A.D.M. COLLEGE FOR WOMEN

(AUTONOMOUS)

Nationally Accredited with "A" Grade by NAAC - 3rd Cycle

(Affiliated to Bharathidasan University, Thiruchirappalli)

No.1, College Road, Velippalayam,

Nagapattinam – 611 001, Tamil Nadu, India

SYLLABUS

B.Sc. ZOOLOGY

(2021-2024 Batch)

PG AND RESEARCH DEPARTMENT OF ZOOLOGY

B.Sc. Zoology COURSE STRUCTURE UNDER CBCS
(2021-2024 Batch)

OBE ELEMENTS

Programme Educational Objectives (PEO):

PEO 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
PEO 2:	To acquire basic skills in the observation and study of nature, biological techniques, experimental skills and scientific investigation.
PEO 3:	To address the socio-economical challenges related to animal sciences.
PEO 4:	To facilitate students for taking up and shaping a successful career in Zoology and its related subject.
PEO 5:	To gain experience investigating life science problems and to solve them.

Programme Outcomes (PO):

On completion of the course the learner will be able

PO 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.
PO 2:	To appreciate the complexities of biological organization and address scientifically controversial issues in a rational way.
PO 3:	To assess the scope of animal biology and select particular areas for further study.
PO 4:	To inculcate transformational impact on the quality of education and to inspire the students to adopt scientific temper and live with scientific values.
PO 5:	To make the students aware of applications of Zoology and to highlight the potential of various branches to become an entrepreneur.

Programme Specific Outcomes (PSO):

On completion of the course the learner will be able

PSO 1:	Gain the knowledge of Zoology through theory and practical's. and analyze the relationships among animals with their ecosystems
PSO 2:	Learn to classify the major groups of organisms under different phyla, understanding the functioning of organisms.
PSO 3:	Able to compare and contrast anatomical and physiological characteristics of animals and understand good laboratory practices as per laboratory standards
PSO 4:	Handling the sophisticated instruments/equipment to develop technical skills, research oriented skills about research methodologies.
PSO 5:	Develop effective communication and skills of problem solving methods.

B.Sc., Zoology 2021- 2024 Batch

STRUCTURE OF THE PROGRAMME

Part	Title of the part	No. of Courses	Hours	Credit
I	LC- Language Course	4	24	12
II	ELC – English Language Course	4	24	12
III	CC- Core Course	13	72	65
	AC –Allied Course	6	28	18
	MBE - Major Based Elective	3	15	15
IV	NME - Non- Major Elective	2	4	4
	SBE - Skill Based Elective	3	6	6
	SSD – Soft Skill Development	1	2	2
V	ES - Environmental Studies	1	2	2
	VE - Value Education	1	2	2
	EA - Extension Activities	0	0	1
	GS - Gender Studies	1	1	1
	Total	**39**	**180**	**140**

* Extra Credit Courses:

- Semester I - **Community Medicine-I**
- Semester II- **Community Medicine-II**

SCHEME OF THE PROGRAMME

Sem.	Part	Course Code	Course	Ins. Hrs	Credit	Exam Hours	Marks		Total Marks
							CIA	SE	
I	I	LCTA	LC- Language Course I- **Tamil/Other Language. –Ikkala Ilakkiyam**	6	3	3	25	75	100
	II	LCEA	ELC – English Language Course I - **Prose for Effective Communication**.	6	3	3	25	75	100
	III	ZUA	CC- Core Course I - **Biology of Invertebrates**	6	6	3	25	75	100
		ZUCY	CC- Core Course III - **Practical – I: Biology of Invertebrates and Chordates**	3	-	-	-	-	-
		WUA1	AC – I-Allied Course I – **Botany-I**	4	3	3	25	75	100
		WUA2Y	AC – I-Allied Course II – **Botany Practical-II**	3	-	-	-	-	-
	IV	VE	Value Education	2	2	3	25	75	100
			Total	**30**	**17**	**-**	**-**	**-**	**500**
II	I	LCTB	LC- Language Course II - **Tamil/Other Language- Idaikala Ilakkiyamum Puthinamum**	6	3	3	25	75	100
	II	LCEB	ELC – English Language Course II – **Poetry for Effective Communication**	6	3	3	25	75	100
	III	ZUB	CC - Core Course II - **Biology of Chordates**	6	6	3	25	75	100
		ZUCY	CC- Core course III - **Practical – I: Biology of Invertebrates and Chordates**	3	3	3	40	60	100
		WUA2Y	AC –I-Allied Course II – **Botany Practical-II**	3	3	3	40	60	100
		WUA3	AC –I- Allied Course III – **Botany-III**	4	3	3	25	75	100
	IV	ES	ES – Environmental Studies	2	2	3	25	75	100
			Total	**30**	**23**	**-**	**-**	**-**	**700**

III	I	LCTC	LC- Language Course III - **Tamil/Other Language- Kappiyamum Nadagamum**	6	3	3	25	75	100
	II	LCEC	ELC – English Language Course III- **Drama for Effective Communication**	6	3	3	25	75	100
	III	ZUD	CC - Core Course IV- **Cell Biology**	6	6	3	25	75	100
		ZUFY	CC- Core course - **Practical – II (Core Course III & IV)**	3	-	-	-	-	-
		QUA1	AC –II- Allied Course I- **Chemistry-I**	4	3	3	25	75	100
		QUA2Y	AC- II- Allied Course II - **Chemistry Practical**	3	-	-	-	-	-
	IV	ZUE1	NME -Non Major Elective I - **Public Health and Hygiene / Food and Nutrition**	2	2	3	25	75	100
			Total	**30**	**17**	**-**	**-**	**-**	**500**
IV	I	LCTD	LC- Language Course IV - **Tamil/Other Language- Pandaya Ilakkiyamum Urainadayum.**	6	3	3	25	75	100
	II	LCED	ELC – English Language Course IV- **Short stories for Effective communication**	6	3	3	25	75	100
	III	ZUE	CC - Core Course V - **Developmental Biology**	4	4	3	25	75	100
		ZUFY	CC- Core Course VI- **Practical – II (Core Course III & IV)**	3	4	3	40	60	100
		QUA2Y	AC- II- Allied Course II - **Chemistry Practical**	3	3	3	40	60	100
		QUA3	AC –II- Allied Course III- **Chemistry-II**	4	3	3	25	75	100
	IV	ZUE2	NME - Non Major Elective II - **Commercial Zoology /Ornamental Fish Farming**	2	2	3	25	75	100
	V	ZUS1	SBE – Skill- Based Elective I – **Apiculture / Bioinstrumentation**	2	2	3	25	75	100
			Total	**30**	**24**	**-**	**-**	**-**	**800**

V	III	**ZUG**	CC - Core Course VII- **Animal Physiology**	5	5	3	25	75	100
		ZUH	CC- Core Course VIII- **Genetics and Evolution**	5	5	3	25	75	100
		ZUI	CC - Core Course IX - **Microbiology**	5	5	3	25	75	100
		ZUJY	CC- Core Course X - **Practical III (Core Course - V,VI, and VII)**	4	4	3	40	60	100
		ZUE3	MBE –Major Based Elective I - **Vermiculture / Coastal Aquaculture**	5	5	3	25	25	100
	IV	**ZUS2**	SBE –Skill Based Elective II - **Poultry science/ Dairy farming**	2	2	3	25	25	100
		ZUS3	SBE – Skill Based Elective III - **Animal Biotechnology/ Economic Entomology**	2	2	3	25	25	100
		SSD	Soft Skills Development	2	2	3	25	25	100
			Total	**30**	**30**	**-**	**-**	**-**	**800**
VI	III	**ZUK**	CC- Core Course – XI - **Environmental Biology**	7	6	5	25	75	100
		ZUL	CC- Core Course – XII - **Immunology**	7	6	3	25	75	100
		ZUMY	CC -Core Course XIII - **Practical – IV (Core Course VIII and IX)**	5	5	3	40	60	100
		ZUE4	MBE – Major Based Elective II- **Medical Lab Technology /Bioinformatics**	5	5	3	25	75	100
		ZUE5	MBE – Major Based Elective III- **Economic Zoology/Wild life Biology**	5	5	3	25	75	100
	V		EA - Extension Activities-	-	1	-	-	-	-
		GS	GS - Gender Studies-	1	1	3	75	75	100
			Total	**30**	**29**	**-**	**-**	**-**	**600**
			Grand Total	**180**	**140**	**-**	**-**	**-**	**3900**

Semester-I / Core Course-I	**CC I - BIOLOGY OF INVERTEBRATES**	Course Code: **ZUA**
Instruction Hours: 6	Credits: 6	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To understand the systematic and functional morphology of various groups of invertebrates. 2. To study the characteristics, economic importance, affinities and adaptations of invertebrates. 3. Understand the non chordate animals in the world that surrounds us. 4. Observe the process of evolution from unicellular cells to multi cellular organism. 5. Able to recognize economically important invertebrate fauna.
Unit I	**General characters and classification of protozoa up to Order with suitable examples of biological interest.** 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
Unit II	**General characters and classification of Coelenterata up to Order with suitable examples of biological interest.** 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*)

Unit III	**General characters and classification of Nemathelminthes up to Order with suitable examples of biological interest.** 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
Unit IV	**General characters and classification of Arthropoda up to Order with suitable examples of biological interest.** Phylum Arthopoda - Detailed study of Penaeus monodon 1. Organisation & affinities of Peripatus 2. Crustacean larvae & their significance 3. Economic importance of Insects**.**
Unit V	**General characters and classification of Mollusca and Echinodermata up to Order with suitable examples of biological interest.** 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**.**
Unit-VI (Activity)	**Study about the Human protozoan diseases in the society.**

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 et al., 2015. 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,.)
4. JORDON E.L and VERMA P.S.(`2020) Invertebrate zoology S.chand & co
5. KOPTAL R.L(1997)Modern text book of zoology, Rastogi company,Meerut(VP),India.
6. PARKER and HASEWELL(1964) Text book of zoology vol.I (Invertebrate)AZTBS. Publishers and distributes-New Delhi 11051- 874pp.
7. PRASAD .S.N.- Text book of Invertebrate zoology kitab mahal, Allahabad.
8. DHAMI.P.S and J.K.DHAMI. (2003).Invertebrate Zoology, Chand .R and Co Publishers – New Delhi.
9. KADAM .K .The Invertebrates Emkay Publication, Delhi.

e- Resources:

1. http://india.accurascan.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Able to describe the distinguishing characteristics of the major taxa.
CO 2:	Recall certain morphological attributes and physiological processes that are distinct and significant to each Phyla
CO 3:	Understand the systemic and functional morphology of various groups of invertebrates Explain the basic aspects of structural and functional details of Invertebrates
CO 4:	To compare and understand the general and specific characteristics within each Phyla.
CO 5:	Interpret the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Non Chordates

Mapping of Cos with Pos & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-I / Core Course-III	**CP I - BIOLOGY OF INVERTEBRATES AND CHORDATES - PRACTICAL**	Course Code: **ZUCY**
Instruction Hours: 3	Credits: 3	Exam Hours: 3
Internal Marks – 40	External Marks- 60	Total Marks: 100

Course Objectives:	**1.** To demonstrate the internal anatomy of Invertebrate and vertebrate animals. **2.** To study about the various characteristic features and adaptations of Invertebrates and vertebrate animals. **3.** To mount the important parts of Invertebrate animals. **4.** Understand the comparative anatomy of chordates. **5.** Learn biological significance of invertebrates and chordates.
Unit I	DISSECTIONS 1. Earthworm: Digestive system and Nervous system 2. Lamellidens: Digestive system 3. Pila: Digestive system
Unit II	MOUNTING 1. Earthworm: Body setae 2. Prawn: Appendages 3. Mouth parts of Mosquito, Honey Bee and House Fly. 4. Pila: Radula
Unit III	**SPOTTERS** 1. Classify Giving Reason. Amoeba, Plasmodium, Metridium, Megascolex, , Periplaneta,. 2. Draw labeled sketch T.S.of Planaria, T.S. of Sea anemone, T.S of Taenia solium, & T.S of Nereis. 3. Biological significance Gemmule of sponge, Physalia, , Heteronereis, Limulus, Sepia, 4. Relate structure and function Sponge Spicules, Tape worm- Scolex, Nereis- Parapodium, Starfish- Pedicellari, 5. Write notes on adaptation Madrepora, Chaetopterus, Cyclops, Octopus, Mytilus,
Unit IV	**BIOLOGY OF CHORDATA** Dissection Shark: Mounting of placoid scales Fish – Digestive system

Unit V	**Spotters** 1. Classify giving reasons: Balanoglossus, Shark, Calotes versicolar, Pigeon, Rabbit b)Biological significance Amphioxus, Ascidian,Narcine Axolotyl larva, Draco volans, Chaemelion. c) Write notes on Gambusia affinis, Hippocampus, Anabas scandans, Alytes, Bat,Viper, King fisher d)Relate structure and function Echeneis, Exocoetus, Poison apparatus of Cobra, Quill feather of bird e)Draw labeled Diagram Endoskeleton of Frog: Skull, Pectoral, Pelvic girdle, Fore limbs and hindlimbs.

Text Book:

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(11hordate), 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. KOTPAL , 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

e- Resources:

Earthworm: Digestive system: **https://www.youtube.com/watch?v=mtxjZu0suiw**

Lamellidens: Digestive system: https://www.youtube.com/watch?v=C-3GqvLswc8

Prawn: Appendages: https://www.youtube.com/watch?v=xb7rw4Hz1c8

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Dissect and identify the internal organs of invertebrate organisms
CO 2:	Understand the mounting techniques of parts of the organisms
CO 3:	Understand the diversity of invertebrates and its outline systematic. Discuss their affinities and adaptations to different modes of life
CO 4:	Dissect and identify the internal organs of chordates animals
CO 5:	To infer the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Chordates

Mapping of Cos with Pos & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-II / Core Course-II	**CC II - BIOLOGY OF CHORDATES**	Course Code: **ZUB**
Instruction Hours: 6	Credits: 6	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	**1.** To impart current knowledge about the chordate animals of biological interest. **2.** To know about the Origin, systematic and functional morphology of various groups of chordates. **3.** To study the salient features affinities and adaptations of chordates. **4.** Able to describe the diversity in form structure and habits of vertebrates. **5.** 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. 2. Cyclostomata – Distinctive features and affinities **18 Hours**
Unit II	Fishes and Amphibians Gnathostomata- Detailed study of *Scoliodon sarrakowa* (shark) General Topic 1.Dipnoi and its affinities 2. Accessory respiratory organs in fishes. 3.Adaptive features of Apoda. 4.Parental care in Amphibia. **18 Hours**

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 **18 Hours**
Unit IV	Mammals Detailed study of Rabbit. 1.Dentition in Mammal. 2.Aquatic mammals and their adaptations. 3.Prototheria special features with examples **18 Hours**
Unit V	Comparative Anatomy 1.Comparative study of Heart and Brain in Shark, Frog, Calotes, Pigeon and Rabbit. 2. Endoskeleton of Frog. **18 Hours**
Unit-VI (Activity)	**Identification of different feathers in the pigeon**

Text Book:

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.

e- Resources:

1. http://india.accurascan.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Identify the general and specific characteristics of the different classes and the organization of the representative types
CO 2:	Recognize and describe the major groups of chordates
CO 3:	Understand the diversity of Chordates and its outline systematic. Discuss their affinities and adaptations to different modes of life.
CO 4:	Understand the unique features, taxonomy and functional morphology of different classes of chordates
CO 5:	To infer the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Chordates

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-III / Core Course-IV	**CC III - CELL BIOLOGY**	Course Code: **ZUD**
Instruction Hours: 6	Credits: 6	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
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. **18 Hours**
Unit II	Cell membrane - Structure, Modification and functions. Cell organelles- Structure and functions of Mitochondria – Golgi body - Endoplasmic - Reticulum – Lysosome,Centrosome. Ribosomes. **18 Hours**
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. **18 Hours**
Unit IV	Gene concept: Structure of DNA - Types and functions of RNA - DNA Replication and DNA-repair mechanisms - Genetic Code - Codon, Anticodon. **18 Hours**

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. **18 Hours**
Unit-VI (Activity)	**Observation of giant chromosomes in the salivary gland of *Chironomous* larva**

Text Book:

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

e- Resources:

http:// www.biologybrowser.org

Course Outcomes:

On completion of the course the learner will be able

CO 1:	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.
CO 2:	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.

CO 3:	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.
CO 4:	Studying Cells at molecular level trains the students to think logically, critically and quantitatively.
CO 5:	Learn to interpret statements made in the scientific literature, as well as in non-science areas, based on evidence, not anecdote.

Mapping of Cos with Pos & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-IV / Core Course-VI(IV&V)	**CP II - CORE COURSE (IV & V) - PRACTICAL II**	Course Code: **ZUFY**
Instruction Hours: 3	Credits: 4	Exam Hours: 3
Internal Marks -40	External Marks-60	Total Marks: 100

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 Ccompound microscope to study cell types. 2. Squash preparation of Onion root tip to study the stages of Mitosis.
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. **9 Hours**
Unit III	1. Spotters: Centrifuge – Microtome 2. Cell types – Epithelial (3) – Muscular (3) – Vascular – human **9 Hours**
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. **9 Hours**
Unit V	(SPOTTERS) 1.Lymphoid organs of Calotes (Thymus and Spleen) 2. Calotes-Cell imprinting of Thymus and Spleen **9 Hours**

Text Book:

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, Jhonwiley & Sons.
3. VEERA BALA RASTOGI, Developmental Biology, KedarNath 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.

e- Resources:

1. Squash preparation of Onion root tip to study the stages of Mitosis

https://wwyoutube.cw.om/watch?v=5-ur7bWqlDQ

2. Mounting of Chick blastoderm

https://www.youtube.com/watch?v=ezZBpMfBgI4

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Understand cell type and have thorough knowledge on microscope.
CO 2:	Ability to identify different stages of cell division and get thorough training on squash preparation.
CO 3:	Understand different cell types in human tissues and trained to operate the instrument microtome, centrifuge.
CO 4:	Understand and trained different developmental stages of chick. And get hands on training in mounting of chick blastoderm.
CO 5:	Learn lymphoid organs and know the technique of cell imprinting.

Mapping of Cos with Pos & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	M	M	S	S	S	M	S	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	SM
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-III / NME –Non Major Elective -I	**NME I - PUBLIC HEALTH AND HYGINE**	Course Code: **ZUE1**
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To enlighten the non- major elective students about the general knowledge on their health and hygiene. 2. To create general health awareness the hazardous impacts and remedy. 3. Understand the communicable and non communicable disease and its prevention. 4. Understand the different environmental pollution and its hazards. 5. 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. **6 Hours**
Unit II	Environment and Health hazards: Environmental degradation – Pollution – Air, Water, Land and Noise-associated health hazards **6 Hours**
Unit III	Communicable diseases and their preventive and control measures. Measles, Hepatitis, HIV /AIDS,Cholera, Malaria and Filariasis. **6 Hours**
Unit IV	Non-Communicable diseases and their preventive measures.Genetic diseases, Cancer, Cardio vascular diseases, Chronic respiratory disease, Diabetes, Epilepsy. **6 Hours**
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. **6 Hours**

Text Books:

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

Reference Books:

1. VERMA, S. 2020 : 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.

e-Resources:

1. http:// www.dettol.co.in

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Understand public health practice requires multidisciplinary team of public health workers and professionals.
CO 2:	Improve the quality of life through promotion of healthy behaviors including mental health.
CO 3:	Learn healthy habits to protect yourself from disease and prevent germs and infectious diseases from spreading.
CO 4:	Understand the Socioeconomic impact of non-communicable diseases.
CO 5:	Aware of public health is the result of society's efforts as a whole, rather than that of single individuals

Mapping of Cos with Pos & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	M	S	S	M	S	S	S	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	M	S	S	S	M	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-III / NME –Non Major Elective -I	**NME I – FOOD AND NUTRITION**	Course Code: **ZUE1**
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To learn food sources and energy metabolism in different age group to keep healthy life. 2. To crate awareness of requirement of nutrition in different age group. 3. To know the diet therapy. 4. To know the basal body metabolism. 5. 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. **6 Hours**
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. **6 Hours**
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. **6 Hours**
Unit IV	Nutrition in different stages – Infants, children, adolescents, pregnant, lactating women and old persons. **6 Hours**
Unit V	Principles of diet therapy. Diet during stressed conditions, laborer and patients, therapeutic diets for anemia, malnutrition, obesity, diabetes mellitus and allergy. **6 Hours**

Text Books:

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

Reference Books:

1. POLTER 2001, Food science , CBS publishers & Distributers
2. SWAMINATHAN. M.S, , Essential of food nutrition's, Vol I& II , Bangalore printing
3. ANNIE FREDRICK, 2006 A Text book of food and nutrition, lotus press.

e-Resources:

http://kids.britannica.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Understand food sources ,types and its composition
CO 2:	Learn the essential nutrients and basal body metabolism.
CO 3:	Understand the mineral nutrients and its deficiency disorders
CO 4:	Aware of the requirement of nutrition in different age groups
CO 5:	Know the principles of diet therapy

Mapping of Cos with Pos & PSOs

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	M	M	S
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	S	M	M	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-I V/ Core Course-V	**CC IV - DEVELOPMENTAL BIOLOGY**	Course Code: **ZUE**
Instruction Hours: 6	Credits: 4	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. Understanding of the processes of early embryonic development, to analyze the mechanisms of development. 2. Learn theories of fertilization and cleavage. 3. Ability to find out fate maps, morphogenetic movements and developmental stages of chick embryo. 4. Study metamorphosis in amphibian. 5. Know the human health care and artificial insemination and Birth control.
Unit I	Gametogenesis: Spermatogenesis – Cells in seminiferous tubules, Spermiogenesis, structure and types of sperm. Oogenesis – Growth of oocyte, vitellogenesis, organization of egg cytoplasm. Polarity and symmetry – Maturation of egg, egg envelops-Types of eggs. **12 Hours**
Unit II	Fertilization: External and Internal fertilization, sperm – egg interaction, physiological changes in the organization of egg cytoplasm – Theories of fertilization. Cleavage–Patterns of cleavage–radial, spiral and bilateral; Types– meroblastic, holoblastic and superficial – Factors affecting cleavage – Chemodifferentiation. **12 Hours**
Unit III	Blastulation – Types of blastula. Fate maps. Presumptive organ forming areas in Frog and Chick. Gastrulation in Frog and Chick-Morphogenetic movements- Development of brain and eye in Frog. Developmental stages of Chick embryo up to 96 hours and organogenesis. **12 Hours**
Unit IV	Foetal membranes in Chick and Mammals – Placentation in Mammals-types and physiology. Organizer concept and embryonic induction. Regeneration in Planarians and Amphibians. Metamorphosis in Amphibians. **12 Hours**

Unit V	Precautions and health care during Human Pregnancy and Gestation-infertility. Artificial Insemination – Concept of test-tube baby – Birth control methods – Factors involved in Teratogenesis **12 Hours**
Unit-VI (Activity)	**Observation of developmental stages of chick embryo**

Text Book:

1. Beril., N. J.1974. Developmental Biology. Tata Mc Graw-Hill Publishing Company Ltd. NewDelhi.
2. Berry.A.K.2007. An Introduction to Embryology, Emkay Publications, New Delhi-51.

Reference Books:

1. Arumugam.N. 1998. Developmental Biology, SarasPublications,
2. Balinsky, B.I. 1981. An Introduction to Embryology.
3. W.B.SaundersCompany.Philadelphia.S.Banerjee, Development Biology, Dominant Publishers, NNewDelh.
4. Verma, P.S. And Agarwal V.K. 2005. Chordate Embryology (Developmental Biology)S. Chand&Company Ltd., NNewDelhi.
5. Veer balarastogi, Developmental biology, KedarnathRamnath publishers, meerut.
6. Rastogi, V.B and Jayaraj, M.S. 2002. Developmental Biology KedarNath Ram Nath,Meerut.
7. Twymann, R.M. 2003. Developmental Biology. Viva Books Private Ltd., New Delhi.

e- Resources:

https://en.m.wikipedia.org

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult

CO 2:	Understand how does development affect organization of phenotypes and their variation
CO 3:	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
CO 4:	Explain the concept of Immunology, Mechanism of immunity, Immunity regulating cells.
CO 5:	Understand the Basic structure, classes and function of Antibodies, Antigen-Antibody interaction

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	M	M	S	S	M	M	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-IV / NME II	**NME II - COMMERCIAL ZOOLOGY**	Course Code: **ZUE2**
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To bring about awareness to the various branch of Zoology available to get self employment opportunity. 2. To generate employments. 3. To motivate to become entrepreneurs. 4. Skill to develop apiculture in their own house. 5. 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. **6 Hours**
Unit II	**Apiculture –** Species of Honey Bee, Types of Honey Bee – Newton's Bee hive – Care and Management – Honey extraction , Extracting Equipments – Nutritive and Medical value of Honey. Advantages – Economic importance of Apiculture.) **6 Hours**
Unit III	**Lac Culture** –Types of Lac - Life cycle of Lac insect – Harvesting and Extraction of Lac- Uses of Lac – Enemies of Lac - Economic importance of Lac. **Sericulture:Importance of sericulture- Types of silkworm –Methods of sericulture-Rearing of silkworm -** Life cycle of Bombyx mori – Economic of Silk. **6 Hours**
Unit IV	**Aquaculture** –Definition – salient characters of aquaculture-Types of aquaculture practices - Construction and Management of Pond. Culture practices of Common carp. **Shrimp Culture**– *Penaeus monodon.* **Pearl culture.** **6 Hours**
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. **6 Hours**

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
3. Dr.A.Amsath and Marimuthu Govindharajalu. 2020 Apiculture. Pub. Lambert Academic publisher.

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.

e-Resources:

https://en.m.wikipedia.org
https://oms.bdu.ac.in

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Learn the courses with excitement of biology along with the self employment opportunity in Vermiculture.
CO 2:	Students interested in entrepreneurship and start some small business based on their interest and experience on apiculture.
CO 3:	Ability to impart complex technical knowledge relating to economic importance of Lac and sericulture.
CO 4:	Work precisely in aquaculture field by learning culture practice and construction, management of pond.
CO 5:	Familiar with poultry farming to generate employment opportunity. **6 Hours**

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	S	M	S	S	M	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	M	S	M	S	S	M	S
CO4	S	S	S	M	S	M	S	S	S	S
CO5	S	S	S	S	S	S	S	M	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-IV / NME II	**NME II - ORNAMENTAL FISH FARMING**	Course Code: **ZUE2**
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To learn the techniques of Ornamental fish farming to develop their skill. 2. To become an entrepreneur and provide consultancy service to ornamental fish farms. 3. Ability to setup aquarium in business. 4. Ability to design aquarium equipments. 5. 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. **6 Hours**
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. **6 Hours**
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. **6 Hours**
Unit IV	Aquarium design, Construction of aquarium tank and maintenance of water quality: controlling ammonia build up, pH, feeding regimes. **6 Hours**
Unit V	Disease management: Common bacterial, viral fungal, protozoan and crustacean infections. Their treatment and control. **6 Hours**

Text Books:

RATH, R.K. (2000) Freshwater Aquaculture. Scientific Publishers (India). PO Box:91,Jodhpur.

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.

e-Resources:

https://en.m.wikipedia.org

https://vikaspedia.in

Course Outcomes:

On completion of the course the learner will be able

CO 1:	To study the economics and commercial value of ornamental fish farming at India and world level.
CO 2:	Understand the commercial and popular ornamental fish and their reproduction for multiplication.
CO 3:	Apply the techniques for the mass production of ornamental fish cultivation and reduction of artificial and synthetic feed.
CO 4:	Apply their knowledge to design and construct the aquarium and its maintenance.
CO 5:	Ability to analyze disease and to provide timely control measures and treatment.

Mapping of COs with POs & PSOs

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	S	S	S	S	S	S	S	S
CO2	S	S	S	M	S	M	S	S	S	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	S	M	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-IV / SBE-1	**SBE I - APICULTURE**	Course Code: **ZUS1**
Instruction Hours : 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To Understand the Biology of Honey bee 2. Learn the Teaching of apiculture 3. Understand the economic importance of honey 4. Skill in the apiary management 5. 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. **6 Hours**
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. **6 Hours**
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. **6 Hours**
Unit IV	**Bee products**: Bee Products and benefits - Honey - Chemical nature and use. Bee wax, propolis, Royal Jelly, Bee Pollen, Bee pollination and advantages. **6 Hours**
Unit V	**Honey bee diseases**: Protozoan- Mites - Viral-causes and control. **6 Hours**

Text Book:

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

3. Dr.A.Amsath and Marimuthu Govindharajalu. 2020 Apiculture. Pub. Lambert Academic publisher.

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.

e- Resources:

https://en.m.wikipedia.org

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Know the scope of bee keeping and Learn various concepts of apiculture.
CO 2:	Understand what makes the scientific study of anima land the Bee keeping equipments
CO 3:	Engage in field-based research activities to understand well the theoretical aspects taught besides learning techniques for gathering data in the field .
CO 4:	Be aware of a broad array of career options and activities in human medicine,
CO 5:	Analyses a biological problem, derive testable hypotheses and then design experiments and put the tests into practice

Mapping of COs with POs & PSOs

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	M	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	M	S	S	S	M	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-IV / SBE-1	**SBE I –BIOINSTRUMENTATION**	Course Code:------- **ZUS1**
Instruction Hours : 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. 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 2. Understand the mechanism of different microscope 3. Know different spectroscopy 4. Familiar cell separation technique 5. 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. **6 Hours**
Unit II	**Microscopy** (Hands on) Observation of different microbes. Light – Bright & Dark field; Phase contrast, Inverted Phase contrast; Fluorescent, Electron – TEM & SEM; Confocal. **6 Hours**
Unit III	**Spectroscopy** (Theory & Demo) Colorimeter, Spectrometer, UV visible spectrometer, X – ray spectrometer, ELISA reader, Atomic absorption spectrometer, Flame photometer, Flourimeter & Spectro photometer **6 Hours**
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. **6 Hours**

Unit V	**Electrophoresis** (Theory & Demo) Native & denatured - zone, iso-electrofocusing & isotachophoresis, 1D & 2D.PCR, MoldiTof **6 Hours**

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.

e-Resources:

https://en.m.wikipedia.org
https:// www.sciencedirect.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Learn the concept of basic instruments such as pH, Electronic balance, ECG,FTIR and radioactivity and explore its role in various fields
CO 2:	Understand the principles behind the usage of different microscope.
CO 3:	Apply their knowledge in the principle and instrumentation of various separation techniques
CO 4:	Analyze the working and sedimentation mechanism of different centrifuge
CO 5:	Understand how electrophoresis separate DNA, RNA, or protein molecules based on their size and electrical charge.

Mapping of COs with POs & PSOs

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	M	S	M	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	M	S	S	M	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V/ Core Course-VII	**CC V - ANIMAL PHYSIOLOGY**	Course Code: **ZUG**
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	• Understand the Nutritional requirement of food and its metabolism.. • Study the structure and function of respiration. • Acquire in depth knowledge about the Excretion. • Understand the functions of receptors and bioluminescence. • Understand the role of endocrine organs in human.
Unit I	Nutrition-Food requirements-Carbohydrates, Proteins, Fats, Minerals, and Vitamins. Digestive-enzymes and their role in digestion – metabolism of Protein, Carbohydrates and Lipids. Absorption and assimilation of digested food materials. Balanced diet, BMR and BMI. **15 Hours**
Unit II	Respiration- Structure of mammalian lungs and gaseous exchange- Transportof Oxygen–Transport of CO_2. Circulation: Structure of mammalian heart and its working mechanism – Heart beat and Cardiac cycle. Myogenic and neurogenic hearts. Properties and Functions of blood - ECG - Blood Pressure - factors contributing to heart problems. **15 Hours**
Unit III	Excretion - Nitrogenous waste material and their formation. Structure and function of mammalian kidney and nephron - mechanism of urine formation. Osmotic and ionic regulation by freshwater and marine animals. Muscles - structure and types of muscles -mechanism of muscle contraction. **15 Hours**
Unit IV	Structure of nerve cell. Conduction of nerve impulse, Structure of synapse, mechanism of synaptic transmission –Neurotransmitters. Bioluminescence – Biological clocks. Receptors: types, Photoreceptor - Structure of Human eye - Physiology of vision, Phonoreceptors – Structure of Human ear- organ of Corti- working mechanism. **15 Hours**

Unit V	Endocrine glands – structure and hormones of Hypothalamus, Adenohypophysis, Neurohypophsis, Pineal gland, Thyroid gland, Parathyroid, Thymus, Adrenal and Pancreas. Endocrine control of mammalian reproduction. – Male and female hormones – Hormonal control of Menstrual cycle in humans. Hormones of insects. **15 Hours**
Unit VI **(Activity)**	**Study on the osmoregulation in freshwater and marine fishes**

Text Book:

1. Rastogi, S.L., 1997. Essential of Animal Physiology. New Age International Publisher, NewDelhi.
2. Verma, P.S. and V.K. Agarwal.1992. Animal Physiology. S. Chand and Co. NewDelhi.

Reference Books:

1. Mariakuttikan and N.Arumugam, 2002. Animal Physiology. Saras Publication,Nagarcoil.
2. Sambasivaiah, Kamalakararao and Augustine Chellappa 1990. A Text book of Animal Physiology and Ecology, S. Chand& Co., Ltd., New Delhi - 110 055.
3. Parameswaran, Anantakrishnan and AnantaSubramananiam, 1975. Outlines of Animal Physiology, S. Viswanathan Pvt.Ltd.,
4. William S. Hoar, 1976. General and Comparative Physiology, Prentice Hall of India Pvt. Ltd., NewDelhi.
5. Wood, D.W., 1983.Principles of Animal Physiology 3rd Ed.,
6. Prosser, C.L. Brown 1985. Comparative Animal Physiology, Satish Book Enterprise, Agra - 282003.

e- Resources:

https://en.m.wikipedia.org
https://www.nature.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Know the role of nutrition in human and its source, types and importance
CO 2:	To understand the mechanism of human respiration
CO 3:	Understand the mechanism of respiration in human.
CO 4:	Recognize the complimentary relationship of structure and function of nerves and describe the interactions between different organ systems to maintain homeostasis.
CO 5:	Able to explain the receptors and biological rhythmsin response to internal and external environmental changes.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V / Core Course-VIII	**CC VI - GENETICS AND EVOLUTION**	Course Code: **ZUH**
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	• Understand the basics concept of Mendel's principles • Study the importance of chromosomal variation in Number & Structure • Learn the fine structure of gene. • Know the origin of life and theories of Evolution. • Distinguish species and speciation
Unit I	Mendel's principles and applications. Linkage and crossing over - chromosome theory of linkage, kinds of linkage, linkage groups, types of crossing over, mechanism of meiotic crossing over, kinds of crossing over, theories about the mechanism of crossing over, cytological detection of crossing over, significance of crossing over. Chromosome mapping - Gene mapping. **15 Hours**
Unit II	Chromosomal variation in Number & Structure – Euploidy, Non-disjunction &Aneuploidy.Chromosomal deletions& duplications, inversions & translocations. Genemutations.Mutagens. Human Cyto-Genetics - human traits – Human karyotype, Banding techniques, classification, Genetic diseases (gout, hypercholesterolemia, cystic fibrosis, phenylketonuria, hemophilia, and muscular dystrophy), syndromes (Down, Klinfelter, and Turner), and congenital anomalies. **15 Hours**
Unit III	Molecular genetics: Structures and replication of DNA. Types and structure of RNA. Organization and functions of genetic materials-Chromatin, nuclear and mitochondrial genome. Gene paradox, Repetitive DNA,Satellite DNA, Overlapping genes, Split genes, Pseudogenes. Fine structure of gene – cistron, recon and muton - Gene expression and regulation in prokaryotes– Operon model – Lac and TrpOperon – Gene regulation inEukaryotes. Gene amplification. **15 Hours**

Unit IV	Chemical origin of life; Evidences – Morphological, Embryological, Biochemical and Paleontological evidences. Fossil and Fossilization, Datingof Fossils. Lamarck, Darwin and De Veries Theories of Evolution and their modern concepts. **15 Hours**
Unit V	Mimicry and animal colouration; Speciation and Species concept; Isolating mechanisms; Hardy Weinberg Principle: Gene pool and Gene frequency. Evolution of horse; Evolution of man. **15 Hours**
Unit VI **(Activity)**	**Observation of mimicry and colouration in the environment**

Text Book:

1. VermaP.S.andAgarwal,V.K. 2015–GeneticsS.Chand&Co.,NewDelhi.
2. Goodenough, U.1997. Genetics. Saunders Coelege Publishing International, NewYork.

Reference Books:

1. Kumar, H.D. 1998. Molecular Biology and Biotechnology. Vikas publishing House,NeNewDel.
2. Lewin,B.1998.GeneVI.WileyEasternLtd.,NewDelhi.
3. Rothwell, N.V.1979. Human Genetics. Prentice Hall of India, NewDelhi.
4. Gupta P.K. 1995-96 Genetics, Rastogi publication, Shivaji Road, Meerut 250 002.
5. Strickberger, M.W. 2002 Genetics (3rd edition). Prentice Hall of India, New Delhi.
6. Friefelder. D. 1997. Microbial Genetics; Narosa Publishing, NewDelhi.
7. Arumugam, N. 1989. Organic Evolution . Saras publication,Nagercoil.

e- Resources:

https://en.m.wikipedia.org
https://nature.com
https://www.britannica.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Able to explain the role of the mendelian inheritance and multiple alleles in day to day life activities.
CO 2:	Understand the cause and effect of alterations in chromosome number in sex determination.
CO 3:	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.
CO 4:	Learn the origin of life and its evolutionary evidence
CO 5:	Identify mimicry and colorations, speciation, p[principle of hardy Weinberg law's.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	M	S	S	S	S	M	S
CO5	S	S	S	M	S	S	S	S	M	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester : V / Core Course : IX	**CC VII - MICROBIOLOGY**	Course Code: **ZUI**
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	**1.** Learn classification of microbes, structure and economic importance of microbes. **2.** Ability to do sterilization of microbes and culture methods. **3.** Know the microorganism in extreme environment. **4.** Know the food born infection and quality of food. **5.** Skilled in diagnosis of disease causing microbes.
Unit I	History and Scope of microbiology- Classification of microbes.Structure of *a bacterium.*Bacterial respiration and reproduction – economic importance of bacteria. Classificationof viruses- physical and chemical structures of viruses on the basis of capsid symmetry - enveloped (Herpes virus), helical (TMV) and icosahedral (Polyomaviruses), complex (Bacteriophage) and Virion. **15 Hours**
Unit II	Concept of Sterilization - Physical and Chemical methods of sterilization. Stains and staining techniques.Bacterial nutrition and Growth- Nutritional types. Growth factors, Types of culture - culture media- Isolation of pure culture –Colony morphology and growth- Growth curve and Growth kinetics. **15 Hours**
Unit III	Microbiological analysis of water purity- Microorganisms in fresh water and marine water.Microorganisms of different soils - interactions with the atmosphere.Microorganisms in extreme environments- Thermophilic, Methanogenic and Halophilic. Photosynthetic bacteria, Cyanobacteria some Archaea who live in extreme conditions like cold, and space. **15 Hours**
Unit IV	Food borne infections and intoxications - Clostridium, Salmonella, and Staphylococcus –microtoxins in food with reference to Aspergillus species- Quality assurance- microbiological quality standards of food, government regulatory practices and policies- FDA,EPA. **15 Hours**

Unit V	Morphological characteristics, Parthenogenesis,laboratory diagnosis and treatment of any five disease causing Protozoa, Bacteria, Virus and Fungus. Prevention and control. **15 Hours**
Unit VI	**Study about the different types of microorganisms in the water and soil**

Text Book:

1. Prescott L.M., John. P. Harvey, Donold A, Klain. Microbiology secondedition–WM.C. Brown Publications.
2. Dubey R.C, D.U. Maheshwari 2005. A Text book of Microbiology, S.Chand and company Ltd, NewDelhi.
3. Rao, A.S. 2001. Introduction to Microbiology. Prentice Hall of India Private Limited, NewDelhi.

Reference Books:

1. Pelczar, M.J., Chan, E.S., Kreig, N.R. 1993. Microbiology (Fifth edition). Tata McGraw-Hill Publishing Company Ltd., NewDelhi.
2. Purohit, S.S. 2005. Microbiology Fundamentals and applications (Sixth Edition). Student edition,Jodhpur.
3. Raman Rao, P.V. 2005. Essentials of Microbiology. CBS Publishers and Distributors, NewDelhi.
4. Malacinski, M.G. 2006. Essentials of Microbiology Narosa Publishing House, NewDelhi.
5. Narayanan, L.M., Selvaraj, A.M and N.Arumugam. 1999. Microbiology Saras Publication, Nagercoil.
6. Ananthanarayanan, R. and JayaramanPaniker, C.K. 1990. Text Book of Microbiology. Orient LongmanLtd.,

e- Resources:

https://en.m.wikipedia.org
https://www.frontiersin.org

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Understand the economic importance of microbes.
CO 2:	Hands on training in culture of microbes.
CO 3:	Know the microorganism in different environment and its effect on human.
CO 4:	Know the pathogenic organisms and standards of food.
CO 5:	Hands on training in the laboratory diagnosis of disease causing microbes.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V/ Core Course X	**CP III -(CC- VII, VIII &IX) - PRACTICAL III**	Course Code: **ZUJY**
Instruction Hours: 4	Credits: 4	Exam Hours: 3
Internal Marks -40	External Marks-60	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To learn qualitative and quantitative tests of macromolecules 2. To get hands on training to operate the instrument 3. To learn the mendelian's concepts 4. To observe the evolutionary characters of an animals 5. To learn the basic technique of microbiology laboratory
Unit I	**Animal Physiology** 1. Qualitative and quantitative tests for proteins, 2. Qualitative tests for carbohydrates and fats 3. Human salivary amylase activity in relation to Temperature and pH. 4. Identification of Nitrogenous waste products 5. Enumeration of RBCs/WBCs by haemocytometer **12 Hours**
Unit II	**Spotters**: 1. Haemoglobinometer, 2. Kymograph, 3. Sphygmomanometer. 4. Models of Amino acids, Haemoglobin, ATP, Steroids. **12 Hours**
Unit III	**GENETICS:** 1. Recording of Mendelian traits in Man, 2. Blood grouping of man, 3. Pedigree Analysis. 4. Models: Monohybrid and Dihybrid crosses. 5. Karyotypes of normal male and female.Klinefelter's syndrome, Turner's syndrome and Down's syndrome

	6. .Drosophila- Male and female identification, Genetic importance, Mutants (Wing, body colour, eye colour) 7. .Models for DNA, RNA, tRNA Structure and DNA replication. **12 Hours**
Unit IV	**Evolution:** Spotters: 1. Protective coloration -Leaf insects, Stick insects, 2. 2. Chameleon Hippocampus, Pepper moth. 3. Mimicry: Monarch and Viceroy butterfly. 4. Quantum evolution; Bat, Pteropus. **12 Hours**
Unit V	**Microbiology** 1. Demonstration of sterilization procedure for culture media equipment. 2. Preparation of culture media for microbes, 3. serial dilution techniques (ingroups) 4. Distribution of microbes in water (demonstration andobservations.) 5. Fixing and gram staining ofbacteria 6. Hanging drop preparation of*Lactobacillus*. 7. **Spotters:** Laminar Air flow, Autoclave, Petri-dish, Inoculation loop. **12 Hours**

Text Book:

1. Rastogi, S.L., 1997. Essential of Animal Physiology. New Age International Publisher, NewDelhi.
2. Verma, P.S. and V.K. Agarwal.1992. Animal Physiology. S. Chand and Co. NewDelhi
3. VermaP.S.andAgarwal,V.K. 2015–GeneticsS.Chand&Co.,NewDelhi

Reference Books:

1. Ananthanarayanan, R. and JayaramanPaniker, C.K. 1990. Text Book of Microbiology. Orient LongmanLtd.,
2. Kumar, H.D. 1998. Molecular Biology and Biotechnology. Vikas publishing House,NeNewDel.
3. Lewin,B.1998.GeneVI.WileyEasternLtd.,NewDelhi

e- Resources:

https://en.m.wikipedia.org
https://www.nature.com

https://en.m.wikipedia.org
https://nature.com
https://en.m.wikipedia.org
https://www.frontiersin.org

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Able to quantify macromolecules
CO 2:	Hands on training to operate the Laboratory instrument
CO 3:	Able to analyze mendelian's principles
CO 4:	Learn the evolutionary characters of an animals for identification
CO 5:	Understand the basic technique of microbiology laboratory

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V / MBE-I	**MBE I - VERMICULTURE**	Course Code: **ZUE3**
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To study the taxonomy and diversity of Earthworms 2. To know the ecology , biology and beneficial role of Earthworms. 3. To gain basic knowledge in Vermicomposting and Vermiculture. 4. To create awareness about vermicompost and its important as fertilizer. 5. 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. **15 Hours**
Unit II	General body structures of earthworms. Morphology – Coelom – Body wall-LocomotionExcretion- Respiration- Digestive, Circulatory, Nervous and Reproductive systems- Cocoon formation.. **15 Hours**
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. **15 Hours**
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. **15 Hours**
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. **15 Hours**

Text Book:

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.
4. Dr.A.Amsath. 2020. Vermitechnology.

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.

e- Resources:

https://en.m.wikipedia.org
https://annamalaiuniversity.ac.in

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Understand the classification and diversity of earthworm
CO 2:	Know the morphology and lifecycle of earthworm.
CO 3:	Aware of the role of earthworm in sustainable agriculture and its feeding habits.
CO 4:	Apply the advanced techniques in organic wastes.
CO 5:	Understand different methods of vermincomposting.

Mapping of COs with POs & PSOs

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	M	S	M	S	S	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	M	S	M	S
CO4	S	S	M	S	S	M	S	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V / MBE-I	**MBE I - COASTAL AQUACULTURE**	Course Code: **ZUE3**
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. Study the different aquaculture techniques 2. Obtain knowledge in the management of aquaculture farms 3. Understand the economic importance of aquaculture 4. Learn hatchery technique and water analysis. 5. Training in aquaculture disease diagnosis.
Unit I	Coastal Aquaculture :Definition,overview,status and importance. Criteria of selecting suitable site for aquaculture – fundamentals of survey, designing and lay out of aquaculture ponds. Criteria for selection of species for Coastal Aquaculture. **15 Hours**
Unit II	Biology of major cultivable species of seaweeds, fin and shellfishes : freshwater prawns – shrimps – molluscs – fishes. Culture techniques – Traditional. extensive, modified extensive, semi intensive, intensive and super intensive. mono and poly culture, integrated and organic farming. Open sea farming – raceways – cages – pens – rafts – racks **15 Hours**
Unit III	Shellfish Culture :Shrimps,prawns,crabs, fatening of crabs,lobsters,oysters, mussels and cephalopods. Fish Culture : Milk fish,mullets,Asian sea bass. Seaweed Culture. Aquaponics an alternative farming system. **15 Hours**
Unit IV	Hatchery techniques – induced maturation and spawning – natural seed resources – hatchery production of fin and shellfish seeds. Farm management – Water quality management – Temperature – salinity – dissolved oxygen – pH – hardness – nutrients – ammonia – hydrogen sulphide. Feed management – feed ration – feeding schedule – feed broadcasting – partial feeding – feed acceptance – types of feeds – live and formulated feeds. **15 Hours**

Unit V	Health management – in Aquaculture disease diagnosis and treatment – prophylactic measures – probiotics – immunostimulants Role of R & D institutions. Coastal zone management – legal issues – Government policies – Aquaculture Authority of India. **15 Hours**

TEXT BOOK:

1. **DR.V.B.SAKHARE** – Reservoir fisheries and Ecology – MangalamPublications,L- 21/1.St.No.5,Shivaji margnear Kali Mandir,Delhi-53.
2. **A.C.LORG**,Fish feeding and Integrated fish farming,Cyber Tech Publications,New Delhi.

REFERENCE BOOKS :

1. **BARDACH, J.E., J.H.RYTHER & W.O. MCLARNEY**; Aquaculture, Wiley- InterScience, 1972.
2. **HUET, M & J. TIMMERMANS**: Text Book of fish culture: Breeding and cultivation of fish, 2nd ed., fishing News Book Ltd., 1986.
3. **PILLAY T.V.R.** Aquaculture Principles and Practices, Fishing News Books, 1981.
4. **ROBERT, R.STICKNEY**: Principles of Aquaculture, John wiley& Sons Inc.1984.
5. **SANTANAM R, N. RAMANATHAM&G. JAGATHESAN**: Coastal Aquaculture, CBS Publishers and Distributors, 1990
6. **IMAI T**.:Aquaculture in shallow seas, Amerind Pub. Co.,1977.
7. **JHINGRAN V.G** : Fish and Fisheries of India,Hindustan Pub. corp., 1982.
8. **MILNE P.H.:** Fish & Shellfish farming in Coastal waters, FNB Ltd., 1972.
9. **SRIVASTA.C.B..** Fisheries Science And Indian Fishery- KitalMahal 22A- Sangai Nadu, Allahabad.
10. **VENKATARAMANUJAM,N.RAMANATHAN** , Introduction to Fishery Science- Janshi Publications 11-A. PalayamkottaiRoad.Tuticorin – 628 008.
11. **SHAMMI.Q.J. BHATINAGAR.A.S.** – Applied fisheries – UpdeshPurohit for agrobios(Indian), Jodhpur.
12. **YADAV.B.N.** – Fish and Fisheries – Daya Publishing house
13. **ROUNSEFELL .G.A.HAMYEVERHART** – Fishery Science. Method & Application – International Books & Periodicals supply services.
14. **KURIAN.C.V. SEBATIAN.V.O.** – Prawns and Prawn fisheries of India. Hindustan Publishing corporation – Delhi.
15. **SHAILENDRA GHOSH** – Fisheries and aquaculture management – Adhyayan publication & Distributors.

e-Resources:

https://en.m.wikipedia.org
https://www.fao.org

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Demonstrate the different aquaculture techniques and methods
CO 2:	Able to manage and maintain aquaculture farms.
CO 3:	Learn the economic importance of aquaculture species
CO 4:	Hands on training in hatchery technique and water quality analysis
CO 5:	Ability to analyze disease diagnosis

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	M	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	M	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V/ SBE-II	**SBE II - POULTRY SCIENCE**	Course Code: **ZUS2**
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
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. **6 Hours**
Unit II	Poultry Nutrition – Feed formulation for Chicks, Growers, Phase I to Phase III Layers & Broilers. Processing and Preservation, Feed additives. Nutrient requirements of chickens. **6 Hours**
Unit III	Poultry Breeding –Breeding principles - Breed selection methods - Methods of mating- Incubation, Hatchery Management. Brooding, Debeaking – Vaccination, Sanitation and Waste disposal. **6 Hours**
Unit IV	Economically important Poultry diseases Bacterial [Salamonellosis, Pasteurellosis, E.Coli infection], Viral[Ranikhetdisese, Fowl pox infections, Bronchits Infection, Bursal disease], Fungal [Aflatoxicosis, Ochratoxicosis], Protozoan[Coccidiosis] – Ticks and Mites – Prevention and Control **6 Hours**
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. **6 Hours**

Text Book:

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, RakeshRastogi 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.

e- Resources:

https://en.m.wikipedia.org
https://www.journals.elsvier.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Know commercial poultry industry in India..
CO 2:	Understand types of poultry, feed formulation and additives
CO 3:	Have practical knowledge on poultry breeding processes, waste disposal and sanitation.
CO 4:	Aware of poultry disease prevention and control measures.
CO 5:	Familiar with management of slaughtering, marketing of poultry meat and its economic importance.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	M	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	M	S	M	S	S	M	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	S	M	S	S	M	M	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V/ SBE-II	**SBE II – DAIRY FARMING**	Course Code: **ZUS2**
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
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,Holsteinfreisiers. b.Drought : Kanagayam, Hallikar,Pulikulam c.Dual : Ongole, Hariyana. d.Breeds of buffalo : Murrah, jaffrabadi **6 Hours**
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 **6 Hours**
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. **6 Hours**
Unit IV	Gross anatomy of udder- Milk secretion – chemistry of milk – Microbiology of milk. **6 Hours**
Unit V	Steps involved in dairy processing- dairy product,fluid and dried products – Ice cream, butter, cheese, yogurt, paneer, butter milk. **6 Hours**

Text Book:

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,Tetrapak,processing systems.
2.EARLY,R.1998 The technology of dairy products. Blackie acedmic and professional

e- Resources:

https://en.m.wikipedia.org
https://niva.co.nz

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Know the different breeds and dairy development in India.
CO 2:	Identify cattle nutrition, preservation of green fodder, feed additives and feed formulations.
CO 3:	Ability to impart complex technical knowledge relating to dairy reproductive physiology and disease control measures.
CO 4:	Ability to have critical thinking and efficient problem solving skills in the milk secretion, chemistry and microbiology of milk
CO 5:	Capability for asking relevant/appropriate questions relating to issues and problems in the field of dairy products.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	M	S	M	S	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	M	S	M	S	S	M	S	M	S
CO4	S	S	M	S	S	M	S	S	S	S
CO5	S	S	S	S	S	S	S	M	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V/ SBE-III	**SBE III - ANIMAL BIOTECHNOLOGY**	Course Code:**ZUS3**
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. Know the application of biotechnology in Biological sciences. 2. Well known the mechanism of gene transfer in prokaryotes. 3. Learn the role of genetic engineering in human welfare. 4. Understand the molecular markers and its application in biotechnology. 5. Know the role of microbes in bioremediations.
Unit I	Biotechnology –Definition, Scope and Importance – Applications of Biotechnology. Genetic Engineering and Gene Cloning: Tools of Genetic Engineering: Enzymes - Gene cloning vectors - pBR 322 Plasmid, Ti plasmid, pSV plasmid and simian virus 40. Preparation of desired DNA; *In vitro* construction of rDNA. **6 Hours**
Unit II	Gene Transfer Mechanisms: Bacterial Conjugation, Transformation, Transfection, Transduction, Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion, Microlaser. Selection (Screening) of Recombinants: Immunochemical Method and Colony Hybridization - Gene cloning in prokaryotes - Gene library and cDNA library. **6 Hours**
Unit III	Genetic Engineering for Human Welfare: Production of Insulin, Somatotropin (HGH), Human Interferons, Vaccine and their applications; Transgenic animals and their uses. Animal Biotechnology: Requirements for Animal cell culture – Maintenance and storage of Cell lines -Methods for Cryopreservation - Cell Bank–Animal Bioreactors and their uses. **6 Hours**

Unit IV	Molecular markers and their applications: Restriction Fragment Length Polymorphism(RFLP) – Random Amplified Polymorphic DNA (RAPD) – Minisatellites or Variable Number of Tandem Repeats (VNTRs) – Microsatellites (SSRs); PCR (Amplification of DNA) – Applications of PCR Technology. DNA sequencing methods: Sanger's method and Automatic DNA sequencing; DNA Fingerprinting– Applications of DNA fingerprinting. **6 Hours**
Unit V	Environmental Biotechnology: Waste treatment–anaerobic and aerobic treatment. Microorganisms in Pollution control – Bioremediation, Biological Bleaching, Biomass Production, Bio-fuels and Bio-prospecting. **6 Hours**

Text Book:

1. Dubey, R.C. 2014. A Text book of Biotechnology. S.Chand and Company Ltd, NewDelhi.
2. Gupta, P.K.2004.Biotechnology and Genomics (1st Edition)Rastogi Publications, Meerut.

Reference Books:

1. Kumerasan, V.2014. Biotechnology (Revised Edition), Saras Publications, Kanyakumari.
2. Ignacimuthu, S.J.2002. Basic Biotechnology. Tata McGraw – Hill Publishing Company, Ltd., NewDelhi.
3. Ignacimuthu, S.J.2008. Biotechnology – An Introduction. Narosa Publishing House NewDelhi.
4. Arora, P.M.2003. Biotechnology. I Edition. Himalaya Publishing House, Mumbai.
5. Gupta, P.K.2001. Elements of Biotechnology and Genomics (I Edition) Rastogi Publications,Meerut.
6. Das, H.K. 2005. Text book of Biotechnology (Second edition).Wiley Dreamtech India (P) Ltd., NewDelhi.
7. Pranav kumar and Usha mina. 2020. Biotechology. Path finder Academy publication.

e- Resources:

https://en.m.wikipedia.org
https://nifa.usda.gov

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Describe the application of biotechnology in Biological sciences.
CO 2:	Apply the mechanism of gene transfer in prokaryotes.
CO 3:	Analyze the role of genetic engineering in human welfare.
CO 4:	Explain the molecular markers and its application in biotechnology.
CO 5:	Evaluate the role of microbes in bioremediations.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-V/ SBE-III	**SBE III - ECONOMIC ENTOMOLOGY**	Course Code: **ZUS3**
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To classify insect pest of agricultural crops. 2. Estimate the prophylactic measures of insects control. 3. Propose integrated pest management methods. 4. Study beneficial insects and its economic importance. 5. Explain mode of transmission of pathogens.
Unit I	Insect Pests: Definition - Classification- Primary and Secondary pests– Pests of Paddy, Sugarcane, Cotton – Their Biology, Nature of damage and management methods (Any two Major pests for each crop) - Pest outbreak - Pest resurgence - Pests of stored products and their Management methods. **6 Hours**
Unit II	Principles of insect control: Prophylactic measures: An overview of cultural, mechanical, physical, biological and chemical methods– Insect Growth Regulators (IGRs), Repellents, Antifeedents, Pheromones, Chemosterilants, Irradiation, Quarantine methods– Bio-Pesticides and their use in management of insect pests of crops. **6 Hours**
Unit III	Integrated Pest Management (IPM): Definition and Integration of methods.PotentialcomponentsofIPManditsapplication.Insectplantinteractions.Pest–Predator Complex - Ecological balance – Economic Threshold Levels (ETLs) **6 Hours**
Unit IV	Beneficial insects: Economic importance of honey bee; silk worm and lac insect - Pollinators, soil builders and scavengers. Biological control agents of Insect Pests – Pathogens, Parasites and Predators – Utilization of Bio-control agents in managing insect pests. **6 Hours**
Unit V	Insects and Diseases: Biology of insect vectors *i.e.,* Housefly, Mosquito, Flea and Cockroaches. Mode of transmission pathogens and epidemiology of typhoid fever, dengue, plague. **6 Hours**

Text Books:

1. David, B.V.2001. Elements of Economic Entomology. Popular Book Depot, Chennai.
2. Fenemore, P.G. and Prakash, A. 2006. Applied Entomology. New Age International (P) Limited Publishers, NNewDelhi.

Reference Books:

1. Chapman, R.F. 1988.The Insects Structure and function. Cambridge University Press, U.K.
2. Kumar, A. and Nigam, P.M. 2003. Economic and Applied Entomology. Emkay Publications, Delhi.
3. Pedigo, L.P.2003. Entomology and pest management. Pearson Education (Singapore) Pvt. Ltd., Delhi.
4. Prakash, I and Mathur, R.P.1987. Management of Rodent Pests. ICAR, New Delhi.
5. Singh, R. and Sachan, G.C. 2004. Elements of Entomology. Rastogi Publications, Meerut.
6. Fitzwater, W.D. and Prakash, I. 1989. Handbook of vertebrate pest control. ICAR, NewDelhi.
7. Ambrose, D.P. 2004.General Entomology. Kalyan Publishers, West Bengal.
8. Rathinasamy, T.K.1986. Medical Entomology. S Viswanathan and Co., Madras,India.

e -Resources:

https://en.m.wikipedia.org
https://academic.oup.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Classify and explain the insect pest of agricultural crop and its outbreaks.
CO 2:	Interpret the insects control methods
CO 3:	Explain the integrated pest management methods
CO 4:	Learn the beneficial insects and its economic importance
CO 5:	Analyze the mode of transmission of pathogen

Mapping of COs with POs & PSOs

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	M	S	M	S	S	S	M	S
CO2	S	S	S	M	M	S	M	S	M	S
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	M	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-VI / Core Course-XI	CC VIII - ENVIRONMENTAL BIOLOGY	Course Code: ZUK
Instruction Hours: 6	Credits: 6	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. Learn the role of Biotic and Abiotic factors in the environment. 2. Know the principle and concept of ecosystem and Biogeochemical cycles. 3. Understand the community ecology. 4. Know the environmental pollution and biomagnifications. 5. Learn the energy crisis of the environment.
Unit I	Definition – Branches of ecology; Environment: Atmosphere (Air), Hydrosphere (Water), Lithosphere (Soil); Abiotic factors: Temperature and light – Effects of light and temperature on animals.Biotic factors: Animal association – symbiosis, Commensalism, Mutualism, Antagonism, Antibiosis, Parasitism, Predators and Competition. **18 Hours**
Unit II	Ecosystem; Natural ecosystem and Man-made ecosystems - Trophic levels, Energy flow, Ecological pyramids and Productivity - Food chain and Food Web. Principles and concepts of Biogeochemical cycles- carbon, oxygen, nitrogen, phosphate and sulphur. Laws of limiting factors. Habitat Ecology: Fresh Water, Marine Water and Terrestrial habitat. **18 Hours**
Unit III	Community Ecology: Types of Communities; Characteristics of Community – Stratification - Community interdependence – Ecotone - Edge effect; Ecological Niche – Ecological succession. Population ecology: Population Sizeand Density, Natality, Mortality, Age Structure,Biotic Potential, Population Dynamics,EmigrationandImmigration;Regulation of Population Size.Terrestrial resources, forest and agriculture, aquatic resources and their conservation.Wildlife conservation - Sanctuariesand Nationalparks. **18 Hours**

Unit IV	Environmental Pollution: Air, Water, Land, Noise, Thermal and Radiation. EIA, GIS, Global warming and Biomagnifications. Biological indicators and their role in environmental monitoring - **18 Hours**
Unit V	Environmental conservation and management Energy Crisis: Conventional Sources of Energy-Coal, Oil and Natural Gas, Thermal Power, Nuclear power-Non-Conventional sources of Energy – Solar, Wind, Tidal, Wind and Bio-energy. **18 Hours**
Unit-VI (Activity)	Group project title related to Environmental Biology and Biodiversity conservation.

Text Book:

1.Sharma, P.D. 2010 (Tenth Edition) Ecology and Environment, Rastogi Publications,Meerut.

2.Verma P.S. and V.K. Agarwal, 2007. Environmental Biology. S. Chand and Co., NewDelhi

Reference Books:

1. Clarke,G.L.1954–ElementsofEcology,JohnWiley&Sons.N.Y.
2. Odum E.P.1971. Fundamentals ofecology.W.B.Saunders Co., Philadalphia.
3. Kendeigh, S.C., 1961 –Animal Ecology, Prentice Hall.
4. S.S. Purohit, D.H. Shanmiand A.K. Agarwal, 2004 – Environmental Sciences: A New Approach, Agrobix, Jodhpur.
5.Arumugam, N.2009. Concepts of ecology. Saras publications,Nagarkoil.
6.Verma, P.S and V.K. Agarwal. 2007. Cell biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand and Company ltd. NewDelhi.
7.Claude, F., Christiane, F., Paul, M. and Jean, D. 1998. EcEcology Science and Practice. Oxford & IBH Publishing Co .Pvt Ltd. ,Delhi.
8.Rastogi, V.B. and M.S. Jayaraj. 1997. Animal ecology and distribution of animals. Kedarnath,Ramnath.

e- Resources:

https://en.m.wikipedia.org
https://openoregon.pressbooks.pub

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Compare the role of Biotic and Abiotic factors in the environment and animal association
CO 2:	Able to interpret the principle and concept of natural and made ecosystem and Biogeochemical cycles.
CO 3:	Understand the community ecology and population dynamics
CO 4:	Estimate the environmental pollution and biomagnifications.
CO 5:	Interpret the conventional and non conventional energy resources of the environment and terrestrial resources

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	M
CO5	S	S	S	S	M	S	S	S	S	M

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-VI / Core Course-XII	CC IX - IMMUNOLOGY	Course Code: ZUL
Instruction Hours: 6	Credits: 6	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. Learn the types of immunity. 2. Understand different Immunoglobulin. 3. Know the hypersensitivity and its types. 4. Learn diseases and immune response. 5. Applying immunotechniques
Unit I	History and Scope of Immunology. Types of immunity- Innate and Acquired. Humoral and cell mediated immunity. Organs of the immune system: Primary and Secondary lymphoid organs, Lymphatic system. Cells of the immune system: B and T lymphocytes, dendritic cells, Macrophages other non-lymphoid cells, **18 Hours**
Unit II	Antigens and Antibody– Structure, properties, functions and types- Theories of antibody production, Antigen-Antibody interaction– Immunoglobulins: structure, properties, classification and functions – Complements: Classical and alternative pathways and its biological consequences- Cytokines: cytokine related diseases **18 Hours**
Unit III	Hypersensitivity - Types of hypersensitivity - Major Histocompatibility Complex (MHC) and its significance. Role of MHC in immunity. - Transplantation immunology- MLR, HLA Typing - Bone marrow transplantation, Organtransplants. Mechanism of allograftrejection. **18 Hours**
Unit IV	Diseases and immune response –Viral – Bacterial diseases – Parasitic infections – Tumour immunology. Immune deficiency diseases – AIDS.Autoimmune diseases – examples, concept and mechanisms.Cancer and the immune system - Identification of B and T epitopes for vaccine development.Monoclonal antibodies and theirapplications **18 Hours**

Unit V	Immunotechniques: detection of molecules using ELISA, RIA, Western blot, Immunoprecipitation, flow cytometry and Immunofluorescence microscopy, *in situ* localization - FISH andGISH. **18 Hours**
Unit VI (Activity)	**Study on the viral and bacterial diseases.**

Text Book:

1. Rao, C.V. 2006. Immunology. Narosa Publishing House, NewDelhi.
2. Kannan, I. 2007. Immunology. MJP Publishers,Chennai.
3. Shameem Rani, K and Dr.A.Amsath. 2020, Immunology, Pothy Publlication

Reference Books:

1. Gupta S.K. (1999) Immunology, Narosa Publishing House, NewDelhi.
2. Ivan Roitt, 1994. Essential Immunology (8th Edition) Blackwell Scientific Publication.
3. Kuby, Goldsby R.A. Kindt T.I. and Osborne B.A. (2000) Immunology IV edn. WH Freeman Co.NY.
4. Shetty, N. 2006. Immunology. New Age International (P) Limited, Publishers. NewDelhi.
5. Shastri, N.V. 2005. Principles of Immunology. Himalaya Publishing House, DDelhi.
6. Fatima, D. and Arumugam, N. 2001. Immunology. Saras Publications, KanyaKumari.
7. Annadurai, B. 2009. A Textbook of Immunology and Immunotechnology. S.Chand& Company Ltd., New Delhi.

e- Resources:

https://en.m.wikipedia.org
https:// www.nature.com

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Classify the types of immunity and organs of immune system.
CO 2:	Estimate antigen and antibody interaction and its biological consequences
CO 3:	Interpret types of hypersensitivity and its role in immunity.
CO 4:	Distinguish diseases and immune responses and their applications
CO 5:	Hands on training in immunotechniques.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	M	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-VI / Core course XIII-	**CP IV -(CC XI & CC XII) PRACTICAL IV**	Course Code: **ZUMY**
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks -40	External Marks- 60	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To estimate the water content. 2. To examine the planktons. 3. To identify animal associations. 4. To learn the basic technique of immunology. 5. To learn the lymphoid organs
Unit I	**Environmental Biology** 1. Estimation of Dissolved Oxygen in water samples. 2. Estimation of Salinity in water samples. 3. Estimation of Calcium in water samples. 4. Intertidal fauna- sandy, muddy and rocky shore. **15 Hours**
Unit II	1. Examination of marine planktons. 2. Observation of pH and salinity variations in different soil/water samples. 3. Estimation of LC_{50} (Demonstration in groups using different toxicants) 4. Estimation of toxicants (metals, organophosphorus) in industrial effluents. **15 Hours**
Unit III	**Spotters**: Animal association, pH meter, Secchi disc, maximum and minimum thermometer, Anemometer, Barometer, Hygrometer. **15 Hours**
Unit IV	**Immunology**: 1. Identification of lymphoid organs in rat / mouse. 2. Preparation of Antigen from sheep blood. 3. Determination of human blood group by haemagglutination test and assessment of specificity of antigen – antibody reactions. 4. Detection of the specific reactivity of precipitating antibody (Igg) with soluble antigens by immunodiffusion test. Vidal- test. Calotes-Cell imprinting of Thymus and Spleen. **15 Hours**
Unit V	Haemocytometer, Lymphoid organs, Immunoglobilin. **15 Hours**

Text Book:

1. Annadurai, B. 2009. A Textbook of Immunology and Immunotechnology. S.Chand& Company Ltd., New Delhi
2. Sharma, P.D. 2010 (Tenth Edition) Ecology and Environment, Rastogi Publications,Meerut.
3. Verma P.S. and V.K. Agarwal, 2007. Environmental Biology. S. Chand and Co., NewDelhi

Reference Books:

1. Shastri, N.V. 2005. Principles of Immunology. Himalaya Publishing House, DDelhi
2. Clarke,G.L.1954–ElementsofEcology,JohnWiley&Sons.N.Y.
3. Odum E.P.1971.Fundamentals of ecology. W.B.Saunders Co., Philadalphia.

e- Resources:

https://en.m.wikipedia.org
https:// www.nature.com
https://en.m.wikipedia.org
https://openoregon.pressbooks.pub

Course Outcomes:

On completion of the course the learner will be able

.CO 1:	Understand the water quality parameters
CO 2:	Able to examine the planktons.
CO 3:	Understand the animal associations.
CO 4:	Able to handle the basic immunological technique
CO 5:	To learn the lymphoid organs.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-VI / MBE-II	**MBE II - MEDICAL LAB TECHNOLOGY**	Course Code: **ZUE4**
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. Know the clinical use of instrumentation. 2. Study the analysis of blood, urine, sputum, semen and stool. 3. Study the nature and causes of various diseases. 4. Understand the blood component in human. 5. 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. **18 Hours**
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) – AneamiasDiagitalGlucometer – Blood glucose. **18 Hours**
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. **18 Hours**
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. **18 Hours**

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. **18 Hours**

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

e-Resources:

1. https://ves.ac.in/tulsitech/wp-content/uploads/sites/16/2017/05/Medical_Laboratory_Technician.pdf
2.https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/medicallabtechnology.pdf

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Acquired technical skills will help the students for collecting and processing biological specimens for analysis
CO 2:	Understand fundamental analytical principles and processes used in clinical laboratory testing
CO 3:	Application of medical laboratory test will enable the students to understand normal and abnormal
CO 4:	Students enable their critical and analytical thinking in the detection of diseases
CO 5:	Application of medical laboratory procedures will enable the students to distinguish normal and abnormal microscopic pathogens

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	M	S	M	S	S	S	S	S
CO2	S	S	S	S	S	S	M	S	S	S
CO3	S	S	M	M	M	S	M	S	S	S
CO4	S	S	M	S	S	M	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-VI / MBE-II	MBE II- **BIOINFORMATICS**	Course Code: ZUE4
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. Understand the importance of bioinformatics in biology 2. Familiar with application of bioinformatics tool 3. Know the concept of Algorithms. 4. Ability to learn phylogenetic analysis. 5. Training on 3D structure presiction.
Unit I	Objectives of Bioinformatics, kinds of data used, Data integration, Data analysis, Carriers in Bioinformatics, Scope of bioinformatics – Useful bioinformatics sites – Bioinformatics in Pharmaceutical industry – Bioinformatics orientation in IT industry. **18 Hours**
Unit II	Biological databases –Tools for Searching biological databases – Sequence and Structural databases – Nucleotide Sequence Databases - NCBI, GENE BANK, EMBL DDBJ.Protein Sequence databases – Swissprot, PIR – Structural database(PDB, CATH, and SCOP). **18 Hours**
Unit III	Sequence alignment – Methods of pair wise alignment –Algorithms– Needleman &wunchalgorithm – Smith waterman algorithm – Amino acid substitution matrices – PAM – BLOSUM- Multiple sequence alignment (MSA) – Clustal W. **18 Hours**
Unit IV	Phylogenetic analysis: Concept of trees, Methods of Phylogenetic analysis - Distance matrix methods, Characters based methods- Steps on Constructing alignments and phylogenies. **18 Hours**
Unit V	Conceptual models of protein structure – Predicting Protein structure and function from sequence – Determination of structure – feature detection – secondary structure prediction – predicting 3 D structure - the relationship of protein three – dimensional structure to protein function. **18 Hours**

TEXT BOOKS:

1. **DR.A.JOHN DE BRITTO**.Bioinformatics, St.Xaviers College, Palayamkottai.
2. **JASON.T.L.WARG**, Data mining in Bioinformatics,TBHPublishers,MohamedZaki.J Distributors.3 Nallathambist, Chennai.
3. **SAILESH KUMAR AGGARWA**l, A Introduction to Bioinformatics, Arise Publishers & Distributors4648/1, 21-Ansari Road, Darya Gang, New Delhi.

REFERENCES :.

1. **ATTWOOD, T.K.** and **D.J. PARRY SMITH**. 2002. Introduction to Bioinformatics. Pearson Education Publication, Delhi.
2. **DAN E. KRANE** and **MICHAEL L. RAYMER**. 2003. Fundamental concepts of Bioinformatics. Pearson Education Publication, Delhi.
3. **IRFAN A. KHAN**. 2003. Recent advances in Bioinformatics. Ukaaz Publications, Andhara Pradesh.
4. **IRFAN A. KHAN** and **ATIYA KHANUM**. 2002. Emerging trends in Bioinformatics. Ukaaz Publications, Andhara Pradesh
5. **SUNDARA RAJAN, S**. and **R. BALAJI**. 2002. Introduction to Bioinformatics. Himalaya Publishing House, Delhi.
6. **GAUTHAM.N.**Bioinformatics Databases and algorithms,Narosa Publishing House,www.narosa.com.
7. **ZOE LACROIX TERENCE CRITCHLOW**, Bioinformatics, Managing Scientific data, Morgan Kaufmann publishers.
8. **DARBESHWAR ROY**. Bioinformatics, Narosa publishing house, New Delhi.
9. **JEAN MICHEL CLAVERIE**, **CEDRIC NOTREDAME**, Bioinformatics. A Beginner's guide, Wiley India(p) ltd, New Delhi.
10. **SHUIQINGYE**. Bioinformatics a Practical approach.

e-Resources:

1.http://bioinformaticsinstitute.ru/sites/default/files/lapidus_1_0.pdf

2.https://www.researchgate.net/publication/343039538_Bioinformatics_Concepts_and_Applications

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Compare the importance of bioinformatics in lifesciences
CO 2:	Hands on training with bioinformatics tool
CO 3:	Familiar with applying algorithm and substitution matrices
CO 4:	Hands on training in phylogenetic analysis
CO 5:	Ability and interpret the 3D structure prediction.

Mapping of COs with POs & PSOs

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	M	S	S	S	M	S
CO2	S	S	S	S	M	S	M	S	M	S
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	M	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-VI/ Core Course-II	**MBE III - ECONOMIC ZOOLOGY**	Course Code: **ZUE5**
Instruction Hours: 6	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To study the culture aspects of fish, prawn, pearl and lac. 2. To study the economic importance of fish, prawn, pearl, and lac.. 3. To gain knowledge in piggery and rabbit farming. 4. Ability to rear commercially important edible gastropod species. 5. 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. **18 Hours**
Unit II	Crustacean Fishery: Scope of shrimp fishery – Species of Shrimp – Culture of Marine shrimp – Spoilage of shrimp – Preservation and processing of shrimp .Culture of Macro trachiumbosenbergii.Mud crab culture and fattening of crab. **18 Hours**
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. **18 Hours**
Unit IV	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. **18 Hours**
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. **18 Hours**

Text Book:

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

e- Resources:

5. https://www.researchgate.net/publication/297328448_Applied_and_Economic_Zoology
3. http://www.freebookcentre.net/biology-books-download/ZOOLOGY-Notes-(PDF-303p).html

Course Outcomes:

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

On completion of the course the learner will be able

CO 1:	Explore various techniques used in fishery practices. Understanding the scientific terms, concepts, facts, phenomenon & their interrelationship of fish.
CO 2:	Aware of the crustacean fishery and field management practices
CO 3:	To understand Lac culture status in India and its economic importance.
CO 4:	To understand the economic importance of Molluscan fisheries and knowledge on mass culture and enrichment of live food organisms.
CO 5:	To gain in depth knowledge and field exposure on sustainable piggery practices.

Mapping of COs with POs & PSOs

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	M	S	M	S	M	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	M	M	S
CO5	S	S	S	M	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation

Semester-VI/ Core Course-II	**MBE III - WILD LIFE BIOLOGY**	Course Code: ZUE5
Instruction Hours: 6	Credits: 5	Exam Hours: 3
Internal Marks -25	External Marks-75	Total Marks: 100

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**
Course Objectives:	1. To study about wildlife biologists and zoologists. 2. To understand research & development, carry out in wildlife management. 3. To know the conservation plans that combat these threats, and protect our natural resources. 4. Understand the importance of wildlife censes 5. Know the wild life protection Act And its importance
Unit I	Definition of wildlife: Causes of wildlife depletion- need for wildlife conservation – IUCN Categories – endangered species of birds and mammals in India. **18 Hours**
Unit II	Wildlife sanctuaries, National park and Biosphere reserves – Definition and importance.Sanctuaries: vedanthangal Bird sanctuary – Mudumalai wildlife sanctuary – point calimere wildlife sanctuary.National parks: Corbett national park, guindy national park, Biosphere reserves – Gulf of Mannar. **18 Hours**
Unit III	Importance of Wildlife Censes – Censes Techniques: Direct methods – Line Transect Method –Block count method. Indirect Method: Pugmark techniques and pellet methods **18 Hours**
Unit IV	Zoos and their importance – types of enclosures – food and feeding of zoo animals – veterinary care of zoo animals – zoo education.Case study of Aringar Anna Zoological Park. **18 Hours**
Unit V	Wildlife (Protection) Act 1972: Introduction – Schedule – Declaration of Wildlife Sanctuary and National parks. Human wildlife conflicts with reference to Elephant. **18 Hours**

Text Books:

1. **Saharia.V.B** 1982 Wildlife in India, Nataraj Publishers, Dehradum.
2. **Goutam Kumar Saha and SubhenduMazumdar**- Wildlife Biology: An Indian Perspective
3. **Ashok Shantilal Kothari and BomanFramjiChhapgar**; Wildlife of the Himalayas and the Terai Region (Bombay Natural History Society)"
4. **Raymond F Dasmann**- Wildlife Biology

Reference Books:

1. **Dasman.R.F** 1964 Wildlife Biology, Jhon and Wildy and sons New York. Pp231
2. **Giles R.H.J** (Ed) 1984 Wildlife Management Techniques 3rd Edition. The Wildlife Society, Washington, D.C. Natraj Publishers, Dehradum, India.
3. **Sesharri.B** 1986 India's Wildlife reserves, Sterling Pup'rspvt Ltd,. New Delhi.
4. A. R. E. Sinclair, Graeme James Caughley, and John M. Fryxell

John M. Fryxell, A. R. E. Sinclair and Graeme James Caughley

Anthony R.E.. Sinclair, John M. Fryxell, Graeme Caughley. – 2nd ed. p. cm. Rev. ed

e-Resources:

1.http://www.jnkvv.org/PDF/06042020101735WILDLIFE%20BIOLOGY.pdf
2.https://www.researchgate.net/publication/318570959_Wildlife_Biology_An_Indian_Perspective

Course Outcomes:

On completion of the course the learner will be able

CO 1:	Understand the need of wildlife conservation and categories of IUCN
CO 2:	Know wildlife sanctuaries and National parks
CO 3:	Learn wildlife census techniques and methods
CO 4:	Understand the importance of Zoo's and case study
CO 5:	Know wildlife protection Acts

Mapping of COs with POs & PSOs

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	M	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	M	M	S
CO5	S	S	S	S	S	S	S	S	S	S

S- Strongly correlating
M-Moderately Correlating
W-Weakly Correlating
N-No Correlation