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 2019-2020 onwards)

Semester	Course	Course Title	Ins. Hrs / Week	Credit	Exam Hrs	Marks		Total
						Int.	Extn.	
I	Core Course – I (CC)	Structure and function of Invertebrates	6	5	3	25	75	100
	Core Course – II (CC)	Comparative Anatomy of Chordates	6	5	3	25	75	100
	Core Course – III (CC)	Cell & Molecular Biology	6	5	3	25	75	100
	Core Course – IV (CC)	Evolution	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	6	5	3	25	75	100
	Core Course – VII (CC)	Genetics	6	5	3	25	75	100
	Core Course – VIII (CC)	Developmental Biology	6	5	3	25	75	100
	Core Course – IX (CC)	Practical II	6	4	3	40	60	100
	Elective – I	Toxicology/Research methodology &Bioinformatics	6	4	3	25	75	100
		Total	30	23				500
III	Core Course – X (CC)	Immunology	6	5	3	25	75	100
	Core Course – XI (CC)	Comparative 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	6	4	3	25	75	100
	Elective – III	Vermitechnology/ Microbiology	6	4	3	25	75	100
		Total	30	22				500
	Core Course – XIII (CC)	Environmental Biology	6	5	3	25	75	100

IV	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/ Biotechnology	6	4	3	25	75	100
	Elective V	Fishery Biology/Aquaculture/ Sericulture	6	4	3	25	75	100
		Total	30	21				500
		Grand Total	120	90				2000

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The Department of Zoology will offer the following Major Elective Courses

PART	NAME OF THE PAPER	NO. OF PAPERS	CREDITS
I	Core Course	14	82
II	Elective	5	30
III	Project	1	8
Total		20	120

Head of the Department **Principal**

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

Core Courses include Theory, Practical & Project
No. of Courses 10+4
Credit per Course 5/4/4
Total Credits 70

Elective Courses

(Major based / Non Major / Internship)
No. of Courses 5
Credit per Course 4
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%

OUTCOME BASED EDUCATION

Post Graduate – Science

Programme Outcomes:

PO1: Disciplinary Knowledge, Problem Solving & Decision Making Skill
Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study. Apply knowledge of Management theories and Human Resource practices to solve business problems through research in Global context. Foster analytical and critical thinking abilities for data-based decision-making.

PO2: Ethical Value
Ability to incorporate quality, ethical and legal value-based perspectives to all organizational activities.

PO3: Individual and Team Leadership Skill
Capability to lead themselves and the team to achieve organizational goals.

PO4: Employability & Entrepreneurial Skill
Inculcate contemporary business practices to enhance employability skills in the competitive environment. Equip with skills and competencies to become an entrepreneur.

PO5: Contribution to Society
Succeed in career endeavors and contribute significantly to society.

Programme Specific Outcomes:

PSO1 – Placement: To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.

PSO 2 - Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations

PSO3 – Research and Development: Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.

PSO4 – Contribution to Business World: To produce employable, ethical and innovative professionals to sustain in the dynamic business world.

PSO 5 – Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefit

CORE COURSE I
STRUCTURE AND FUNCTION OF INVERTEBRATES

SUB CODE:19:P08M1

Learning Objective (LO):

LO1	To understand the Structure and Functions of invertebrates.
LO2	To understand the organs of respiration and excretion and their functioning in invertebrates.
LO3	To analyses the nervous systems of various groups in invertebrates
LO4	To evaluate the larval forms of invertebrates to acquire knowledge on various organ system of invertebrates

Unit: I

Principle of animal taxonomy

Species concept; International code of zoological nomenclature - Taxonomic procedures. New trends in taxonomy - Animal collection, handling and preservation - Organization of coelom – Acoelomates – Pseudocoelomates - Coelomates: Protostomia and Deuterostomia.

Unit: II

Locomotion

Pseudopodia - Flagella and ciliary movement in protozoa - Hydrostatic movement in Coelenterata, Annelida and Echinodermata - Nutrition and Digestion - Patterns of feeding and digestion in lower metazoan - Filter feeding in polychaeta, Mollusca and Echinodermata

Unit: III

Respiration

Organs of respiration: gills, lungs and trachea - Respiratory pigments - Mechanism of respiration – Excretion - Organs of excretion: coelom, coelomoducts, nephridia and Malphigian tubules - Mechanisms of excretion - Excretion and osmoregulation

Unit: IV

Nervous system

Primitive nervous system: Coelenterata and Echinodermata - Advanced nervous system: Annelida, Arthropoda (crustacean and insecta) and Mollusca (cephalopoda) - Trends in neural evolution

Unit: V

Invertebrate larvae

Larval forms of free living invertebrates - Larval forms of parasites - Strategies and evolutionary significance of larval forms - Minor Phyla (Structural features and affinity) - Concept and significance - Organization and general characters

COURSE OUTCOMES

At the end of the course, the student will be able to

1) Understand the morphological features and physiological functions like Respiration, reproduction and nervous system of invertebrates.
2) Understand the various salient features of higher invertebrates.
3) Differentiate the patterns of functioning of various organ systems in invertebrates.

Suggested Reading Material

1. Hyman, L.H. The invertebrates. Vol.l Protozoa through Ctenophora, McGraw Hill Co., New York.
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Hyman, L.H. The Invertebrates. Vol.2. McGraw Hill Co., New York.
5. Hyman, L.H. The Invertebrates. Vol.8. McGraw Hill Co., New York and London.
6. Barnes, R.D. Invertebrate Zoology, III edition. W.B. Saunders Co., Philadelphia.
7. Russel-Hunter, W.D. A biology of higher Invertebrates, the Macmillan Co. Ltd., London
8. Hyman, L.H. The Invertebrate smaller coelomate groups, Vol.V. McGraw Hill Co., New York.
9. Read, C.P Animal Parasitism. Prentice Hall Inc., New Jersey.
10. Sedgwick, A. A student text book of Zoology. Vol.I, II and III. Central Book Depot, Allahabad.
11. Parker, T,J., Haswell, W.A. Text Book of Zoology, Macmillan Co., London.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	2	3	2	2	3
CO3	2	2	3	3	2
CO4	3	2	3	3	3
CO5	3	3	3	2	3

CORE COURSE 2

COMPARATIVE ANATOMY OF CHORDATES

SUB CODE:19:P08M2

Learning Objective (LO):

LO1	To understand the Structure and Functions of vertebrates
LO2	To understand the organs of respiration and excretion and their functioning in vertebrates
LO3	To analyses the nervous systems of various groups in vertebrates
LO4	To evaluate the larval forms of invertebrates to acquire knowledge on various organ system of vertebrates

Unit: I

Origin of Chordata

Concept of protochordata - The nature of vertebrate morphology - Definition, scope and relation to other disciplines - Importance of the study of vertebrate morphology.

Unit: II

Origin and classification of vertebrates

Vertebrate integument and its derivatives - Development, general structure and functions of skin and its derivatives - Glands, scales, horns, claws, nail, hoofs, feathers and hairs

Unit: III

General plan of circulation in various groups

Blood - Evolution of heart - Evolution of aortic arches and portal systems - Respiratory system - Characters of respiratory tissue - Internal and external respiration - Comparative account of respiratory organs

Unit: IV

Skeletal system

Form, function, body size and skeletal elements of the body - Comparative account of jaw suspensorium, vertebral column - Limbs and girdles - Evolution of urinogenital system in vertebrate series

Unit: V

Sense organs

Simple receptors - Organs of olfaction, taste and hearing - Lateral line system - Electroreception - Nervous system - Comparative anatomy of the brain in relation to its functions - Comparative anatomy of spinal cord - Nerves-Cranial, Peripheral and Autonomous nervous system

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Understand the morphological features and physiological functions like Respiration, reproduction and nervous system of Vertebrates.
2. Understand the various salient features of higher Vertebrates.
3. Differentiate the patterns of functioning of various organ systems in vertebrates.

Suggested Reading Material

1. Alexander, R.M. The Chordata. Cambridge University Press, London.
2. Barrigton, E.J.W. The Biology of Hemichordata and Protochordata. Oliver and Boyd, Edinbourgh.
3. Bournr, G.H. The structure and function of nervous tissue. Acadamic Press, New York
4. Carter, G.S. Structure and habit in vertebrate evolution –Sedgwick and Jackson, London.
5. Eecles, J. C. The understanding of the brain. McGram Hill Co., NewYork and London.
6. Kingsley, J.S. Outlines of Comparative Anatomy of Vertebrates. Central Book Depot, Allahabad.
7. Kent, C.G. Comparative anatomy of vertebrates.
8. Malcom Jollie, Chordata morphology. East-West Press Pvt. Ltd., New Delhi.
9. Millton Hilderbrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc., New York.
10. Monielli, A.R. The Chordates. Cambridge University Press, London
11. Smith, H.S. Evolution of chordate structure. Hold Rinehart and Winstoin Inc., NewYork
12. Sedgwick, A. A Students Text Book of Zoology, Vol.II
13. Tansley, K. Vision in vertebrate. Chapman and Hall Ltd., London
14. Torrey, T.W. Morphogenesis of vertebrates, John Wiley and Sons Inc.,New York and London.
15. Walters, H.E. and Sayles, L.D. Biology of vertebrates. Macmillan & Co., New York.
16. Wolstenholnf, E.W and Knight, J. (Ed.).Taste and Smell in vertebrates, J&A Churchill, London.
17. Romer, A.S. Vertebrate body, IIIrd Ed. W.B. Saunders Co., Philadelphia.
18. Young, J.Z. Life of vertebrates. The Oxford University Press, London.
19. Colbert, E.H. Evolution of the vertebrates, John Wiley and Sons Inc., New York.
20. Romer, A.S. Vertebrate Paleontology, 3rd Edn. University of Chicago Press, Chicago.
21. Clark, W.E. History of the Primates IV Edn. University of Chicago Press, Chicago.
22. Young, J.Z. Life of mammals. The Oxford University Press, London.
23. Weichert, C.K. and Presch, W. Elements of chordate anatomy, 4th Edn. McGraw Hall Books Co., New York.
24. Messers, H.M. An introduction of vertebrates anatomy.
25. Montagna, W. Comparative anatomy. John Wiley and Sons Inc.
26. de Deer, S.G. Embryos and Ancestors. Clarendon Press, Oxford.
27. Andrews, S.M. Problems in vertebrate evolution. Acadamic Press, New York.
28. Waterman, A.J. Chordata structure and function.
29. Joysey, K.A. and T.S. Kemp. Vertebrate evolution .Oliver and Boyd, Edinbourgh.
30. Lovtrup, S. The phylogeny of vertebrate, John Wiley and Sons, London.
31. Barbiur, T. Reptiles and Amphibians: Their habits and adaptation. Hongton Miffin Co., New York.
32. Kingsely Nobel, G. The biology of the Amphibia. Dover Publications, New York.
33. Smyth. Amphibia and their ways. The McMillan Co., New York.
34. Andrevos, S.M., Miles, R.S. and Walkar, A.D. Problems in vertebrate evolution. Academic Press, New York.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	2	3	3
CO2	3	3	2	2	3
CO3	3	2	3	3	3
CO4	2	2	3	2	3
CO5	3	2	3	3	3

CORE COURSE 3
CELL AND MOLECULAR BIOLOGY

SUB CODE:19:P08M3

Learning Objective (LO):

LO1	To understand the molecular basis of cell structure and functions
LO2	To learn the structure and functions of various organization and cell membrane.
LO3	To learn bioenergetics and biogenesis
LO4	To learn structure and replication of DNA
LO5	To learn various molecular techniques

Unit: I

Introduction – experimental systems in Cell Biology

Biomembranes - Molecular composition and arrangement functional consequences - Transport across cell membrane- Diffusion, active transport and pumps and uniports, symports and antiport -Membrane potential - Co-transport by symports or antiporters - Transport across epithelia

Unit: II

Cytoskeleton

Microfilaments and microtubules-structure and dynamics - Microtubulus and mitosis - Cell movements-intracellular transport, role and kinesin and dynein, signal transduction mechanisms Cilia and flagella - Cell-cell signalling - Cell surface receptors - Second messenger system - MAP kinase pathways - Signalling from plasma membrane to nucleus

Unit: III

Cell- cell adhesion and Communication

Ca++ dependent homophilic cell-cell ahension - Ca++ independent homophilic cell-cell ahension - Gap junctions and connexions - Cell matrix adhesion – Integrins – Collagen - Non-collagrn components - Cell cycle - cyclines and cyclin dependent kinases - Regulation of CDK- cycline activity

Unit: IV

Genome organization

Hierarchy in organization - Chromosomal organization of coding and non-coding DNA – Regulation of gene expression - Mobile DNA - Morphological and functional elements of eukaryotic chromosomes - Genetic analysis in Cell Biology

Unit: V

Intracellular protein traffic

Protein synthesis on free and bound polysomes - Uptake into ER - Membrane proteins,Golgi sorting, post-translational modifications - Biogenesis of mitochondria, and nuclei - Trafficking mechanisms - Biology of cancer - Biology of aging - Apoptosis-definition, mechanism and significance

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Acquire knowledge on cellular structure and functions
2. Understand the process of energetic and genesis in cells
3. Interpret the structural and functional significances of DNA and RNA
4. Take up jobs in molecular biology labs and clinical labs
5. Acquire the knowledge about RNAs and its Transcription

Suggested Reading Material

1. DeRobertis, E.D.D and DeRobertis, E.M.F. (2017). *Cell and Molecular Biology.*
2. Gupta. P.K. (2003). *Cell and Molecular Biology*, Rastogi Publication, Meerut, India.
3. Lewin, B. (2000). *Gene VII,* Oxford University Press, London.
4. Lodish, H., Berk, A., Zipursky, S.L., Matiudaira, P., Baltimore, D. and Darnell, J. (2000). *Molecular Biology of the Cell,* W.H. Freeman and company, New York.
5. Pollard, T.D., W.C. Earnshaw, J.L. Schwartz and G. Johnson. (2017). *Cell Biology,* Elsevier.
6. Verma P.S. and V.K. Agarwal. (2015): *Cell Biology, Genetics, MolecularBiology, Evolution and Ecology*, S. Chand and Company, New Delhi.

Supplementary Readings

1. Alberts, B., A.D. Johnson and J. Lewis. (2014). *MolecularBiology of the Cell*. W.W. Norton & Co., USA.
2. Berk, A., C.A. Kaiser and H. Ledish. (2016). *Molecular Cell Biology*.WH Freeman, USA.
3. Cooper, G.M. and R.E. Hausman. (2013). *The Cell: A MolecularApproach*. Sinauer Associates Inc., USA.
4. Malathi, V. (2012). *Essentials of Biology*. Pearson Education, Chennai, India.
5. Verma, P.S. and V.K. Agarwal. (2016). *Cell Biology*. S.Chand & Co., NewDelhi.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	3	3	3
CO2	3	3	2	2	3
CO3	3	2	3	3	3
CO4	3	2	3	2	2
CO5	3	2	3	2	3

CORE COURSE 4

EVOLUTION

SUB CODE:19:P08M4

LearningObjective (LO):

LO1	To gain awareness about the origin of life
LO2	To understand the roles of variations, polymorphisms, and polyploidy in evolution
LO3	To familiarize the role of isolation and speciation in evolution
LO4	To understand the various types of adaptation sand mimicry
LO5	To learn the evolution of mankind

Unit: I

Emergence of evolutionary theories

Lamarck – Darwin – Concepts – evolutionary synthesis – evolutionary time scale – eras – periods – epoch.

Human evolution: Stages of primate evolution including *Homo*.

Behavioral Evolution: Altruism and evolution – Group selection and kin selection.

Unit: II

Molecular Evolution

Role of gene in evolution - Evolution of gene families, Molecular drive - Assessment of molecular variation

Origin of higher categories

Phylogenetic gradualism and punctuated equilibrium - Major trends in the origin of higher categories - Micro- and Macro-evolution – speciation.

Unit: III

Molecular phylogenetics

How to construct phylogenetic tress? - Phylogenetic inference –Distance methods ,parsimony methods, maximum likelihood method - Immunological techniques -

Unit: IV

Amino acid sequences and phylogeny - Nucleic acid phylogeny-DNA-DNA hybridizations, Restriction Enzyme sites, Nucleotide sequence comparisons and homologies - Molecular clocks

Unit: V

Population genetics and ecology

Metapopulations - Monitoring natural populations - Why small populations become extinct? - Loss of genetic variations - Conservation of genetic resources in diverse taxa – Artificial evolution (*in vitro*)

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

1. Analyse the evolutionary history of biological organisms

2. Critically assess the evolutionary relationship among various phyla
3. Identify the role of natural selection in the survival of the species
4. Understand the various mechanisms involved in evolution.
5. Understand the mechanism of speciation in evolution

Suggested Reading Materials

1. Dobzhansky, Th. Genetic and Origin of Species. Columbia University Press.
2. Dobzhansky, Th., F.J. Ayala, G.L. Stebbines and J.M Valentine. Evolution. Surjeet Publication, Delhi
3. Futuyama, D.J. Evolution Biology, Suinuaer Associates, INC Publishers, Dunderland.
4. Hartl, D.L. A Primer of Population Genetics. Sinauer Associates. Inc, Massachusetts.
5. Jha, A.P. Genes and Evolution. John Publication, New Delhi.
6. King, M. Species Evolution –The role of chromosomal change .The Cambridge University Press, Cambridge.
7. Merrel, D.J. Evolution and Genetics. Holt, Rinchart and Winston, Inc.
8. Smith, J.M. Evolutionary Genetics. Oxford University Press, New York.
9. Strikberger, M.W. Evolution. Jones and Bartett Publishers, Boston London.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	2	3	3
CO2	3	3	2	2	3
CO3	2	2	3	3	3
CO4	3	3	3	2	3
CO5	3	2	3	2	3

CORE COURSE 5
PRACTICAL – I
STRUCTURE AND FUNCTION OF INVERT EBRATES , COMPARATIVE ANOTOMY OF CHORDATES, CELL AND MOLECULAR BIOLOGY AND EVOLUTION

SUB CODE:19:P08M5P

COURSE OBJECTIVES

1) To understand the Structure and Functions of invertebrates and vertebrates.
2) To understand the organs of respiration and excretion and their functioning ininvertebrates.
3) To analyses the nervous systems of various groups in invertebrates.
4) To evaluate the larval forms of invertebrates to acquire knowledge on various organ system of vertebrates.

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.

B. CELL AND MOLECULAR BIOLOGY

Micrometry

Camera Lucida Drawings
Human Buccal Smear
Blood Smear – Cockroach, Man
Cytochemical detection of Carbohydrates, Proteins, Lipids, DNA and RNA.

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

C. EVOLUTION

PHYLOGENY:
Invertebrate larval forms - Trochophore, Nauplius, Bipinnaria, Tornaria Fossils – Ammonoids, Belemnoids, Nautiloids , Echinoderm fossils, Dinosaurs and Archaeopteryx.
Molecular Phylogeny
How to construct phylogenetic trees

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Understand the morphological features and physiological functions like Respiration, reproduction and nervous system of invertebrates and Vertebrates.
2. Understand the various salient features of higher invertebrates and Vertebrates.
3. Differentiate the patterns of functioning of various organ systems in invertebrates and vertebrates.
4. Know the structural organization and functioning of various organs in invertebrates and vertebrates.
5. Understand the Structural functioning of respiratory and nervous system.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	2
CO2	2	3	2	2	3
CO3	3	2	3	3	3
CO4	3	2	3	2	3
CO5	3	3	3	2	3

CORE COURSE 6
BIOCHEMISTRY

SUB CODE:19:P08M6

COURSE OBJECTIVES

1. To learn classification and metabolism of carbohydrates
2. To understand the structure and metabolism of protein
3. To learn the structure and functions of lipids
4. To acquire knowledge about various enzymes and hormones and their actions
5. To acquire knowledge about the significance of vitamins

Unit: I

Structure of atoms, molecules and chemical bonds. Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligativeproperties).

Unit: II

Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Composition, nature of bonds/linkages, structure of biomolecules (carbohydrates, lipids, proteins,nucleic acids and vitamins).

Unit: III

Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.Principles of catalysis, classification of enzymes and enzyme kinetics, enzyme regulation, inhibitors of enzymes - mechanism of enzyme catalysis, isozymes.

Unit: IV

Conformation of proteins (Ramachandran plot, primary, secondary, tertiary and quaternary structures, domains, motif and folds).
Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA).

Unit: V

Stability of proteins and nucleic acids.
Metabolism of amino acids, carbohydrates, lipids, nucleotides and vitamins.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Understand various micro and macro molecules and their significance
2. Discriminate various metabolic disorders
3. Take up jobs in clinical labs
4. Analyze biological samples of bio-chemical importance
5. Understand the metabolism of macromolecules

Suggested books

1. D.Voet and J.G. Voet. Biochemistry, John wiley & sons.
2. D.Freifelder, Physical Biochemistry, W.H. Freeman & Company
3. I.H. Segal, Biochemical calculations, john Wiley & sons.

4. T.E. Creighton, Proteins-structure and Molecular Properties, W.H. Freeman & Company.

5. D.Freifelder, Essentials of Molecular Biology.

6. K. Wilson and K.H. Goulding, A. Biologist's gide to principles and techniques of practical biochemistry.

7. T.G.Cooper. Tools of Biochemistry.

8. Hawk. Practical Physiological Chemistry.

9. R.H. Garrett and C.M. Grisham. Biochemistry, Saunders college publishers.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	3	3	2	3	3
CO3	2	2	3	2	2
CO4	3	3	3	2	3
CO5	3	2	3	2	3

CORE COURSE 7
GENETICS

SUB CODE:19:P08M7

Learning Objective (LO):

LO1	To learn the fundamental concepts of genetics
LO2	To study human health related genetic problems, qualitative and quantitative traits and population genetics
LO3	To learn the structure of genes and their regulation
LO4	To acquire skills in chromosomal alterations, gene mutations and cancer.
LO5	To learn application of genetics concepts in microbial genetics and genetic engineering.

Unit: I

Basic concepts of Genetics

Mendelian principles: Dominance, segregation, independent assortment.

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

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.

Unit: II

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mappingby using somatic cell hybrids, DNA foot printing.

Extra chromosomal inheritance: Inheritance of Mitochondrial genes, maternal inheritance.

Unit: III

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

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

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

Unit: IV

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.

Recombination: Homologous and non-homologous recombination including transposition. Population Genetics: Genetic equilibrium – distinguishing forces – natural selection – mutation and genetic drift.

Unit: V

Molecular Genetics – Structure of gene – genetic code – gene regulation – genome analysis – functional genomics – RNA processing – Transcription: factors and regulation – Translation: control and regulation.

Molecular population genetics: Patterns of change in nucleotide and amino acid sequences.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Interpret phenotypic expressions based on genotype
2. Understand and interpret genetically linked diseases
3. Perform blood group analysis and test metabolic disordersWorking in clinical laboratories and take up researches
4. Understand the chromosomal alterations and significance of gene

Suggested Reading Material

1. Brooker: Genetics: Analysis and Principles
2. Gardner et al: Principles of Genetics
3. Griffith et al: Modern Genetic Analysis
4. Hartl & Jones: Essential Genetics: A Genomic Perspective
5. Lewin, Genes
6. Russell: Genetics
7. Snustad & Simmons: Principles of Genetics

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	3	3	3
CO2	3	3	2	2	3
CO3	3	2	3	2	3
CO4	3	3	3	3	3
CO5	2	2	3	2	2

CORE COURSE 8
DEVELOPMENTAL BIOLOGY

SUB CODE:19:P08M8

Learning Objective (LO):

LO1	**To understand the various concepts of development**
LO2	**To study gametogenesis and process of fertilization**
LO3	**To learn the processes of embryogenesis, organ formation and differentiation**
LO4	**To analyse the embryonic induction and teratogenesis**
LO5	**To critically explore assisted reproductive technologies for human welfare**

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; embryogenesis, establishment of symmetry.

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

Neoteny: Occurrence and significance – Regeneration: Regenerative capacity in the Animal Kingdom – Factors influencing regeneration – Stimulation and Suppression – Polarity and Gradiants – Development of immune system in vertebrates.

Unit: V

Programmed cell death, aging and senescence - Asexual reproduction - Assisted Reproductive Technology (ART) – Male infertility – Sperm abnormalities – Superovulation – IVF, ICSI, GIFT – Screening of genetic disorders.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Acquire knowledge on reproduction and development
2. Understand process of fertilization
3. Understand the whole process of embryogenesis

4. Acquisition of skills in common methods and practices followed in developmental biology related laboratory activities

5.Take up jobs in fertilityclinics and research labs

Suggested Reading Material

1. Balinsky., Introduction to Embryology
2. Grant, Biology of Devloping System
3. Austen, C.R. and short, R.V., Reproduction in animals.
4. Schatten and Schatten. Molecular biology of fertilization.
5. F.T. Longo. Fertilization, Chapman & Hall.
6. R.G. Edwards. Human Reproduction.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	2	3	3
CO2	3	3	2	2	2
CO3	3	2	3	2	3
CO4	3	2	3	3	3
CO5	3	2	3	3	3

CORE COURSE 9
PRACTICAL II
BIOCHEMISTRY, GENETICS and DEVELOPMENTAL BIOLOGY

SUB CODE:19:P08M9
Learning Objectives

LO1	To learn the fundamental concepts of quantitative estimation.
LO2	To study human health related genetic problems, qualitative and quantitative traits and population genetics
LO3	To learn the structure of genes and their regulation
LO4	To acquire skills in chromosomal alterations, gene mutations.
LO5	To learn effect of metamorphosis in frog.

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.

Principles and Applications of Colorimeter , Centrifuge, Chromatography, Electrophoresis Using samples.

B. GENETICS

Drosophila culture – Identifications of mutants & sexes.

Blood groups ABO & Rh their genetic significance.

Pedigree analysis.

Human karyotyping & Chromosomal abnormalities.

Hardy Weinberg law & gene frequencies.

C.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.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Interpret estimation of carbohydrates, protein and lipid and calculations of moles and millimoles.
2. Understand and interpret genetically linked diseases

3. Perform blood group analysis and test metabolic disorders Working in clinical laboratories and take up researches

4. Understand the chromosomal alterations and significance of gene

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	2
CO2	3	3	3	2	3
CO3	2	2	3	2	3
CO4	3	3	3	2	3
CO5	3	2	3	2	3

ELECTIVE I A TOXICOLOGY

SUB CODE:19:P08E1R

Course Objectives (CO):

The main objectives of this course are:

1	To learn the concepts and processes involved in toxicology
2	To understand the various methods to know absorption and distribution of toxicants
3	To study the biotransformation and excretion of toxicants
4	To learn the impacts of toxicants and human beings.
5	To learn the application of antidotes

Unit – II 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.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Carry out toxicological analysis of various environmental samples
2. Make observations and biochemical analysis of biological samples
3. Carry out toxicological testing using live specimen to determine toxicityof toxicants

4. Take up jobs in toxicological research institutions and clinical labs
5. Understand the toxic effect of toxicants and biotransformation

Suggested Reading Material

1. Sharma, P.D. : Environmental Biology and Toxicology. Rastrogi publication, meerut, India.
2. L.U., F.C. , Basic Toxicology. Hemisphere publication. Corporation, Washington, N.Y. London.
3. Gupta,P.K. and Salunka, D.K. Modern toxicology. Vol. I and II, Metropolitan, New Delhi.
4. Sood, A. Toxicology. Sarup & sons, New Delhi.
5. Butler, G.C.. The Principles of Ecotoxicology Scope. 12, ICSO Scope John Wiley and sons, Chicheater.
6. Finner D.J. Probit Analysis, Cambridge University Press.
7. Adrien Albert . Selective Toxicity. University press Cambridge.
8. Gupta, P.K. and V. Raviprakash, Advance in toxicology and Environmental Health. Jagmandar Book Agency, New Delhi.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	2	3	2	2	2
CO3	3	2	3	3	3
CO4	3	2	3	2	3
CO5	3	3	3	2	2

ELECTIVE I B

RESEARCH METHODOLOGY AND BIOINFORMATICS

SUB CODE:19:P08E1

COURSE OBJECTIVES

1) To gain familiarity with research and its types.
2) To learn the appropriate methods of literature collection and analysis.
3) To familiarize Instrumentation and its applications in research.
4) To inculcate interest in students to pursue research.
5) To develop the skill to write the repot writing and thesis

Unit - I

Definition – Development of Biostatistics, Data in Biostatistics – samples and population, Descriptive Statistics: arithmetic mean, median, mode, range, standard deviation, practical methods for computing mean and standard deviation, coefficient of variations.

Probability distribution – binomial and Poisson distribution, estimation and hypothesis testing – Student's t, confidence limit, analysis of variance, two way analysis of variance, regression, correlation, analysis of frequencies.

Unit - II

Literature collection: Need for review of literature, Review process and bibliography, Research Reading, Discriminative Reading, Consulting source material, Working Bibliography, Index cards and Reference cards. Literature citation: Introduction, Different systems if Citing References.

Unit - III

Experimental designs: Introduction, Observation, Hypothesis and Null-hypothesis, Basic Principles of Experiments – Experimental Unit and Sampling Unit, Experimental Error. Statistical packages – BMDP, GENSTAT, MINITAB, SAS and SPSS.

Unit - IV

Components of Bioinformatics, Applications of Bioinformatics, Origin of Bioinformatic Tools. Biological Sequence Alignment: Sequence alignment, Global alignment, Pairwise alignment, Multiple sequence alignment, Uses of sequence analysis. DALI, Drug discovery and Development, Phylogeny, Phylogenic trees.

Unit V

Major Databases in Bioinformatics: Properties of databases, Classification of Biological Databases Functions & Types of Databases , Nucleic Acid and protein sequence Databases, Database similarity Search Tools: BLAST, FASTA and its uses.

Course Outcomes (CO)

At the end of the course, the student will be able to

1. To understand and improve the art of scientific writing.
2. To analyse the raw data and its interpretation.
3. Principles and applications of reliable methods and instruments.
4. The method of publishing an article and impact factors.
5. Understand the testing of hypothesis and interprets the results

Suggested Reading Material

1. Bailey, N.T.J., Statistical Methods in Biology, III Ed., Cam. University Press, N.Y.
2. Sokal, R. and JAMES, F. Introduction to Biostatistics, W.H. Freeman and Company Ltd., Tokyo, Japan.
3. N. Gurumani, Research methodology for biological science MJP publications. Arthur M. Lesk. Introduction to Bioinformatics, United states, Oxford UniversityPress, New York.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	3	3	2	2	3
CO3	3	2	3	2	3
CO4	3	2	3	2	3
CO5	3	2	3	2	3

CORE COURSE 10

IMMUNOLOGY

SUB CODE:19:P08M10

Learning Objectives

LO1	To develop awareness regarding the molecules, cells and organ involved in immune system and their significances in up keeping the organism
LO2	To learn the various types of antigen and antibody and interaction
LO3	To gain knowledge regarding the application of immunological techniques
LO4	To learn the basic concepts in T cell generation
LO5	To learn the various techniques used in Cytokinines

Unit: I

Innate and Acquired Immunity

Phlogeny and Ontogeny of immune system - Organization and structure of lymphoid organs Cells of the immune system and their differentiation - Lymphocyte traffic - Nature of immune response

Unit: II

Nature of antigens

Antigenicity and immunogenicity - Factors influencing immunogenicity - Epitopes and haptens - Superantigens - Structure and Functions of Antibodies - Classes and subclasses - Gross and fine structure - Antibody mediated effector functions - Antigen- Ab interactions in vitro and in vivo

Unit: III

Complement system: Components, control proteins and activation pathways

Major Histocompatibility Complex in mouse and HLA system in human

MHC haplotypes - Class I and class II molecules - Cellular distribution - Peptide binding - Expression and diversity - Disease susceptibility and MHC/HLA

Organization and expression of Ig genes - Models for Ig gene structure - Multigene organization of Ig genes - DNA rearrangements and mechanisms - Generation of antibody diversity - Differential expression of Ig genes.

Unit: IV

T-cell generation, activation and differentiation

Isolation, molecular components and structure of T-cell receptor complex - T-cell maturation and thymus - TH- cell activation mechanism - T- cell differentiation - Cell death and T- cell population - B- cell generation, activation and differentiation - B-cell receptors - Selection of immature self-reactive B-cells - B-cell activation and proliferation - TH- B- Cell interactions

Unit: V

Cytokines - Definition and salient functional features - Cytokine receptors - Cytokines and immune response - Cell-mediated effector functions - Cell adhesion molecules - Effectors cells and molecules - CTL and NK cells- mechanism of action - Immunological tolerance and Anti-immunity - Delayed type hypersensitivity - Hypersensitivity: Types and immunological reactions and immune response to infection agents especially intracellular parasites

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

1. Analyze the various immunological issues
2. Apply immunological procedures for various immunological testing procedures
3. Acquired the knowledge about antigen and antibody interaction
4. Master the theoretical knowledge in various field of immunological studies.

5. Perform various experiments related immunology

Suggested Reading Material

1. Kuby Immunology, W.H. Freeman, USA.
2. W. Paul. Fundamentals of Immunology. I.M. Roitt, Essential Immunology, ELBS Edition

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	2	3	2	2	2
CO3	3	2	3	2	3
CO4	3	3	3	2	3
CO5	3	2	3	3	3

CORE COURSE 11 COMPARATIVE ANIMAL PHYSIOLOGY

SUB CODE:19:P08M11

COURSE OBJECTIVES

1. To learn the significance of food and physiology diagram
2. To understand the significance of excretory and osmoregulation system.
3. To study the functioning of cardiovascular system
4. To study respiratory and nervous systems including various receptors

Unit: I

Adaptation - Levels of adaptation - Mechanism of adaptation - Significance of body size - Adaptation, acclimation and acclimatization - Concepts of homeostasis.

Physiological adaptations of different environments – Marine - Shores and Estuaries – Freshwater - Extreme aquatic environments - Terrestrial life - Extreme terrestrial environments - Parasitic habitats.

Stress Physiology - Basic concept of environmental stress and strain; concept of elastic and plastic strain; stress resistance, stress avoidance and stress tolerance.

Unit: II

Endothermy and physiological mechanism of regulation of body temperature - Physiological adaptation to osmatic and ionic stress; mechanism of cell volume regulation - Osmoregulation in aquatic and terrestrial environments - Physiological response to oxygen deficient stress - Physiological response to body exercise - Meditation, Yoga and their effects.

Unit: III

Respiratory physiology – Structures – Respiratory gases – uptake – respiratory pigments – O2 & CO2 dissociation curves – transport of respiratory gases.

Unit: IV

Excretory physiology – Excretory organs – mechanism of excretion – physiology – adaptations of excretion to environment – Excretory products: synthesis and elimination.

Endocrine glands – Feedback regulation – Pituitary – gonadal axis – Role of reproductive hormones – gamete formation; fertilization; embryonic development; parturition; lactation; neuroendocrine regulation.

Unit: V

Neural and muscular physiology – Neurons – action potential – nerve impulse transmission – neurotransmitters – mechanism of neural transmission – neuro-degenerative diseases

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Understand the normal physiological functions and necessity to maintaina healthy Life
2. Get an opportunity to understand various factors that could lead to altered physiological functions and thereby health problems
3. Perform various physiological experiments and observations
4. Take up jobs in clinical labs and research institutes
5. Understand the various physiological functions and importance

Suggested Reading Material

1. Eckert, R. Animal Physiology: Mechanisms and Adaptations. W.H. Freeman and Company, New York.
2. Hochachka, P.W. and Somero, G. N. Biochemical Adaptation. Princeton, New York.
3. Hoar, W.S. General and Comparative Animal Physiology, Prentice Hall of India.
4. Schiemdt Nielsen. Animal Physiology: Adaptation and Environment. Cambridge.
5. Strand, F.L. Physiology: A regulation System Approach. Macmillan Publishing Co., New York.
6. Pummer, L. Practical Biochemistry, Tata McGraw-Hill
7. Prosser, C.L. Environmental and Metabolic Animal Physiology. Wiley-Liss Inc., New York.
8. Wilson K. and Walker. J. Practical Biochemistry.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	3	3	2	3	3
CO3	3	2	3	2	2
CO4	3	2	3	2	3
CO5	2	2	3	3	3

CORE COURSE 12

PRACTICAL – III

IMMUNOLOGY and ANIMAL PHYSIOLOGY

SUB CODE:19:P08M12P

Learning Objectives

LO1	To develop awareness regarding the molecules, cells and organ involved in immune system and their significances in up keeping the organism
LO2	To learn the various types of antigen and antibody and interaction
LO3	To understand the significance of excretory and osmoregulation system.
LO4	To study the functioning of cardiovascular system.
LO5	To learn the various techniques used in Cytokinines

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.

Cell imprinting of lymphoid organs.

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.

Oxygen consumption of fish

ELECTIVE II A BIOINSTRUMENTATION

SUB CODE:19:P08E

COURSE OBJECTIVES

1) To gain familiarity with research and its types.
2) To learn the appropriate methods of recombinant DNA
3) To familiarize Instrumentation and its applications in research.
4) To inculcate interest in students to pursue research.
5) To develop the skill to microscopic technique.

Unit I

Molecular biology and recombinant DNA methods: Isolation and purification of RNA DNA (genomic and plasmid) and proteins, different separation methods; analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, isoelectric focusing gels; molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems; expression of recombinant proteins using bacterial, animal and plant vectors; isolation of specific nucleic acid sequences;

Unit II

DNA sequencing methods, strategies for genome sequencing; methods for analysis of gene expression at RNA and protein level, large scale expression analysis, such as micro array based techniques; isolation, separation and analysis of carbohydrate and lipid molecules; RFLP, RAPD and AFLP techniques

Unit III

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.

Unit IV

Biophysical methods: Analysis of biomolecules using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using X-ray diffraction and NMR; analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.

Unit V

Microscopic techniques: Visualization of cells and sub-cellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.

Suggested Reading Material

1. De Robertis, E.D.P. and De Robertis , E.M.F. Cell and Molecular Biology, VIII Ed., Lea and Febiger, Philadelphia.
2. David Freifelder. Molecular Biology, II Ed., Narosa Publishing House, New Delhi
3. John D. Hawkins. Gene Structure and Expression, III Ed., Cambridge University Press

4.Watson *et al*., Molecular Biology of the Gene, the Benjamin Cummings Publishing Co., Inc., California.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	2
CO2	3	3	2	2	3
CO3	3	2	3	2	3
CO4	3	2	3	2	3
CO5	2	3	3	2	3

ELECTIVE II B

POULTRY SCIENCE

SUB CODE:19:P08E2

COURSE OBJECTIVES

1)Give information about the poultry and its importance. It gives an idea for the self- employment opportunities to the students.

2)To understand the poultry industry based on the past, present and emphasis of future growth.

3)To understand with different systems of rearing commercial layers and broilers production and efficiently marketing.

4)Imparting knowledge of different types of feeds and feeding methods and common diseases and their control

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.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Knowledge about the Prospects of Poultry Industry.
2. Knowledge about the commercial layer production systems, housing and equipments.
3. Knowledge about the commercial broiler production systems, housing and equipments.
4. Knowledge about the poultry nutrients and feeding of poultry farming and diseases and their control.
5. Develop into entrepreneurship.

Suggested Reading Material

1) Sunil Kumar Das . Poultry production, CBC Publishers and Distributors, Delhi – 110032.
2) Banerjee G.C. (1992) A textbook of animal husbandary, Oxford and IBM Publishing Co., New Delhi.
3) Shukula, G.S. and Upadhyay V.B. Economic Zoology, Rakesh Rastogi Meenit.
4) Indian Poultry Industry year book By Sakuntbak B.Gupta, C34, New Bactak Road, New Delhi – 110 005.
5) Intensive Poultry Management for egg production. Bulletin NO. 152, her majesty stationery office, London.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	2
CO2	3	3	2	2	3
CO3	2	3	3	2	3
CO4	3	2	3	3	3
CO5	3	2	3	2	3

ELECTIVE III A
VERMITECHNOLOGY

SUB CODE:19:P08E3

COURSE OBJECTIVES

1) To understand the knowledge of Earthworms and their biological diversity and importance
2) To gain the principals and applications of vermitechnology and their application techniques
3) To identify the different methods of Composts and their benefits in agriculture fields
4) To understand the significant of vermitecholgy and their impacts.
5) To Understand the role of earthworms on the decomposition process

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.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Gained the theoretical as well as practical knowledge in the field of and Vermiculture practices
2. Interpret the Modern concepts and their application
3. Appreciate the biological – soil elements in the behavior of various Earthworm Composts and their significance
4. Understand the impact of soil reclamations in various case studies
5. Understand the effects of earthworms on the number, biomass and activity of microorganisms

Suggested Reading Material

1. Edwards, C.A & P.J Bohlen, 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, Chapman & Hall Publications N.Y.U.S.A.

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

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	2	3
CO2	3	3	2	3	2
CO3	3	2	3	2	3
CO4	3	3	3	3	3
CO5	2	2	3	2	3

ELECTIVE COURSE III B

MICROBIOLOGY

SUB CODE:19:P08E

COURSE OBJECTIVES

1) To inculcate knowledge on the fundamentals of microorganisms.
2) To learn the structural organization, morphology and reproduction of microbes.
3) To know the principles of microscopy and advancements of microscopy.
4) Students will be able to isolate, identify and characterize microorganisms.
5) To update the technology innovations of microbial applications.

Unit - I

Introduction to Microbes:

Scope of microbiology – three domain system of classification : Microbial diversity. Morphology and fine structure of bacteria, gramstainer, 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: Cultural media: Characteristics, types and preparation and Stylization method, 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;; 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.

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

1. Students will get theoretical knowledge and laboratory skills to do basic operations in the microbiological laboratory.
2. Knowledge on historical perspectives of microbiology.
3. Basic knowledge on different structure of microbes.
4. Understand the knowledge about different type of microscope.
5. Acquired the skill about the microbes and its importance

Suggested Reading Material

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

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	2
CO2	2	3	3	2	3
CO3	3	3	3	2	3
CO4	3	2	3	2	3
CO5	3	2	2	2	2

CORE COURSE 13
ENVIRONMENTAL BIOLOGY

SUB CODE:19:P08M13

COURSE OBJECTIVES

1) To gain awareness about the basic concepts of environment and ecology
2) To create a mindset for conservation of biodiversity
3) To familiarize the concept of environmental impact assessment
4) To understand the significance of natural resources and sustainable development
5) To create awareness about environmental pollution and its prevention
6) To learn the phenomenon of global warming and its prevention

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.

Unit: II

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.

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

Unit: III

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: IV

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

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

Unit: V

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

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

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

1. Analyse and appreciate the basic ecological concepts
2. Critically assess environmental disasters and suggest counter measures
3. Develop a mind set to safeguard natural resources and take forward the concept of sustainable development
4. Understand the Environment Protect by acting against pollution,
5. Take up employment in environment related agencies and institution and Educate the public regarding the importance of rain water harvesting and water Conservation

Suggested Reading Material

1. Odum: Fundamentals of Ecology
2. Odum: Basic Ecology
3. Turk and Turk: Environmntal Science
4. Primark: A Primer of Conservation Biology
5. Calabrese: Pollutants and High-Risk Groups
6. Raven, Berg, Johnson: Environment
7. Sharma: Ecology and Environment
8. Cunningham and Saigo: Environmental Science
9. Ricklefs and Miller: Ecology
10. Kormandy: Population Ecology

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	2	3	3
CO2	3	3	2	3	3
CO3	3	2	3	2	3
CO4	3	3	2	2	3
CO5	3	2	3	2	3

CORE COURSE 14

PRACTICAL IV

ENVIRONMENTAL BIOLOGY

SUB CODE:19:P08M14P

COURSE OBJECTIVES

1) To gain awareness about the basic concepts of environment and ecology
2) To create a mindset for conservation of biodiversity
3) To familiarize the concept of environmental impact assessment
4) To understand the significance of natural resources and sustainable development
5) To create awareness about environmental pollution and its prevention
6) To learn the phenomenon of global warming and its prevention

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}.

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

7) Analyse and appreciate the basic ecological concepts
8) Critically assess environmental disasters and suggest counter measures
9) Develop a mind set to safeguard natural resources and take forward the concept of sustainable development
10) Understand the Environment Protect by acting against pollution,
11) Take up employment in environment related agencies and institution and Educate the public regarding the importance of rain water harvesting and water Conservation

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	3	3
CO2	3	3	2	2	3
CO3	3	2	3	3	3
CO4	2	3	3	2	3
CO5	3	2	3	2	3

ELECTIVE IV A

GENERAL AND APPLIED ENTOMOLOGY

SUB CODE:19:P08E4

COURSE OBJECTIVES

1) To learn various insects and their classification
2) To learn the morphological, anatomical and physiological systems in insects
3) To learn knowledge in agricultural entomology as well as beneficial insects
4) To learn vector insects and their role in public health
5) To learn knowledge on pest management

Unit - I

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

Morphology of insect. Head, thorax and abdomen . Integumentary System.

Unit - II

Physiology of Respiration – terrestrial respiration – aquatic respiratory organs. Circulatory system – Components of haemocoel, fat body and mechanism of circulation.

Excretory system: Types , Excretory organs, accessory excretory organs, and physiology of excretion.

Unit - III

Nervous system: Structure and function of Stridulatory organ.

Reproductive system: Male –and female reproductive systems

Role of hormones in male and female reproduction.

Unit - IV

Economic importance of Insects – Honey bee- Types of bees, life cycle, structural adaptation , bee hives and its accessories and uses.

Destructive insects: Biology, damage caused and control methods of any 2 major insect pests (Paddy and Sugar cane) of agricultural importance : 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- general classification –classification based on mode of action, mode of entry and

Bio pesticides: Integrated Pest management (IPM) definition, Integration of methods potential components – need for IPM and uses.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Identify insects based on morphological features
2. Start entrepreneurial activities in sericulture and apiculture
3. Take up jobs in vector control and public health departments
4. Take up integrated pest management activities
5. Understand the Beneficial Insects and Vector insects

Suggested Reading Material

1. Temphare, D.B., Modern Entomology, Himalaya Publishing , Mumbai.
2. Ambrose, Dunstorn, P. The Insects: Structure, function and Biodiversity. Kalyani publishers, Ludhiana – New Delhi – Chennai.
3. Nayar, K.K., T.N. Ananthakrishnan, and B.V. David General and Applied Entomology, Tata McGraw Hill Publications, New Delhi.
4. Vasantharaj David, B. Elements of Economic Entomology, Popular Book Depot., Chennai – 15.
5. Chapman R.F. The Insects structure and function Cambridge University Press.
6. Snodgrass, R.E. Principles of Insect Morphology, McGraw Hill and Co., New York.
7. Wigglesworth, V.B. Principles of Insect Physiology IX Ed., Chapman and Hall, London.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	2	3	2	3	3
CO3	3	2	3	2	3
CO4	3	3	3	3	2
CO5	3	2	2	2	3

ELECTIVE IVB

BIOTECHNOLOGY

SUB CODE:19:P08E

COURSE OBJECTIVES

1) To learn the basic concepts in biotechnology
2) To learn the various techniques used in biotechnology
3) To gain knowledge regarding the application of Medical biotechnology.
4)To learn the various methods using animal biotechnology.
5) To gain knowledge regarding the environmental biotechnology.

Unit - I

Basic Biotechnology: Definition – Scope – Achievements of Biotechnology – Restriction Enzymes, DNA ligases, polymerase etc. Cloning vehicles – Plasmids Bactriophage, Cosmids, Yeast plasmids . Cloning methods, Blunt end sticky end- Construction of DNA Library – genomic cDNA- application.

Unit - II

Techniques in Biotechnology: PCR, DNA finger printing, DNA probes, Hybridization Southern blotting, Northern blotting, Western blotting DNA sequencing method,

Unit - III

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

Unit - IV

Animal Biotechnology: Cloning, reproductive cloning, Transgenic , microinjection – electrophoration, animal gene therapy- methods application current status.

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).

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

1. Analyze the basic biotechnological studies.
2. Apply to techniques in biotechnological studies.
3. Acquired the knowledge about medical biotechnological.
4. Master the theoretical knowledge in various field of biotechnology.
5. Perform various experiments related to biotechnology.

Suggested Reading Material

1. Dubey R.C. A text book of Biotechnology. S. Chand & Co. Ltd. New Delhi.
2. Gupta. R.K. Elements of Biotechnology. Rastogi & Company, Meerut.
3. Kumar. H.D. A text book of biotechnology. Affiliatiated East – west press pvt. New Delhi
4. Purohit. S.S Biotechnology, Fundamentals and Application. Agrobios Jodhpur.
5. Primrose. S.B. Molecular Biotechnology. 2nd Edition Blackwell, Oxford.
6. Meyers. R.A. Molecular Biology and Biotechnology. VCH publishers.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	2
CO2	3	3	2	2	3
CO3	2	2	3	3	3
CO4	3	2	3	2	3
CO5	3	3	3	2	3

ELECTIVE V A

FISHERY BIOLOGY

SUB CODE:19:P08E5

COURSE OBJECTIVES

1) To learn the principles and practices followed in Inland fisheries and aquaculture
2) To learn biology and fisheries potential of marine fisheries
3) To acquire skills in culturing finfishes
4) To develop skill on fin fish culture
5) To learn fish harvesting and post harvesting technology

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.

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

1. Understand and analyse various issues related to fisheries and aquaculture
2. Take up jobs in fisheries and aquaculture sectors
3. Start aquaculture activities on their own
4. Take up jobs in marine product export sectors and also take up research activities in various fisheries institutions and Universities
5. Acquired the knowledge about fisheries entrepreneurship

Suggested Reading Material

1) Biswas, S.P., Manual of Methods in Fish Biology, International Book Co., Absecon Highlands, New Jersey.
2) Jhingran, V.G. Fish and Fisheries of India. Hindustan Publishing Copr., New Delhi.
3) Pillai, T.V.R. Aquaculture : Principles and Practices. Fishing News Agency, London.
4) Bose, A.N., Yang C.T., and Misra, A. Coastal Aquaculture Engineering. Oxford and IBH Publishing Co., PVt. Ltd., New Delhi.
5) Chakrabarti, N.M., Diseases of Cultivable Freshwater Fishes and Their Control. International Books and Periodicals Supply service, New Delhi.
6) Day, F., The Fishes of India, Vols. I & II. Today and Tomorrow's Book Agency, New Delhi.
7) Govindan, T.K. Fish processing Technology, Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.
8) MPEDA Hand book of Aquafarming Freshwater Fishes, Marine Products Export Development Agency, Kochi.
9) New, M.B., Tacon., A.G.J., and Csavas, I. Farm – made – Aqua feeds. Food and Agrilculture Organization of United nations, Rome.
10) Sandthanam, R.Fisheries Science, Daya Publishing House, New Delhi.
11) Seghal, K.K. Recent Researches in Cold Water Fisheries, Today and Tomorrow's Pbulishers and Printers, New Delhi.
12) Sinha, V.R.P. A Compendium of Aquaculture Technologies for Developing Countries. Center for Science and Technology and Oxford and IBH Publishing Co., Pvt., Ltd., New Delhi.
13) SubbhaRao Economics of Fisheries, Daya Publishing House, New Delhi.
14) Trivedi, K.K. Fisheries Development: A.D. Association of Indian Fishery Industries and Oxford and IBH Publishing Co., Pvt. Ltd., New Delhi.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	2	3	3
CO2	3	3	3	2	3
CO3	3	2	3	2	2
CO4	3	2	3	2	3
CO5	3	3	3	2	3

ELECTIVE V B
AQUACULTURE

SUB CODE:19:P08E

COURSE OBJECTIVES

1) To learn the principles and practices followed in Inland fisheries and aquaculture
2) To learn biology and fisheries potential of marine fisheries
3) To acquire skills in culturing finfishes
4) To develop skill on fin fish culture
5) To learn fish harvesting and post harvesting technology

UNIT I

Definition- Scope of aquaculture- Aquaculture in India, Role of aquaculture on economic development, constraints in aquaculture, organization related to aquaculture and fisheries, types of aquaculture- Freshwater aquaculture, coastal aquaculture and marine aquaculture. Fresh water culturable fishes, marine water culturable fishes.

UNIT II

Fish ponds-Definition, breeding ponds, nursery ponds, rearing ponds, culture ponds (stocking ponds). Preparation of pond for fish culture, management of fish ponds, water quality management of fish ponds. Importance and composition of feeds; types of feed, wet and dry feeds, Artificial and live feeds- Artemia, Diatoms, Daphnia and Spirulina cultures.

UNIT III

Types of cultures – Extensive culture, Intensive culture and semi-intensive culture, monosex culture, monoculture, polyculture, cage culture and pen culture. Integrated fish farming – paddy cum fish culture, Animal husbandry cum fish culture, sewage fed fish culture. Culture practices : Major carps, Prawns, Lobster, Pearl Oyster, Edible Oyster Mussels and seaweeds.

UNIT IV

Fish disease management: Common bacterial, viral, fungal, protozoans and crustaceans diseases, their symptoms and treatment. Aquatic pollution – Definition, causes, ecological effects and control of water pollution. Hypophysation- Definition, principle and procedure of hypophysation – collection, preparation and injection of pituitary extract, selection of breeders, mechanism of pituitary action and advantages of hypophysation.

UNIT V

Genomic manipulation- Hybridization, Androgenesis, Gynandrogenesis and Polyploidy. Harvesting and transport of fish and its products. Fish preservation and fish processing technology – By products of fish and its uses. Marketing of
fishery products, Government organizations in Aquaculture. ICAR, CMFRI, CIFRI, CICFRI, CIFA, CIBA, CIFT & MPEDA.

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

1. Understand and analyse various issues related to fisheries and aquaculture
2. Take up jobs in fisheries and aquaculture sectors
3. Start aquaculture activities on their own
4. Take up jobs in marine product export sectors and also take up research activities in various fisheries institutions and Universities
5. Acquired the knowledge about fisheries entrepreneurship

Suggested Reading Material

1. Pillay, T.V.R. Aquaculture principles and practices. Fishing New Books, Blackwell Science Ltd., Oxford.
2. Shanmugam, K. Fishery biology and Aquaculture. Leo Pathipagam, Madras.
3. Santhanam, Sugumaran and Natarajan, P. A Manual of freshwater aquaculture. Oxford and IBH Pub. Co. Ltd., New Delhi.
5. Arumugam.N. Aquaculture Saras Publications, Nagercoil.
6. Baradach, JE, JH Ryther and WO McLarney Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, New York.
7. Chadar, S.L. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, PP.146
8. Exporters manual and Documentation. Jain Book Agency. New Delhi.
9. Jhingran.V.C. Fish and fisheries of India, Hindustan Pub. Cord. New Delhi.
10. Kurian,C.V and Sebastin. Prawn and prawn fisheries of India, Hindustan Pub. Cord. New Delhi.
11. Rath, R.K. Freshwater Aquaculture. Scientific Publishers, (India), PO.Box.91, Jodhpur.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	3	2	3	3
CO2	3	3	2	2	3
CO3	3	3	3	2	3
CO4	3	2	3	3	2
CO5	3	2	3	2	3

ELECTIVE V C

SERICULTURE

SUB CODE:19:P08E

COURSE OBJECTIVES

1) To acquire the knowledge of silkworm and their social values
2) To acquire the clear knowledge about the rearing techniques and different types of silkworm.
3) To acquire the knowledge about the importance of silk products and their marketing.
4) To acquire the clear knowledge about the silkworm enemies and diseases and their control measures.
5) To acquire the knowledge of silkworm and their social values

UNIT I

Sericulture: Definition, history and present status; silk route. Mulberry and types of non-mulberry sericulture. Commercial varieties of mulberry plants used in Sericulture in India. Requirement for Mulberry Cultivation - Soil Climatic conditions: Temperature, photoperiod, humidity and rainfall. Mulberry management: Land preparation- Irrigation- Manuring - Propagation of mulberry plant- Plantation methods. Profitable cultivation and Harvesting. Diseases of mulberry – fungal, bacterial, viral and Nematode diseases, Deficiency diseases and their remedial measures

UNIT II

Silkworm taxonomy and distribution. Univoltine, Bivoltine and Multivoltine races. Exotic and indigenous races in India. Life cycle of Mulberry Silkworm: Egg, larva, pupa and adult, life span. Morphology: Egg, Larvae: Mouth parts, legs, prolegs, spiracles, eyes, claspers and integumentary hair and sexual markings. Pupa: Sexual dimorphism. Adult: Mouth parts, antenna, wings and external genitalia - Silk glands: Structure, development and mechanism of silk synthesis - Hormonal control on metamorphosis, diapause, silk synthesis and reproduction.

UNIT III

Silkworm rearing: Rearing house -CSB model. Early age and late age rearing. Rearing appliances- Mountages- types of mountages and disinfectants. Seed: Collection of disease-free layings (DFLs), incubation, Hatching and Brushing- Feeding and rearing, spacing, cleaning and dusting. Mounting and cocoon production: spinning of cocoons. Harvesting, preservation, assessment, storage. Transportation: Cocoons, record maintenance, cost of cocoon production, leaf cocoon ratio.

UNIT IV

Silkworm diseases : Etiology, Structure, Symptoms, Preventive and control measures of viral Bacterial and Fungal Diseases .

UNIT V

SILK TECHNOLOGY: Selection of Cocoon for reeling - Quality of cocoon Physical and chemical properties of silk fibre. Raw materials for silk reeling - Cocoon processing - Cocoon drying-stifling, Cocoon sorting and preservation: deflossing.

Marketing organization for Cocoon and Yarn - Raw silk manufacture - Silk by-products: Reeling waste and its utility in spun silk industry utility of pupae. Role of Central Silk Board and Directorate of Sericulture in extension programmes - Sericulture organization at state and national

levels.

COURSE OUTCOMES (CO)

At the end of the course, the student will be able to

1. The students will be able to understand the basic knowledge of sericulture.
2. The students will have to understand and learn the prospect of sericulture as a self-employment venture.
3. The students will the able to understand role and different types of silkworm rearing.
4. The students will the able to learn the economic importance of silkworm.
5. Acquired the knowledge about Cultivation of silkworm and become entrepreneurship

Suggested Reading Material

1. Ganga, G. and Sulochana Chetty, J. An Introduction to Sericulture (2nd Edition). Oxford and IBH Publishing co. Pvt-Ltd., New Delhi.
2. Ullal, S.R. and Narasimhanna, M.N. Hand book of Practical Sericulture. Central Silk Board, Bombay.
3. Taxima, Y. Hand Book of Silkworm Rearing. Fuji Publication, Tokyo.
4. Handbook of silkworm Rearing: Agriculture and technical manual-1, Fuzi pub. Co. ltd., Tokyo, Japan
5. Jolly,M.S. Director, CSR & TI, mysore Appropriate sericultural Techniques: Ed.
6. Krishnaswamy S. Improved method of rearing young age silkworm: reprinted CSB, Bangalore. NarasimhannaN M.N. Manual of silkworm egg production, CSB, Bangalore
7. Sengupta,K. Director ,A guide for bivoltine sericulture: CSR & TI, Mysore
8. Shukla, G.S. and Upadhyay, V.B. Economic Zoology. Rastogi Publications, Meerut.
9. Tomar, B.S and N.Singh. A Text Book of Applied Zoology. Emkay publications. Delhi.
10 Wupang-chun and da-chung Silkworm rearing:, FAO, Rome.

Outcome Mapping

Mapping with Programme Outcomes*					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	3	3	2	2	2
CO3	3	3	3	2	3
CO4	2	2	3	3	3
CO5	3	2	3	2	3

BOARD OF STUDIES 2019-2020

M.Sc., ZOOLOGY
(2 YEARS PROGRAMME)

SYLLABUS HAS FRAMED AS PER THE STATE INTERGRATED BOARD OF STUDIES, TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION CHENNAI- 600 005

POOMPUHAR COLLEGE (AUTONOMOUS)
MELAIYUR -609107

State Integrated Boards of Studies

Preamble*

In keeping with the announcement of the Honorable Minister for Higher Education (Policy Note 6.3 2013-2014, *Department of Higher Education, Government of Tamil Nadu*), with the view to provide compatibility in courses offered by various universities, autonomous colleges & deemed universities in Tamil Nadu facilitating the mobility of faculty and students from one university to another and to easily solving the problem of equivalence among courses, *Tamil Nadu State Council for Higher Education (TANSCHE)* has formed the *State Integrated Boards of Studies* comprising experts in the areas of knowledge concerned. The *State Integrated Boards of Studies,* with great diligence and expertise has devised the mandatory areas that have to be covered for three year undergraduation and two year postgraduation courses to realize the above objectives. Great care has been taken so that these areas would take 75% of the course content and the remaining 25% can be decided by the individual institutions.

In other words, the areas that have to be covered by the student that are mandatory for earning the degree to have due value has been worked out so that the student will gain enough depth of knowledge in the subject concerned. It is recommended that the institutions specify in their brochures if the course is equivalent or not so that the stakeholder could opt for the course offered with enough awareness about the future possibilities of deciding on the course. The *State Integrated Boards of Studies* have striven their best to see that the standards of higher education in our State are raised to be on a par with international standards.

***Note: It is stated that it is not a compulsion on the part of any educational institution in the State to follow *State Integrated Board of Studies*. However, if the subjects are to be equivalent, Section 'A' must be covered in the 75% of the syllabus of the subjects concerned.**