A.D.M.COLLEGE FOR WOMEN (AUTONOMOUS),

NAGAPATTINAM

(Nationally Re-accredited with "A" gradeby NAAC-3rd Cycle)

PG & RESEARCH DEPARTMENT OF ZOOLOGY

(for the candidates admitted from the academic year 2019-2020 onwards)

B.Sc., ZOOLOGY

SYLLABUS

A.D.M. COLLEGE FOR WOMEN(AUTONOMOUS), NAGAPATTINAM

B.Sc., ZOOLOGY

(for the candidate admitted from the Academic year 2019 – 2020onwards)

PROGRAMME OBJECTIVE

1. To impart quality life science education to women students and to develop young women as outstanding scholars/ teachers/ career women/ entrepreneurs and responsible citizens.
2. To acquire basic skills in the observation and study of nature, biological techniques, experimental skills and scientific investigation.
3. To address the socio-economical challenges related to animal sciences.
4. To facilitate students for taking up and shaping a successful career in Zoology and its related subject.
5. To gain experience investigating life science problems and to solve them.

B.Sc. Zoology 2019-2022
STRUCTURE OF THE PROGRAMME

Part	Title of the Part	No. of Papers	Hours	Credit
I	Language - Tamil	4	24	12
II	English	4	24	12
III	Core Course (Theory & Practical)	14	70	83
	Allied	1	7	8
	Major Based Elective	3	15	15
IV	Skill Based Elective	3	6	6
	Non-Major Elective	2	4	4
V	Extension Activities	0	0	1
	Value Education	1	2	2
	Environmental Studies	1	2	2
	Soft-Skill Development	1	2	2
	Gender Studies	1	1	1
	Total	**39**	**180**	**140**

Passing Minimum

A candidate shall be declared to have passed in each course if she secures not less than 40% marks in the end semester examination and 40% marks in the continuous internal assessment and not less than 50% in the aggregate, taking continuous internal assessment and end semester examination marks together.

A.D.M.COLLEGE FOR WOMEN (AUTONOMOUS), NAGAPATTINAM
Accredited with "A" grade by NAAC
U.G. PROGRAMME – REVISED COURSE STRUCTURE UNDER CBCS (140 CREDITS)
B.SC., ZOOLOGY
(For Candidates to be admitted in the academic year 2019– 2020)

Semester	Paper	Title	Inst. hours/ week	Credit	Exam hours	Marks		Total Marks
						CIA	SE	
I	Part - I	Language Course - I (LC) Tamil/Other Language	6	3	3	25	75	100
	Part - II	English Language Course – I (ELC)	6	3	3	25	75	100
	Part – III Core Course – I	Biology of Invertebrates – (CCI)	6	5	3	25	75	100
	Core Practical – I (CP)	Practical – I: Biology of Invertebrates - & Chordates	3	-	-	-	-	-
	I Allied Course I	I -Botany paper	4	4	3	25	75	100
	I Allied Course II	II -Botany Practical	3	-	-	-	-	-
	Part – IV	Value Education	2	2	3	25	75	100
	Total		**30**	**17**				**500**
II	Part - I	Language Course - II (LC) Tamil/Other Language	6	3	3	25	75	100
	Part -II	English Language Course – II (ELC)	6	3	3	25	75	100
	Part – III Core Course - II	Biology of Chordates –(CCII)	6	5	3	25	75	100
	Core Practical – I (CP)	Practical - I (Biology of Invertebrates - & Chordates)	3	3	3	40	60	100
	I Allied Course II	II -Botany Practical	3	3	3	40	60	100
	I Allied Course III	III -Botany paper	4	4	3	25	75	100
	Part – IV	Environmental Studies	2	2	3	25	75	100
	Total		**30**	**23**	**-**	**-**	**-**	**700**

III	Part - I	Language Course – III (LC) Tamil/Other Language	6	3	3	25	75	100
	Part -II	English Language Course – III (ELC)	6	3	3	25	75	100
	Part – III Core Course – III	Cell and Molecular Biology(CCIII)	5	5	3	25	75	100
	Core Practical – II (CP)	Practical – II (Core Course III & IV)	2	-	-	-	-	-
	II Allied Course I	Chemistry-I(AC)	4	3	3	25	75	100
	II Allied Course II	Chemistry Practical	3	-	-	-	-	-
	Skill Based Elective I	Apiculture/Bio-instrumentation	2	2	3	25	75	100
	Non Major Elective I	Public Health and Hygiene/Food and Nutrition	2	2	3	25	75	100
	Total		**30**	**18**	**-**	**-**	**-**	**600**
IV	Part - I	Language Course – IV (LC) Tamil/Other Language	6	3	3	25	75	100
	Part -II	English Language Course – IV (ELC)	6	3	3	25	75	100
	Part – III Core Course – IV	Developmental Biology and Immunology (IV)	5	5	3	25	75	100
	Core Practical – II (CP)	Practical – II (Core Course III & IV)	2	3	3	40	60	100
	IIAllied Course II	Chemistry Practical(ACII)	3	4	3	40	60	100
	IIAllied Course III	Chemistry Paper – II	4	3	3	25	75	100
	Skill Based Elective II	Poultry Science/Dairy Farming	2	2	3	25	75	100
	Non Major Elective II	Commercial Zoology/Ornamental Fish Farming	2	2	3	25	75	100
	Total		**30**	**25**	**-**	**-**	**-**	**800**

V	Core Course V	Genetics and Microbiology	4	4	3	25	75	100
	Core Course VI	Environmental Biology and Evolution	6	5	3	25	75	100
	Core Course VII	Biotechnology	6	5	3	25	75	100
	Core Practical – III (CP)	Practical III (Core Course - V,VI, And VII)	5	5	3	40	60	100
	Major Based Elective I	Applied Entomology /Sericulture	5	5	3	25	75	100
	Skill Based Elective – III	Vermiculture/ Coastal Aquaculture	2	2	3	25	75	100
	Soft Skill Development	Soft Skill Development	2	2	3	25	75	100
	Total		**30**	**28**				**700**
VI	Core Course VIII	Animal Physiology	6	6	5	25	75	100
	Core Course IX	Biophysics, Biochemistry and Biostatistics	7	6	3	25	75	100
	Core Practical – IV (CP)	Core Practical – IV (Core Course VIII& IX)	6	5	3	40	60	100
	Major Based Elective II	Medical Lab Technology /Bioinformatics	5	5	3	25	75	100
	Major Based Elective – III	Economic Zoology/Wild life Biology	5	5	3	25	75	100
	Extension Activities	Extension Activities	-	1	-	-	-	-
	Gender Studies	Gender Studies	1	1	3	25	75	100
	Total		**30**	**29**				**600**
			180	**140**				**3900**

PG & Research Department of Zoology

Mark Allocation for Theory Papers

CIA	-	25 Marks
External	-	75 Marks
		100 Marks

CIA Component

Test	-	10 Marks
Assignment	-	2 Marks
Seminar	-	3 Marks
Quiz/Group Discussion	-	5 Marks
Attendance	-	5 Marks
		25 Marks

Pattern of question Paper (Theory)

Section – A	10 x 2 = 20 Marks	(No Choice)
Section – B	5 x 5 = 25 Marks	(Either or)
Section – C	3 x 10 = 30 Marks	(Any three out of 5)
Total	75 Marks	

NME for B.A./B.Sc./B.B.A. –III & IV Semester

1. Public Health and Hygiene/Food and Nutrition
2. Commercial Zoology/Ornamental Fish Farming

Pattern of question Paper (Theory)

Section – A	10 x 2 = 20 Marks	(No Choice)
Section – B	5 x 5 = 25 Marks	(Either or)
Section – C	3 x 10 = 30 Marks	(Any three out of 5)
Total	75 Marks	

PROGRAMME OUTCOME

1. To impart basic knowledge of various branches of Zoology and to understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance.
2. To appreciate the complexities of biological organization and address scientifically controversial issues in a rational way.
3. To assess the scope of animal biology and select particular areas for further study.
4. To inculcate transformational impact on the quality of education and to inspire the students to adopt scientific temper and live with scientific values.
5. To make the students aware of applications of Zoology and to highlight the potential of various branches to become an entrepreneur.

PROGRAMME SPECIFIC OUTCOME:

1. Gain the knowledge of Zoology through theory and practicals.
2. Analyze the relationships among animals with their ecosystems
3. Learn to classify the major groups of organisms under different phyla, understanding the functioning of organisms.
4. Able to compare and contrast anatomical and physiological characteristics of animals.
5. Understand good laboratory practices as per laboratory standards.
6. Handling the sophisticated instruments/equipment to develop technical skills, research oriented skills about research methodologies.
7. Develop effective communication and skills of problem solving methods.
8. Understand the applications of zoological knowledge in Agriculture, Medical and daily life.

CORE COURSE I
BIOLOGY OF INVERTEBRATES

Internal	**: 25**	**Semester**	**: I**
External	**: 75**	**No. of Hours/ Week**	**: 6**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives:

- To understand the systematic and functional morphology of various groups of invertebrates.
- To study the characteristics, economic importance, affinities and adaptations of invertebrates.
- Understand the non chordate animals in the world that surrounds us.
- Observe the process of evolution from unicellular cells to multi cellular organism.
- Able to recognize economically important invertebrate fauna.

General characters and classification up to classes with suitable examples of biological interest.

UNIT I

Phylum Protozoa - Detailed study of Paramaecium and Plasmodium

1. Nutrition in Protozoa

2. Protozoa and Human diseases (Entamoeba, Trypanosoma, Leishmania, Trichomonas, Toxoplasma, Balantidium with special reference to mode of infection, pathology and control)

Phylum Porifera- Detailed study of Sycon

1. Canal system in sponges

2.Spicules in sponges

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT II

Phylum Coelenterata - Detailed study of Obelia

1. Corals and Coral reefs

2. Ctenophora-General organization and affinities.

Phylum-Platyhelminthes-Detailed study of Fasciola hepatica.

3. Parasites affecting Man & Domestic animals

(Schistosoma haematobium, Taenia solium, Hymenolepis nana, Diphyllobothrium latum, Schistosoma nasolis and Echinococcus granulosa)

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT III

Phylum-Nemathelminthes Detailed study of Ascaris

1. Nematode parasites in man (Enterobius vermicularis, Ancyclostoma duodenale, Wuchereria bancrofti, Dracunculus medinensis, Trichinella spiralis with special reference to mode of infection, pathology and control).

Phylum Annelida-Detailed study of Nereis

2. Adaptive radiation in Polychaetes

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT IV

Phylum Arthopoda - Detailed study of Penaeus monodon

1. Organisation & affinities of Peripatus
2. Crustacean larvae & their significance
3. Economic importance of Insects**.**

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT V

Phylum Mollusca - Detailed study of Pila globosa

1. Economic importance of mollusca

Phylum Echinodermata - Detailed study of starfish- Asterias rubens

2. Larval forms of Echinoderms & their significance
3. Water vascular system in Echinoderms**.**

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

Text Book:

1. EKAMBARANATHA AYYAR M and ANANTHAKRISHNAN.T.N(1994) Manual of Zoology vol.I, S.Viswanathan pvt.Ltd.,Madras.
2. N.ARUMUGAN N.C.NAIR,DR.T.MURUGAN ETAL-Text book of Invertebrates, Saras Publications.

Reference Books:

1. BARNES R.D.(1968)Invertebrate zoology W.B.,Saunders company, Philadephia.
2. CHENG (`1964) Parasitology. W.B.company, Philadephia.
3. HYMAN .L.H,1960.The Invertebrates vol.I to VII (M.C.Hraw hill book co,.)
5. JORDON E.L and VERMA P.S.(`1983) Invertebrate zoology S.chand & co
6. KOPTAL R.L(1997)Modern text book of zoology, Rastogi company, Meerut(VP),India.
7. PARKER and HASEWELL(1964) Text book of zoology vo.I(Invertebrate)AZTBS. Publishers and distributes-New Delhi 11051- 874pp.
8. PRASAD .S.N.- Text book of Invertebrate zoology kitab mahal, Allahabad.
9. DHAMI.P.S and J.K.DHAMI. (2003).Invertebrate Zoology, Chand .R and Co Publishers –New Delhi.
10. KADAM .K .The Invertebrates Emkay Publication, Delhi.

Course Outcomes:

On Completion of the Course, Students should be able to

- Describe the distinguishing characteristics of the major taxa. Explain the basic aspects of classification details of invertebrates. Understand biodiversity, habitat, adaptation organization and taxonomic status of invertebrates
- Recall certain morphological attributes and physiological processes that are distinct and significant to each Phyla
- Understand the systemic and functional morphology of various groups of invertebrates Explain the basic aspects of structural and functional details of Invertebrates
- To compare and understand the general and specific characteristics within each Phyla.
- Interpret the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Non Chordates.

CORE COURSE II

CORE PRACTICAL II (CC I & III)

(BIOLOGY OF INVERTEBRATES AND BIOLOGY OF CHORDATES)

Internal	**: 40**	**Semester**	**: II**
External	**: 60**	**No. of Hours/ Week**	**: 3**
Exam Hours	**: 3**	**Credit**	**: 3**

Course Objectives :

- To demonstrate the internal anatomy of Invertebrate and vertebrate animals.
- To study about the various characteristic features and adaptations of Invertebrates and vertebrate animals.
- To mount the important parts of Invertebrate animals.
- Understand the comparative anatomy of chordates.
- Learn biological significance of invertebrates and chordates.

UNIT I

FAUNAL DIVERSITY - INVERTEBRATA

DISSECTIONS

1. Earthworm: Nervous system
2. Lamellidens: Digestive system
3. Pila: Digestive and Reproductive system
4. Prawn : Nerovous system

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT II

MOUNTING

1. Earthworm: Body setae
2. Prawn: Appendages
3. Mouth parts of Mosquito, Honey Bee and House Fly.
4. Pila: Radula

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT III

SPOTTERS

1. Classify Giving Reason.
   Paramaecium, Plasmodium, Sycon, Obelia, Metridium, Taenia, Ascaris (Male & Female), Nereis, Megascolex, Penaeus, Periplaneta, Pila, Lamellidens, Asterias.
2. Draw labeled sketch
   T.S.of Planaria, T.S. of Fasciola hepatica, T.S of Taenia solium, T.S of Ascaris (Male & Female) & T.S of Nereis.
3. Biological significance
   Paramaecium – Binary fission, Conjugation, Gemmule of sponge, Ephyra larva of Aurelia, Physalia, Obelia-medusa, Wuchereria bancrofti, Enterobius vermicularis, Heteronereis, Nauplius larva, Zoea larva, Megalopa larva,

Limulus, Chiton, Sepia, Bipinnaria.

4. Relate structure and function

Sponge Spicules, Tape worm- Scolex, Nereis- Parapodium, , Pila - Radula, Starfish Pedicellari, Seaurchin - Airstotle's lantern.

5. Write notes on adaptation

Madrepora, Gorgonia, Favea, Fungia, Arenicola, Chaetopterus, Cyclops, Lepas, Hippa,
Murex, Octopus, Cuttle bone of sepia, Mytilus, Sea Urchin.

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT IV

FAUNAL DIVERSITY - CHORDATA

Dissection

Shark: Mounting of placoid scales
Fish - Digestive system

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT V

Spotters

a) Classify giving reasons:

Balanoglossus,Shark,Ranahexadactyla,Hyla,Bufo
Calotes versicolar,Hemidactylus brooki,Varanus monitor,Chelone mydas
Pigeon, Rabbit

b)Biological significance

Amphioxus,Tornaria larva of Balanoglossus,Ascidian,Narcine
Axolotyl larva,Draco volans,Bat

c) Write notes on

Gambusia affinis,Hippocampus,Anabas scandans,Periophthalmus
Ophiocephalus,Alytes,Naja naja,Viper,King fisher

d)Relate structure and function

Echeneis,Exocoetus,Poison apparatus of Cobra,Quill feather of bird
Dentition in Rabbit,Dentition in man,Bat

e)Draw labeled Diagram

T.S. of Amphioxus,Endoskeleton of Frog: Skull, Pectoral, Pelvic girdle, Fore limbs and hindlimbs.

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

A record of lab work should be maintained and submitted at the time of practical examination for valuation.

Text Books:

1.EKAMBARANATHA AYYAR M and ANANTHAKRISHNAN.T.N(1994)Manual of Zoology vol.I, S.Viswanathan pvt.Ltd.,Madras.

2.AYYAR E.M and ANANTHAKRISHNAN .T.N ,1992. Manual of zoology ,Vo.II(chordata), Viswanathan .S (Printers and Publishers), Pvt., Ltd., Madras 981pp.

Reference Books:

1.BARNES R.D.(1968)Invertebrate zoology W.B.,Saunders company, Philadephia.
2.CHENG (`1964) Parasitology. W.B.company, Philadephia.
3.JORDON, E.L and VERMA .P.S. 1955. Chordate Zoology and Elements of Animal Physiology., S.Chand & Co.
4.KOPTAL , R.L(1997) Modern Text Book of Zoology Vertebrates, Rastogi Publications Meerut, India.
5.MAJUPURIA T.C., 1978. Introduction to Chordates, Pradeep Publications, Jullundur.
6.PARKER and HASEWELL .1964.Text book of zoology Vol.II (Chordata), A.Z.T.B.S Publishers and distributiors , New Delhi 110051m 952 pp.

Course outcomes:

- Dissect and identify the internal organs of invertebrate organisms
- **.**Understand the mounting techniques of parts of the organisms
- Understand the diversity of invertebrates and its outline systematic. Discuss their affinities and adaptations to different modes of life
- Dissect and identify the internal organs of chordates animals.
- To infer the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Chordates

CORE COURSE III
BIOLOGY OF CHORDATES

Internal	**: 25**	**Semester**	**: II**
External	**: 75**	**No. of Hours/ Week**	**: 6**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives:

- To impart current knowledge about the chordate animals of biological interest.
- To know about the Origin ,systematic and functional morphology of various groups of chordates.
- To study the salient features, affinities and adaptations of chordates.
- Able to describe the diversity in form structure and habits of vertebrates.
- Skill to explain characteristics and classifications of different vertebrates.

UNIT I

Prochordates and cyclostomes

1. Origin of Chordates

2. Protochordata - Distinctive features and affinities of Amphioxus, Balanoglossus and Ascidian.

1.General Topic: Retrogressive metamorphosis in Ascidian.

3. Cyclostomata - Distinctive features and affinities

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT II

Fishes and Amphibians

Gnathostomata- Detailed study of Scoliodon(shark)

General Topic

1.Dipnoi and its affinities

2. Accessory respiratory organs in fishes.

3.Adaptive features of Apoda.

4.Parental care in Amphibia.

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT III

Reptiles and Birds

Detailed study of Calotes and Pigeon

1.Identification and distribution of poisonous and non- poisonous snakes of India.

Poison apparatus

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT IV

Mammals

Detailed study of Rabbit.

1.Dentition in Mammal.

2.Aquatic mammals and their adaptations.

3.Prototheria special features with examples**.**

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT V

Comparative Anatomy

1.Comparative study of Heart and Brain in Shark, Frog, Calotes, Pigeon and Rabbit.

2. Endoskeleton of Frog.

(Content- 15 Hrs, Assessment - 3 Hrs) (18 Hrs)

Text Books:

1.AYYAR E.M and ANANTHAKRISHNAN .T.N ,1992. Manual of zoology ,Vo.II(chordata),Viswanathan .S (Printers and Publishers), Pvt., Ltd., Madras 981pp.

2.DHAMI, D.S and . DHAMI J.K. 1978. Chordate Zoology Chand .R & Co

3. DR.THANGAMANI .A, DR.PRASANNAKUMAR.S, DR.NARAYANNAN .L.M, DR.ARUMUGAM. N, 9 th Revised Edition. Saras Publication.

Reference Books:

1. JORDON, E.L and VERMA .P.S. 1955. Chordate Zoology and Elements of Animal Physiology., S.Chand & Co.
2. KOPTAL , R.L(1997) Modern Text Book of Zoology Vertebrates, Rastogi Publications Meerut, India.
3. MAJUPURIA T.C., 1978. Introduction to Chordates, Pradeep Publications, Jullundur.
4. PARKER and HASEWELL .1964.Text book of zoology Vol.II (Chordata), A.Z.T.B.S Publishers and distributiors , New Delhi 110051m 952 pp.

Course outcomes:

- Identify the general and specific characteristics of the different classes and the organization of the representative types
- Recognize and describe the major groups of chordates
- Understand the diversity of Chordates and its outline systematic. Discuss their affinities and adaptations to different modes of life.
- Understand the unique features, taxonomy and functional morphology of different classes of chordates
- To infer the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Chordates.

CORE COURSE IV
CELL AND MOLECULAR BIOLOGY

Internal	**: 25**	**Semester**	**: III**
External	**: 75**	**No. of Hours/ Week**	**: 5**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives:

- To study about the techniques of cell and cellular organelles.
- To understand the basic concept of cell structures and functions.
- To know the cell structure at molecular level in prokaryote and Eukaryote
- Know different molecular and biologic technique
- Able to differentiate prokaryotic and eukaryotic protein synthesis mechanism.

UNIT I

Microscopy – Principles and applications of Light and Electron Microscopes – SEM, TEM. Micro-technique – tissue fixation, embedding, sectioning and staining. Prokaryotes and Eukaryotes – Ultra structure and Organization of Prokaryotes– Bacteria- Virus – Bacteriophage and Animal cell.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT II

Cell membrane - Structure, Modification and functions. Cell organelles- Structure and functions of Mitochondria – Golgi body - Endoplasmic -Reticulum – Lysosome,Centrosome. Ribosomes.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT III

Ultra structure and functions of Nucleus , nucleolus, fine structure of chromosomes, nucleosome concept and role of histones, euchromatin and heterochromatin, Giant chromosomes. Cell division and cell cycle (Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle. Cellular ageing and cell death. Biology of Cancer cell.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT IV

Molecular biology – Gene concept: Structure of DNA - Types and functions of RNA - DNA Replication and DNA-repair mechanisms - Genetic Code - Codon, Anticodon.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT V

Protein Synthesis and processing: Transcription –Initiation – Elongation and elongation factors and Termination; Translation, translational inhibitors, Post- translational modification of proteins. Gene regulation: Operon model transcription – Transcription factors, Regulation in prokaryotes.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

Text Books:

1.ARUMUGAM.N.(2014) – Cell Biology. Saras Publication.

2.DE ROBERTIES&DE ROBERTIES. 1988, Cell & Molecular biology, International edition, Hong kong.

Reference Books:

1.KUMAR, H.D, 1988, Molecular Biology and Biotechonology, Vikas Publishing house, New Delhi.
2. POWER,C.B. 1989.Essential of Cytology, Himalaya Publishing house,Bombay.
3.VERMA P.S&AGARWAL .V.K. 1985 Cytology. Chand .S & Co.
4. TOMAR.B.S&SINGH .S.P. 10th EDI.Cell Biology. Rastogi Publication, Meerut.
5. MUNESWARAN. A.1999. Cell Biology, Brighton Book House, Madras.
6. BERRY .A.K. 2007. A Text book of Cell Biology, Emkay- Publications,Delhi
7. MEYYAN.R.P – Genetics .Saras Publication

Course outcomes:

- To impart knowledge about the prokaryotic and eukaryotic cell, biosynthesis of cellular membranes and organelles and the unified role it plays for the ultimate sustainability of the organisms.
- Rigorous foundation in the principles of molecular and cellular biology give insights into the mechanisms involved in the synthesis and function of macromolecules such as DNA, RNA, and proteins.
- Ability to make connections between the molecular mechanisms, holistic understanding of biological organization and function from the molecules to cells, tissues, organs and entire organism.
- Studying Cells at molecular level trains the students to think logically, critically and quantitatively.
- **.**Learn to interpret statements made in the scientific literature, as well as in non-science areas, based on evidence, not anecdote.

SKILL BASED ELECTIVE COURSE I
APICULTURE

Internal	**: 25**	**Semester**	**: III**
External	**: 75**	**No. of Hours/ Week**	**: 2**
Exam Hours	**: 3**	**Credit**	**: 2**

Course Objectives :

- To Understand the Biology of Honey bee
- Learn the Teaching of apiculture
- Understand the economic importance of honey
- Skill in the apiary management
- Ability to do apiary cost benefit analysis

UNIT I

History and Scope of Bee keeping:Systematics - Species diversity - Types of Honeybees in India; Biology and life-history.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Honey bee colony:Caste polymorphism, Bee keeping equipments-Newton's Bee hive. Honey extracting equipments - Honey extracter, Smoker, Queen excluder, Drone. Excluder and Bee veil.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Apiary Management:Selection of Apiary site - Supplementary feeding in dearth season - Protective measures against Bee predators - Economics of Bee keeping - Cost benefit analysis – Promotional Institution for Apiculture.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Bee products:Bee Products and benefits - Honey - Chemical nature and use. Bee wax, propolis, Royal Jelly, Bee Pollen. Bee pollination and advantages.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Honey bee diseases: Protozoan- Mites - Viral-causes and control

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1.NAGARAJA.N&RAJAGOPAL.D – Honey Bees, Disease,Parasites,Pests,Predators and their Management – MJP Publishers – Chennai

2.RARE, S. 1988 – Introduction to Bee keeping, Vikas Publishing house

Reference Books:

1. CHERIAN, R. & K.R.RAMANATHAN, 1992, - Bee keeping in India.
   .MISHRA, R.C., 1985 – Honey bees and their Management in India, ICAR.
2. SINGH, S. 1992 – Bee Keeping – ICA
3. SHARMA, P. and SINGH, L. 1987 – Hand book of Bee keeping, controller printing and stationery, Chandigar.
4. .RARE, S. 1988 – Introduction to Bee keeping, Vikas Publishing house.
5. SHUKLA, G.S. and UPADHYAY V.B (1997) Economics zoology, Rastogi Publication,
   Meerut.
6. MORSE, R.A. 1990. The ABC and XYZ of Bee culture 40th edition A.1 Root & co., Ohio.
7. MANJU YADAV – Economic zoology – Discovery Publishing house – New Delhi.
8. RAVINDRANATHAN K.R. – A Text book of Economic Zoology.
9. SATHE T.V. – Fundamentals of Bee Keeping –Daya Publishing House – Delhi.
10. NAGARAJA.N&RAJAGOPAL.D – Honey Bees, Disease,Parasites,Pests,Predators and their Management – MJP Publishers – Chennai.
11. MAHINDRU.S.N – BeeKeeping – APH Publishing Corporation – New Delhi

Course outcomes:

- Know the scope of bee keeping and Learn various concepts of apiculture.
- Understand what makes the scientific study of animaland the Bee keeping equipments
- Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field .
- Be aware of a broad array of career options and activities in human medicine, biomedical research and allied health professionsat local or global level.
- **.**Analyse a biological problem, derive testable hypotheses and then design experiments and put the tests into practice

SKILL BASED ELECTIVE COURSE I
BIOINSTRUMENTATION

Internal	**: 25**	**Semester**	**: III**
External	**: 75**	**No. of Hours/ Week**	**: 2**
Exam Hours	**: 3**	**Credit**	**: 2**

Course Objectives :

- This course will give an understanding about the working principles, construction and applications of the instruments used in the studies related to various disciplines of Biological sciences
- Understand the mechanism of different microscope
- Know different spectroscopy
- Familiar cell separation technique
- Hands on training in advanced electrophoresis technique

UNIT I

Basic Instruments (Theory & Demo)

Principles, operation protocol & applications of the following instruments:Weighing balance, pH meter, Polarography, Radioactivity, ECG, FTIR.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Microscopy (Hands on)

Observation of different microbes. Light – Bright & Dark field; Phase contrast, Inverted Phase contrast; Fluorescent, Electron – TEM & SEM; Confocal.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Spectroscopy (Theory & Demo)

Colorimeter, Spectrometer, UV visible spectrometer, X – ray spectrometer, ELISA reader, Atomic absorption spectrometer, Flame photometer, Flourimeter & Spectro flourimeter.

(**Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)**

UNIT IV

Separation Techniques (Theory & Demo)

Centrifugation - Principle, operation, types & applications. Chromatography - Principle, operation & applications - Paper – ascending, descending & Circular, TLC, HPTLC, GC, HPLC, Column Chromatography, Ion Exchange & Affinity Chromatography, LC – MS.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Electrophoresis (Theory & Demo)

Native & denatured - zone, iso-electrofocusing & isotachophoresis, 1D & 2D.PCR, MoldiTof

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. S.SADASIVAM., A. MANICKAM. 1996. Biochemical Methods. 2nd Edition. New Age International (p) Ltd, Publishers.
2. DR. G.RAJAGOBAL., DR. B.D.TOORA. 2001. Practical Biochemistry. 1st Edition. Ahuja Book Company Pvt.Ltd.

Reference Books:

1. .JAYARAMAN. 2000. Laboratory Manual in Biochemistry. New Age International (p).
2. PLUMMER MU, DAVID T.PLUMMER. 1988. Introduction to Practical Biochemistry. Tata McGraw-Hill Education.
3. M. MOOYOUNG. 1985. Comprehensive Biotechnology. Vol. 2, 3 & 4. Pergamon press.

Course outcomes:

- Learn the concept of basic instruments such as pH, Electronic balance, ECG,FTIR and radioactivity and explore its role in various fields
- Understand the principles behind the usage of different microscope. Apply their knowledge in the principle and instrumentation of various separation techniques.
- Analyze the working and sedimentation mechanism of different centrifuge.
- Understand how electrophoresis separate DNA, RNA, or protein molecules based on their size and electrical charge.

NON MAJOR ELECTIVE COURSE I
PUBLIC HEALTH AND HYGIENE

Internal	**: 25**	**Semester**	**: III**
External	**: 75**	**No. of Hours/ Week**	**: 2**
Exam Hours	**: 3**	**Credit**	**: 2**

Course Objectives :

- To enlighten the non- major elective students about the general knowledge on their health and hygiene.
- To create general health awareness the hazardous impacts and remedy.
- Understand the communicable and non communicable disease and its prevention.
- Understand the different environmental pollution and its hazards.
- Learn WHO programme of public health and hazards.

UNIT I

Scope of Public health and Hygiene – nutrition and health – classification of foods – Nutritional deficiency diseases- Vitamin deficiency diseases.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Environment and Health hazards: Environmental degradation – Pollution – Air, Water, Land and Noise-associated health hazards

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Communicable diseases and their preventive and control measures. Measles, Hepatitis, HIV /AIDS,Cholera, Malaria and Filariasis.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Non-Communicable diseases and their preventive measures.Genetic diseases, Cancer, Cardio vascular diseases, Chronic respiratory disease, Diabetes, Epilepsy.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Health Education in India – WHO Programmes – Government and Voluntary Organizations and their health services – Precautions, First Aid and awareness on epidemic/sporadic diseases.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. PARK AND PARK, 1995: Text Book of Preventive and Social Medicine – BanarsidasBhanot Publ. Jodhpur – India.

Reference Books:

1. VERMA, S. 1998 : Medical Zoology, Rastogi publ. – Meerut – India
2. SINGH, H.S. AND RASTOGI, P. 2009 : Parasitology, Rastogi Publ. India.
3. DUBEY, R.C AND MAHESWARI, D.K. 2007 : Text Book of Microbiology- S. Chand & Co. Publ. New Delhi – India.

Course outcomes:

- Understand public health practice requires multidisciplinary team of public health workers and professionals.
- Improve the quality of life through promotion of healthy behaviors including mental health.
- Learn healthy habits to protect yourself from disease and prevent germs and infectious diseases from spreading.
- Understand the Socioeconomic impact of non-communicable diseases.
- Aware of public health is the result of society's efforts as a whole, rather than that of single individuals.

NON MAJOR ELECTIVE COURSE I
FOOD AND NUTRITION

Internal	**: 25**	**Semester**	**: III**
External	**: 75**	**No. of Hours/ Week**	**: 2**
Exam Hours	**: 3**	**Credit**	**: 2**

Course Objectives :

- To learn food sources and energy metabolism in different age group to keep healthy life.
- To crate awareness of requirement of nutrition in different age group.
- To know the diet therapy.
- To know the basal body metabolism.
- To understand the nutrition deficiency and disorders.

UNIT I

Source food composition, properties and storage of common foods, functions of food in relation to health – classification of food based on nutrients, food preservation – food additives. Types of food - body building foods, energy foods and protective foods – Bomb colorimeter.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Essential nutrients: fats, carbohydrates and proteins, Energy needs. Definition of unit of energy – Kcal, RQ, SDA, NPU, Basal metabolism – BMR – factors influencing BMR. Role of fiber in diet.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Micro and macro mineral nutrients: Distribution, sources, metabolic functions and deficiency manifestion vitamins – classification, sorce functions and Deficiency disorder – hyper and hypovitaminosis. Water and electilyte balance

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Nutrition in different stages – Infants, children, adolescents, pregnant, lactating women and old persons.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Principles of diet therapy. Diet during stressed conditions, laborer and patients, therapeutic diets for anemia, malnutrition, obesity, diabetes mellitus and allergy.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. L.G.MEYERS, Food Chemistry, , CBS, 2004, Puiblishers & Distributors.

Reference Books:

1. POLTER 2001, Food science , CBSpublishers & Distributers
2.SWAMINATHAN. M.S, , Essential of food nutritions, Vol I& II , Bangalore printing
3. ANNIE FREDRICK, 2006 A Testbookof food and nutrition, lotus press.

Course outcomes:

- Understand food sources ,types and its composition.
- Learn the essential nutrients and basal body metabolism.
- Understand the mineral nutrients and its deficiency disorders.
- Aware of the requirement of nutrition in different age groups.
- Know the principles of diet therepy

CORE COURSE II

CORE PRACTICAL-II (CC IV & V)

(CELL AND MOLECULAR BIOLOGY, DEVELO[MENTAL BIOLOGY & IMMUNOLOGY)

Internal	**: 40**	**Semester**	**: IV**
External	**: 60**	**No. of Hours/ Week**	**: 2**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives :

- To get hands on training on the techniques of cell and molecular biology, developmental biology and Immunology.
- Ability to observe different stages of cell division
- Skill to differentiate different cell types.
- Identify the developmental stages of frog and chick.
- Learn the roll of lymphoid organs in humans.

UNIT I

1 .Handling of Compound Microscope to study cell types.
2.Squash preparation of Onion root tip to study the stages of Mitosis.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT II

. 1 Squash preparation of Grasshopper testis to study the stages of Meiosis.
2.Squash preparation of Salivary gland of Chironomous larva to study the Giant

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT III

1. Spotters: Centrifuge – Microtome
2. Cell types – Epithelial (3) – Muscular (3) – Vascular – human

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT IV

1.Mouting of Chick blastoderm
2.Observation of developmental stages of.Frog: Egg, Cleavage, Blastula & Yolk plug stage.
Chick: 24 hrs, 48hrs, 72hrs & 96hrs.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT V

(SPOTTERS)

1.Lymphoid organs of Calotes (Thymus and Spleen)

2. Calotes-Cell imprinting of Thymus and Spleen.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

Text Books:

1.ARUMUGAM.N.(2014) – Cell Biology. Saras Publication.

2. ARUMUGAM.N Developmental Biology, Saras publication

3.DULSY FATHIMA .I and N. ARUMUGAM 1998 immunology Saras Publications.

Reference Books:

1. DE ROBERTIES&DE ROBERTIES. 1988, Cell & Molecular biology, International edition, Hong kong.

2.CLARK, W.R 1991 The experimental foundations of modern immunology, Jhon wiley &Sons.

3. VEERA BALA RASTOGI, Developmental Biology, Kedar Nath Ram Nath Publishers, Meerut.

4. DAVID A. THOMPSON. 2011. Cell and Molecular Biology Lab. Manual.

5. P.GUNASEKARAN. 2007. Laboratory Mannual in Microbiology. New Age International.

6. D O HALL, S E HAWKINS. 1974. Laboratory Manual of Cell Biology. British Society for Cell Biology, Published by Crane, Russia.

7. MARY L. LEDBETTER. 1993. Cell Biology: Laboratory Manual. Edition: 2. Published by RonJon Publishing.

Course outcomes:

- Understand cell type and have thorough knowledge on microscope.
- Ability to identify different stages of cell division and get thorough training on squash preparation.
- Understand different cell types in human tissues and trained to operate the instrument microtome, centrifuge,
- Understand and trained different developmental stages of chick. and get hands on training in mounting of chick blastoderm.
- Learn lymphoid organs and know the technique of cell imprinting.

CORE COURSE IV
DEVELO[MENTAL BIOLOGY & IMMUNOLOGY

Internal : 25 | **Semester : IV**
External : 75 | **No. of Hours/ Week : 5**
Exam Hours : 3 | **Credit : 5**

Course Objectives :

- Understand the fundamentals of development
- Understand the factors involving in regulation of development process
- Understand the basics of immune system
- Understand the role of immunity in human.
- Learn the different immunoglobulin.

UNIT I

DEVELOPMENTAL BIOLOGY

Gametogenesis – Spermatogenesis ,. Oogenesis. Structure of human sperm and ovum. Types of Eggs. Fertilization – Physiological changes.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT II

Cleavage – Planes and patterns –Blastulation in Frog. Gastrulation in frog and chick up to the formation of three germ layers. Fate map in Frog . Organogenesis – Eye and Brain in Frog.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT III

Foetal membranes in mammals, Reproductive Cycles - Menstrual cycle, Placentation. Hormonal control of reproduction, Precaution and Health care during Pregnancy and Gestation. Birth Control.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT IV

IMMUNOLOGY

Types of immunity : Innate and Acquired immunity, Active & Passive. Immune System - Lymphoid organs - primary and secondary. Cells of immune system –Lymphocytes, Monocytes, Macrophages, Neutrophils, Basophils, Eosinophils, NK Cells and Null Cells.

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT V

Immunoglobulin – Structure and Functions. Antigen – Antibody Reaction . Cell mediated and humoral mediated immunity- Immune responses- Primary & Secondary . Complement factors – Hypersensitivity

(Content- 13 Hrs, Assessment - 3 Hrs) (16 Hrs)

Text Books:

1.ARUMUGAM.N Developmental Biology, Saras publication
2.BREEY A.K An Introduction to Embryology Emkay Publications

Reference Books:

1.BALINSH.B.I 1981 An introduction to Embryology. W.B Saundars company. Philadelphia.
2.CLARK, W.R 1991 The experimental foundations of modern immunology, Jhon wiley &sons.
3.DULSY FATHIMA .I and N. ARUMUGAM 1998 immunology Saras Publications.
4.ROIFF. J.M 1998 Essential immunology. Backwell scientific publishers.
5.ROIFF.J.M BROSTH OFF.J and D.K MALE 1997 immunology, Mobby international Ltd.
6.CHAKARAVARTHY .A.K Immunology, Tata MC Graw Hill Publishing Co.Ltd New Delhi.
7.VEERA BALA RASTOGI, Developmental Biology, Kedar Nath Ram Nath Publishers, Meerut.
8. S.BANERJEE, Developmental Biology, Dominant Publishers, New Delhi.
9. VAMAN RAO ,Immunology , Narosa Publishing -Chennai.
10.LEON.W.BROWDER , Developmental Biology, Sounders College Publishing, Sounders Japan.
11.BERRIL..N.J. Developmental Biology T.M.H. edition ,Hill Publishing Company Ptd, New Delhi.

Course outcomes:

- Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult.
- Understand how does development affect organization of phenotypes and their variation.
- Aware of the reproductive cycle, hormones, Birth control and critically assess relevant scientific literature in reproductive biology and present their argument in oral and written work.
- Explain the concept of Immunology, Mechanism of immunity, Immunity regulating cells
- Understand the Basic structure, classes and function of Antibodies, Antigen-Antibody interaction.

SKILL BASED ELECTIVE COURSE II
POULTRY SCIENCE AND MANAGEMENT

Internal : 25 | **Semester : IV**
External : 75 | **No. of Hours/ Week : 2**
Exam Hours : 3 | **Credit : 2**

Course Objectives :

- To understand the basics in poultry science.
- To understand the management strategy
- To Understand the economic importance of Poultry
- Skill in observing poultry diseases.
- Skill to become an entrepreneur.

UNIT I

Introduction of Poultry Science – History & Development of Commercial Poultry Industry in India. Classification and Types of Fowls. Housing and Equipments – Construction of Poultry shed, Deep litter system, Cage system. Farming practices of Emu, Turkey, Quail and their importance.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Poultry Nutrition – Feed formulation for Chicks, Growers, Phase I to Phase III Layers & Broilers. Processing and Preservation, Feed additives.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Poultry Breeding – Incubation, Hatchery Management. Brooding, Debeaking – Vaccination, Sanitation and Waste disposal.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Economically important Poultry diseases – Bacterial[Salamonellosis, Pasteurellosis, E.Coli infection], Viral[Ranikhet disese, Fowl pox infections, Bronchits Infection, Bursal disease], Fungal [Aflatoxicosis, Ochratoxicosis], Protozoan[Coccidiosis] – Ticks and Mites – Prevention and Control.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Composition and Nutritive value of egg – Microbial spoilage – Preservation and storage of egg. Poultry meat – Care and Management of Slaughtering – Preservation of Poultry meat – Marketing of Poultry meat – Marketing of Poultry meat. Economic importance of Chicken.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. **BANERJEE, G.C** (1992) A Text book of Animal Husbandry, Oxford and IBM Publishing & co., New Delhi.
2. **SHUKULA, G.S** and **UPADHYAY**, **V.B** (1997) Economic Zoology, Rakesh Rastogi Meerut.

Reference Books:

1. M.R. GNANAMANI – Modern aspects and commercial Poultry keeping – Deepam Publication.
2. JAGADISH PRASAD – Animal Husbandry & Dairy Science.
3. GOVE HAMBIDGE (2012) Diseases and Parasites of Poultry. Published by Biotech Books, New Delhi.
4. KEITH WILSON (2007) A Hand book of Poultry Practice. Published by Agrobios, Jodhpur.

5.RAM PRAKASH SINGH (2008) Published by Biotech Books, New Delhi.

Course outcomes:

- Know commercial poultry industry in India..
- Understand types of poultry, feed formulation and additives
- Have practical knowledge on poultry breeding processes, waste disposal and sanitation.
- Aware of poultry disease prevention and control measures.
- Familiar with management of slaughtering, marketing of poultry meat and its economic importance.

SKILL BASED ELECTIVE COURSE II
DAIRY FARMING

Internal	**: 25**	**Semester**	**: IV**
External	**: 75**	**No. of Hours/ Week**	**: 2**
Exam Hours	**: 3**	**Credit**	**: 2**

Course Objectives

- To understand and identify appropriate resources required for skill development in the field of Dairy farming.
- Skill to develop dairy feeds and identify food additives.
- Understand the infections of dairy farm.
- Ability to observe the microbes in milk.
- Skill to produce dairy products.

UNIT I

Dairy development in India-livestock census-Cattle shed construction-site selection-Different breeds of livestock-cattle,Buffalo(India and Exotic)

a.Milch /dairy : Gir,shiwal,sindhi,jersey,Holstein freisiers.
b.Drought : Kanagayam, Hallikar,Pulikulam
c.Dual : Ongole, Hariyana.
d.Breeds of buffalo : Murrah, jaffrabadi

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Principles of dairy Cattle nutrition-classification of feeds and fodders-Formulation of rations for different classes of dairy animals-System of feeding calves- Utilization of agriculture by products- Preservation of green fodders- food additives and supplements.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Reproductive physiology- Sign of heat- Breeding-Artificial Insemination-natural service-Gestation and parturition-general Management practices (Castratron ,dehoming)-bacterial diseases(Anthrax, ,brucellosis)-Viral diseases(Foot and mouth diseases, Cowpox)-Parasitic diseases (Fascioliasis, Trypanosomiasis)and Infertility.

(**Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)**

UNIT IV

Gross anatomy of udder- Milk secretion – chemistry of milk – Microbiology of milk.

(**Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)**

UNIT V

Steps involved in dairy processing- dairy product,fluid and dried products – Ice cream, butter, cheese, yogurt, paneer, butter milk.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. UMA SHANKAS SINGH- dairy farmimg-Anmol publication Pvt.Ltd.
2. SAXENE.R.K. Food & dairy microbiology.

Reference Books:

1.BYLUND,G.1995.Tetra Pak ,Dairy processing handbook,Tetra pak,processing systems.
2.EARLY,R.1998 The technology of dairy products. Blackie acedmic and professional

Course outcomes:

- Know the different breeds and dairy development in India.
- Identify cattle nutrition, preservation of green fodder, feed additives and feed formulations.
- Ability to impart complex technical knowledge relating to dairy reproductive physiology and disease control measures.
- Ability to have critical thinking and efficient problem solving skills in the milk secretion, chemistry and microbiology of milk
- Capability for asking relevant/appropriate questions relating to issues and problems in the field of dairy products.

NON MAJOR ELECTIVE COURSE II
COMMERCIAL ZOOLOGY

Internal : 25 | **Semester : IV**
External : 75 | **No. of Hours/ Week : 2**
Exam Hours : 3 | **Credit : 2**

Course Objectives :

- To bring about awareness to the various branch of Zoology available to get self employment opportunity
- To generate employments.
- To motivate to become entrepreneurs.
- Skill to develop apiculture in their own house.
- Ability to produce vermicompost.

UNIT I

Vermiculture : Common species – *Eigenia, Endrilues* and *Perionix excavates*. Biology of Earthworm – Vermicomposting – Required conditions- Methods (Pit & Heap) – Advantages - Economic importance.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Apiculture – Species of Honey Bee, Types of Honey Bee – Newton's Bee hive – Care and Management – Honey extraction and Honey Extracting Equipments (Honey Extractor, Smoker, Queen excluder, Drone excluder, Bee veil) – Nutritive and Medical value of Honey. Advantages – Economic importance of Apiculture.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Lac Culture – Life cycle of Lac insect – Economic importance of Lac. **Sericulture:** Life cycle of Bombyx mori – Economic of Silk.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Aquaculture – Construction and Management of Pond. Culture practices of Common carp.
Shrimp Culture– *Penaeus monodon*- Pearl culture.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Poultry farming – Types of Poultry – Care and Management – Poultry Nutrition – Diseases and their management – Composition and Nutritive value of egg – Economics of Poultry production.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1.PILA, T.V.R 1988, Aquaculture principles and practices. Fishing news books.
2.RAMASAMY P 1992 Disease of Shrimps in Aquaculture systems, Vanitha publication

Reference Books:

1. SANTHANAM R 1987 Fisheries science Daya publishing house.
2. SHUKLA G.S and UPADHYAY V.B 1997 Economics Zoology Rastogi publications, Meerut.
3.ARUMUGAM N Aquaculture Saras publications.
4.MORSE R.A 1990 The ABC and XYZ of Bee Culture 40th Edition A.I Root & Co Ohio.
5.MARY VIOLET CHRISTY**.A.** Vermitechnology **,** MJP Publishing ,Chennai.

Course outcomes:

- Learn the courses with excitement of biology along with the self employment opportunity in vermiculture**.**
- Students interested in entrepreneurship and start some small business based on their interest and experience on apiculture.
- Ability to impart complex technical knowledge relating to economic importance of Lac and sericulture.
- Work precisely in aquaculture field by learning culture practice and construction, management of pond.
- Familiar with poultry farming to generate employment opportunity.

NON MAJOR ELECTIVE COURSE II
ORNAMENTAL FISH FARMING

Internal	**: 25**	**Semester**	**: IV**
External	**: 75**	**No. of Hours/ Week**	**: 2**
Exam Hours	**: 3**	**Credit**	**: 2**

Course Objectives :

- To learn the techniques of Ornamental fish farming to develop their skill.
- To become an entrepreneur and provide consultancy service to ornamental fish farms.
- Ability to setup aquarium in business.
- Ability to design aquarium equipments.
- Skill for production of aquarium food.

UNIT I

Importance and scope of ornamental fish culture -Economics. Commercial value andpotential, trends in ornamental fish farming in the world and in India. Taxonomy ofimportant freshwater and marine ornamental fish-indigenous and exotic species.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Popular ornamental fishes: Beta, Colisa, Macropodus, Trichogaster leeri, T. italicsmicrolepis, Zebra fish.Gold fish varieties: Koi, Puntius, tetra, Glass fish, cichilids, angel fish, molly, guppy.Marine species: Hippocampus, scat, Basics on biology, habits (sociability andaggression) and patterns of reproduction.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Mass production of fancy fishes Fish farms: Preparations for breeding – breedingbehaviour of chosen fishes: carp, fighter fish –induced breeding –food and feeding –live feeds: rotifers, tubifex, artificial feeds.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Aquarium design, Construction and preparation: size, shape, substrate, ornamentalaquatic plants. Construction and functions of Biofilters; aerators –accessories for fishtanks –hood and light, nets, suction tube and maintenance of water quality: controllingammonia build up, pH, feeding regimes.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Disease management: Common bacterial, viral fungal, protozoan and crustaceaninfections. Their treatment and control.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. RATH, R.K. (2000) Freshwater Aquaculture. Scientific Publishers (India). PO Box:91,Jodhpur.
2. JHINGRAN, AVG (1991) Fish and Fisheries of India. Hindustan Publishing Co.

Reference Books:

1.BARADACH, JE, JH RYTHER and WO Mc LARNEY (1972). Aquaculture. The Farming And Husbandry of Freshwater and Marine Organisms. Wiley Interscience, New York

2.JAMESON, J.D. and R.SANTHANAM (1996). Manual of ornamental fisheries and Farmingtechnology. Fisheries College and Research Institute, Thoothukudi.

3.MITCHELL BEAZLEY, 1998. The complete guide to tropical aquarium fish care. Readand Consumes Book Ltd., London.

4. Everything for the aquarist. Tetra Werke Publication, West Germany.

5.JAMESON, J.D. Alangara Meen Valarpu (in Tamil). National Book House, New Delhi.

Course outcomes:

- To study the economics and commercial value of ornamental fish farming at India and world level**.**
- Understand the commercial and popular ornamental fish and their reproduction for multiplication.
- Apply the techniques for the mass production of ornamental fish cultivation and production of artificial and synthetic feed.
- Apply their knowledge to design and construct the aquarium and its maintenance.
- Ability to analyze disease and to provide timely control measures and treatment.

CORE COURSE V
GENETICS AND MICROBIOLOGY

Internal	**: 25**	**Semester**	**: V**
External	**: 75**	**No. of Hours/ Week**	**: 4**
Exam Hours	**: 3**	**Credit**	**: 4**

Course Objectives :

- To understand the basics of Genetics
- To study the importance of sex determination and mutation
- To obtain in depth knowledge in Microbiology
- To study the importance of Microbial Diseases
- Distinguish different chromosomal aberration in human.

UNIT I

GENETICS

Mendelien Inheritance- Laws, Monohybrid & Dihybrids cross.
Multiple allele: Blood group inheritance: ABO & RH. Linkage and Crossing over: Mechanism. Drosophila as an example

(Content-129 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT II

Sex Determination

Chronosornal mechanism – Genicbalance theory – Environmental and Hormonal basis – Gynandromorphism. Population Genetics: Hardy – Weinberg law and equilibrium.

(Content-129 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT III

Mutation

Gene mutation – Chromosomal aberrations – Structural deletion – Duplication – Invertion and
Translocation. Numerical – Aneuploidy – Types – Polyploidy- Types – Significance. Human Genetics –Chromosomes – Karyotype.

(Content-129 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT IV

MICROBIOLOGY

Organisation of Bacteria – Gram staining – Gram positive and negative bacteria. Growth curve of Bacteria, Culture medium types (Solid, Semisolod and Liquid) – Serial dilution technique – Streak plate method.

(Content-129 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT V

Microbial genetics: Recombination in Bacteria – Conjugation – Transformation – Transductiopn.
Microbial diseases in Man – Symptoms, causative agent & Treatment of Bacterial diseases –
Tuberculosis, Typhoid, Leprosy. Viral diseases – AIDS, Poliomyelitis, Chicken pox, Measles.

(Content-129 Hrs, Assessment - 3 Hrs) (15 Hrs)

Text Books:

1. MEYYAN.R.P Genetics, Saras Publications
2. SCHLEGEL H.G 1993, General Microbiology, Cambridge University Press.
3. VERMA.P.S and V.K. AGARWAL, 1997, Genetics S.Chand & Co, New Delhi.
4. SHARMA .P.D Microbiology, Rastogi Publications, Meerut

Reference Books:

1. GUNASEKARAN. P 1955, Lab Manual in Microbiology New Age International.
2. PELCZAR. M.J and R.D. REID 1996, Microbiology. Tata Mc Graw Hill.
3. POWER. C.B and H.F. DANGINA WALA. 1987. General Microbiology, HimalayaPunlishing House, Bombay.
4. URSULA GOOD ENOUGH. U 1997, Genetics, Halt Saunders International Edition,Mewyork.
5. GUPTA.P.K. Genetics. Rastogi publication, Meerut.
6. STRICKBERGER, Genetics Prentice Hall of India New Delhi.
7. PUROHIT.S.S Microbiology Fundamentals and application.
8. VEER BALA RASTOGI, A Text book of Genetics, Kedarnath ramnath Publications, Meerut.
9. RAJAN, S. 2009. Medical Microbiology. MJP publishers.
10. SUMITRA JOSHI. 2011. Medical Microbiology,Random publication.

Course outcomes:

- Able to explain the role of the mendelian inheritance and multiple alleles in day to day life activities.
- Understand the cause and effect of alterations in chromosome number in sex determination.
- Understanding the applications of genetics for the welfare of health and treatment of disease, and the impact of selective advantage and natural selection on human genetic disorders.
- Acquired technical skills will help the students for collecting and processing biological specimens for analysis.
- Students enable their critical and analytical thinking in the detection of diseases and to distinguish normal and abnormal microscopic pathogens.

CORE COURSE VI
ENVIRONMENTAL BIOLOGY, BIODIVERSITY CONSERVATION AND EVOLUTION

Internal	**: 25**	**Semester**	**: V**
External	**: 75**	**No. of Hours/ Week**	**: 6**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives :

- To understand the concept of Environmental Biology
- To study the physical, chemical and biological parameters and their impact on
- environment.
- To obtain basic knowledge in Biodiversity Conservation
- To study the values of Evolution

UNIT I

ENVIRONMENTAL BIOLOGY

A Biotic factors: Light,Temperature, Soil – Soil Profile, Water – Physicochemical Characteristics. Ecosystem – Pond as an example. Biotic factors : Symbiosis – Commensalism – Mutualism-Antagonism- Antibiosis- Parasitism- predation and Competition.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT II

Community Ecology – Characteristics of community – Stratification – Community. Interdependence – Ecotone – Edge effect – Ecological niche. Population – Ecology – Definition – Density – Estimation – Natality – Mortality – Age distribution – Age pyramids – Population growth – Population equilibrium – Biotic potential.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT III

BIODIVERSITY CONSERVATION

Introduction – Definition – Types of Biodiversity – Genetic, Species and Ecosystem diversity – Value of Biodiversity – Consumptive use – Productive use, Social, Scientific – Ethical and Aesthetic values, Threats to biodiversity – Habitat loss, Poaching and Man – Wildlife conflicts.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT IV

India as a mega biodiversity, Hot spots of biodiversity, Conservation of Biodiversity – Insitu & Exsitu conservation – Sanctuary, National park & Biosphere reserves in Tamil Nadu, Role of Zoo in Conservations.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT V

EVOLUTION

Origin of life Theories of Evolution – Lamarckism, Darwinism' Devries theory & Modern Synthetic theory , Molecular evolution and Bar-coding of species. Evolution of man with reference to fossils.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

Text Books:

1.ARUMUGAM. N and V. KUMARESAN, Environment and Pollution. Saras Publication

2.AGARWAL, Environmental Biology, AgroBotanical Publishers (India) , New Delhi.

Reference Books:

1.CLARKE G 1954, Elements of ecology, Jhon wiley & sons N.K

2.KENDEIGH S.C 1961 Animal ecology, Prenticehall.

3.ODUM E.P 1971 Fundamentals of ecology W.B Sunders company.

4.SHARMA. P.D 1990 Ecology and Environment, Rastogi publication Meerut.

5.SEDGIWICK C.H 1976 Ecology and the Quality of environment. Van nodtrand.D &Co

6.VERMA.P.S and AGARWAL V.K 1996 principle of Ecology Chand.S & Co New Delhi.

7.RANGANATHAN T.K 1983, Evolution CMS Printingpress.

8.ROSTOGI V.B 1985, Organic Evoluton, Kedarnath Ramnath.

9.SAVAGE G.M 1979 Evolution Amerind Publishing Co.

10.KUMAR U ASIJA M.J 2000, Biodiversity , Principles and conservation.

11.SINHA R.K 1997 Global biodiversity INA shree Pub.Jaipur.

12.NEGI S.S 1993 Biodiversity & its conservation in India, Indus pub Company, New Delhi.

Course outcomes:

- Understand the basic concept of Ecosystem and the factors.
- Know the population and community ecology.
- Aware of sources of pollution, ecological effect and control measures.
- Understand types, values and conservation of biodiversity,
- Compare and contrast the various theories on formation of new species and identify the factors that play a role in the process of evolution and understand the genetic basis of evolutionary change.

CORE COURSE VII
BIOTECHNOLOGY

Internal	**: 25**	**Semester**	**: V**
External	**: 75**	**No. of Hours/ Week**	**: 6**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives :

- To study the concept of Biotechnology
- To study the biotechniques and their expression in animals.
- To understand the importance and application of Biotechnology in various field
- Familiar with tools and technique of biotechnology.
- Understand the applications and principles of biological technique.

UNIT I

Scope and importance, Genetic engineering: Gene cloning: Isolation of desired DNA – insertion of DNA into vector – introducing DNA into host – identification, selection and expression of cloned DNA. Tools of genetic engineering: Enzymes – Vectors – Transposons. Transgenic animals and Plants.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT II

Molecular probes: Southern, Northern and western blotting – gene bank and libraries – Polymerase chain Reaction – Immunotechnology – Monoclonal Antibodies – Production – Uses of Vaccines – Application of biotechnology in medicine – Hormones – Genetheraphy – Grafting – Foetus sexing – Forsenic medicines.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT III

Industrial Biotechnology: Fermentaton: Fermentor – Construction, types-process of fermentation: upstream and downstream, use of fermentation: Ethanol production.
Application of biotechnology inindustry.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT IV

Agricultural Biotechnology: Biofertilizers: microbes as biofertilizers, Culture methods – Single cell protein, nitrogen fixation: nitrogen fixing organisms, mechanism of fixation, Bio Pesticides.
Application of biotechnology in Agriculture and Environmen

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT V

Enzyme biotechnology: Source and uses – Applications of enzymes – Extraction of enzymes:
preparation of crude enzymes, centrifugation, precipitation, purification of enzymes, dialysis
electrophoresis. Immobilization of enzymes – Need, method, types and uses. Basis protein engineering, Biotechnology and future and ethical concern.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

Text Books:

1.GUPTA P.K 1997, Elements of biotechnology Rastogi publications Meerut
2. V.KUMARESAN Biotechnology, Saras Publication.

Reference Books:

1.BALASUBRAMANIA D, 1996, Concepts in Biotechnology, University press (India) Ltd,Hyderabad.
2.CHOPRA V.L and A.NASIM 1996, Genetic engineering and biotechnology, xford & IBH, newDelhi.
3.DHARMARAJAN M 1989, Genetic engineering S.Viswanathan & Co
4.DUBEY R.C 1995, Text book of Biotechnology S. Chand & Co
5.GLICK B.R J.J and pastemark 1998, molecular biotechnology SSM press, Wasington.
6.JOGDAN S.N 1999 advances in biotechnology, Himalaya publishing, New Delhi.
7.PORTER D.G 1992, Ethical scores for animal experiments Nature.,356:101-102.
8.PRIMOSE S.M 1990 Modern biotechnology Blackwell scientific publishers New Delhi.
9.TREVEN M.D 1990 Biotechnology The biological principles Tata Mcgraw Hill publishing Co NewDelhi.
10.VIJAYARAMAN K.S CHELLAMMAL and P.MANILILI 1998 Uyiriyathozhilnutpam,Chimeeraa, Trichy.
11.KESHAV TREHAN Biotechnology Wiley Eastern Limited.
12.HEMANT RAWAT Text book of Biotechnology Oxford Book Company.
13. DUBEY, R.C (2008) A text book of biotechnology. S. Chand and Company, New Delhi.
14 SATHYANARAYANA, U (2005) Biotechnology. Books and Allied P.Ltd. Kolkata.
15. KUMAR H.D (1991) A text book of biotechnology – Affiliated East west.
16. TREHAN (KESHAV) (1990), Biotechnology –Wiley Eastern Ltd.
17. JOGDAN S.V (1993), Advances in Biotechnology -Himalaya.
18. RANA S.V.S (1990) Recent trends in Biotechnology & Biosciences society of Bioscience.
19 .SOHAL (HARVINDER S) ; SRIVASTAVA (Asok.k) (1994), Ashish Pulishing House.
20. IGNACIMUTHU .s (1995) , Basics Biotechnolgy - Tata Mcgraw Hill.
21.PUROHIT S.S MATHUR s.k - Biotechnology: Fundamental and application – Agrobios goel.

22.ABBASI (SA) RAMASAMI E(1999), Biotechnology methods of pollution control.
23.BAHADUR (BIR),ED , Essential of biology & biotechnology.
24.LOHAR(PRAKASH.S)(2004) Biotechnolog

Course outcomes:

- To impart comprehensive understanding of the principles and practices of biotechnology.
- Application of genetic engineering in prevention and diagnosis of diseases and discuss the different applications of biotechnology.
- Understanding the principles and practices of biotechnology give insights into the fermentation technology.
- Understanding the application of genetic engineering in agriculture for production of biofertilizer.
- Know the application of biotechnology in the field of enzyme technology.

CORE PRACTICAL III

PRACTICAL III (CORE COURSE - V,VI, AND VII)
(GENETICS AND MICROBIOLOGY, ENVIRONMENTAL BIOLOGY, BIODIVERSITY CONSERVATION & EVOLUTION, BIOTECHNOLOGY)

Internal : 40 | **Semester : V**
External : 60 | **No. of Hours/ Week : 5**
Exam Hours : 3 | **Credit : 5**

Course Objectives :

- Ability to understand syndromes and mendelian traits in human.
- Skill in microbial basic technique.
- Skill to estimate physiochemical parameters.
- Ability to develop case study report from filed visit.
- Understand the evolutionary fossil record.

UNIT I

A. Genetics

1. Human Karyotype
2. Syndromes in man
3. Mendelian traits

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT II

B. Microbiology

1. Sterilization procedure
2. Fixing and staining of bacteria
3. Serial dilution techniques
4. Streak plate method
5. Spotters: Autoclave – Petri plat

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT III

C. Environmental Biology

1. Measuremental of Physico-chemical parameters in Aquatic environment.

a) Estimation of Dissolved oxygen

b) Estimation of Salinity

c) Estimation of Carbon – di - oxide

2. Indentification of Marine plankton –(4)
3. Animal association – Parasitism – Mutualism and Commensalism
4. Study of Intertidal fauna – Rocky, Sandy and Muddy shore (2 example in each category)
5. Spotters:Secchi disc – Six's Maximum and Minimum thermometer – Anemometer Barometer – Hygrometer.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT IV

D. Biodiversity conservation

Study tour - Study of Protected areas- Field visit, Ecosystems/ Sewage treatment plant/ Biodiversity

E. Evolution

1. Evolutionary importance – Peripatus – Archaeopteryx. Fossil records of man Darwinism finches , Lamarkian giraffee
2. Mimicry – Leaf insect – Stick insect-

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT V

F. Biotechnology

1. Demonstration of Rhizobium Test from Ground nut-MBR Test. (Methylene Blue Reduction Test)
2. Spotters:

a) PCR
b) Southern Blotting
c) Vector (pBR 322, Shuttle vector, Cosmid SV40)
d) Electrophoresis

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

Text Books:

1. V.KUMARESAN Biotechnology, Saras Publicatio
2.ARUMUGAM. N and V. KUMARESAN, Environment and Pollution. Saras Publicatio
3.MEYYAN.R.P Genetics, Saras Publications.
4.SHARMA .P.D Microbiology, Rastogi Publications, Meerut

Reference Books:

1.BALASUBRAMANIA D, 1996, Concepts in Biotechnology, University press (India) Ltd,Hyderabad.
2.CHOPRA V.L and A.NASIM 1996, Genetic engineering and biotechnology, xford & IBH, newDelhi.
3.AGARWAL, Environmental Biology, AgroBotanical Publishers (India) , New Delhi.
4.ODUM E.P 1971 Fundamentals of ecology W.B Sunders company.
5.GUNASEKARAN. P 1955, Lab Manual in Microbiology New Age International.
6. RAJAN, S. 2009. Medical Microbiology. MJP publishers.

Course outcomes:

- Able to explain the role of the mendelian inheritance, and effect of alterations in chromosome number in sex determination.
- Enable their critical and analytical thinking in the detection of diseases and to distinguish normal and abnormal microscopic pathogens
- Know the Ecosystem and the factors**.**
- Understand types, values and conservation of biodiversity.
- understand the principles and practices of biotechnology

MAJOR BASED ELECTIVE COURSE I
APPLIED ENTOMOLOGY

Internal	**: 25**	**Semester**	**: V**
External	**: 75**	**No. of Hours/ Week**	**: 5**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives :

- To understand the classification and working of insect systems
- To understand their adaptations to the environment
- To look into some commercial applications of entomology with special reference to beneficial insects, sericulture, insect pests and their control, vector borne diseases etc.
- Skill to rear and mass production of commercially important insects.
- skill to identify the harmful insect pest.

UNIT I

Taxonomy and Classification: Classification and key characters of important Orders such as Coleoptera (Rhinoceros beetle), Lepidoptera (Plain tiger butterfly), Diptera (Aedes mosquito), Hemiptera(Bed bug), Hymenoptera (Indian Honey Bee), Orthoptera (Grasshopper) , Isoptera
(Termites).

(Content-13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT II

Biology of insects: General organization of a typical Insect - types of head; Thorax – Abdomen – Antenna – Mouth Parts –Legs –Wings - Sense organs; Sound producing organs; Structure of Digestive system – Circulatory system – Excretory system – Respiratory system –
Nervous system – Reproductive system ; Metamorphosis and types; Types of larvae and pupae; Role of endocrine and pheromones.

(Content-13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT III

Commercial Entomology: Apiculture- Biology and life-history of honeybees: Methods ofbeekeeping -Equipment and tools-Apiary management, Bee products, Diseases of honeybees.
Sericulture- Mulberry sericulture - Non-Mulberry sericulture-
Lac culture:-Propagation of lac insects -Natural enemies of lac insects and their management-Lac extraction

(Content-13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT IV

Harmful insects:
Vector borne diseases: Method of transmission of parasitic agents with special reference tomosquitoes and housefly. Host – parasite interaction with examples.Polyphagous insect pests: Locusts, termites, hairy caterpillars, cutworms, gram pod borer.

(Content-13 Hrs, Assessment - 3 Hrs) (16 Hrs)

UNIT V

Insect pests and their control
Insects as crop pests: Major pests of the following crops and their life cycles, Types ofinjuries and nature of damage caused to paddy (Brown pant hopper), sugarcane (Root borer),
pulses (plume moth), vegetables (brinjal-Shoot and fruit borer), Coconut (Red Palm Weevil)and stored grain pests (Pulse beetle).

(Content-13 Hrs, Assessment - 3 Hrs) (16 Hrs)

Text Books:

1. RATHINASWAMY, T.K.1986. Medical Entomology. S.Viswanathan and Co.,Madras.
2. SUNDARI, M.S.N. AND SANTHI, R. 2006. Entomology. MJP Publishers, Chennai.
3. NAYAR, K.K., ANANTHAKRISHNAN, T.N. AND B.V.DAVID. 1989. General andApplied Entomology. Tata McGraw Hill Publications, New Delhi
4. V.B.AWASTHI ,2009.Introduction to General and Applied Entomology. 3rd RevisedEdition .Scientific Publishers,India.Jodhpur.

Reference Books:

1. ANANTHAKRISHNAN, T.N. 2002. Insect Plant Interactions. Oxford and I.B.H, NewDelhi.
2. CHAPMAN, R.F.1988. The insect structure and Function. Cambridge UniversityPress, U.K.
3. RICHARDS, O.W. AND DAVIES, R.G. 1997. Imm's General Text Book of Entomology Tenth Edition. Vol I and II. R.I Publications, New Delhi.
4. DAVID B.V., MURALIRANGAN M.C. AND MEERA MURALI RANGAN. 1992.Harmful and Beneficial Insects. Popular Book Depot, Chennai.
5. RAMAKRISHNA AYYAR T.V. 1989. Handbook of Economic Entomology for SouthIndia. Books and Periodicals Supply Service, New Delhi.
6. FROST S.W.1994. General Entomology. Narendra Publishing House, Delhi.
7. DENNIS S.HILL. 1993.Agricultural Insect Pests of the Tropics and their Control.Second Edition, Cambridge University Press, U.K.
8. CHARLES A TRIPLEHOM AND NORMAN F. JOHNSON 2005. Borror and DeLong's Introduction to the Study of Insects Thomson Brooks/Cole Publishing.U.S.A.
9. RAJEEV K.UPADHYAY, MUKERJII K.G. CHANDA, B.P. AND DUBEY, O.P. 1998. Integrated Pest and Disease Management. APH Publishing Corporation, NewDelhi.
10. V.B.AWASTHI,2007.Agricultural Insect Pests and their control..Scientific

Publishers,India.Jodhpur.
11. M.M.TRIGUNAYAT.2009.AManual of Practical Entomology. 2rd Revised Edition .Scientific Publishers,India.Jodhpur.

Course outcomes:

- Know about the steps required to do insect systematic and classify insect pest using key characters.
- Understand morphology of insect pest.
- Apply the skill for various sustainable commercial production of apiculture, sericulture and lac culture.
- Understandtheimpact of harmful insect pest in agriculture.
- Analyze and apply multi-disciplinary approaches related to integrated pest control.

SKILL BASED ELECTIVE COURSE III
VERMICULTURE

Internal	**: 25**	**Semester**	**: V**
External	**: 75**	**No. of Hours/ Week**	**: 2**
Exam Hours	**: 3**	**Credit**	**: 2**

Course Objectives :

- To study the taxonomy and diversity of Earthworms.
- To know the ecology ,biology and beneficial role of Earthworms.
- To gain basic knowledge in Vermicomposting and Vermiculture.
- To create awareness about vermicompost and its important as fertilizer.
- Ability to provide consultancy services.

UNIT I

Earth worms – Outline Classification – Features of Eudrilidae – Megascolidae – Lumbricidae – Ecological Classification – Epigeic – Anecie and Endogeic forms – Humus Feeders – Humus Formers.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

General body structures of earthworms. Morphology – Coelom – Body wall- LocomotionExcretion- Respiration- Digestive, Circulatory, Nervous and Reproductive systems- Cocoon formation.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Food and Feeding of earthworm -Humus feeders- Humus formers- Saprophages- DetritivoresGeophages Role of earthworms in sustainable agriculture – organic farming – Earthworm activities- soil fertility and texture- soil aeration- water percolation- decomposition and moisture.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Organic wastes: Municipal, Agricultural and other wastes – Animal dung- requirements/ materials required for vermiculture and vermiwash- preparation of pre-digested materials - selection of suitable species, optimal culture condition required-protection from sun light, rain, predator and parasites- methods of harvesting, packing and storage.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Composting – Vermicomposting -Methods – Pit, Heap and Tank. Advantages –Products – Vermicompost and Verrmiwash –Earthworms in waste water management. Economy of Vermiculture. Cost benefits analysis.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. ISMAIL S.A 1970 Vermiculture, The Biology Earth worms, Orient long man, London.
2. L.S RANGANATHAN, Vermibiotechnology from soil Health to human Health, AgrobiosIndia
3. M.SEETHALAKSHMY, DR.R.SHANTHI.2012. Vermitechnology. Saras publication.

Reference Books:

1. EDWARDS C.A and P.J BOHELN 1996, Ecology and Earthworms 3rd Edition Chapman and Hall.
2. LEE K.E 1985 Earth worms Therecology and relationship with soil and land use Academic press, Sydney.
3. V. BANERJII 2003, Environmental Biotechnology.
4. S.C TALASHILKAR & A.A.K DOSANI Earthworms in Agriculture, Agrobios-India.
5. M.MARY VIOLET CHRISTY. 2008. Vermitechnology. MJP Publication.
6. GOWRAV SINGH, Organic farming & Vermiculture, ALP Books.2009.
7. SARANI. Vermicomposting & Vermiwash, Agrotech publishing.2008.

Course outcomes:

- Understand the classification and diversity of earthworm.
- Know the morphology and lifecycle of earthworm
- Aware of the role of earthworm in sustainable agriculture and its feeding habits.
- Apply the advanced techniques in organic wastes.
- Understand different methods of vermincomposting.

SSD -PART IV

SOFT SKILL DEVELOPMENT

Internal : 25 **Semester : V**
External : 75 **No. of Hours/ Week : 2**
Exam Hours : 3 **Credit : 2**

Course Objectives :

- To impart knowledge Self development through inter personal relation, Communication and self presentation.
- To develop inter personal skills.
- Ability to communicate with others.
- Understand the co worker and time management.
- Ability to develop document preparation.

UNIT I

Know Thyself / Understanding Self

Introduction to Self Skills – Self discovery – Developing positive attitude - Improving perception – Forming values

(Content- 3 Hrs, Assessment - 3 Hrs) (6 Hrs)

UNIT II

Interpersonal Skills \ Working with Others

Developing interpersonal relationship – Team building – group dynamics - Net working – improving work relationship.

(Content- 3 Hrs, Assessment - 3 Hrs) (6 Hrs)

UNIT III

Communication Skills \ Working with Others

Art of listening – Art of reading – Art of Speaking – Art of Writing – Art of Writing E – mails –E mail etiquette.

(Content- 3 Hrs, Assessment - 3 Hrs) (6 Hrs)

UNIT IV

Corporate Skills \ Working with Others

Developing body language – Practising etiquette and mannerism – Time Management – Stress Management.

(Content- 3 Hrs, Assessment - 3 Hrs) (6 Hrs)

UNIT V

Selling Self\ Job Hunting

Writing resume\cv – interview skills – discussed – Mock interview – Mock GD – Goal setting – Career planning.

(Content- 3 Hrs, Assessment - 3 Hrs) (6 Hrs)

Text Books:

1. Dr.K.Meena & Dr.V.Ayothi - A book on development of Soft Skills.
2. Dr.K.Alex - Soft Skills. S.Chand & Company Ltd. Ram Nagar, New Delhi -110055

Reference Books:

1. Developing the leader within you John C Maxwell
2. Good to Grent by jim Collins
3. The seven habit of highly effective people Stephen Covey
4. Emotional Intelligence Daniel Goleman
5. You can win shive Khera
6. Principal centred leadership Stephen

Course outcomes:

- Know Thyself / Understanding Self
- Understand Interpersonal Skills \ Working with Others
- Ability to Communication Skills \ Working with Others
- Develop Corporate Skills \ Working with Others
- Learn Selling Self\ Job Hunting

CORE COURSE VIII
ANIMAL PHYSIOLOGY

Internal : 25 | **Semester : VI**
External : 75 | **No. of Hours/ Week : 6**
Exam Hours : 3 | **Credit : 6**

Course Objectives :

- To understand the basics of Physiology.
- To study the structure and physiology of different Organs.
- To acquire in depth knowledge about the endocrine glands and their role.
- Understand the functions of receptors.
- Understand the role of endocrine organs in human.

UNIT I

Nutrition – Types, Digestion in man and role of hormones in digestion. Vitamins – Source, Types and Importance.
Respiration – Types of respiratory organs ,Respiratory pigments in animals. Transport of O2 and CO2 in man.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT II

Circulation –Structure and function of Heart – Composition – Functions of blood in man. Excretion cycle – Mammalian kidney- ultra structure – Urine formation, Osmo - Regulation in fresh water and marine fishes – Homeostasis.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT III

Muscle physiology: Types of Muscle – Ultra structure and contraction of skeletal muscle and chemistry of muscle contraction. Nerve physiology: Neuron – types – nerve impulse and its conduction – Synaptic transmission – reflexes.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT IV

Receptors: Phono and photoreceptors in man. Rhythm – Circadian, Lunar, Diurnal, photo periodicity – Endogenous and Exogenous factors influencing rhythms.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT V

Endocrine glands: Pituitary – Thyroid – Parathyroid, adrenal and Islets of Langerhans. Reproduction – Histomorphology of male and female reproductive system – Role of hormones in reproduction of mammals.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

Text Books:

1. VERMA P.S and V.K AGARWAL 1992 Animal physiology S. Chand & Co.
2. MARIAKUTTIAN A & ARUMUGAM N – Animal Physiology – Saras Publication.
3. KAPOOR.A.S. A text book of Animal Physiology, Emkay publications 1995. Delhi

Reference Books:

1.HONAR H.A 1983 General and Comparative physiology prentice hall of India.
2.LEHNIGAR L 1990 Biochemistry W.H Freeman & Co.
3.NAGABUSHNAM R 1991 Animal Physiology S.Chand & Co.
4.PROSSER C.L and F.A BROWN 1995 Comparative Animal physiology W.B Saunders.
5.WILSON J.A 1984 Principles of Animal physiology, Macmillan.
6.WEST E.S TODD W.R MASON H.S and VANBRUGEN J.T 1963, Text book of biochemistry, Macmillan co. 7.RESTOGI S.C Experimantal Physiology – Restogi Publication – Meerut.
8.BERRY A.K A Text book of Physiology – Amkay Publications – New Delhi.
9.MOHAN.P.ARORA 1992 Animal Physiology, Himalaya publishing house – New Delhi.
10.ASHOK KUMAR BORAL – Mammalian Endocrinology, New Central book Agency P(ltd) – London & Ernakulam.
11.PRAKASH & S.LOHAR, Endocrinology – MJP Publishers- Chennai.
12.MISHRA.S.P.Animal Physiology – Silverline Publications – Allahabad.
13.SOBTI.R.C.Animal Physiology – Narosa Publishing house – Chennai

Course outcomes:

- Know the role of nutrition in human and its source, types and importance. To understand the mechanism of human respiration
- To understand the blood circulation and excretion of human.
- Recognize the complimentary relationship of structure and function of nerves and describe the interactions between different organ systems to maintain homeostasis
- Able to explain the receptors and biological rhythmsin response to internal and external environmental changes.
- Know the role of hormones in reproduction of mammals.

CORE COURSE PRACTICAL
CORE PRACTICAL IV (CC XI & XII)
ANIMAL PHYSIOLOGY & BIOPHYSICS, BIOCHEMISTRY AND BIOSTATISTICS.

Internal	**: 40**	**Semester**	**: VI**
External	**: 60**	**No. of Hours/ Week**	**: 6**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives :

- Ability to quantify human physiological products.
- Understand the different blood cells.
- Familiar with the principles of bio medical instrument.
- Skill to estimate heamoglobin, protein, sugar and albumin.
- Skill in observing, analyzing and calculating various biological data.

UNIT I

I. ANIMAL PHYSIOLOGY

1. Quantitative test for Ammonia, Urea and Uric acid
2. Quantitative test for Carbohydrates, Protein and Lipids.
3. Effect of temperature on the ciliary activity of Fresh water mussel.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT II

4. Total and differential counts of RBC and WBC
5. Demonstration of Blood pressure in Man

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT III

II. BIOPHYSICS

Spotters: Spectrophotometer – pH meter.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT IV

III. BIOCHEMISTRY

1. Simple test Sugar & Albumin in Human urine.
2. Estimation of Haemoglobin in Human blood.
3. Spotters
   a) Amino acid
   b) Haemoglobin
   c) ATP

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT V

IV. BIOSTATISTICS

1. Calculation of Mean – Median & Mode by using Biological data.
2. Calculation of standard deviation and standard error between length and width of Biological samples.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

Text Books:

1. VERMA P.S and V.K AGARWAL 1992 Animal physiology S. Chand & Co.
2. BERRY, A.K. 1988. A text book biophysical chemistry, EMKAY Publication, NewDelhi.
3. SUBRAMANIAN, M.A., 2005. Biophysics principles and techniques, MJP Publisher

Reference Books:

1. MARIAKUTTIAN A & ARUMUGAM N – Animal Physiology – Saras Publication.
2. KAPOOR.A.S. A text book of Animal Physiology, Emkay publications 1995. Delhi.
3.ACKERMAN E, 1962, Biophysical science, Prenticehall, New Delhi.
4.ARORA P.N, 1998, Biostatistics, Himalaya publishing house.
5. DANIEL M, 1992, Basis biophysics for Biologist, Wiley International, New Delhi.

Course outcomes:

- Understand quantitative test of macromolecules.
- Know the Hematological study and its purpose.
- Understand bioinstrument principles and functions.
- Know the technique of biochemical samples
- Apply biostatistics in biological samples.

CORE COURSE IX
BIOPHYSICS, BIOCHEMISTRY AND BIOSTATISTICS.

Internal	**: 25**	**Semester**	**: VI**
External	**: 75**	**No. of Hours/ Week**	**: 7**
Exam Hours	**: 3**	**Credit**	**: 6**

Course Objectives :

- To study the basics of Biophysics and its role.
- To obtain the importance of bio-molecules and metabolic process.
- To know the basic concept of Biostatistics and application in the Bioscience.
- To understand the metabolic pathways.
- Ability to analyze the biological data.

UNIT I

BIOPHYSICS

and Components of Colorimeter and Spectrophotometer.
Colloids – Definition – Types – Properties: Electro kinetic Properties – Donnan equilibrium – Tyndall effect – Surface tension – Brownian movement – Filtration – Osmosis – Adsorption – Diffusion - Dialysis.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT II

Energy sources – Principle and Application of Thermodynamic laws – Free energy; Natural radiation – Theories and Properties of Natural light – Effect of UV light and lionizing radiation – Detection – Disintegration. Measurement of radioactivity – Gieger Muller Counter – Isotopes as tracers.

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT III

BIOCHEMISTRY

Classification -Structure and functions of Proteins – Carbohydrates – Lipids. Enzymes – Classification – Mechanism of action – Kinetics – Co enzymes

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT IV

Metabolism: Protein – Deamination – Transamination, Carbohytrate – Glycogenesis – Glycogenolysis – Glycolysis – Citric and cycle – Oxidative Phosphorylation – Lipids – Oxidation

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

UNIT V

BIOSTATISTICS

Types of data – Collection of data – diagrammatic and Graphical representation of data. Mean Median, Mode and Standard Deviation. Co- Efficient of Variation, Correlation analysis and Regression

(Content-15 Hrs, Assessment - 3 Hrs) (18 Hrs)

Text Books:

1. MEYYAN R.P and Arumurugam N., Biochemistry, Saras Publication
2. BERRY, A.K. 1988. A text book biophysical chemistry, EMKAY Publication, New Delhi.
3. SUBRAMANIAN, M.A., 2005. Biophysics principles and techniques, MJP Publishers

Reference Books:

1.ACKERMAN E, 1962, Biophysical science, Prenticehall, New Delhi.
2.ARORA P.N, 1998, Biostatistics, Himalaya publishing house.
3.DANIEL M, 1992, Basis biophysics for Biologist, Wiley International, New Delhi.
4.DAS D, 1996, Biophysical and Biological chemistry, Academic publishers, Calcutta.
5.SAHAY K.B and SAXENA R.K 1971 Biomechines, Wiley Esten New Delhi.
6.UPATHAY and K.NATH, 1993, Biophysical Chemistry, Himalaya publishing house.
7.FRUCTION J.S and SIMMONDS S.G General and R.H DOL, 1987 Outlilne of Biochemistry Jhon. 8.HORPER H.A 1973, Review phusiological chemistry, Muruzen Asian ED.
9.HOAR W.S, 1983, General and Comparative Physiology, Prentice hall of India.
10.ISRNAEL AZAD, Biophysics , Arise publishers New Delhi.
11.VASANTHA PATTABHI N.GAUTHAM, Biophysics, Narosa Publishing House.
12.VEERBALA RASTOGI, Biostatistics, Ane books India, New Delhi.
13.RAMAKRISHNAN P, Biostatistics, Saras publication New Delhi.
14.KUMARASAMY.V -2012,Biophysics & Bioinstrumentation- Saras Publication.
15.ANNIE – 2010, Biochemistry & Biotechniques – Saras Publications
16.PATTABHI(VASANTHA) and GAUTHAM -2010, Biochemistry - Narosa Publishing house.
17.CASEY, E.J. 1969. Biophysics: Concepts and mechanics, Affiliated East Press

Course outcomes:

- Develop a thorough grounding in fundamental analytical approaches for quantitative study of living systems and life processes.
- To determine the physical phenomena which influence living organisms and some of their basic applications in science and society
- Understand the structure and function of macromolecules.
- Identify the metabolic pathways of macromolecules
- Know to analyze the biological data and document preparation.

MAJOR BASED ELECTIVE COURSE II
MEDICAL LAB TECHNOLOGY.

Internal	**: 25**	**Semester**	**: VI**
External	**: 75**	**No. of Hours/ Week**	**: 5**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives :

- To know the clinical use of instrumentation.
- To study the analysis of blood, urine, sputum, semen and stool.
- To study the nature and causes of various diseases.
- To understand the blood component in human.
- Skill in diagnosing the human disease.

UNIT I

Clinical Diagnostic equipments – Sphygmomanometer – Stethoscope – Compound microscope Centrifuge – Hot air over – Autoclave – Incubator – Refrigerator – Laminar airflow – Spectrophotometer – X-ray(Chest, Heart, Plain, Abdomen, Bones), MRI & CT Scans – ECG and EEG.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT II

Collection of Blood – Blood grouping – blood bank – Haemocytometer – Total count of Blood cells (RBC & WBC). Differential count of WBC (Leishman's stain), Platelet count, Absolute Eosinphil counts, Packed cell volume, ESR, Determination of clotting time and Bleeding time. Haemoglobimeter – Hb (Sahli's method) – Aneamias Diagital Glucometer – Blood glucose.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT III

Glucose tolerance test(Diabetes Mellitus), Atherosclerosis, Heart failure, Cholesterol, HDL, LDL, Urea, Creatine, Creatitine, Bill salls and Bile pigments.Composition of Urine, Methods of Urine analysis for sugar, Urea & Albumin. Glucosuria – fehling's test, Pregnency test and Widal test.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT IV

General Examination – Temperature, Pulse, BP (Normal, Hypertension and Hypotension), Edema and Jaundice. Medical Emergencies – Respiratory failure, Shocks, Acute Gastroentreritis (food poisoning), haemophilia, Acute renal failure, Hypoglycemia, Amoebic dysentery, Snake bite, Rabies, Drowning. Safety precautions and First aid treatment for Superficial Wounds, Burns, Chemical poisoning and Electrical shock.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT V

Diagnostic methods of Protozoan parasites – Malarial parasites and Entamoeba histolytica – Helminthes parasites – Ascaris, Tapeworm, Wuchereria and Hook Worm. VDRL test, ELISA, Thyroid function test, Analysis of semen, Sputum and stools.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

Text Books:

1.SAMUEL K.M – Notes on Clinical lab.
2.DR. NAGINI Text Book of Biochemistry.
3.NANCY.SR.2004.Nursing Arts Procedure- Sole Distributors –N.R.Brothers- M.Y.H Road – Indore.
4.ARUMUGAM.N.2014.Biotechniques- Saras Publication – Nagerkoil – Kanyakumari.

Reference Books:

1.METHAS P.J 1988, Practical medicine for student and Practitioners. The National book Department Mumbai,Pp 1-180.
2.GURUMANI N 2006, Research methodology for biological science. MJP Publications, Chennai.
3.HAROLD VARIEY 1988 Practical Clinical Biochemistry.
4.CHATTERJEE- Clinical Biochemistry.
5.KANAI .L.MUGARGEE-2005, Medical Laboratory Technology-A Procedure Manual for routine diagnostic tests-Tata Megraw Hill Publications.
6.PANIKAR C.K J AND ANATHANARAYANAN- A Text book of Microbiology.
7.LEHINGER – Biological Chemistry.
8.RAJAN.S & SELVI CHRISTY.R – Experimental Procedures in life sciences – Anjanaa Book – Koyembedu – Chennai.
9.RAMNIK SOOD ,2015 Concise Book of Medical laboratory Technology- Health Science Publications

Course outcomes:

- Acquired technical skills will help the students for collecting and processing biological specimens for analysis.
- Understand fundamental analytical principles and processes used in clinical laboratory testing
- Application of medical laboratory test will enable the students to understand normal and abnormal
- Students enable their critical and analytical thinking in the detection of diseases.
- Application of medical laboratory procedures will enable the students to distinguish normal and abnormal microscopic pathogens.

MAJOR BASED ELECTIVE COURSE III
ECONOMIC ZOOLOGY

Internal	**: 25**	**Semester**	**: VI**
External	**: 75**	**No. of Hours/ Week**	**: 5**
Exam Hours	**: 3**	**Credit**	**: 5**

Course Objectives :

- To study the culture aspects of fish, prawn, pearl and lac.
- To study the economic importance of fish, prawn, pearl, and lac..
- To gain knowledge in piggery and rabbit farming.
- Ability to rear commercially important edible gastropod species.
- Understand the culture of lack for jewellery shop.

UNIT I

Fish Culture – Composite Fish culture (Catla, Rohu, Mrigal) – Site selection – Pond construction – Water sources – Layout and Design – sea bass culture. Ornamental fish culture –Design and setting up of fish tank – types, construction, Accessories and Maintenance of Home aquarium. Aquarium plants and their uses.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT I I

Crustacean Fishery: Scope of shrimp fishery – Species of Shrimp – Culture of Marine shrimp – Spoilage of shrimp – Preservation and processing of shrimp . Culture of Macro trachium bosenbergii. Mud crab culture and fattening of crab.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT III

Lac culture: Status of Lac industry in India – Distribution – Description – Life history – Enemies of Lac insect – Composition of Lac – Host plants – cultivation of Lac insect – Inoculation – Swarming – Use of Lac – Economic importance of Lac.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT I V

Molluscan Fisheries: Commercially important edible species – Pearl industry – Pearl culture technique – Problem of Pearl industry – Artificial pearl – Edible oyster culture. Brief accounts on leather Industry – Wool Industry – By product of Fish Industry – Pharamaceuticals from Animals – Rabbit FarmiNG.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

UNIT V

Status of piggery – The country pigs – Advantages of Pig production – Selection and types of Breed – Feeding management – Gestation period – Artificial Insemination – Slaughter of Pigs – Product of piggery and other uses – Diseases control.

(Content-12 Hrs, Assessment - 3 Hrs) (15 Hrs)

Text Books:

1.MANJUYADAV – Economic zoology – Discovery Publishing house – New Delhi

Reference Books:

1.G.S SHUKLA & V.B UPADHYAY – Economic zoology, Rastogi publications – Meerut.

2.K.R. RAVINDRANATHAN – A Text book of Economic Zoology – Dominet Publisher.

3.K.K.C. VISHWAPREMI (2011) Economic Zoology. Published by Silver line Publications

Course outcomes:

- Explore various techniques used in fishery practices. Understanding the scientific terms, concepts, facts, phenomenon & their interrelationship of fish.
- Aware of the crustacean fishery and field management practices
- To understand Lac culture status in India and its economic importance.
- To understand the economic importance of Molluscan fisheries and knowledge on mass culture and enrichment of live food organisms.
- To gain in depth knowledge and field exposure on sustainable piggery practices.

PG & RESEARCH DEPARTMENT OF ZOOLOGY

ALLIED ZOOLOGY

(I B.SC CHEMISTRY)

2019 – 2020

Semester	Paper	Title	Inst hrs	Credit	Exam hrs	Marks		Total
						I.A	U.E	
I	Allied Course-I	I -Biology of Invertebrates and Chordates	4	4	3	25	75	100
	Allied Course –II	II -Allied Zoology Practical	3	-	-	-	-	-
II	Allied Course –II	II -Allied Zoology practical	3	3	3	40	60	100
	Allied Course -III	III –Entrepreneurial Zoology	4	4	3	25	75	100
			14	11	-	-	-	300

ALLIED COURSE-I

ALLIED ZOOLOGY (I B.SC., CHEMISTRY)

AC–I -BIOLOGY OF INVERTEBRATES AND CHORDATES

Internal	**: 25**	**Semester**	**: I**
External	**: 75**	**No. of Hours/ Week**	**: 4**
Exam Hours	**: 3**	**Credit**	**: 4**

Course objectives:

- To learn the organization and life history of invertebrate and vertebrate organisms.
- Able to identify invertebrate and vertebrate fauna.
- Identify the larval forms.
- Learn the affinities of fauna.
- Understand the internal organs of fauna.

BIOLOGY OF INVERTEBRATES

UNIT I

Organisation and life history

Phylum Protozoa - Paramaecium.
Phylum Porifera - Ascon sponge
Phylum Coelenterata - Obelia

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Organisation and life history

Phylum Platyhelminthes - Taenia solium
Phylum Ashelminthes - Ascaris
Phylum Annelida - Earthworm

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Organisation and life history

Phylum Arthropoda - Tiger Prawn
Phylum Mollusca - Freshwater mussel
Phylum Echinodermata - Star fish

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

BIOLOGY OF CHORDATES

UNIT IV

Pisces – Shark – External feature & Respiratory system
Amphibia – Frog – External feature , Excretory & Circulatory system
Reptilia – Calotes – External feature & Structure of Brain.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Aves – Pigeon – External feature , Respiratory system & Flight adaptation
Mammalia – Rabbit – Dentition, Digestive system and Urinogenital system.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. Nair,N.C., Leelavathy, S., Soundarapandian, N., Murugan, T., and Arumugam, N. 2010.
   A Text Book Of Invertebrates. Saras Publication, Nagercoil. 3rd Edition. ISBN: 978-81-89941-53-6.
2. Jordan,E.L., and Verma,P.S. 2014. Invertebrate Zoology. S.Chand Pub. New Delhi. ISBN:81-219-0367-X.

Reference Books:

1. Prasad,S.N.,and Kashyap,V.,2011.A Text Book of Vertebrate Zoology,New age International (P) LTD., Publishers, New Delhi. 14th Edition – Pages:710.
2. Thangamani,A.,Prasannakumar.S.,Narayanan,L.M., and Arumugam,N.,2014. A Text Book of Chordates, Saras Publication, Nagerkoil. 25th Edition – Pages: 956.

Course outcomes:

- Understood the Organization of various groups of invertebrates and chordates.
- Acquired knowledge on the characteristics and adaptations of invertebrates and chordates.
- Identify the organization and life history of invertebrate and vertebrate organisms.
- Learn the affinities of fauna.
- Understand the internal organs of fauna.

ALLIED COURSE –II

ALLIED ZOOLOGY PRACTICAL

(BIOLOGY OF INVERTEBRATES & CHORDATES AND ENTREPRENEURIAL ZOOLGY)

Internal : 40 **Semester : II**
External : 60 **No. of Hours/ Week : 3**
Exam Hours : 3 **Credit : 3**

Course objectives:

- To dissect invertebrate and vertebrate fauna.
- To mount important body parts.
- To identify invertebrate and vertebrate animals.
- To learn Economically important fauna
- To understand by product of important animals.

UNIT I

I DISSECTION

1. Earthworm- Digestive system and Nervous system
2. Freshwater Mussel- Alimentary canal
3. Fish – Digestive system

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

II MOUNTING

1. Earthworm - Body setae and Pineal setae
2. Mouthparts - Cockroach, Honey Bee and Mosquito
3. Shark - Placoid scales

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

III SPOTTERS

Invertebrata

Paramecium caudatum – Entire, Paramecium – Conjugation, *Obelia genicultata* - Entire
Taenia solium – Entire, Scolex, Neries, Pila, Star fish

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Chordata

Shark, Flying fish, Hyla, Bufo, Calotes, Cobra, Pigeon, Bat, Rabbit

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Entrepreneurial Zoology

1.Earthworm, Honey Bee, Lac insect, Silk Insect, Catla, Rohu, Mirgal, Tiger Prawn, Pearl oyster and Hen

Products of Animal

Vermicompost, Honey, Lac, Silk,Pearl , Hen egg, Fish liver oil

A record of lab work should be maintained and submitted at the time of practical examination for valuation.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. Ramasamy,P., 1992. Diseases of Shrimps in aquaculture systems, Vanitha publication
2. Arumugam**, N**. Aquaculture Saras Publications.
3. Nair,N.C., Leelavathy, S., Soundarapandian, N., Murugan, T., and Arumugam, N. 2010. A Text Book Of Invertebrates. Saras Publication, Nagercoil. 3rd Edition. ISBN: 978-81-89941-53-6.
4. Jordan,E.L., and Verma,P.S. 2014. Invertebrate Zoology. S.Chand Pub. New Delhi. ISBN:81-219-0367-X.

Reference Books:

1. Shukla, G.S. and Upadhyay V.B. (1997) Economics Zoology, Rastogi publications, Meerut.
2. Morse, R.A. 1990. The ABC and XYZ of Bee Culture 40th Edition A.I. Root & Co., Ohio.
3. Manjuyadav**.**,(2003).Economic Zoology ,Discovery Publishing House. New Delhi
4. Prasad,S.N.,and Kashyap,V.,2011.A Text Book of Vertebrate Zoology,New age International (P) LTD., Publishers, New Delhi. 14th Edition – Pages:710.
5. Thangamani,A.,Prasannakumar.S.,Narayanan,L.M., and Arumugam,N.,2014.
6. A Text Book of Chordates, Saras Publication, Nagerkoil. 25th Edition – Pages: 956.

Course outcomes :

- Familiar to dissect invertebrate and vertebrate animals.
- Understand the mounting purpose of different body parts of animals
- Able to identify and classify invertebrate and vertebrate animals.
- Understand the culturing of important insects
- Able to produce by products from beneficial insects.

ALLIED COURSE –III
AC III ENTREPRENEURIAL ZOOLGY

Internal	**: 25**	**Semester**	**: II**
External	**: 75**	**No. of Hours/ Week**	**: 4**
Exam Hours	**: 3**	**Credit**	**: 4**

Course objectives:

- Acquired knowledge on various branch of Zoology available to get the self employment opportunity .
- To generate employments.
- To motivate to become entrepreneurs.
- Able to culture economically important insects.
- Learn to construct poultry farm, aquaculture farm.

UNIT I

Vermiculture-Types :*Eisenia fetida, Eudrilus eugenia*, and *Perionyx excavatus* Biology of Earthworm – Vermicomposting **-** Required Conditions – Methods (pit and heap) – Advantages – Economic importance of vermiculture

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT II

Apiculture – Species of Honey Bee, Types of Honey bee – Newton's Bee hive – Care and Management – Honey extraction and Honey extracting equipments (Honey extractor, Smoker, Queen excluder, Drone excluder, Bee veil. – Nutritive and Medicinal value of Honey, Advantages –Economic importance of Apiculture

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT III

Lac Culture – Life cycle of Lac insect - Economic importance of Lac.
Sericulture: Life cycle of *Bombyx mori* – Economic importance of silk.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT IV

Aquaculture – Construction and Management of Pond. Culture practices of Common Carp.
Shrimp Culture – *Penaeus mondon*- Pearl culture

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

UNIT V

Poultry farming – Types of Poultry – Care and Management – Poultry nutrition – Diseases and their management – Composition and Nutritive value of egg- Economics of Poultry production.

(Content- 9 Hrs, Assessment - 3 Hrs) (12 Hrs)

Text Books:

1. **Ramasamy,P**., 1992. Diseases of Shrimps in aquaculture systems, Vanitha publication
2. **Arumugam, N**. Aquaculture Saras Publications.

Reference Books:

1. **Shukla, G.S**. and **Upadhyay V.B**. (1997) Economics Zoology, Rastogi publications, Meerut.
2. **Morse, R.A**. 1990. The ABC and XYZ of Bee Culture 40th Edition A.I. Root & Co., Ohio.
3. **Manjuyadav.**,(2003).Economic Zoology ,Discovery Publishing House. New Delhi

Course outcomes :

- Able to do self employment opportunity in the field of Vermiculture
- Able to generate employment opportunity in Apiculture.
- Know the life cycle of economically important insect.
- To motivate to become entrepreneurs.
- Able to produce by products from commercial insects.