POOMPUHAR COLLEGE (AUTONOMOUS) (Of the Tamil Nadu H.R & C.E Department) (Accredited B⁺ by NAAC) MELAIYUR 609 107

PG AND RESEARCH DEPARTMENT OF ZOOLOGY



B.Sc. SYLLABUS

(FROM THE ACADEMIC YEAR 2022- 2023 ONWARDS)



POOMPUHAR COLEGE (AUTONOMOUS) (H R & C E Admin. Dept. Tamil Nadu) MELAIYUR - 609 107 PG & Research Department of Zoology

B.Sc., Zoology-Course structure under CBCS

(Applicable to the candidates admitted from the academic year 2022 - 2023 onwards)

Comoston	Dout	Subject	Uoung	Jours Cradit		Ma	arks	Tatal
Semester Falt		Subject	Hours	Credit	Exam	Internal	External	Total
	I Tamil - I		5	3	3	25	75	100
	II	English - I	5	3	3	25	75	100
		Core - I Invertebrata	5	5	3	25	75	100
	Ш	Core - II Practical Invertebrata & Chordata	3	-	-	-	-	-
Ι		First Allied I - Botany	5	3	3	25	75	100
		First Allied II - Botany Practical	3	-	-	-	-	-
IV	IV.	Value Education	2	1	3	25	75	100
	1 V	Gender Studies	2	1	3	25	75	100
			30	16				600
	Ι	Tamil - II	5	3	3	25	75	100
	II	English - II	5	3	3	25	75	100
		Core - II Practical Invertebrata & Chordata	3	3	3	40	60	100
Π	III	Core - III Chordata	5	5	3	25	75	100
		First Allied II - Botany Practical	3	3	3	40	60	100
		First Allied III - Botany	5	4	3	25	75	100
	IV	Skill Based Elective - I	2	2	3	25	75	100
	1 4	Environmental Studies	2	1	3	25	75	100

Semester	Part	Subject	Hours	Credit	Exam	Marks		Total
			30	24				800
	Ι	Tamil - III	5	3	3	25	75	100
	II	English - III	5	3	3	25	75	100
		Core - IV Cell Biology & Biochemistry	5	5	3	25	75	100
		Core - V Practical Cell Biology & Biochemistry	3	-	-	-	-	-
III	III	Second Allied I - Chemistry	4	3	3	25	75	100
		Second Allied II - Chemistry Practical	2	-	-	-	-	-
		Major Based Elective - I Biodiversity Conservation	4	4	3	25	75	100
IV		NME - I Public Health & Hygiene	2	2	3	25	75	100
			30	20				600
	Ι	Tamil - IV	5	3	3	25	75	100
	II	English - IV	5	3	3	25	75	100
		Core - V Practical Cell Biology, Biochemistry & Animal Physiology	3	3	3	40	60	100
IV	III	Core Course -VI Animal Physiology	5	4	3	25	75	100
		Second Allied II - Chemistry Practical	3	3	3	40	60	100
		Second Allied III - Chemistry	5	4	3	25	75	100
	IV	NME –II Ornamental Fish Culture	2	2	3	25	75	100
		Skill Based Elective - II	2	2	3	25	75	100
			30	24				800

Semester	Part	Subject	Hours	Credit	Exam	Marks		Total
		Core -VII Genetics	4	4	3	25	75	100
		Core - VIII Ecology	4	4	3	25	75	100
		Core - IX Biotechnology	4	4	3	25	75	100
V	III	Core - X Practical Genetics, Ecology, Biotechnology, Applied Entomology & Aquaculture	6	4	3	40	60	100
		MBE - II Applied Entomology	4	4	3	25	75	100
		MBE - III Aquaculture	4	4	3	25	75	100
	13.7	Skill Based Elective - III	2	2	3	25	75	100
	IV	Skill Based Elective - IV	2	2	3	25	75	100
			30	28				800
		Core - XI Evolution	5	5	3	25	75	100
	Core - XII Developmental Biology		5	5	3	25	75	100
		Core - XIII Microbiology & Immunology	4	4	3	25	75	100
		Core - XIV Bioinstrumentation	4	4	3	25	75	100
VI		Core - XV Practical Developmental Biology, Evolution, Microbiology, Immunology, Bioinstrumentation & Poultry Farming	6	4	3	40	60	100
		MBE- IV Poultry farming	4	4	3	25	75	100
	IV	Soft Skills Development	2	1	3	25	75	100
	V	Extension Activities	-	1	-	-	-	100
			30	28				800
		GRAND TOTAL	180	140				4400

POOMPUHAR COLLEGE (AUTONOMOUS) MELAIYUR 609107

COURSE STRUCTURE FOR ALL UG DEGREE COURSES

(Applicable to the candidates admitted from the academic year 2022 - 2023 onwards)

PART	NAME OF PAPERS	NUMBER OF PAPERS	CREDITS
Ι	TAMIL	04	12
II	ENGLISH	04	12
	CORE (Including Optional)	19	79
III	FIRST ALLIED	03	10
	SECOND ALLIED	03	10
	NON MAJOR ELECTIVE	02	04
	SKILL BASED ELECTIVE	04	08
	VALUE EDUCATION	01	01
IV	ENVIRONMENTAL STUDIES	01	01
	SOFT SKILLS DEVELOPMENT	01	01
	GENDER STUDIES	01	01
V	EXTENSION ACTIVITIES	01	01
	TOTAL	44	140

OUTCOME BASED EDUCATION

Under Graduate – Science

Programme Outcomes:

PO1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study.

PO2: Critical Thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.

PO3: Problem Solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's earning to real life situations.

PO4: Analytical & Scientific Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints. Ability to analyze, interpret and draw conclusions from quantitative / qualitative data; and critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.

PO6: Self-directed & Lifelong Learning: Ability to work independently, identify and manage a project. Ability to acquire knowledge and skills, including "learning how to learn", through self-placed and self-directed learning aimed at personal development, meeting economic, social and cultural objectives.

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

Question pap	oer pattern (for part I, II,	III)
Ten questions		10x2 = 20 marks
(Two questions fro	om each unit – No choice)	
PART – B Five questions (eit	her or type)	5x5 = 25 marks
(One question from	n each unit)	
PART – C Three questions ou	ut of five	3x10 = 30 marks
(One question from	n each unit)	
Total	- 75 marks	
Question pap PART – A	er pattern (for part IV o	nly)
Three questions (e	ither or type)	3x10 = 30 marks
(One question from	n each unit)	
PART – B Three questions ou	ut of five	3x15 = 45marks
(Atleast One quest	tion from each unit,	
Not more than two	o questions from each unit,	
No unit shall be o	omitted)	
Total		75marks

Head of the Department

Principal

CORE – I: INVERTEBRATA

22AU:08M1

Course Objectives:

- 1. To acquire wide knowledge about different kinds of animal species especially Invertebrates.
- 2. To understand the systematic and functional morphology of various groups of Invertebrates.
- 3. To study their Economic Importance, Affinities and Adaptations.

Unit I- Protozoa:

General characters and classification up to classes with examples Type study: Paramecium General topics: Parasitic Protozoans- (Entamoeba, Trypanosoma and Plasmodium)

Unit II- Porifera & Coelenterata:

General characters and classification up to classes with examples Type study: Leucosolenia, Obelia colony General topics: Canal system in sponges, Polymorphism in Coelenterates, Types of corals and coral reefs.

Unit III - Platyhelminthes & Aschelminthes:

General characters and classification up to classes with examples Type study: *Fasciola hepatica*, *Wuchereria bancrofti* General topics: Parasitic adaptations of Platyhelminth & Aschelminth parasites (*Taenia solium*, *Schistosoma & Ancylostoma duodenale* and *Ascaris lumbricoides*).

Unit IV - Annelida & Arthropoda:

General characters and classification up to classes with examples Type study: *Megascolex mauritii*, Prawn General topics: Metamerism in Annelids, Excretion in Annelids, Larval forms of Crustacea, Beneficial & Harmful Insects, Mouth parts of Insects, Affinities of Peripatus.

Unit V - Mollusca & Echinodermata:

General characters and classification up to classes with

examples Type study: Pila, Starfish.

General topics: Torsion in Mollusca, Economic importance of Mollusca, Larval forms of Echinodermata.

Course Outcome

1. To understand the principle of taxonomy

- 2. To learn the general characters, classification of Invertebrates and their phylum
- 3. To understand the morphology and their systems of various groups of Invertebrates.
- 4. To study the economic importance of invertebrates
- 5. To study the affinities and adaptations of Invertebrates

Reference Books:

- 1. Ekambaranatha Ayyar.M. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol.1 [Invertebrata], Viswanathan [Printers and Publishers] Pvt. Ltd.; Madras.
- 2. Jordan, E.L. and P.S.Verma, 1993. Invertebrate Zoology, 12th Edition. S.Chand and Co.Ltd., NewDelhi.
- 3. Kotpal, R.L. 1988-1992 Protozoa, Porifera, Coelenterata, Helminthes, Annelida, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
- Parker and Haswell, 1964. Test Book of Zoology. Vol.1 [Invertebrata].
 A.Z.T; B.S.Publishers and distributors, New Delhi.
- 5. L.A Borradile and F.A.Pott. The Invertebrates. Cambridge University Press. UK.
- Adam Sedgwick. 1972 A student text book of Zoology. Vol.I and II. Central book Depot. Allahabad.
- 7. P.S.Dhami and J.K.Dhami. Invertebrate Zoology, S.Chand and Co. New Delhi.
- 8. Hyman L.H. The Invertebrate Vol.I-IV. 1955, McGraw Hill Co. New York.
- 9. Barrington, E.J.W. 1969. Invertebrate structure and function. ELBS Publication.
- 10. Barnes. Invertebrate Zoology. Toppan International Co.

OUTCOME MAPPING

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

CORE II - PRACTICAL - INVERTEBRATA & CHORDATA

22AU:08M2P

Course Objectives:

To impart training on the techniques of dissecting Invertebrate and Chordate animals

To understand the various system present in their body

To train the students to discriminate the various external body parts of Invertebrates and Chordates To observe the preserved animals in the museum and to study their characteristic features

INVERTEBRATA

Dissections:

- 1. Earthworm Nervous systems
- 2. Cockroach / Prawn Nervous system

Mountings:

- 1. Earthworm: Body setae
- 2. Cockroach: Mouthparts
- 3. Prawn: Appendages

Spotters:

- 1. Protozoa: Paramecium, Paramecium: Conjugation, Euglena
- 2. Porifera: Sponge gemmule, Sponge spicules, Sycon
- 3. Coelenterata: Obelia entire, Physalia, Porpita, Aurelia, Madrepora, Fungia
- 4. Platyhelminthes: Liverfluke, Tapeworm, Planaria
- 5. Nematyhelminthes: Ascaris (Male and female), Filarial worm
- 6. Annelida: Nereis, Heteronereis, Cheatopterus, Arenicola Leech, Trocophore larva.
- 7. Arthropoda : Prawn, Nauplius larva, Zoea Larva, Mysis larva, Crab, Limulus, *Bombyx mori*, Honey bee, Lac insect, Peripatus, Scorpion
- 8. Mollusca: Pila, Radula, Pearl Oyster, Chiton, Dentalium

9. Echinodermata: Starfish, Sea urchin, Bipinnaria larva, Aristotle's lantern, Sea urchin, Holothurian

CHORDATA

Dissection:

1. Fish – Digestive system

Mountings:

1. Placoid scales, Cycloid / Ctenoid scales

Spotters:

- 1. Prochordata: Amphioxus, Ascidian, Balanoglossus, Tornaria larva
- 2. Pisces: Shark, Ray, Clarius, Echnies, Hippocampus, Carp
- 3. Amphibian: Alytes, Axolotl larva, Hyla, Salamander, Ichthyophis
- 4. Reptilian: Naja naja, viper, Draco, Chelone mydas
- 5. Aves: Pigeon, Quill feather
- 6. Mammalian: Bat, Rabbit
- 7. Dentition: Rabbit, Dog and Man

8. Osteology: Pigeon - Synsacrum Rabbit – pectoral & pelvic girdles, forelimb & hind limb bones Students be introduced to learning of dissections / anatomy adapting CDS / Web sources.

HOURS:6 CREDITS:3 Record of Laboratory work shall be submitted at the time of practical Examination.

Text/ Reference Books:

- 1. Verma, P.S. 2013. A Manual of Practical Zoology of Invertebrates, S. Chand & Company Ltd., New Delhi.
- 2. Vijayaraman. K and palanivel.K, 1997 Cheimurai Vilangial, chimeera Publications.
- 3. Amsath, A. 2013. Practical manual in Zoology. MMA Publications, Adirampattinam.

OUTCOME MAPPING

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

CORE- III CHORDATA

22AU:08M3

Course Objectives:

- 1. To identify the classes of vertebrate animals and recognize their distinguishing features.
- 2. To understand the systemic and functional morphology of various groups of chordates.
- 3. To study their affinities and adaptations to different modes of life.
- 4. To appraise the diversity of animals in a phylogenic context.

Unit I: Prochordates & Pisces

General characters and classification of Chordates (up to classes) with examples.

Type Study: Amphioxus, Scolidon.

General topics: Affinities of Hemichordates, Retrogressive metamorphosis in Ascidian, Accessory respiratory organs in fishes, Fins of fishes, Migration of Fishes.

Unit II: Amphibia

General characters and classification up to orders Type Study: Frog General topics: Adaptive features of Apoda, Neoteny and Parental care in Amphibia

Unit III: Reptiles

General characters and classification up to orders Type Study: Calotes General topics: Poisonous snakes of south India, Poisonous and non-poisonous snakes – Poison apparatus and biting mechanism, Venom and Antivenom.

Unit IV: Aves

General characters and classification up to orders Type Study: Pigeon. General topics: Characters of Archaeopteryx, Ratitae, Flight adaptation, Migration of Birds.

Unit V: Mammals

General characters and classification up to orders Type Study: Rabbit General topics: Dentition in mammals, Flying Mammals, Aquatic mammals.

Course Outcome:

- 1. On completion of the unit the students will able to describe the salient features of phylum Chordata
- 2. After completion of this unit the students will able to observe the diversity in class Pisces and their classification
- 3. It provides the way of identifying different orders of Amphibians
- 4. Students will able to list out the unique characters of Aves
- 5. To know the classification of class Mammalia up to orders

References:

- 1. Ekambaranatha Ayyar, M and T.N Ananthakrishnan 1992, A manual of Zoology Vol. II[Chordata]. S. Viswanaathan (Printers and Publishers] Pvt. Ltd., Madras.
- 2. Jordan E.L. and P.S. Verma 1995. Chordata Zoology and elements of Animal Physiology. S. Chand and Co., New Delhi.
- 3. Kotpal R.L. 1992. Vertebrata, Rastogi Publications, Meerut
- 4. Nigam.H.C. 1983 Zoology of chordates, Vishal publications, Jalandhar.
- 5. Waterman, Allyn J.et al. 1971, Chordate Structure and functions. Mac.Millan and Co., New York.
- 6. Jollie. M. 1968. Chordate Morphology. East west press Pvt. Ltd., New Delhi.
- 7. Hyman. L.H. Comparative vertebrate Zoology. McGraw Hill Co., New York.

OUTCOME MAPPING

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

ENVIRONMENTAL STUDIES

(For all UG students - candidates admitted in the academic year 2022-23 onwards)

22AU:ES

Course Objectives

- 1. To create awareness on insight of scientific developments in conservation of biodiversity.
- 2. To understand the distribution of species and threats to concerning biodiversity.
- 3. To study the climate change and its problems in conservation of biodiversity.
- 4. To study the various conservation measures adopted in India.
- 5. To make the student get aware with various legislations related to wildlife and conservation.

Unit: I

The Multidisciplinary nature of environmental studies. Definition, scope and importance. Need for public awareness.

Natural Resources: Renewable and non-renewable resources: Forest resources: use and over exploitation, deforestation

Water resources: Use and over-utilization of surface and ground water, floods, drought, dams benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems.

Unit: II

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Food chains, food webs and ecological pyramids. **Types of ecosystem:** Forest ecosystem, Grassland ecosystem, Aquatic ecosystems, (ponds, lakes, rivers)

Biodiversity and its conservation: Introduction – Definition: Genetic, species and ecosystem diversity - Value of biodiversity - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity. Endangered and endemic species of India - Conservation of biodiversity

Unit: III

Social Issues and the Environment: Definition- causes, effects and control measures of: air pollution, water pollution, soil pollution, noise pollution, marine pollution, nuclear hazards. **Disaster management:** floods, earthquake, cyclone and landslides. Water conservation- rain water harvesting. Climate change, global warming, acid rain, ozone layer depletion. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act.

Course Outcomes

- 1. Students can able to understand the types and values of Biodiversity.
- 2. To be understand the pollution and threats.
- 3. Students can follow and interpret various rules and regulations related to wildlife conservation.

References:

- 1. Agarwal, K.C. 2001 Environmental Biology, Nidi Public Ltd Bikaner.
- 2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt ltd, Ahamedabad, India.
- 3. Brunner R.C. 1989, Hazardous Waste Incineration, McGraw Hill Inc 480 p
- 4. Clark R.S. Marine Pollution, Clanderson Press Oxford (TB)
- 5. Cunningham, W.P.Cooper, T.H.Gorhani E & Hepworth, M.T. 2001.
- 6. De A.K. Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R)
- 7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security.
- 8. Stockholm Env. Institute Oxford University, Press 473p.
- 9. Hawkins, R.E. Encyclopedia of India Natural History, Bombay Natural History Society, Bombay (R)
- **10.** Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press 1140 p.
- **11.** Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws Himalaya Pub. House, Delhi 284 p.
- **12.** Mckinney, M.L. & Schoch R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition 639 p.
- 13. Mhaskar A.K. Matter Hazardous, Techno-Science Publications (TB)
- 14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB).
- 15. Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Co. USA. 574 p

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	2	3	3	3
CO3	2	3	3	2	3
CO4	3	3	3	3	3
CO5	3	3	2	3	3

OUTCOME MAPPING

CORE - IV: CELL BIOLOGY & BIOCHEMISTRY

22AU:08M4

Course Objectives

- 1. To give an insight to the ultra-structure of cellular components.
- 2. To give an idea about the biochemistry.
- 3. To give a clear idea about how the basic metabolism occur inside the cell.

Unit I: Introductory Cytology

History and scope of cell biology. Cell theory – Types of cells: Prokaryotic and Eukaryotic cells. Cytological techniques: Fixation– Sectioning & Staining. Principle, resolving power & uses of compound microscope, confocal microscope and electron microscope. Cell Junctions - Ultrastructure and functions of plasma membrane.

Unit II: Cell Organelles

Nucleus & Nucleolus. DNA structure and functions – types of DNA Replication - Chromatin – Nucleosome. Chromosomes: – Structure, types, Giant chromosomes. Ultrastructure and functions of Endoplasmic reticulum & Golgi bodies.

Unit III: Biochemistry& Cell cycle

Ultrastructure and functions of Lysosomes, centrosomes, Mitochondria. Glycolysis and Krebs cycle. Electron transport chain and formation of ATP. Cell cycle - Mitosis, Meiosis & interphase its regulation. Cancer biology and apoptosis.

Unit IV: Protein Synthesis

RNA: Structure, types & role. Structure of t-RNA. Ultra structure, types and functions of ribosome. Detailed study of Protein synthesis – Polysome – differences in eukaryotes – Short outline of post transcriptional modifications.

Unit V: Enzymes & Metabolism

Structure and classification of Carbohydrates, Protein and Lipids. Enzymes: - mechanism of action – classification and factors influencing enzyme action – Enzyme Inhibition. Glycogenesis – Glycogenolysis, Gluconeogenesis and HMP shunt. Deamination & Transamination. Beta oxidation of fats.

Course Outcomes:

- **1.** To understand the Principles of microscopes, Cytological techniques and to describe the Cell theory, Ultra structure of animal cell.
- **2.** To recognize the properties of cytoplasm, cell cycle, cell division, Ultra structure and functions cell organelles.
- 3. To get knowledge on biochemical and cell culture techniques.
- **4.** To understand the structure and function of chromosomes, giant chromosomes, DNA and types of RNA.
- 5. To describe the mechanism of DNA replication and Protein synthesis.

Books for reference

- 1. Arumugam N, Cell Biology & Molecular Biology, Saras Publications, Nagercoil.
- 2. Arumugam N, Cell Biology, Saras Publications, Nagercoil.
- 3. De Robertis EDP &De Robertis EMF, Cell and Molecular Biology, Lippincott Williams & Wilkins.

- 4. Fatima D, Narayanan LM, Meyyan RP, Nallasingam K, Prasannakumar S, Arumugam N. Biochemistry, Saras Publication, Nagercoil.
- 5. Gupta PK, Cell Biology, Rastogi Publications, Meerut.
- 6. Jain JL, Jain N & Jain S, Fundamentals of Biochemistry, S. Chand Publications, New Delhi.
- 7. Pawar CB, Cell Biology, Himalaya Publications.
- 8. Ramadevi K, Ambika Shanmugam's Fundamentals of Biochemistry for Medical Students, Lippincott Williams & Wilkins
- 9. Verma PS & Aggarwal VK Cell Biology S. Chand Publishers, New Delhi.

COURSE MAPPING

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	2
CO2	3	2	2	3	2
CO3	3	2	3	2	2
CO4	3	3	2	3	2
CO5	2	2	3	2	2

CORE- V: PRACTICAL - CELL BIOLOGY & BIOCHEMISTRY AND ANIMAL PHYSIOLOGY

22AU:08M5P

HOURS:6 CREDITS:3

Course objectives:

- 1. To impart training on the techniques of physiological concepts in vertebrate animals and to understand molecular structures.
- 2. To impart training on the principles of microscope and their importance in cell study.
- 3. To train the students to prepare the smear and squash of blood and other cells to observe different types of cell structure.

Cell Biology & Bio Chemistry

- 1. Onion root tip-squash preparation and study of mitosis.
- 2. Grasshopper testis-squash preparation and study of meiosis.
- 3. Chironomous larva squash preparation of Giant Chromosome
- 4. Temporary mount of human cheek epithelial cells, and to study its characteristics.
- 5. pH measurement of various biological samples.

Spotters:

Light and Compound microscope, Stage and Ocular Micrometers, blood of man and frog. Centrifuge, Micrometer, Camera Lucida. Observation of meiotic cell division stages using permanent slides; Model of DNA double helical structure, RNA structure, Models of Hemoglobin, Diet chart.

Animal Physiology

- 1. Qualitative and quantitative tests for proteins.
- 2. Qualitative tests for carbohydrates and fats.
- 3. Human salivary amylase activity in relation to temperature and pH.
- 4. Identification of nitrogenous waste products
- 5. Blood cell counting by Haemocytometer

Spotters:

Columnar, Ciliated, Squamous Epithelium, Cardiac, Striated, Non-Striated muscles, nerve cells, Haemoglobinometer, Kymograph, Sphygmomanometer, Electrocardiogram, Reflex arc.

Course Outcomes

- 1. Students will learn the practical knowledge about principle and working procedure of microscope.
- 2. Identify various stages of cell divisions and giant chromosome structure.
- 3. Students can analyse nutrients in various food samples
- 4. Students will be able to distinguish and count their own blood cells under the microscope
- 5. Students will be able to handle various equipment.

Reference Books:

- 1. Amsath, A. 2013. Practical manual in Zoology. MMA Publications, Adirampattinam.
- 2. Veer Bala Rastogi. (2019). A Text book of Cell Biology and Genetics. Kedar Nath Ram Nath Publication, Meerut. U.P.
- 3. Verma, P.S. and Agarwal, V.K. (2013). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd, New Delhi.
- 4. Powar, C.B., (2012). Cell Biology. Himalaya Publishing house, Mumbai.

Outcome MAPPING

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

MAJOR BASED ELECTIVE – I

22AU:08MBE1 BIODIVERSITY CONSERVATION

Course Objectives

- 1. To give the student insight of scientific developments in Conservation of Biodiversity.
- 2. To understand the distribution of species and threats to concerning biodiversity.
- 3. To study the climate change and its problems in conservation of biodiversity.
- 4. To study the various conservation measures adopted in India.
- 5. To make the student get aware with various legislations related to wildlife and conservation.

Unit I: Biodiversity and their values

Biodiversity: definition – Biodiversity conservation strategies - types of diversity – genetic, species and ecosystem.

Value of Biodiversity: Biodiversity and environmental services - Consumptive, Productive, Social, Ethical and moral values, Aesthetic value.

Unit II: Biodiversity Hot spot and Threats

Hot spot: Mega diversity centers – Global 200 - India's Biogeographic Zones - Biodiversity Hot spot - North-East, the Western Ghats, Andaman and Nicobar Islands.

Threats to biodiversity: Habitat loss, poaching of wildlife, invasive species; consequences of biodiversity loss; Endangered faunal species of India.

Unit III: Global warming and Biodiversity

Global warming: Greenhouse gases and sources – CO2 –Methane –and Chloro-flouro-carbon (CFCs) –Aerosols in the atmosphere – Sea level rise– Ozone depletion– Irregular monsoon – Droughts – Cyclones & Cloudburst –Tsunami – Acid rain – Impact of climate change on biodiversity.

Unit IV: Conservation of biodiversity

Conservation Methods: In situ conservation (Biosphere Reserves, National Parks, Wildlife Sanctuaries); Ex-situ conservation (botanical gardens, zoological gardens, gene banks, seed and seedling banks, pollen culture, tissue culture and DNA banks), Integrated Protected Area System (IPAS): Community Reserves or Community Conserved Areas - Sacred Grooves – Corridors.

Unit V: People participation, Environmental legislation & Authority

People participation in Conservation: Chipko Movement – Navdanya Movement and Ecotourism. Environmental legislation & Authorities: Wildlife Protection Act (1972) - Biological diversity act 2002– The National Green Tribunal Act 2010 – National biodiversity authority (NBA) and State Biodiversity Boards.

Course Outcome

- 1. Students can able to understand the types and values of Biodiversity.
- 2. Understand the distribution and threats.
- 3. Analyse and interpret the problems in conservation of biodiversity.
- 4. Explain the various strategies adopted in conservation of various species.
- 5. Students can follow and interpret various rules and regulations related to biodiversity.

Reference Books

- 1. Lawmann, J. (2017). Wildlife Protection Act 1972. Kamal Publishers, New Delhi.
- 2. Majumdar, A.B., Nandy, D, and Mukherjee, S. (2013). Environment and Wildlife Laws in India. LexisNexis Publishers.
- 3. Saha, T. K. (2007). Ecology and environmental Biology. Books and allied(P) Ltd. Kolkata, India.
- 4. Mitra, A.P., Sharma, S., Bhattacharya, S., Garg, A., Devotta, S. and Sen, K. (2004). Climate Change and India. Universities Press, India
- 5. Khitoliya, R. K. (2004). Environmental pollution: management and control for sustainable developments. S. Chand & company (p) Ltd., New Delhi, India.
- 6. Sodhi, N.S., Gibson, L. and Raven, P.H. (2013). Conservation Biology: Voices from the Tropics. Wiley-Blackwell, Oxford, UK.
- 7. Philander, S.G. (2012). Encyclopedia of Global Warming and Climate Change (2nd edition). Sage Publications.
- 8. Hardy, J.T. (2003). Climate Change: Causes, Effects and Solutions. John Wiley & Sons.
- 9. Primack, R.B. (2002). Essentials of Conservation Biology (3rd edition). Sinauer Associates, Sunderland, USA.
- 10. Divan, S. and Rosencranz, A. (2001). Environmental Law and Policy in India. Oxford University Press

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	2	3	2	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	2	3	2

OUTCOME MAPPING

NON MAJOR ELECTIVE -1

PUBLIC HEALTH AND HYGIENE

22AU:08NME1 Course Objectives

- 1. To impart awareness on public health, Hygiene and diseases.
- 2. To educate and emphasize on preventive measures of diseases.
- 3. To create knowledge on Health Education.

UNIT - I

Scope - Nutrition and health - Classification of foods – Macronutrients (Carbohydrate, Protein and lipids) and micronutrients (Vitamins and minerals); Balanced Diet.

UNIT - II

Malnutrition - Kwashirkor, Marasmus, Obesity, Anaemia, - Vitamin deficiency diseases. Food hygiene - Food toxicants.

UNIT - III

Communicable diseases and their control measures such as cholera, tuberculosis, tetanus, typhoid, hepatitis, measles, polio and AIDS.

UNIT - IV

Non - communicable diseases and their preventive measures such as cancer, chronic kidney diseases, chronic respiratory diseases, Hypertension, Coronary Heart Diseases, Stroke and Diabetes.

UNIT - V

Health Education and Health programs in India – Social Welfare Schemes in Tamil Nadu Precautions First Aid and awareness on sporadic diseases.

Course outcome

- 1. Will understand the classification of nutritive and healthy foods.
- 2. Will be able to understand the causative and effect of malnutrition.
- 3. Will come to know the spread of diseases from person to person and their control measures.
- 4. Will acquire knowledge about the preventive measures of non-communicable diseases.
- 5. Will gain knowledge about Health Education and Health programs in India as well as world-wide.

Text Books

1. Sornaraj, R. and Kumaresan, V. 2010. Public health and hygiene, Saras publication, Nagercoil.

- 2. Park and Park, 1995: Text book of preventive and social medicine Banarsidas Bhanot Publ. jodhpur- India.
- 3. Verma, S. 1998: Medical zoology, Rastogi Publ.- Meerut- India
- 4. Singh, H.s. and Rastogi, P. 2009: Parasitology, Rastogi Publ. India.
- 5. Dubey, R.C and Maheswari, D.K. 2007: Text Book of Microbiology S. Chand & co. Publ. New Delhi- India.

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	2
CO2	3	2	2	3	2
CO3	3	2	3	2	2
CO4	3	3	2	3	2
CO5	2	2	3	2	2

CORE -VI : ANIMAL PHYSIOLOGY

22AU:08M6

HOURS:5 CREDITS:4

Course objectives:

- 1. To emphasize the basic needs of macromolecules of food and their importance.
- 2. To study the basic principles of animal Physiology.
- 3. To understand the physiology of various organs and organ systems.

UNIT - I: NUTRITION AND DIGESTION

Introduction - Definition of food, balanced diet. Classification of food constituents - carbohydrates, proteins, fats, minerals, water and vitamins. Types of nutrition, Ingestion, Feeding mechanisms, Digestive enzymes, Physiology of digestion - absorption, assimilation, defecation. Metabolism - Definition of metabolism - Carbohydrate metabolism

UNIT – II: RESPIRATION AND CIRCULATION

Definition of Respiration, Respiratory Pigments and functions. Respiratory mechanism- Inspiration, Expiration. Transport of gases $[CO_2 \text{ and } O_2]$ - Respiratory quotient. Circulation: Types of heart - Myogenic heart, Neurogenic heart. Composition, properties and functions of blood, coagulation of blood. Human - Cardiac Cycle - Cardiac rhythm - Origin of heart beat - regulation of heart beat - ECG - Blood Pressure - Factors contributing to heart problems - coronary circulation.

UNIT - III: EXCRETION AND OSMOIONOREGULATION

Definition of Excretion - kinds of excretory products - Ammonotelism, Ureotelism, Uricotelism. Kidney of man, Nephron structure and formation of urine in mammals - ultrafiltration, reabsorption, hormonal regulation of excretion. Kidney failure and Transplantation. Osmo-ionic regulation - Definition: Types of medium, Osmosis, Osmoregulation in fishes and mammals.

UNIT – IV: NEUROMUSCULAR CO-ORDINATION

Nervous tissue – Neuron: Structure and types of neurons. Nerve impulse - Synapse – Synaptic transmission, neuromuscular junction, reflex actions, transmission of impulses neurotransmitters. Muscles: types of muscles - chemistry of muscles - ultrastructure of muscle fibre, types of muscle contraction - physical and chemical changes of muscle contraction - theories of muscle contraction.

UNIT – V: RECEPTORS AND ENDOCRINE SYSTEM

Receptors – Photoreceptor: mammalian eye - structure of retina - visual pigments – physiology of vision - Phonoreceptors : mammalian ear - Organ of Corti – working mechanism - phonoreception in bat. Endocrine glands - structure, secretions and functions of endocrine glands of vertebrates - Pituitary-Thyroid - Parathyroid - Adrenal- Thymus, Islets of Langherhans - sex organs - testis, ovary.

Course Outcomes

- 1. To describe the process of nutrition and digestion
- 2. To understand the process of respiration and circulation.
- 3. To recognize excretory system and osmo ionoregulation in fishes and mammals
- 4. To evaluate the nervous system and muscular system
- 5. To acknowledge about receptors and structure, secretions and functions of endocrine glands.

Reference Books:

Sambasivaiah, Kamalakara rao and Augustine chellappa 1990. A Text book of Animal physiology and ecology, S. Chand & co., Ltd., New Delhi - 110 055.

Parameswaran, Anantakrishnan and Ananta Subramanyam, 1975. Outlines of Animal Physiology, S. Viswanathan [printers & Publishers] Pvt. Ltd.

William S. Hoar, 1976. General and comparative physiology, prentice Hall of India Pvt. Ltd., New Delhi. 110 001.

Wood.D.W, 1983, Principles of Animal Physiology 3rd Ed.,

Prosser, C.L. Brown, 1985, Comparative Animal Physiology, Satish Book Enterprise, Agra- 282 003.

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
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CO5	3	3	3	3	2

NON MAJOR ELECTIVE - II ORNAMENTAL FISH CULTURE

22AU:08NME2

Course Objectives:

- 1. To create knowledge on self-employment opportunity.
- 2. To inculcate importance of ornamental fish farming in relation with entrepreneurship development.
- 3. To give students knowledge about various techniques of ornamental fish breeding, rearing and its marketing to make them self-sustainable after graduation.
- 4. To teach techniques of construction of glass aquarium and its maintenance.

UNIT-I

Scope and Importance of Ornamental Fish Culture - Types and Importance of

Aquarium - Budget required for setting upon Aquarium - Live Fish Transport

UNIT-II

Important Freshwater Ornamental Fishes: Indigenous and exotic species -Guppy - Sword Tail - Gold Fish - Angel Fish - Butterfly Fish - Zebra Fish - Molly Fish -Gourami Fish and Fighter Fish. - Breeding Behaviour - Induced Breeding Techniques -Preparation and Composition of Formulated Fish Feed - Live Feed.

UNIT-III

Aquarium Design: Construction and Preparation of Aquarium - Functions of Bio Filters - Hood Light - Nets - Aerators - Suction Tube. Water Quality Maintenance in breeding and rearing of fishes in Aquarium.

UNIT-IV

Food and feeding of Aquarium fishes - Common aquarium plants - Fish handling, Packing and forwarding techniques - Ornamental fish form as a cottage Industry

UNIT-V

Diseases Management of Ornamental Fishes : Symptoms, Treatment and Control Measures of Common Bacterial, Viral, Fungal, Protozoan and Crustacean Infections.

HOURS:2 CREDITS:2

Course Outcomes

- 1. The student will be able to understand the basic knowledge of Aquarium fish keeping
- 2. The students will be able to know how to maintain an aquarium.
- 3. The student will be able get knowledge about different varieties of ornamental fish.
- 4. The student will be able to acquire knowledge about disease management in aquarium fish culture.

Text Books:

- 1. Jingran V.G., 1991: Fish and fisheries in India Hindustan Publ. co New Delhi India.
- Shanmugam K. 1992, Fishery Biology and Aqua Culture Leo Pathipagam Chennai-India.
- 3. Mill Dick, 1993: Aquarium fish, DK Publ.Co,Inc. New York -USA

Supplementary Readings

- 1. Yadav. 1995: Fish and fisheries, Daya publ. co., New Delhi India
- 2. Hall, C.B. 2005: Ponds and Fish culture Agrobios Jodhpur India.
- 3. Day, F. 1978: Fishes of India Vol. I & II, William Danisan & Sons, India.

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

CORE- VII: GENETICS

22AU:08M7

HOURS:4 CREDITS:4

Course Objectives

- 1. To enable the students understand the basic principles of inheritance.
- 2. To learn polygenic inheritance, linkage and crossing over.
- 3. To understand genetics of Sex determination and sex linked inheritance.
- 4. To acquire knowledge of the gene structure and mutation.
- 5. To understand the human genetic characters and disorders

UNIT – I

Introduction to genetics – Basis of Mendelian Inheritance and Mendelian Laws – Genetic Interaction of Genes – Non-Epistatic Interaction, Epistasis, Meotic drive, Segregation, distortion and Selfish genes. Multiple Alleles – Blood Groups and their Inheritance in Human, Tissue typing.

UNIT – II

Linkage and crossing over – Drosophila – Morgan's Experiments – Cytological detection of crossing over, crossing over and its significance. Sex determining mechanisms- Genetical, Metabolical, and Environmental. Sex determination in human beings - Cytoplasmic Inheritance.

UNIT – III

Gene Mutation-Types of mutation -Physical and Chemical mutagens, DNA Repair. Applied Genetics – Animal Breeding – Heterosis, Inbreeding, Out breeding, Out Crossing, Hybrid Vigour. Population Genetics: Hardy Weinberg Law – Factors affecting Hardy-Weinberg equilibrium.

Unit IV:

Mutation, Population genetics: Fine Structure of Gene: Cistron – Recon – Muton. Gene expression and regulation: Operon model- Lac operon. Mutation: Mutagens – physical, chemical; point mutation –chromosomal aberrations – numerical - structural.

Unit V: Human Genetics and Genetic Counseling: Human chromosome - Karyotype, Idiogram; Pedigree analysis. Chromosomal syndromes in man: Down's, Turner's and Klinefelter's syndromes. Inborn errors of metabolism: Phenylketonuria, Alkaptonuria and Albinism. Genetic Counseling: Eugenics- positive and negative, Euthenics and Euphenics.

Course Outcome:

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

- 1. Explain the key concepts in genes and its expression and Interpret phenotypic expressions based on genotype.
- 2. The Basis of genetic variation and heritability.
- 3. Interpret genetics of sex determination and inheritance.
- 4. Understand the gene structure, expression and regulation and understand the alterations of chromosome number arise during mitosis and meiosis.
- 5. Evaluating the principles to describe genetic profiles of populations and understands the importance of Genetic Counseling.

Reference Books

- 1. Veer Bala Rastogi. (2019). A Text book of Cell Biology and Genetics. Kedar Nath Ram Nath Publication, Meerut. U.P.
- 2. Snustad, D.P. and M. J. Simmons. (2017). Principles of Genetics. John Wiley & Sons Inc., India.
- 3. Verma, P.S. and V.K. Agarwal, (2010). Genetics. S. Chand and Co., New Delhi.
- 4. Gupta P.K. (2009). Genetics. Rastogi Publication Ltd., New Delhi
- 5. Dipak Kumar, K. and Soma Halder. (2009). Cell Biology, Genetics & Molecular Biology. New Central Book Agency (P) Ltd. Kolkata.
- 6. Robert Tamarin. (2017). Principles of Genetics. McGraw Hill, USA.
- 7. James, D. Watson, A. Baker Tania and P. Bell Stephen. (2017). Molecular Biology of the Gene. Pearson Education, New Delhi.
- 8. Gangane, S.D. (2017). Human Genetics. Elsevier India.
- 9. William S. Klug, Michael R. Cummings and Chariotte A. Spencer. (2016). Genetics. Pearson Education, New Delhi.
- 10. Gardener, E.J. and M.J. Simmons. (2009). Principles of Genetics. John Wiley & Sons. Inc. New York.

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
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CO4	3	3	3	3	2
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CORE- VIII: ECOLOGY

22AU:08M8

Course Objectives

- 1. To develop awareness about the environment and the interaction of various components.
- 2. To understand about various ecosystems.
- 3. To make an awareness about various effects of pollution and its management.
- 4. To create an awareness about the biodiversity and need for its conservation.

Unit I: Ecological concepts

Concept of ecology -Biosphere -Atmosphere Concept of Ecosystem: structure & function. Abiotic factors and its ecological role –Soil, Light, Temperature, Water. Limiting factors. Concept of Species, Population dynamics and Growth curves - Population Ecology – Community Ecology.

Unit II: Nutrient cycles & Interactions

Biogeochemical cycles: Carbon, Sulphur, Nitrogen and Phosphorous. Food chain & web, ecological Pyramids & Trophic levels -Energy flow in an ecosystem. Animal relationships: - Mutualism, commensalism, parasitism, competition, predation.

Unit III: Habitat Ecology

Concept of Species, Population dynamics and Growth curves. Community Structure and dynamics and Ecological Succession. Ecological Adaptations in Freshwater (Lotic &lentic), Marine, estuarine, mangrove, tundra, Savanna, cave, forest and desert ecosystems, Ecotone& edge effect. Significance & Conservation of wetlands.

Unit IV: Pollution

Types, causes, effects (with examples) & management of Land, Water, Air, Thermal & Pesticide pollution. Nuclear Hazards – Management of Solid wastes, Plastic waste, Medical waste and e-wastes and municipal wastes

Unit V

Wildlife Conservation: Biodiversity – definition, loss & cause. IUCN, CITES & Brief out lines of Indian laws of conservation. Biodiversity hot spots in India. Indian Endangered species & conservation, Community reserves, Sanctuaries, National parks and Tiger reserves in Tamilnadu. Afforestation & Deforestation. Human wildlife conflicts.

Course Outcome:

1. The students will be able to present an overview of diversity of life forms in an ecosystem, will be able to differ between Qualitative & Quantitative study.

- 2. The learner can correlate choice of habitat for organisms to Abiotic Factors, aspects of energy transfer and will be able to explain the necessity for and adaptations, providing examples.
- 3. The learner can understand the reasons and capable of managing pollution and after effects.
- 4. The learner will be able to understand the value & need of Biodiversity conservation

Books for reference

- 1. Arumugam N Concepts of Ecology, Saras Publication, Nagercoil.
- 2. Gupta PK, Cytology, Genetics & Evolution, Rastogi Publications, Meerut.
- 3. Verma PS, & Agarwal VK, *Environmental Biology: Principles of Ecology*, S Chand Publishers, New Delhi.
- 4. Sharma PD, *Elements of Ecology*, Rastogi Publications, Meerut.
- 5. Chapman JL & Reiss MJ, *Ecology: Principles and Applications*, Cambridge University Press, New Delhi.
- 6. Odum EP, Fundamentals of Ecology, W.B Saunders College Publishing, Philadelphia.
- 7. Arumugam N Organic Evolution, Saras Publication, Nagercoil.
- 8. Caughley G, Sinclair AR. Wildlife ecology and management. Blackwell Science.
- 9. Divan S, Rosencranz A. Environmental law and policy in India: Cases, materials and statutes. New Delhi: Oxford University Press.

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
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CO5	3	3	3	3	2

CORE IX – BIOTECHNOLOGY

22AU:08M9

- 1. Revolutionary scientific discipline which will provide platform to understand biology more technically.
- 2. It will pave way for understanding the application of each gene and its specific applications.
- 3. Will enable to do wet laboratory experiments with or without support of dry laboratory techniques.
- 4. To impart an introductory knowledge about the subject of Bioinformatics to the students studying any discipline of science.
- 5. Will enable to work in dry lab & minimize time on wet laboratory experiments.

Unit I : Introduction

Scope of biotechnology – branches and applications. DNA and RNA – Structure, Composition and Types. Cell cycle – DNA replication, recombination and repair.

Unit II: Molecular Techniques

Principles, applications and types of Polymerase Chain Reaction (PCR), Electrophoresis (Agarose gel), Blotting (Northern, Southern), Random Amplified Polymorphic DNA (RAPD), Restriction Fragment Length Polymorphism (RFLP).

Unit III: Genetic Engineering / Recombinant DNA Technology / Gene cloning

Isolation of DNA/RNA – Restriction enzymes – isolation of desired gene – Amplification of gene by PCR. Cloning vectors – types, Probes – types, DNA sequencing. Examples : commercial production of insulin.

Unit IV: Applications

Cell lines: HeLa and WI-38. Organ culture – Techniques and applications. Transgenic animals – Mice, Dolly, Pigs. Transgenic plants – Resistance to insect pests, microbial diseases. Super bug for oil pollution. Human Genome Project.

Unit V: Gene structure/sequence alignment

Introduction to Nucleic Acid and Protein sequence Data Banks; Nucleic acid sequence data banks: NCBI, EMBL, SWISSPROT. Multiple sequence alignment programs – CLUSTALW – methods and applications of phylogenetic analysis: phylogenetic tree, structures and construction of phylogenetic tree.

Course Outcomes

- 1. Students will learn molecular techniques of handling DNA and RNA.
- 2. Importance of genes and commercial utilization of molecular techniques.
- 3. Commercial production of medicinal needs for human.
- 4. Vast usage of molecular techniques for various therapies.
- 5. Learn the usage of various Open source software for analyzing gene structure. Non-biology students will understand the basic concepts of biological structures and functions.

Text Books

- 1. Lohar, P.S. 2005. Biotechnology. MJP Publishers, Chennai, India.
- 2. Dubey, S. 2006. Text book of Biotechnology. S. Chand and Co., New Delhi, India.
- 3. Baxevanis A.D. & B.F.F. Ouellettee. 2001. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins. Wiley Interscience.
- 4. Mount, D.W. 2001. Bioinformatics: Sequence and Genome Analysis. Spring Harbor, CSHL Press.

Supplementary Readings

- 1. Satyanarayana, U. 2008. Biotechnology. Books and Allied (P) Ltd., Kolkata, India.
- 2. Software Manuals and Help Files.

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
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CO5	3	3	3	3	3

CORE-X PRACTICAL: GENETICS, ECOLOGY, BIOTECHNOLOGY, APPLIED ENTOMOLOGY & AQUACULTURE

HOURS:3 CREDITS:3

22AU:08M10P

Course Objectives

- 1. To give students competent lab skills in genetics
- 2. Students will learn the environmental parameters
- 3. To give students advanced technical skills in Biotechnology
- 4. To give students competent lab skills in Applied entomology
- 5. Students will gain practical knowledge for identification and culturing of fishes

GENETICS

- 1. Drosophila male and female identification, Mutant forms (from pictures), Genetic importance.
- 2. Study of finger prints and their patterns of inheritance in man
- 3. Observation of simple Mendelian traits in man.
- 4. Monohybrid cross
- 5. Dihybrid cross
- 6. Test the hypothesis of law of independent assortment by Chi-square test Using models (Peas/Beads).
- 7. Polygenic / Quantitative genetics Human height

Spotters:

Pedigree Analysis. Models: Karyotypes of normal male and female. Klinefelter's, Turner's and Down's syndrome.

Drosophila - Male and female identification, Genetic importance, Mutants (Wing, body colour, eye colour).

Models for DNA, tRNA Structure and DNA replication.

ECOLOGY

- 1. Estimation of dissolved oxygen
- 2. Estimation of salinity
- 3. Estimation of Calcium.
- 4. Mounting and identification of plankton (freshwater / marine)

Spotters:

Animal association, Intertidal fauna, Secchi disc, Maximum and minimum thermometer, Barometer, Lux meter. 5. Visit to a local polluted area – Solid waste / sewage treatment plant 6. Construction of a food web diagram based on a field visit. Biodiversity Field collection methods; Identification of common animals - Soil invertebrate diversity, diversity of birds and mammals in parks / botanical gardens, threats to local biodiversity – Field visit is compulsory.

BIOTECHNOLOGY

1. Isolation of genomic DNA and horizontal electrophoresis of DNA -demonstration only

2. Transgenic Plants - Observation from Pictures,

3. Transgenic Animals - Observation from Pictures,

Spotters:

Lambda phage, Vectors, Bio-gas unit.

APPLIED ENTOMOLOGY

Mounting

Mouth parts – Mosquito and House fly

Collection and preservation of insects – insect store box

Note: The Students may be asked to submit a minimum of 10 whole mounts of the insects.

Spotters

Insect net, light trap, pheromone trap, sprayer.

AQUACULTURE

Spotters:

Catla catla, Labeo rohita, Cirrhinus mrigala, Oreochromis mossambicus, Cyprinus Carpio.

Field visit:

Visit to nearby aqua farms – to observe nursery, rearing and stocking ponds.

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	2	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

MAJOR BASED ELECTIVE - II APPLIED ENTOMOLOGY

22AU:08MBE2

Course Objectives

- 1) To provide extensive knowledge in the field of applied entomology.
- 2) To be able to categorize insects based on basic ecological, behavioral, morphological, physiological or developmental attributes.
- 3) The familiarity between insect and environment was highlighted to various field like agricultural entomology, medical entomology and industrial entomology.
- 4) To understand about productive insects and their biology.
- 5) To acquire knowledge about various pest control methods and approaches to the biological control of insect pests.

UNIT – I: General Entomology

Scope- morphology of head, thorax and abdomen; Mouthparts in insects; Metamorphosis in insects; classification up to orders – Salient features and economic importance of Thysanura, Odonata, Orthoptera, Dermaptera, Isoptera, Hemiptera, Thysanoptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera

UNIT – II: Agricultural entomology

Insect as pollinators, as pests, as predators, as weed killers, as scavangers, as food. Pest identification marks, nature, symptoms of damage. pests - grains, pulses, sugar cane, cotton, coconut, vegetables.

UNIT – III: Medical entomology

General account on personal pests (Lice, Fleas, Bedbugs, Ticks, Scabies mites); Major insect borne diseases and their management- malaria, filariasis, dengu, leishmaniasis; Recent developments in forensic entomology

UNIT – IV: Industrial Entomology

Productive Insects (a) Honey bee: life history, Bee products- Honey and Bee wax, and Uses (b) Silk moth: types of silkworm, life cycle; Sericulture, uses of silk, silk worm diseases. (c) Lac insect: Different strains of Lac insects, uses of lac.

UNIT – V: Pest control methods and application

Components of pest control: Biological and chemical; Integrated pest management- its importance & applications. Recent advances in pest control - sterilization techniques, liquid vaporizers, Pheromones.

Course Outcomes

1. To obtain knowledge on basic introduction of entomology

- 2. To recognize beneficial and harmful insects in the agricultural entomology
- 3. To describe vector borne diseases, control measures and awareness in medical entomology
- 4. To identify productive insects in industrial entomology
- 5. To understand pest control methods and application

Text Books:

- 1. Vasantharaj David and T. Kumaraswami 1988. Elements of Economic Entomology Popular Book Depot, Chennai.
- 2. Nayar, K.K., Ananthakrishnan, T.N. and B.V. David 1992 General and Applied Entomology Tata McGraw, New Delhi.
- 3. P.G. Fenemore and AlkaPrakash 1997 Allied Entomology, Wiley Eastern Ltd., New York.
- 4. R. L. Kotpal 2001. Arthropoda, Rastogi publications, Meerut.
- 5. Nalina Sundari M. S and shanthi. R 2006. Entomology, MJP publishers, Chennai

Supplementary Readings:

- 1. Wigglesworth J.B., 1994. Insect Physiology, Chapman and Hall, London.
- 2. A.Upadhyaya, K.Upathyaya and N.Nath, 2003 Biophysical chemistry, Principles and Techniques,3rd Ed, Himamalaya publishing house.
- 3. Gurumani.N 2006. Research methodology for biological sciences MJP publ. Chennai.

COURSE MAPPING

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	2
CO2	3	2	2	3	2
CO3	3	2	3	2	2
CO4	3	3	2	3	2
CO5	2	2	3	2	2

MAJOR BASED ELECTIVE - III AQUACULTURE

22AU:08MBE3

Course Objectives:

- 1. To acquire knowledge about the importants of aquaculture.
- 2. To know the different types of culture and pond management.
- 3. To obtain knowledge about cultivable species and aquarium keeping.
- 4. To gather information about poly culture
- 5. To learn the role of organizations and funding agencies involved in aquaculture.

UNIT-I Importance of Aquaculture:

Definition Scope and Importance of Aquaculture - Status of Aquaculture in India - Organizations involved and their role in Aquaculture - ICAR - CMFRI - CIFRI and MPEDA.

UNIT-II Fish Pond and Management:

Definition - Breading Ponds - Nursery Ponds - Rearing Ponds - Culture Ponds - Stocking ponds - Basic Fish Farm Design: Selection of Site - Construction of Pond for Fish Culture - Water Quality Maintenance of Fish Ponds - Importance and Composition of Feed: Types of Feed - Wet and Dry Feeds - Live Feeds

UNIT-III Cultivable species:

Cultivable species of Fishes - Crustaceans, Molluscs and Algae - Socio economic and environment Problems of Freshwater Prawn Culture and Pearl Culture - Different types of Culture: Extensive Culture - Intensive Culture - Semi-Intensive Culture. Mono Culture - Mono Sex Culture - Poly Culture. Common species for Ornamental Fish Farming - Advantages of Integrated Fish Farming's.

UNIT-IV Fish Disease Management:

Common Bacterial, Viral, Fungal, Protozoan and Crustacean Diseases their symptoms and treatment and Control Measures.

UNIT-V Marketing the Products:-

Marketing the fish to the local markets and for export - Harvesting and Transport of Fish and it's Products - Fish Preservation and Processing Methods.

Course Outcomes

- 1. Students will be able to describe the history and development of aquatic life.
- 2. Students will be able to theoretical and practical aspects of fisheries across different species.
- 3. Students will be able to explain how the management of aquatic ponds and to analyze biological samples of Aquaculture ponds.
- 4. Students can make knowledge of how the difference of cultivable forms evolved in the earth.
- 5. To take up jobs in Aquaculture farms.

Text Book :

- 1. Pillay, T.V.R. 1995. Aquaculture principles and practices. Fishing New Books, Blackwell Science Ltd., Oxford.
- 2. Shanmugam, K. 1990. Fishery biology and Aquaculture. Leo Pathipagam, Madras.
- 3. Santhanam, Sugumaran and Natarajan, P. 1997. A Manual of freshwater aquaculture. Oxford and IBH Pub. Co. Ltd., New Delhi.

Reference Books:

1. Arumugam.N. 2008. Aquaculture. Saras Publications, Nagercoil.

2. Baradach, JE, JH Ryther and WO McLarney (1972) Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley Interscience, New York.

3. Chadar, S.L. 1980. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, PP.146

4. Exporters manual and Documentation. 1999. Jain Book Agency. New Delhi.

5. Jhingran.V.C. 1991. Fish and fisheries of India, Hindustan Pub. Cord. New Delhi.

Kurian, C.V and Sebastin. 1992. Prawn and prawn fisheries of India, Hindustan Pub. Cord. New Delhi.

PO/CO	P01	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2

CORE – XI: EVOLUTION

- 1. To develop an idea of the adaptations and its significance in relation to evolution.
- 2. To make the students aware of how organic evolution occurred and how the various life forms come into existence.
- 3. To learn the origin of life and geological time scale and theories of evolution.
- 4. To learn about mechanisms of evolution.
- 5. To learn speciation and evolution of man.

Unit I: Origin and Evidences of Evolution

Introduction - Origin of life - Abiogenesis, Biogenesis, Cosmic theory, Biochemical origin of life, Urey-Miller experiment. Evidences of evolution - Morphological and Anatomical, Embryological, Physiological and Biochemical, Taxonomic and paleontological evidences.

Unit II: Theories of Organic Evolution

Lamarkism, Neo Lamarkism, Darwinism, Neo Darwinism, Mutation theory of De Vries and Modern version of mutation theory. Modern Synthetic theory of evolution. Natural selection. Convergent and Divergent evolution.

Unit III: Polymorphism and Population genetics

Polymorphism – Types and origin of polymorphism - Variation – Sources of variations – Hardy-Weinberg Law – Genetic Drift – Salient features of genetic drift– Evolutionary significance of genetic drift.

Unit IV: Animal Distribution

Zoogeographical regions – Palaearctic, Nearctic, Neotropical, Oriental, Australian and Ethiopian regions. Animal distribution – Methods, Classification, Patterns of distribution. Geological time scale (Up to periods for Paleozoic, Mesozoic era; Cenozoic era).

Unit V: Speciation, Isolation and Evolution of man

Speciation – Types of speciation – Mechanism of speciation – Patterns of speciation – Species concept – Isolating mechanisms – Patterns of evolution Evolution of man – Fossils, types and significance - Living fossils –Mimicry and Colouration – Adaptation and adaptive radiation.

Course Outcomes

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. Students will be able to explain how speciation occur and reasons for extinction.

Text Books

- 1. Colbert, E.H. (1969). Evolution of vertebrates, Wiley, New York.
- 2. Arumugam, N. (2016). A text book of evolution Saras Publication. Nagercoil, Tamil Nadu.
- 3. Rastogi, V.B. (2018). *Organic evolution*, Kedar Nath Ram Nath Publishers, Meerut, UP.
- 4. Hall, B.K. and B.Hallgrimson. (2014). *Strickbergers Evolution*, Jones and Bartlett Publishers ltd., New Delhi.
- 5. Gupta.P.K., N. (2008). Cytology, genetics and Evolution, Rastogi Publications, Meerut, UP.

Reference Books:

- 1. Richard Swann Lull, (2012). Organic Evolution, Sagwan Press, UK.
- 2. Reena Mathur, B.S. Tomar and S.P. Singh, (2014). *Evolution and behavior*, Rastogi Publications, Meerut, UP.
- 3. Clarkson E.N.K. (2011).*Invertebrate Palaeontology and Evolution*. WileyIndia Pvt. Ltd.
- 4. Edwin H. Colbert, Michael Morales and Eli C. MinKoff. (2011). *Colbert''sEvolution of the Vertebrates*. Wiley India.
- 5. Kenneth V. Kardong. (2018). *Vertebrates: Comparative Anatomy, Function, Evolution*. McGraw Hill, USA.

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	2	3	2
CO3	2	3	3	3	2
CO4	3	3	3	3	2

CORE -XII: DEVELOPMENTAL BIOLOGY

22AU:08M12

- 1. To make an awareness to the students about the theories, concepts and basics of Developmental Biology.
- 2. To provide students about the idea of sex cells, fertilization, cleavage, differentiation and development of organs.
- 3. To make an awareness of the induction, organizers and development of extra embryonic structures.
- 4. To provide adequate explanation to students about the late embryonic developments and post embryonic development and ageing.
- 5. To give an idea about teratogenesis, *in vitro* fertilization, stem cells and amniocentesis to the students.

Unit I: Gametes & Fertilization

Basic concepts of developmental biology: Structure & types of Spermatozoa, Mammalian egg-Egg membranes. Patterns of egg - Spermatogenesis – Oogenesis. Fertilization – mechanism, theories and significance – Parthenogenesis.

Unit II: Blastulation & Gastrulation

Cleavage - Planes & Patterns, Factors controlling cleavage - Fate map & its construction. Blastulation. Morphogenetic movements - Gastrulation of frog & chick.

Unit III: Organogenesis

Development of Brain, Eye and Heart in frog. Development of Nervous system in chick & Foetal membranes in chick. Placentation in Mammals. Development of Pro, Meso & Metanephric kidneys.

Unit IV: Applied Embryology

Organizer concept –Structure – mechanism of embryonic induction and competence. Nuclear transplantation - teratogenesis – Regeneration: types - events and factors. Embryonic stem cells & significance. Methods to culture embryo.

Unit V: Embryological Techniques

Ostrous, Menstrual cycle and menopause - Pregnancy – trimesters – development. *Erythroblastosis foetalis* -Twins – types. Infertility – causes - Test tube baby and Assisted Reproductive Technology – Embryo transfer – Amniocentesis, Aging and Senescence.

Course Outcome

- 1. The learner will be able to understand methodological approaches to the study of embryonic development and the characteristics of the principal experimental models.
- 2. The students will be able to identify embryonic structures in preparations, photographs and diagrams.
- 3. The students will be able to develop an idea, how to arrange sequences in developmental processes in order.
- 4. The learner will be able to understand the derivatives of embryonic structures.
- 5. The students will be attain a basic conceptual knowledge of the principal cellular mechanisms of development and identify the genetic and molecular elements that are involved.
- 6. The students will be able to explain the clinical implications of development and the mechanisms that intervene in developmental alterations.
- 7. The students will be able to apply the principles of the development in applied sciences like Biotechnology, Genetic engineering and Molecular Biology.

Books for reference:

- 1. Arumugam NA Text Book of Embryology, Biotechnology Saras Publication Nagercoil.
- 2. Balnisky BI An Introduction to Embryology, W.B. Saunders and Co.
- 3. BerrilNJ,Kars G(1986). Developmental biology, McGrawHills
- 4. Gilbert SF (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- 5. Majumdar NN Vetebrate embryology; Tata McGraw-Hill, New Delhi.
- 6. Verma PS & Agarwal VK Chordate Embryology, S. Chand Publishers, New Delhi.

OUTCOME MAPPING

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	2	3	3	3	2
CO2	3	2	2	3	2
CO3	3	2	3	2	2
CO4	3	3	2	3	2
CO5	2	2	3	2	2

CORE - XIII: MICROBIOLOGY & IMMUNOLOGY

HOURS:4

CREDITS:4

22AU:08M13

Course Objectives:

- 1. To understand classification of microorganisms.
- 2. To know the methodologies of culturing bacteria.
- 3. To distinguish communicable and non-communicable diseases.
- 4. To impart knowledge on the defense system of our body.
- 5. To learn about molecules or cells involved and impact of defective defense system.

A. Microbiology

Unit I : Classification

Scope of microbiology. Classification of bacteria, virus and fungus. Structure of *Escherichia coli*, bacteriophage and fungi, Economic importance of bacteria.

Unit II: Culture techniques

Culture of bacteria: Sterilization, types of media, bacterial staining, bacterial growth and growth curve – factors influencing growth of bacteria. Maintenance of the colonies.

Unit III: Applied Microbiology

Microbes in food spoilage – preservation of milk, role of microbes in nitrogen-fixation. Types and methods of fermentation products. Diseases in man: Bacterial (cholera, typhoid), Viral (rabies, HIV) and Fungal (candidiasis, dandruff).

B. Immunology

Unit IV

Scope of Immunology. Immunity, Types – Humoral and cellular. Lymphoid organs: Primary and Secondary cells of the immune system. Immunoglobulins – structure, types and functions of Immunoglobulins. T-cell and B-cell activation.

Unit V

Antigens – epitopes, paratopes, haptens, adjuvants. Antigen-antibody reactions: agglutination, precipitation. Major Histocompatibility Complex (MHC). Hypersensitivity – types. Autoimmunity and Immunodeficiency diseases. Vaccines and immunization.

Course outcome:

- 1. Classify microorganisms.
- 2. Learn to prevent communicable diseases.
- 3. Mechanisms of immunity and immune system.

Text Books

- 1. Ananthanarayanan, T. & C.K. Jayaram Paniker. 2000. Text Book of Microbiology, Sixth Edition, Orient Longman Ltd., Chennai, India
- Roit, I.M. & P.J. Delves. 2001. Roitt's Essential Immunology. Blackwell Science Ltd., USA.

Supplementary Readings

- Pelczer, M.J., R.D. Reid, and E.C.S. Chan. 1996. Microbiology, 5 Edn., Tata McGraw Hill Publishing Company Ltd., New Delhi, India.
- 2. Kuby. J. 2008. Immunology. W.H. Free man and Co. New York, USA.

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3
CO2	3	3	3	3	3
CO3	2	3	2	3	3
CO4	3	3	2	2	3
CO5	3	3	3	3	3

CORE – XIV: BIO INSTRUMENTATION

HOURS:4 CREDITS:4

22AU:08 M14

Course Objectives

- 1. To acquire knowledge on working in a laboratory and handling biomaterials.
- 2. To understand the tools used in biological experiments.
- 3. To handle basic instruments used for biological sample analysis.

UNIT-I

Principles and applications of Physical Balance - Digital Balance and Mono Balance. Principles, types and applications of Rotor and Centrifuge. Principles, types and applications of pH Meter.

UNIT-II

Principle and applications of Incubator - Water Bath - PCR (Polymerase Chain Reaction), Sterilization Techniques. Preparation and Uses of Glassware's - Selection and Cleaning of Glassware's - Syringes and Needles.

UNIT-III

Electrophoresis: Principle and applications of Paper Electrophoresis - Principle and applications of Gel Electrophoresis.

UNIT-IV

Chromatography: Principle and applications of Paper Chromatography - TLC (Thin Layer Chromatography) - GLC (Gas Liquid Chromatography) - Principle and applications of HPLC - High Performance Liquid Chromatography.

UNIT-V

Principle working mechanism parts and applications of colorimeter - Principle and applications of distilled water unit - autoclave and hot air oven.

Course Outcome

- 1. Safely working in a laboratory.
- 2. Handle electrical equipment to analyze biological samples.
- 3. Understand the preparation of biological solutions.

Text Books:

- 1. Veerakumari, L. 2006. Bioinstrumentation. MJP Publishers, Chennai, India.
- 2. Wilson, K. & J. Walker (Eds). 1995. Principles and techniques of Practical Biochemistry. Cambridge University Press.
- 3. Instrumental methods of clinical analysis, Chatwal Anand, 2003.
- 4. Biophysical Chemistry, Upadhayay Nath, 2001.

5. Biophysical Chemistry, R.N.Roy, 2005.

6. Turk and Turk 1995. Ewt. Science, Samders Company.

7. Park and Park 2985. Social and preventive medicine, East West Publications, New Delhi.

8. Application of World Health Organization on Health and Diseases.

9. Bio physics and Bioinstrumentation, N. Arumugam & V. Kumaresan, Saras Publications – 2022.

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3
CO2	3	3	3	3	3
CO3	2	3	2	3	3
CO4	3	3	2	2	3
CO5	3	3	3	3	3

CORE-XV PRACTICAL: DEVELOPMENTAL BIOLOGY, EVOLUTION, MICROBIOLOGY, IMMUNOLOGY, BIOINSTRUMENTATION & POULTRY FARMING

22AU:08M15P

Objectives:

- HOURS:3 CREDITS:4
- 1. To provide fundamental ecological principles that provides in-depth understanding of our natural world.
- 2. The scientific basis for understanding how environmental systems work.
- 3. Developmental Biology provides understanding of the processes of early embryonic development and developing embryos

1. Developmental Biology:

- 1. Frog /Bull sperm motility
- 2. Mounting of Chick embryo

Spotters: Sperm, T. S. of Mammalian ovary. Frog: Egg, cleavage, blastula, gastrula, Yolk plug and tadpole tags Chick: Egg, Developmental stages - 24 hrs, 48 hrs, 72 hrs and 96 hrs. Sheep: Placenta

2. Evolution:

Spotters: Protective colouration -Leaf insects, Stick insects, *Chameleon, Hippocampus*, Pepper moth. Mimicry: Monarch and Viceroy butterfly. Quantum evolution; Bat, *Pteropus*

3. Microbiology & Immunology

- 1. Demonstration of sterilization procedure for culture media and equipment.
- 2. Preparation of culture media for microbes, serial dilution techniques (in groups)
- 3. Distribution of microbes in water (demonstration and observations.)
- 4. Fixing and Gram staining of bacteria
- 5. ABO Blood grouping based using antibodies, Rh blood typing & and its immunological significance.
- 6. Observation of lymphoid organs in rat.

Spotters: Laminar Air flow, Autoclave, Petri-dish, Petri plate, Inoculation loop. Immuno-electrophoresis, Rocket immuno-electrophoresis.

4. Bioinstrumentation

Determination of thermal death time and thermal death point. **Spotters:** Distillation unit, water bath, spectrophotometer, vertical gel electrophoresis.

5. Poultry Farming

- 1. Study of various equipments (feeder, waterer, brooder).
- 2. Identification and handling of eggs.
- 3. Comb pattern in chicken.
- 4. Commercially available antibiotics.
- 5. Field visit to poultry farms.

Course outcome:

- 1. To understand the developmental stages
- 2. To acquire knowledge on evolutionary aspect
- To understand the microbiological and immunological techniques
 To gather knowledge on scientific equipment
- 5. Acquire proficiency on entrepreneurial skills

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3
CO2	3	3	3	3	3
CO3	2	3	2	3	3
CO4	3	3	2	2	3
CO5	3	3	3	3	3

MAJOR BASED ELECTIV - IV: POULTRY FARMING

22AU:08MBE4

Course Objectives:

- 1. To impart training on Modern Poultry Farming technology
- 2. To create knowledge on self-employment opportunity
- 3. To acquire knowledge about raising birds domestically and commercially

Unit I: Prospects of Poultry Industry

Introduction - definition of poultry - broiler, layer and breeder - common terms related to poultry - Classification of fowls based on their uses: Meat types - Broilers, Egg types - White Leghorn and Commercial layers, Dual purpose varieties, Game and Ornamental purpose varieties.

Unit II: Poultry Housing, Automation and Equipments

Site selection, location of the farm, construction of poultry sheds, layout of a broiler and layer farm, importance of poultry housing and equipment's, System of rearing- cage and deep litter, Advantages and Disadvantages

Unit III: Food and Feeding of Poultry Farming

Feed stuffs for poultry – Energy source, vegetable protein source, animal protein source, mineral source. Feed additives – Antibiotics, Antioxidants and Coccidiostats. Feed formulation – Chicks, Growers, Layers and broilers

Unit IV: Incubation and Hatchery Management

Management principles of incubation – factors affecting fertility and hatchability-Selection, cleaning, sanitation of eggs, Storage of hatching eggs - incubation methods - single and multistage incubators. Hatchery operations - setting, candling, transfer, hatching, grading, packing and chick dispatch

Unit V: Poultry Diseases and Pharmacology

Diseases definition – Classification, Viral - Ranikhet disease, Mareks disease, Fowl pox and Gumboro disease - Bacterial – CRD, Fowl cholera, Pullorum, Botulism - Fungal- Aspergillosis & Mycotoxicosis - Protozoal and Parasitic - Coccidiosis, Lice & Ticks- Nutritional deficiency diseases - Prevention and precaution during Vaccination.

Course Outcome:

- 1. The students will have knowledge about the Prospects of Poultry Industry
- 2. The students will have knowledge about the poultry production systems, housing, automation and equipment's

- 3. The students will have knowledge about the food and feeding of poultry farming
- 4. The students will have knowledge about the incubation and hatchery management
- 5. The students will have knowledge about the environment, poultry production and diseases

References:

1. Jull Morley, A. 1971: Poultry Husbanry, Tata-McGraw Hill Publ. Co. New Delhi-India.

Sastry, Thomas and Singh, 1982: Farm Animals Management and Poultry Production-Vikas
 Publ. Co. New Delhi – India

3. Harbans Singh and Earl. N. Moore, 1982 : Live Stock and Poultry Production – Prentice Hall India Publ. Co., New Delhi - India

4. Banarjee, G.C. 1986: Poultry, Oxford - IBH Publ. Co. New Delhi - India

5. Modern Aspects of Commercial Poultry Keeping - Giri Publication- India

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	2	3	3	2

SKILL BASED ELECTIVE -1

MUSHROOM CULTURE

HOURS:2 CREDITS:2

22AU:08SBE1

Course objectives

- 1. To understand the instruments, techniques, lab etiquettes and good laboratory practices for working in a food-based industry or laboratory.
- 2. Develop skills for cultivating and identifying mushrooms, using them for commercial purposes.
- 3. Will understand the pathology associated with mushrooms and their pre-harvest & post-harvest management.
- 4. To distinguish poisonous and non-poisonous mushrooms.
- 5. Can start their own enterprise on mushroom production.

Unit-I

Introduction to mushrooms, their biology, nutritional value and their significance. Classification of edible and non-edible mushrooms.

Unit-II

Preparations for Mushroom culture - Bed preparation - Nutrients preparation climatic conditions and parameters - Mushroom spawn (seed) production/ procurement.

Unit-III

Mushroom types and their cultivation: 1) Button mushroom, 2) Pearl mushroom, 3) Oyster mushroom, 4) Paddy straw mushroom and 5) Milky mushroom.

Unit-IV

Nutrient supplements for human consumption as vegetable meat. Nature, Medicinal value. Health

benefits: Microbicidal effects. Therapeutic aspects: Antitumour effect.

Unit-V

Disease management in mushroom cultivation: fungal, bacterial, viral and insect pests. Management of spent substrates and waste disposal of various mushroom. Marketing of mushrooms in India and worldwide.

Course Outcome

- 1. Students will understand the principles of mushroom cultivation.
- 2. Will acquire the practical knowledge to grow mushrooms.
- 3. Will get confidence to approach mushroom production industry for potential employment opportunities.
- 4. Students will be able to procure knowledge on nutritive and medicinal values of mushroom.

Suggested Readings

- 1. Pathak, V.N. 2007. Mushroom Production and Processing Technology. Agrobios, India.
- 2. Sharma, V.P. 2006. Diseases and Pests of Mushrooms. Agrobios, India.

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	2	3	3	2

SKILL BASED ELECTIVE – II APICULTURE

22AU:08SBE2

Course Objectives

- 1. To acquire knowledge of different species of honey bees and their biology.
- 2. To understand the social organization and behavior of bees.
- 3. To gain the knowledge of tools required in Bee Keeping and hive maintenance.
- 4. To obtain the knowledge to protect the bee hives from enemies and diseases.
- 5. To acquire Knowledge of harvesting bee products from the combs and work out business plan and economics of apiculture.

Unit 1: Biology of Bees

History of bee keeping in India; scope and advantages of bee keeping. Honey bee species their identification, characters and distribution - *Apis dorsata, A. florea and A. cerana indica, A. mellifera.* Biology and life history: Egg, larva, pupa and adult - characteristics.

Unit 2: Rearing of Bees

Bee keeping Equipments: Newton's bee hive, smoker, knife, honey extractor, queen excluder, queen gate, comb foundation, feeder.

Management of bee hive: Seasonal management – summer and winter, artificial feeding - sugar solution, bee bread preparations; Swarming and colony multiplication.

Unit 3: Diseases and Enemies

Natural Enemies: Wax-moth, wasp, ants, reptiles and amphibians, birds - their control measures. Diseases: Brood diseases - Bacterial (American Foul brood), Viral (Sac brood), Fungal (Chalk brood) - their control measures.

Unit 4: Bee Economy

Bee products: honey, bee wax, royal jelly, propolis, pollen - collection and processing.

Unit 5: Entrepreneurship

Bee Keeping Industry – Central Bee Research and Training institute, National Bee Board. Methods in employing artificial Beehives for cross pollination in horticultural gardens.

Course Outcome

- 1. Students will understand the principles of bee keeping.
- 2. Will acquire the practical knowledge to maintain honey bees.
- 3. Students will get confidence to maintain apiary and for potential self-employment.
- 4. Students will be able to procure knowledge on nutritive and medicinal values of honey.

HOURS:2 CREDITS:2

Text Books

- 1. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- 2. Bisht D.S., Apiculture, ICAR Publication.
- 3. Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.
- 4. Abrol, D.P. (2013). *Beekeeping: A Comprehensive guide to bee and beekeeping*. Scientific Publishers, India.

Reference Books

- 1. Mahindru. S.N. (2014). Beekeeping. APH. Publishing Corporation, New Delhi, India.
- 2. Stuart. F.S, (2010). Beekeeping practice, Axis Books, India.
- **3.** Wheeler, W.M. (2006). Social Insects their origin and evolution. Discovery publishing house, New Delhi.
- **4.** George. A, Carter, (2004). Beekeeping. A guide to the better understanding of Bees, their disease and the chemistry of Beekeeping. Biotech Books. Delhi.
- 5. Mishra, R. C. and R. Garg. (2002). Perspectives in Indian Apiculture. Agrobios Publication, India.

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	3	3	3	2

SKILL BASED ELECTIVE- III VERMICULTURE

22AU:08SBE3

HOURS:2 CREDITS:2

Course Objectives

- 1. To acquire knowledge about biofertilizer
- 2. To impart training on Earthworm culture technology
- 3. To create knowledge on Self Employment opportunity
- 4. To understand the potential of vermicomposting as an alternative to chemical fertilizer
- 5. To understand the role of vermiculture in protecting the environment and managing the waste

Unit I :

Eathworm types - Morphological and Anatomical characteristics. Biology of Lampito maruitti and Eschenia foteda

Unit II:

Vermicompost process - Types of Vermicomposting materials. Monoculture and polyculture techniques, factors affecting vermicomposting - pH, Moisture, temperature etc.

Unit III:

Vermicomposting methods such as – Small scale and Large scale pit method, heap method, window method etc., Factors affecting vermicomposting such as pH, moisture, temperature etc.

Unit IV:

Vermicomposting General procedure in Homes. Maintenance of vermicomposting beds. Harvesting the worms. Earthworm Predators, parasites and pathogens

Unit V:

Nutrients availability - Application of vermicomposting in agriculture and horticultural practices. Advantages of vermicomposting and marketing

Course Outcomes

- 1. Learn about the characteristics and biology of earthworm
- 2. Get an in-depth knowledge about the culture techniques
- 3. Understand about the methods of composting
- 4. Learn the factors for proper maintenance of the vermicomposting beds
- 5. Learn about the application and marketing of the compost.

Text Books

- 1. Edwards, C.A., and Bother, B. 1996: Biology of Earthworms Chapman Hall Publ. Co., London
- 2. Ismail, S.A. 1997: Vermitechnology the Biology of Earthworms Orient Longman Publ. India.
- 3. Ranganathan, L.S. 2006: Vermibiotechnology from soil health to Human health Agrobios India.

Supplementary Readings

- **1.** Talashikar, S.C. 2008: Earthworms in Agriculture Agrobios India
- 2. Gupta, P.K. 2008: Vermicomposting for sustainable agriculture [2nd edition] Agrobios India.
- 3. Rajeev Prathap Singh. 2012: Organic Fertilizers: Types, Production and Environmental Impact Nova Science Inc. New York

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	2	3	3	2

SKILL BASED ELECTIVE – IV VECTOR BIOLOGY

22AU:08SBE4

HOURS:2 CREDITS:2

Course Objectives:

1. To acquire knowledge of the types of vectors, host and parasite and vector control

2. To learn morphology, life cycle, diseases transmission and control measures of vectors

Unit I: Concept of Vector, Host, Parasite and Vector control

Vectors - Definition – Characteristics – Types (Biological and mechanical) Host and Parasite - Definition – Characteristics – Types. Vector control: Integrated vector management - chemical - Larvicides, Adulticides and Insect Growth Regulators (IGRs).

Unit II: General Features of Vectors

Mosquito: Morphology and Life cycle – Identification characters of different stages of Anopheles, Aedes and Culex; Disease transmission cycle - role of mosquito in disease transmission of Malaria, Filariasis, Dengue.

Unit III: Housefly and Sandfly

Housefly: Morphology - life cycle - disease transmission (Amoebic Dysentery) – control measures. Sand fly: Morphology – life cycle - disease transmission (Leishmaniasis) - control measures.

Unit IV: Flea, Louse and Ticks

Fleas: Morphology - life cycle - disease transmission (Plague) control measures.

Louse: Morphology – life cycle - disease transmission (relapsing fever and secondary dermatitis) - lice control.

Ticks: Morphology - difference between Hard and Soft ticks - disease transmission (typhus, 'Q' fever) – control measures.

Unit V: Cyclops and Freshwater snail

Cyclops (water-flea): Morphology – disease transmission (Dracunculiasis) – prevention and control measures.

Freshwater snails - disease transmission (Schistosomiasis) - Control measures.

Course Outcome:

1. To acquire basic knowledge on types of vectors, host and parasites & take up integrated vector management activities.

2. To acquire basic knowledge on the general characters of vectors, types of disease transmission.

3. To acquire basic knowledge on the biology, epidemiology and control of the vectors (Housefly and Sandfly).

4. To acquire basic knowledge on the biology, epidemiology and control of these three vectors (Fleas, Lice and Ticks).

5. To acquire basic knowledge on the biology, life cycle and control methods of Cyclopes and freshwater snail.

Text Books

1. Park, K. (2021). Park's Text book of preventive and social medicine. 26th Edition. Banarsidas Bhanot Publisher, USA.

2. Jayaram Panikar, C.K. (2018). Textbook of Medical Parasitology. Jaypee Brothers Medical publishers Pvt. Ltd, New Delhi.

- 3. Tembhare, D.B. (2012). Modern Emtomology. Himalaya Publishing House, New Delhi.
- 4. Tyagi , B.K. (2012). Medical Entomology. Scientific publishers, Chennai.

5. Parthiban, M. and B. Vasantharaj David, (2007). Manual of Household & Public Health pests and their control. Namrutha Publications, Chennai.

Reference Books

1. Sudhir R. Wagh and Vishnu K. Deshmukh. (2015). Medical Entomology. Success Publications.

2. Rathanswamy, G.K, (2010). A Hand book of Medical Entomology. S.Viswanatham Printers & Private & Ltd., Chennai.

3. Arthropods of Medical importance (1981) Edited by Nicholas R.H.Burgess, Published by Noble Books Ltd, Hampshire.

4. Rao, T. R. (1981). The Anophelines of India. Indian Council of Medical Research, New Delhi.

OUTCOME MAPPING

PO/CO	P01	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	2	3	3	2

SKILL BASED ELECTIVE – V: BIO-FERTILIZER PRODUCTION

22AU:08SBE5

Course Objectives:

1. To impart awareness on bio fertilizer technology

2. To create knowledge on Environmental degradation.

UNIT- I

Scope and principles of Bio fertilizers – Types of soil – Role of microbes in soil fertility - physical and chemical composition of soil. Types of microorganisms in soil.

UNIT-II

Production of bacterial bio fertilizers – Importance of bio fertilizer, Importance of organic fertilizer -Mass production and utilization of different strains of cyanobacteria. Mass cultivation of Azolla, Azospirillum, Azotobacter and its utilization.

UNIT-III

Isolation and identification of endophytic nitrogen fixers. Rhizobium and legume root Nodulation and Nitrification process. Cyanobacteria – Vermicomposting.

UNIT-IV

Production of Micorrhizal Bio fertilizer- Phosphate solubilising microorganisms – Arbuscular vesicular Mycorrhizal (VAM) fungi as bio fertilizer and its applications – microbial enzymes.

UNIT-V

Use of composite Bio fertilizers – Fermentation technology. Methods for enhancing soil fertility. Renewable properties of biofertilizers.

Course Outcomes

- 1. To understand the soil composition
- 2. To describe bacterial biofertilizer
- 3. To get knowledge about nitrification
- 4. To understand mycorrhiza biofertilizer
- 5. To know the applications of biofertilizer

Text Books

- 1. Singh, T. And Purohit, S.S. 2008: Bio fertilizer Technology. Agrobios-India
- 2. Sharma, A.K. 2007: Bio fertilizer for sustainable agriculture-Agrobios-India
- 3. Pandiyarajan, P.2008: Techniques in Agricultural Microbiology Agrobis Jodhpur India.

HOURS:2 CREDITS:2

Supplementary Readings

- 1. Purohit,S.S. 2005: Microbiology Fundamentals and Application [6th edition] student Edition-Jodhpur India.
- **2.** Dubey,R.C., and Maheswari, D.K. 2007: A text book of microbiology-S. Chand & co. New Delhi, India.
- 3. Chandhirasekar P 2009: Biofertilizers T.K Publication Pudukottai.

OUTCOME MAPPING

PO/CO	P01	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	2	3	3	2

ALLIED ZOOLOGY SECOND ALLIED – I : BIOLOGY OF INVERTEBRATES AND CHORDATES

22AU:01A4:1

Course Objectives

- 1. To acquire wide knowledge about different kinds of animal species.
- 2. To understand the systematic and functional morphology of various groups of Invertebrates and chordates.
- 3. To study their Economic Importance, Affinities and Adaptations.

Unit I

Classification of major Invertebrates and Chordates with phylum, class characteristics, and diversity with suitable examples.

Unit II

Detailed study: Paramecium, Obelia, Fasciola hepatica and Earthworm.

Unit III

Detailed study of Prawn, Lamellidens and Star fish.

Unit IV

Detailed study of external features, digestive system, respiratory system, circulatory system, urinogenital system and brain of Shark, Frog and Calotes.

Unit V

Detailed study of external features, digestive system, respiratory system, circulatory system, urinogenital system and brain of Pigeon and Rabbit.

Course outcome:

- 1. Students will be able to differentiate phylum invertebrate and chordata.
- 2. Students can identify specimens up to species level
- 3. They can learn the organs involved in physiological functions.

References:

- 1. Outlines of Zoology M. Ekambaranatha Ayyar Viswanathan Publications.
- 2. A Manual of Zoology, Vol 1 & 2 M.E.K.Ayyar Viswanathan Publications.
- 3. Invertebrate Zoology E.L. Jordan S.Chand and Co.
- 4. Chordate Zoology E.L. Jordan S.Chand and Co.

OUTCOME MAPPING

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	3	2	3	3	2

HOURS:5 CREDITS:4

SECOND ALLIED – II: PRACTICAL

BIOLOGY OF INVERTEBRATES, CHORDATES & ECONOMIC ZOOLOGY 22AU:01A4:2P

Objectives:

- 1. To impart training on the techniques of dissecting Invertebrate and Chordate animals
- 2. To understand the various systems present in their body
- 3. To observe the preserved animals in the museum and to study their characteristic features

1. **Dissections**

Earthworm Nervous System Cockroach: Digestive system/ Nervous system.

2. Mountings:

Earthworm – Body and Penial

setae. Cockroach and Honey

Bee - Mouth Parts Shark -

Placoid Scale

Any carp - Cycloid or Ctenoid Scale

3. Spotters:

Amoeba, Paramecium, Trypanosoma, Plasmodium, a simple sponge, Obelia colony, Sea anemone, Ascaris, *Fasciola hepatica*, *Taenia solium* ,Planaria, Earthworm, Nereis, Leech, Prawn, Scorpion, Grass hopper, Fresh water mussel, Pila, Starfish Amphioxus, Shark, Catla, Frog, Salamander, Calotes, Turtle, Snake, Pigeon, Rat & Bat.

4. Species of animals used in Culture:

Vermiculture, apiculture, lac culture, sericulture, aquaculture and poultry farming.

5. Products of Animals:

Honey, Bee's Wax, Lac, Silk, Cod liver oil, Pearl, Eggs of different poultry birds, leather, wool.

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

HOURS:3 CREDITS:3

Course outcome:

- 1. Students will be able to differentiate phylum invertebrate and chordata.
- 2. Students can identify specimens up to species level
- 3. They can learn animal culture methods for future entrepreneurial development.
- 4. Students will get sufficient knowledge on income generating animal products.

Text/ Reference Books:

- 1. Verma, P.S. 2013. A Manual of Practical Zoology of Invertebrates, S. Chand & Company Ltd., New Delhi.
- 2. Vijayaraman. K and palanivel.K, 1997 Cheimurai Vilangial, chimeera Publications.
- 3. Amsath, A. 2013. Practical manual in Zoology. MMA Publications, Adirampattinam.

OUTCOME MAPPING

PO/CO	P01	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	2	3	3	3

SECOND ALLIED III: ECONOMIC ZOOLOGY

22AU:01A4:3

Course Objectives:

- 1. To encourage young learners to take up small scale industries.
- 2. To generate motivation for self-employment.
- 3. To disseminate information on economic aspects of Zoology.
- 4. To inculcate knowledge on useful animals to mankind.
- 5. To satisfy the learners with modern techniques of animal culture.

Unit - I : Apiculture

Species of honey bees - bee colony - social life in honey bees - types of beehive & other accessories. Honey extraction - uses of honey.

Unit – II : Sericulture

Nature and economic importance of sericulture in India. Types of silkworm - Bombyx mori. Silk production and its economic importance. Diseases of silkworm.

Unit - III : Aquaculture

Pisciculture - Techniques of induced breeding (Hypophysation) Commercial culture of Catla catla and Heteropneustes fossilis. By Products of Fishing and its commercial values.

Prawn culture - Culture techniques of fresh water (Macrobrachium rosenbergii).

Shrimp culture - (Penaeus monodon) preservation - processing and export techniques adopted in fishery.

Pearl culture - Formation and nature of Pearls - Commercial importance of Pearl Culture in India.

Unit - IV Poultry farming

Economics of Poultry keeping: Morphology of different breeds of Chicken - Brooding and Rearing of Chicks-Processing of Egg, Meat and By-Products of Poultry.

Unit - V Dairy

Dairy farm - Management, Milch breeds. Draught breeds, Dual purpose breeds and New Cross breeds of Cows and Buffaloes in India.

Sheep farming - Indigenous and Exotic breeds of Sheep.

Improvement for best breeds - Economic importance of Dairy, Leather, Wool, Fur and Pharmaceutical Industries in India.

Course Outcome

- 1. Able to understand techniques of beekeeping, honey production and silk production.
- 2. Able to understand techniques of commercial culture of fishes, valuable products.
- 3. Understand the importance of poultry, egg production including nutrition, health welfare and product quality.
- 4. To provide basic input to students about production, planning and management of dairy farms and future strategies for Livestock Development.

Text Books

Sukla, G.S. and V.B. Upadhyay. 2000. Economic Zoology, Rastogi Publications, Meerut, India.

Jawaid Ahsan and Subhas Prasad Sinha, 2000. A Handbook on Economic Zoology, S. Chand & Co., Ltd., New Delhi.

References

1. G.S. Shukla and V.B. Upadhyay - Economic Zoology, Rastogi Publications.

- 2. J.Ahsan and S.P.Sinha A hand book of Economic Zoology S. Chand & Co.,
- 3. Sardar Singh Bees Keeping in India.
- 4. Santhanam Aquaculture
- 5. Ullal, S.R. and M.N. Narasimhanna Central Silk Board, Government of India, Bombay.
- 6. Singh Livestock and Poultry Production.
- 7. ManjuYada, 2003. Economic Zoology, Discovery Publishing House, New Delhi.

PO/CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	2	3	3	3