of agricultural practices and chemicals on earthworms.

The effects of cultivation.

The effects of cropping.

The effects of fertilizers, Chemicals and Radio isotopes.

Heavy metals and acid deposition and earthworms.

UNIT - V

Earthworms and microorganisms and field sampling methods.

The effects of earthworms on the number, biomass and activity of microorganisms.

Importance of microorganisms as food for earthworms.

Dispersal of microorganisms earthworms.

Role of intestinal microbes of earthworms on the decomposition of organic wastes.

Field sampling – Passive methods, behavioural methods and Mark recapture methods.

Counting of mass and biomass estimation.

REFERENCES:

1. Edwards, C.A & P.J Bohlen, 1996. Biology and ecology of earthworms III Edn. Chapman & Hall N.Y.U.S.A.

2. Edwards, C.A & J.R Lofty Vermicology – The Biology of earthworm, 1997 Chapman & Hall Publications N.Y.U.S.A.

3. Lee, K.E. 1985. Earthworms their ecology and relationships.

CORE COURSE XIII : ENVIRONMENTAL BIOLOGY

SUB CODE:16:P08M13

Unit I

The Environment: Physical environment; biotic environment; biotic and abiotic interactions.

Habitat and niche: Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (*r* and *K* selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations.

Unit II

Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

Ecological succession: Types; mechanisms; changes involved in succession; concept of climax.

Unit III

Ecosystem: Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

Unit IV

Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

Applied ecology: Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches.

Unit V

Conservation biology: Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

RECOMMENDED TEXT BOOKS:

1. ODUM, E.P. (1996) Fundamentals of Ecology (III Edn), Nataraj Publishers, Dehradun.
2. SHARMA, B.K. and KAUR, H. (1997) Environmental Chemistry, Goel Publishing House, Meerut.
3. TACCONI, L. (2000) Biodiversity and Ecological Economics : Participation, Values and Resource Management. Earthscan Publications Ltd., London.

4. CASTRI, F.D. and YOUNES, T. (1996). Biodiversity : Science and Development. CAB Int., Wallingford, U.K.

Reference Books :

1. CHAPMAN, J.L., and REISS, M.J. (1997). Ecology – Principles and Applications, CAMBRIDGE University Press, U.K.
2. CLARK, G.L. (1963). Elements of Ecology, John Wiley and Sons, Inc., New York.
3. GHOSH, G.K. (1992). Environmental Pollution, Ashish Publishing house, New Delhi.
4. SHARMA, B.K. and KAUR, H. (1997). An Introduction to Environmental pollution, Goelm Publishing House Meerut.
5. SIMMONS, I.G. (1981). The Ecology of Natural Resources (II Edn), Edward Arnold Publishers Ltd., Bedford Square, London.
6. KAPOOR, V.c. (1995). Theory and Practice of Animal Taxonomy (III Edn) Oxford and IBH Publishing Co., New Delhi.
7. Global Biodiversity strategy (1992). Report by World Resources Institute (WRI). The Work Conservation Union, and United Nations Environment Programme (UNEP).
8. SINHA, R.K. (1996) Biodiversity (Global Concerns), Commonwealth Publishers, New Delhi.
9. SOLBRIG, O.T., VAN EMDEN, H.M., and VAN OORDT, P.G.W.J. (1995). Biodiversity and Global change, CAB International, Wallingford, U.K.
10. STEAMS, S.C and HEKSTRA, R.F. (2000) Evolution – An Introduction, OUP, London.
11. MUNN, R.E. (1975) Environment Impact Assessment, Principles and Procedures, John Wiley and Sons, Toronto.
12. AHMAD, Y.J and SAMMY, G.K. (1985). Guidelines to Environmental Impact Assessment in Developing Countries. Hodder and Stoughton, London.

CORE COURSE XIV PRACTICAL IV ENVIRONMENTAL BIOLOGY

SUB CODE:16:P08M14P

Environmental Biology

Report on ecological collection representing different habitats and their adaptations – sandy, muddy, rocky shores, Deep Sea.

Hydrological studies of water samples with special reference to pollution: Chlorides, silicates, calcium, total hardness, phosphates and nitrates – pH, dissolved oxygen and BOD.

Water quality index (WQI) calculation using 9 parameters such as pH, Temperature, Turbidity, Conductivity, Total solids, Dissolved Oxygen, BOD, Nitrate and Phosphate.

Quantitative and qualitative estimation of marine & freshwater plankton.

Effect of pollutants on primary productivity Determination of LC_{50}.

A record of laboratory work shall be submitted at the time of practical examination.

MAJOR ELECTIVE COURSES

ELECTIVE COURSE IV GENERAL AND APPLIED ENTOMOLOGY

SUB CODE:16: P08E4

Unit - I

Taxonomy : Basics of insect classification – Classification of insects up to super families – Key characteristics with common South Indian examples.

Morphology of a typical insect. Physiology : Integumentary system – structure and chemistry Neuroendocrine system in insects. physiology of moulting – Endocrine control of moulting and metamorphosis.

Unit - II

Physiology of Respiration – aerial respiration – aquatic respiration.

Circulatory system – structure of heart, mechanism of haemolymph circulation – haemolymph and its composition.

Excretory system: Malpighian tubules and their functions – role of rectum in water and ionic regulation.

Unit - III

Nervous system: Structure – Structure and function of compound eye. Stridulatory organ.

Reproductive system: Male and female reproductive systems – types of ovaries – vitellogenesis – accessory reproductive glands – their secretions and functions. Viviparity – Role of hormones in male and female reproduction.

Unit - IV

Economic importance of Insects – Biology of Honey bee, Silk moth and Lac insect Culture methods for honey bee and, silk worm – Appliances used and problems related to these cultures.

Helpful insects – Pollinators, predators, parasitoids scavengers – weeds killers.

Destructive insects: Biology, damage caused and control methods of any 3 major insect pests of agricultural importance : Pests of paddy, sugar cane, cotton – Pests of stored products.

Unit – V

Principles of Insect control – Prophylactic measures – cultural, mechanical, physical methods – Genetic control and quarantine.

Biological control: Parasites, Predators and Microbial agents.

Chemical methods: Pesticides, classification – types of formulation – mode of action – toxicity – insecticide resistance – environmental safety.

Non – conventional methods: Use of insect growth regulators (IGR), repellents, antifeedants, pheromones, chemosterilants and irradiation.

Integrated Pest Management (IPM) – definition, Integration of methods – potential components – need for IPM and uses.

RECOMMENDED TEXT BOOKS

1. AMBROSE, DUNSTON P. (2004) The Insects: Structure, function and Biodiversity. Kalyani publishers, Ludhiana – New Delhi – Chennai.
2. NAYAR, K.K., T.N. ANANTHAKRISHNAN, and B.V. DAVID (1986) General and Applied Entomology, Tata McGraw Hill Publications, New Delhi.
3. VASANTHARAJ DAVID, B (2001) Elements of Economic Entomology, Popular Book Depot., Chennai – 15.
4. CHAPMAN R.F.(1998). The Insects structure and function Cambridge University Press.
5. SNODGRASS, R.E. (1985) Principles of Insect Morphology, McGraw Hill and Co., New York.
6. WIGGLESWORTH, V.B. Principles of Insect Physiology IX Ed., Chapman and Hall, London.

ELECTIVE COURSE V – FISHERY BIOLOGY

SUB CODE:16:P08E5

Unit - I

World and Indian Fisheries – Prospects and Problems – Plans, Polices and Current Status of Indian Fisheries. Fish Gears and Crafts used in South Indian Fisheries.

Unit - II

Marine fisheries ; Sardines, Mackerels, Bombay duck, Sciaenids, Ribbonfish, Silver bellies, Pomfrets, Carangids, Sharks, Shrimps, Prawns, Crabs Lobstres, Oysters, Molluscs ; Mussels, Clams and Scallops.

Unit - III

Inland fisheries; Freshwater – riverine, reservoir, pond and cold water fisheries – Spawning and breeding habits of fishes.

Estuarine and brackish water fisheries and their economics.

Ornamental fish culture and economics.

Unit IV

Assessment of fish stocks : Marking and recapture method, area sampling method, biostatistical method, egg count method, hydroacoustic method, remote sensing.

Age and Growth : Scale method, otolith method, other skeletal parts as age indicators, length – frequency method, length – weight relationship and condition factor.

Population studies : estimation of population size, marking, tagging, population dynamics, population models.

Unit V

Culture fisheries : Integrated fish farming technology – rice – cum – brackish water fisheries, ricecumcommon carp culture, fish –cumduck culture, Sewage – fed fisheries – monosex culture – polyculture.

Fish endocrinology – Induced breeding – technicques – examples.

Fish Processing and Preservation – fish by – products – brief account on transport and marketing. Effect of pollution of fisheries.

Fish Pathology : Parasites – Protozoan, fungal, bacterial, worms and arthropods.

Recommended Text Books :

1. BISWAS, S.P., (1993) Manual of Methods in Fish Biology, International Book Co., Absecon Highlands, New Jersey.
2. JHINGRAN, V.G., (1991) Fish and Fisheries of India. Hindustan Publishing Copr., New Delhi.
3. PILLAI, T.V.R. (1993) Aquaculture : Principles and Practices. Fishing News Agency, London.

Reference Books :

1. BOSE, A.N., YANG, C.T., and MISRA, A. (1991) Coastal Aquaculture Engineering. Oxford and IBH Publishing Co., PVt. Ltd., New Delhi.
2. CHAKRABARTI, N.M., (1994) Diseases of Cultivable Freshwater Fishes and Their Control. International Books and Periodicals Supply service, New Delhi.
3. DAY, F., (1986) The Fishes of India, Vols., I & II. Today and Tomorrow's Book Agency, New Delhi.
4. GOVINDAN, T.K. (1992) Fish processing Technology, Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.
5. MPEDA Hand book of Aquafarming (1992) Freshwater Fishes, Marine Products Export Development Agency, Kochi.
6. NEW, M.B., TACON., A.G.J., and CSAVAS., I. (1993) Farm – made – Aqua feeds. Food and Agrilculture Organization of United nations, Rome.
7. SANTHANAM, R., (1990) Fisheries Science, Daya Publishing House, New Delhi.
8. SEGHAL, K.K. (1992) Recent Researches in Cold Water Fisheries, Today and Tomorrow's Pbulishers and Printers, New Delhi.
9. SINHA, V.R.P. (1993) A Compendium of Aquaculture Technologies for Developing Countries. Center for Science and Technology and Oxford and IBH Publishing Co., Pvt., Ltd., New Delhi.
10. SUBBHA RAO (1986) Economics of Fisheries, Daya Publishing House, New Delhi.
11. TRIVEDI, K.K. (186) Fisheries Development: 2000 A.D. Association of Indian Fishery Industries and Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.

PROJECT WORK(16:P08PW)

NON MAJOR ELECTIVE COURSE

COURSE I : INHERITED DISEASES AND GENETIC COUNSELLING

Unit - I

Introduction : Basic principles of inheritance – chromosomes and genes – human chromosomes – karyotype sex determination in man.

Unit - II

Blood groups in man : Inheritance of ABO blood groups – MN blood group – Rh factor – ABO incompatibilities – Inherited diseases associated with blood – haemolytic anemia – Thalassemia and Cooley's anemiaGenetic counseling.

Unit - III

Inborn errors of metabolism : amino acid metabolism – phenylketonuria, alkaptonuria, albinism, and genetic goitrous cretinism – sickle cell anemia – diabetes mellitus. Genetic counseling.

Unit - IV

Sex linked inheritance : Xlinked inheritance – haemophilia and colour blindness; Ylinked inheritance – ichthyosis hystrix; Y chromosome based problems in sex determinations and differentiations (introduction only). XY – linked genes – total cololur blindness, xeroderma pigmentosum and retinitis pigmentosa.

Abnormal human karyotyes – autosomal abnormalities in man – Down syndrome (21^{st} trisomy), Turner syndrome, Kleinfelter syndrome and multiple sex chromosome syndrome. Genetic counseling.

Unit - V

Inherited diseases in man : Dominantly inherited disease – Glaucoma, Alzherimer's diseases and manic depression. Recessively inherited diseases – retinoblastoma and haemolytic anemia.

Diagnosis of genetic disorders : prenatal screening – noninvasive types – ultra sonography; invasive testing methods – foetoscopy, amniocentesis and chorionic villi biopsy.

Management of genetic disorders gene therapy

Reference:

1. Strikberger, M.W. (1985). Genetics, Prentice Hall of India, New Delhi.

2. Stine, C.J. (1989). The new human genetics. Wm.C.Brown Publishers, Iowa.

3. Sarin, C.Genetics (1985). Tata Mcgraw Hill publishing Co., New Delhi.

4. Verma, P.s. and Agarwal, V.K.(1998). Concept of genetics, human genetics and eugenics, S.Chand & Co., Ltd, New Delhi.

NON MAJOR ELECTIVE II FRESH WATER FISH CULTURE

Unit - I

Historical background and present status of aquaculture; Purpose and importance of aqua culture; Categories of farm types and fish farming systems.

Unit - II

Types of culture systems – Traditional, extensive, semi intensive, intensive and super intensive; Characteristic feature of freshwater cultivable species (Indian major carps, murrels, cat fish and Tilapia)

Unit - III

Types of aquaculture – Freshwater aquaculture, brackish water aquaculture and mariculture-merits and demerits; Selection criteria for cultivable species; Construction of ponds – Types of fish ponds.

Unit - IV

Composite fish culture, monosex culture, culture of air breathing fishes; sewage fed fish culture, Induced breeding of carps – Brood stock management – Management of farms.

Unit -V

Control of aquatic weeds and predators; Fish diseases (Parasitic, bacterial, fungal and viral) and control measures.

Reference Books:

1. Jhingaran V.G.(1983) Fish and fisheries of India, Hindustan publishing corporation, New Delhi.
2. Santhanam R, Sukumaran N and Natarajan P. (1990) A manual of freshwater aquaculture. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
3. Shanmugam K. Fishery biology and aquaculture.
4. Pillay T.V.R. Aquaculture – Theory and practice, Black well publishers.
5. Rath R.K. Freshwater aquaculture, scientific publishers.
6. Shukla, G.S. and Upadhyay V.B. (1997) Economic zoology, Rakesh Rastogi, Meerut.

NON MAJOR ELECTIVE COURSE III BIO RESOURCES

Unit - I

Biodiversity – understanding biodiversity, value of biodiversity, threats, conserving biodiversity, biodiversity sustainability, natural and man included changes in Biodiversity – Applications of Biotechnology in Biodiversity.

Unit - II

Renewable energy – Sugar cane molasses to ethanol, Bagasse to ethanol, Biomass to renewable energy beneficial by products, biofuels.

Unit - III

Bio resources and biotechnology – Genetically modified organisms; benefits and risk generic conservation and sustainable use of bioresources.

Unit - IV

Conservation strategies, past, present and future; Managing land resources, Managing aquatic resources monitoring and the future prospects.

Unit - V

Patterns of resource use : Protected ecosystems, Biosphere reserves, National parks, Wild life sanctuaries, Forest Reserves. Agricultural land – ecological consequences of agriculture, Restoration of ecosystems.

Reference Books:

1 Wilson, E.J. 1988 Biodiversity. National Academy Press, Washington, D.C., 521 pp.

2 Sen, P.K. and Prasad, N. 2002, Introduction to Geomorphology of India, Allied Publishers Private Limited, Mumbai, 378 pp.

3 Peter D.Stiling 1992, Ecology : Theories and Applications, Prentice Hall, new Jersey 539 pp.

4 Noss, R.F. & A.Y. Cooperinder 1994, Saving Nature's Legacy : Reabsorbing and protecting Biodiversity. Island Press, Washington, D.C. 416 pp.

NON MAJOR ELECTIVE COURSE IV ORNAMENTAL FISH CULTURE

Unit - I

Importance of ornamental fish culture Design and setting up of fish tank**:** Types, construction, accessories and maintenance of home aquarium plants and their uses.

Unit - II

Popular tropical fresh water ornamental fishes and their characteristics.

Live bearers – guppy, molly, platy and swordtail.

Egg layersfighter, gourami, angelfish, koi carp, zebra fish and red tailed shark.

A compatible group of fishes for home aquarium.

Food and feeding: artificial feedsmaking pelleted food – quantity and time of feeding.

Unit - III

Fish food organisms: Culturing micro algae, zooplankton, tubifecid blood worms, brine shrimp.

Genetics and Biotechnology: Genetics of gold fish, koi carp, gupy and platy.

Diseases and treatment methods in brief**:** Ectoparasite – anchor worm and argulus, white spot, fin rot, mouth fungus, dropsy and velvet disease.

Unit - IV

Breeding of aquarium fishes: Conditioning to breed, signs, mode of reproduction; breeding of gold fish, fighter, angel fish and barbs, breeding of live bearers; Care of the fry Techniques for the genetic improvement of these fishes.

Unit - V

Economics of Commercial farming:

Construction and Management of commercial ornamental fish farm: Structure, construction and types; costs and returns estimate.

Setting up of an exporting unit: Collection, breeding and rearing unit;

Reconditioning of export stock: transportation techniques – oxygen packing, method of packing, anesthetics use, and transport and export consignment.

Text Book:

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