

**ARULMIGU PALANIANDAVAR ARTS COLLEGE FOR WOMEN, PALANI**

**(AUTONOMOUS)**

**RE-ACCREDITED WITH B<sup>++</sup> GRADE BY NAAC**

**(Affiliated to Mother Teresa Women's University, Kodaikanal)**

**PG AND RESEARCH DEPARTMENT OF ZOOLOGY**

**CURRICULUM FRAMEWORK AND SYLLABUS FOR  
OUTCOME BASED EDUCATION**

**IN**

**B.Sc., (ZOOLOGY)**

**&**

**EXTRA-CREDIT COURSES**

**UNDER**

**CHOICE BASED CREDIT SYSTEM**

**2019-2022**

## **Preamble:**

The Department of Zoology has been established as Undergraduate Department in the year 1974 and upgraded as Postgraduate Department in 1987. The Department is enriched with altruistic contribution of a galaxy of teachers. It is noted for its good academic record and well established laboratories. The highlight of the Department is the active participation of the faculty members in Research activities with research publications in International and National level reputed journals. The faculty has received many awards and Research grants from various funding agencies such as UGC, DST etc., The faculty strives towards women education and empowerment at all levels.

## **Bloom's Taxonomy in fixing the Learning Objectives:**

Since the Academic year 2019 – 2020, the curriculum of B.Sc., (Zoology) & M.Sc., (Zoology) has been designed and the learning objectives and outcomes of the programmes are set, following the Bloom's Taxonomy Cognitive Domain. Accordingly, it is broken into six levels of learning objectives of each course. They are -

K1 / Knowledge = Remember

K2 / Comprehension = Understand

K3 / Application = Apply

K4 / Analysis = Analyze

K5 / Evaluation = Evaluate

K6 / Synthesis = Create

## **Bloom's Taxonomy Action Verbs:**

**K1 / Knowledge:** Arrange, Define, Describe, Duplicate, Identify, Label, List, Match, Memorize, Name, Order, Outline, Recognize, Relate, Recall, Repeat, Reproduce, Select, State

**K2 / Comprehension:** Classify, Convert, Defend, Describe, Discuss, Distinguish, Estimate, Explain, Express, Extend, Generalize, Give example(s), Identify, Indicate, Infer, Locate, Paraphrase, Predict, Recognize, Rewrite, Review, Select, Summarize, Translate

**K3 / Application:** Apply, Change, Choose, Compute, Demonstrate, Discover, Dramatize, Employ, Illustrate, Interpret, Manipulate, Modify, Operate, Practice, Predict,

Prepare, Produce, Relate, Schedule, Show, Sketch, Solve, Use, Write

**K4 / Analysis:** Analyze, Appraise, Breakdown, Calculate, Categorize, Compare, Contrast, Criticize, Diagram, Differentiate, Discriminate, Distinguish, Examine, Experiment, Identify, Illustrate, Infer, Model, Outline, Point out, Question, Relate, Select, Separate, Subdivide, Test

**K5 / Evaluation:** Appraise, Argue, Assess, Attach, Choose, Compare, Conclude, Contrast, Defend, Describe, Discriminate, Estimate, Evaluate, Explain, Judge,

Justify, Interpret, Relate, Predict, Rate, Select, Summarize, Support, Value  
**K6 / Synthesis:** Arrange, Assemble, Categorize, Collect, Combine, Comply, Compose, Construct, Create, Design, Develop, Devise, Explain, Formulate, Generate, Plan, Prepare, Rearrange, Reconstruct, Relate, Reorganize, Revise, Rewrite, Set up, Summarize, Synthesize, Tell, Write

### **Mapping COs with POs:**

For each programme, the Educational objectives and the Specific objectives are specified. The programme outcomes are designed according to the curriculum, teaching, learning and evaluation process. For each course, the definite outcomes are set, giving challenge to the cognitive domain. The course outcomes are mapped with the programme outcomes. The performance of the stakeholders is assessed and the attainment rate is fixed, by using the measurements 'high', 'medium' and 'low'. The restructuring of the curriculum is done based on the rate of attainment.

### **Institutional Objectives:**

- Women Education
- Women Empowerment
- Self-reliance and
- Making Model Citizens.

### **Programme Educational Objectives:**

**PEO – I:** Graduates of the program will develop a strong and competent knowledge in basic biological science required for critical learning and research.

**PEO – II:** Graduates will develop diversified basic professional skills through various laboratory technical training, communicational and presentation skills.

**PEO – III:** Graduates will possess an ability to identify, formulate, and solve biological problems to contribute to service efforts to communicate in both the professional and private realm.

**PEO – IV:** Graduates will integrate related topics from separate parts of the course such as levels of organization, cell biology, ecology, evolution, biochemistry, genetics, embryology, basic biotechnology, physiology, molecular biology for successful career.

### **Programme Outcomes:**

Upon completion of B.Sc., Zoology Degree Programme the graduates will be able to –

**PO – I:** Develop a broad fundamental knowledge of the animal diversity especially local fauna pattern of evolution, morphology, adaptations and classification.

**PO – II:** Analyze the relationship between plants, animals, microbes and deal with the deal with the local national global environment issues by realizing the right of the individuals and also need to conserve our biosphere.

**PO – III:** Understand how organisms function at the level of gene, genome, cell tissue, organs, organ system, drawing upon this knowledge, they are able to give specific examples of the physiological adaptations developed, reproduction and behavior of different forms of life.

**PO – IV:** Gain knowledge about the application of biological sciences in aquaculture, apiculture, vermiculture, poultry farming, pest management, there by impart skill as well a source of income and self employment

**PO – V:** Generate innovative ideas for performing experiments in the areas of biochemistry, physiology, genetics, microbiology, Developmental biology, Bioinformatics, Biostatistics, anatomy, taxonomy, economic zoology, and ecology.

**PO – VI:** Explain the recent developments in genetic engineering, biotechnology, immunology, informatics, for research activities in the department or in collaboration with other research institutions.

**PO – VII:** Organize and deliver relevant applications of knowledge through effective written verbal, graphical/virtual communications and interact with people from diverse back ground.

### Mapping PEOs with IOs:

Programme Educational Objectives	Institutional Objectives			
	1	2	3	4
<b>B.Sc., (Zoology)</b>				
<b>PEO1:</b> Graduates of the program will develop a strong and competent knowledge in basic biological science required for critical learning and research.	*			
<b>PEO2:</b> Graduates will develop diversified basic professional skills through various laboratory technical training, communicational and presentation skills.		*		
<b>PEO3:</b> Graduates will possess an ability to identify, formulate, and solve biological problems to contribute to service efforts to communicate in both the professional and private realm.			*	
<b>PEO4:</b> Graduates will integrate related topics from separate parts of the course such as levels of organization, cell biology, ecology, evolution, biochemistry, genetics, embryology, basic biotechnology, physiology, molecular biology for successful career.				*

**Measuring: H – High; M – Medium; L – Low**

**COMMON ACADEMIC STRUCTURE**

**EFFECT FROM THE ACADEMIC YEAR 2019-20 ONWARDS**

Part No	Course code	COURSE TITLE	Lecture/Practical	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
<b>SEMESTER I</b>								
<b>I</b>	MUGT1	Part – I Tamil	6	3	25	75	100	3
<b>II</b>	MUGE1	Part – II English	6	3	25	75	100	3
<b>III</b>		Part – III: Core I - Invertebrata I	4	3	25	75	100	4
	MUZC2	Core II - Invertebrata II	4	3	25	75	100	4
	MUBA1	Core Practical I - Invertebrata and Chordata. (Non semester)	2	-	-	-	-	-
	MUZBA1	Ancillary – I (Botany) Animal Diversity and Genetics	3	3	25	75	100	3
		Ancillary Practical I (Botany) (Paper I & II - Non semester)	2	-	-	-	-	-
<b>IV</b>	MUGAC1	Part – IV: SBC I - Apiculture	2	3	25	75	100	2
<b>V</b>	MUVE	Part – V: VBE	1	3	25	75	100	2
<b>SEMESTER II</b>								
<b>I</b>	MUGT2	Part – I Tamil	6	3	25	75	100	3
<b>II</b>	MUGE2	Part – II English	6	3	25	75	100	3
<b>III</b>	MUZC3	Part – III: Core III - Chordata	8	3	25	75	100	4
	MUZP1	Core Practical I ( Non Semester)	3	3	40	60	100	4
	MUBA2	Ancillary II (Botany)	3	3	25	75	100	3
	MUBAP	Ancillary Practical I (Botany) I & II SEm (Non semester)	2	3	40	60	100	4
<b>IV</b>	MUZPF2	Part – IV: SBC II - Poultry Farming	2	3	25	75	100	2
<b>SEMESTER III</b>								
<b>I</b>	MUGT3	Part – I Tamil	6	3	25	75	100	3
<b>II</b>	MUGE3	Part – II English	6	3	25	75	100	3
<b>III</b>	MUZC4	Part – III: Core IV - Developmental biology	6	3	25	75	100	4
		Core Practical (Sem II& III) (Non-Semester)	3	-	-	-	-	-
	MUCA3	Ancillary Theory I (Chemistry)	3	3	25	75	100	3
		Ancillary Practical I (Chemistry)	2	-	-	-	-	-
<b>IV</b>	MUZVC3	Part – IV: SBC III - Vermiculture	2	3	25	75	100	2
	MUZN1	NME I - Sericulture	2	3	25	75	100	2

Part No	Course code	COURSE TITLE	Lecture/Practical (Hours/week)	Duration of exam (hours)	Max Marks			Credit points
					Internal	External	Total	
<b>SEMESTER IV</b>								
<b>I</b>	MUGT4	Part – I Tamil	6	3	25	75	100	3
<b>II</b>	MUGE4	Part – II English	6	3	25	75	100	3
<b>III</b>	MUZC5	Part – III: Core V - Genetics	4	3	25	75	100	4
	MUZC6	Core VI – Biostatistics and Bioinformatics	4	3	25	75	100	4
	MUZP2	Core Practical II – Developmental biology, Genetics Biostatistics and Bioinformatics. (Non Semester)	3	3	40	60	100	4
	MUCA4	Ancillary Theory II (Chemistry)	3	3	25	75	100	3
	MUCAP	Ancillary Practical I (Chemistry)	2	3	40	60	100	4
<b>IV</b>	MUZSC4	Part – IV: SBC IV - Sericulture	2	3	25	75	100	2
<b>V</b>	MUEXA4	Part – V: Extension Activity	-	-	100	-	100	1
<b>SEMESTER V</b>								
<b>III</b>	MUZC7	Part III: Core VII: Biochemistry	6	3	25	75	100	5
	MUZC8	Core VIII: Cell and Molecular Biology	6	3	25	75	100	5
		Core Practical III – Biochemistry & Cell and Molecular Biology (Non-Semester)	6	-	40	-	-	-
	MUZE1	Major Elective I: Immunology/ Medical diagnostics	5	3	25	75	100	5
	MUZE2	Major Elective II: Microbiology / Medical Transcription	5	3	25	75	100	5
<b>IV</b>	MUZOF5	Part – IV: SBC V- Ornamental Fish Culture	2	3	25	75	100	2
<b>SEMESTER VI</b>								
<b>III</b>	MUZC9	Part – III: Core IX: Animal Physiology	6	3	25	75	100	5
	MUZC10	Core X: Biotechnology	7	3	25	75	100	5
	MUZP3	Core Practical III: Biochemistry & Cell and Molecular Biology (Sem - III)	-	3		60	100	4
	MUZP4	Core Practical IV: Animal Physiology Biotechnology (Sem - IV )	6	3	40	60	100	4
	MUZE3	Major Elective III – Evolution/Entomology	5	3	25	75	100	5
	MUZN2	Part – IV: NME II Human Reproductive Biology	2	3	25	75	100	2
	MUZPR	Part – IV: SBC VI: Group project	2	-	75	25	100	2
<b>V</b>	MUES6	Part – V: Environmental Studies	2	3	25	75	100	2

### EXTRA CREDIT COURSES

Course code	Course Title	Lecture/Practical (Hours/week)	Duration of exam (hours)	Max Marks			Credit points
				Internal	External	Total	
UGEIPM	Extra Credit Course I: (Semester – I) Insect pest management	-	-	-	100	100	2
UGECDM	Extra Credit Course II: (Semester – III) Communicable Diseases and Management	-	-	-	100	100	2
UGEHH	Extra Credit Course – III: (Semester - III) Health and Hygiene	-	-	-	100	100	2

## **SEMESTER - I**



**Programme: B.Sc.,**

**Subject: Zoology**

**Semester: I**

**Course: Invertebrata – I**

**Course Type: Core – I**

**Credits: 4**

**Contact Hours: 4 hours/Week**

**Course Code: MUZC1**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To describe common and distinctive features of invertebrate organisms including protozoans, Porifera, Coelenterates, Platyhelminthes and annelids.
- To explain phylogenetic relationships between the phyla covered
- To discuss important concepts in invertebrate organization including body symmetry, body cavity and segmentation
- To describe important biological processes in invertebrates
- To gain knowledge about locomotion, body support, feeding and digestion, excretion and osmoregulation, respiration, circulation, sensory perception and behavior reproduction and development.

**COURSE CONTENT**

**Unit - I:**

Taxonomy – Units of classification, Criteria of classification-types of coelom, types of symmetry, Principles of classification and binomial nomenclature. General characters and outline classification up to class level with one example – Protozoa, Porifera, Coelenterata, Helminthes and Annelida

**Unit – II:**

Protozoa-Type Study-Paramecium-General organisation, cyclosis, contractile vacuole and reproduction only.

General topic: Life cycle of Plasmodium.

Porifera-Type study-Ascon sponge Leucosolenia-general organisation, histology, spicules, reproduction and development only.

Canal system in sponges- with reference to Leucosolenia.

**Unit – III:**

Coelenterata-Type study-Obelia- Structure of Obelia colony, medusa, nematocyst, reproduction and development (metagenesis).

General topic: Polymorphism in Coelenterata, Coral reefs.

**Unit – IV:**

Helminthes- Type study- Liver fluke-external characters, digestive system, excretion, reproduction and development (life cycle).

General topic: Parasitic adaptations of Platyhelminthes. Structure, pathology and control measures of Ascaris.

**Unit – V:**

Annelida-Type study-Earth worm-external morphology, setae, nephridia, nervous system and reproductive system only.

General topic: Metamerism in Annelida.

**Prescribed Text:**

- N.C.Nair,S.Leelavathy,N.Soundrapandian,T.Murugan,N.Arumugam, *A Prescribed Text: of Invertebrates*, Saras Publication, 2012.

**Reference Books:**

- EkambaranathaAyyar, M., Ananthakrishnan, *A Manual of Zoology Volume I Invertebrata*. T.N.,S.Viswanathan Printers & Publishers, Chennai
- Kotpal, *Invertebrate, Phylum Series*, R.L. Rostagi Meerut. 1990
- Jordan, *Invertebrate Zoology*, S.Chand & Co.
- R.D.Barnes, *Invertebrate Zoology*, Saunders.
- Dhama and Dhama, *Invertebrate Zoology*
- E.J.W. Barrington, *Invertebrata Structure and Functions*, Borton Houghton, Miffin & ELBS.

**Programme: B.Sc.,**

**Subject: Zoology**

**Semester: I**

**Course: Invertebrata – II**

**Course Type: Core – II**

**Credits: 4**

**Contact Hours: 4 hours/Week**

**Course Code: MUZC2**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To understand the Classification and General characteristics Phylogeny of Invertebrates.
- To explain general characters of Arthropoda and metamorphosis and economic importance of insects
- To study the external as well as internal characters of non chordates
- To describe the general biology of few selected non-chordates which are useful to mankind
- To gain enriched knowledge on Mollusc and Echinoderms

**COURSE CONTENT**

**Unit - I: General Classification:**

General characters and outline classification up to class level with following example  
Arthropoda, Mollusca and Echinodermata

**Unit – II: Arthropoda**

Type Study: Prawn – external morphology, appendages, Reproductive systems and development.

Peripatus : Affinities ( Living fossil)

**Unit – III: General Topics**

Mouth parts in insects

Insect metamorphosis

Economic importance of insects

Commercial products of insects

**Unit – IV: Mollusca**

Type Study : Pila – External morphology, body organization, Digestive system, Reproductive system and Osphradium only.

General Topics: Pearl culture, Cephalopods are advanced Molluscs

**Unit – V: Echinodermata**

Type study : Star fish - External morphology, Pedicellariae, Water Vascular system only.

General topic: Larval forms in Echinodermata.

**Prescribed Text:**

- N.C .Nair,S.Leelavathy,N.Soundrapandian,T.Murugan,N.Arumugam, *A Prescribed Text: of Invertebrates. Saras Publication, 2012.*

**Reference Books:**

- EkambaranathaAyyar, M., Ananthakrishnan, T.N. *A Manual of Zoology Volume I Invertebrata.*,S.Viswanathan Printers & Publishers Ltd. Chennai.
- Kotpal, R.L, *Invertebrata, Phylum series.*,. Rostagi Meercut, 1990.
- Jordan : *Invertebrate Zoology*, S.Chand & Co.
- R.D.Barnes, *Invertebrate Zoology*, Saunders.
- Dhami and Dhami : *Invertebrate Zoology*

**Programme: B.Sc.,**

**Subject: Zoology**

**Semester: I**

**Course: Animal Diversity & Genetics**

**Course Type: Ancillary – I**

**Credits: 4**

**Contact Hours: 3 hours/Week**

**Course Code: MUZC1**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To be familiarized with the classification and identification of animals.
- To know about the external and internal features of the organisms..
- To execute the animal behaviour in biosphere conservation.
- To understand the Concept of human genetics.
- To study the fundamental concepts of genetics.

**COURSE CONTENT**

**Unit - I:**

Principles of animal taxonomy

Outline classification of animal kingdom upto phylum level with example (flow chart only)

General characters of the following phyla-Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata.

Protozoa-Entamoeba histolytica-structure, lifecycle, pathology, prevention and treatment

**Unit – II:**

Porifera: Olynthus type study

Coelenterate: Types of coral reefs

Platyhelminthes: Fasciola hepatica external morphology only

Aschelminthes: Parasitic adaptations in helminthes

Annelida:Earth worm external morphology and reproductive system.

Arthropoda: Cock roach External features, Mouth parts, digestive and nervous system.

Mollusca: pila- External morphology

Echinodermata: Star fish-External morphology

**Unit – III:**

Classification of phylum chordate upto class level with any (example Flow chart only)

Salient features of Prochordata

External morphology of-Amphioxus, Ascidian, Balanoglossus

Pisces: Shark- external structure

Amphibians: Frog-External morphology, Reproductive system

Reptiles: Calotes- external morphology, digestive system

Aves: pigeon External morphology-respiratory system

Mammals: rabbit external morphology-excretory system

#### **Unit – IV:**

Migration of fishes, Identification of poisonous snakes

Dentition in mammals.

#### **Unit – V:**

Laws of Mendel, Multiple alleles-A,B,O and Rh typing

#### **Prescribed Texts:**

- Arumugam, N. *Allied Zoology Part I & Part – II* – Saras Publications, Nagercoil, 2018.
- Dr.R.P. Meyyan, *A Text of Genetics*.

#### **Books for Reference:**

- Ekambaranatha Ayyer *A Manual of Zoology Vol. I & II*, Ananda Book Depot, “Acton Lodge”, Madras, 1995.
- Jordan E.L & Verma J.K. *Invertebrate Zoology*, S. Chand & Company Ltd, New Delhi, 1997.
- Kotpal R.L. (1983) *Modern Prescribed Text of Zoology*, Rastogi Publications. 2018.

**Programme: B.Sc.,**

**Semester: I**

**Course Type: SBC**

**Contact Hours: 2 hours/Week**

**CIA: 25**

**Course Outcomes:**

- To gain knowledge about steps involved in bee keeping.
- To comprehend innovative ideas to flourish economically.
- To produce value added products from the by products.
- To overcome the practical difficulties in apiculture.
- To learn techniques to commercialize the by products of bee keeping.

**Subject: Zoology**

**Course: Apiculture**

**Credits: 4**

**Course Code: MUZC1**

**CE: 75**

### **COURSE CONTENT**

#### **Unit - I:**

Scope of Apiculture. Honey bee – Classification, types of honey bees – *Apis dorsata*, *Apis cerana*, *Apis florea*, *Apis indica* and *Apis mellifera*.

Biology of honey bee- External structure, life cycle

#### **Unit – II:**

*Apis indica*– Social life of Indian Honey Bee. Foraging behavior of Bees, queen rearing methods.

#### **Unit – III:**

Choice of Bee in Apiculture – Desirable traits for Bee keeping, Poor choice, Good Choice, Best Choice.

#### **Unit – IV:**

Principals of Bee keeping – Methods of bee keeping in India – Primitive hives – Wall type, Movable type, Bamboo hive. Modern hives – Langstroth hive, Newton hive. Appliances used in Bee keeping.

#### **Unit – V:**

Economic importance of Bee products – Chemical composition, Nutritive value and Medicinal uses of Honey, Bees Wax and Bee Venom.

#### **Prescribed Text:**

- Dr.N.Arumugam, Dr.S.Murugan, Dr.J.Johnson Rajeshwar and Dr.R.Ram Prabhu, *Applied Zoology*, Saras Publication, Nagerkovil, 2005.

**Reference Books:**

- Dhama.P.S & Dhama.J.K., *Invertebrate Zoology*, R.Chand& Co., Publishers, New Delhi, 1976.
- Ekambaranath Ayyar. M. *A Manual of Zoology* .Vishwanathan Printers and Publishers Private Ltd., Chennai. 1973.



## **SEMESTER – II**

**Programme: B.Sc.,**

**Subject: Zoology**

**Semester: II**

**Course: Chordata**

**Course Type: Core - III**

**Credits: 4**

**Contact Hours: 7 hours/Week**

**Course Code: MUZC3**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To portray the origin and ancestry of chordates and basic principles of chordate classification.
- To gain knowledge on fundamental chordate characters
- To understand interrelationship of primitive pro-chordates with invertebrates and vertebrates
- To gain knowledge on fishes and their migration.
- To understand the economic importance of higher animals.

**COURSE CONTENT**

**Unit - I:**

General characters and outline classification of chordates.

Prochordates-Type study-Amphioxus-external morphology, digestive system and excretory system only.

General Topic: Affinities of Balanoglossus.

**Unit - II:**

Pisces-Classification of fishes. Type study-Shark-external morphology, digestive system, circulatory system and reproductive system only.

General Topic: Migration of fishes. Identification of edible and non edible fishes – with one example.

Amphibians-Type study-Frog-external morphology, respiratory system, reproductive system and development only.

General Topic: Parental care in Amphibia.

**Unit – III:**

Reptilia-Type study-Calotes, external morphology, nervous system and urinogenital system.

General Topic: Decline of Mesozoic reptiles (Dinosaurs).

Poisonous and non-poisonous snakes-identification, biting mechanism and first aid.

**Unit – IV:**

Aves-Type study-Pigeon- external morphology and respiratory system only.

General Topics: Flight adaptations in birds. Flightless birds.

Fossil bird-Archeopteryx and its evolutionary importance.

**Unit - V:**

Mammalia-Type study-Rabbit- external morphology and digestive system, circulatory system, reproductive system , Endoskeleton - Fore limb and Hind limb only.

General Topics: Salient features of Prototheria and Metatheria

Dentition in Mammals. Adaptations in Aquatic mammals.

**Prescribed Text:**

- A.Thangamani,S.Prasannakumar,L.M.Naryanan,N.Arumugam (2010) *A Prescribed Text: of Chordates*, Saras Publication.

**Reference Books:**

- *A Manual of Zoology Volume I Chordata* . EkambaranathaAyyar, M., Ananthakrishnan, T.N., S.Viswanathan Publishers, Chennai.
- *The Chordates*, 2<sup>nd</sup> Edition,Cambridge University Press, New York.
- *Comparative Anatomy of the Vertebrates*, Library of Congress Catalogue.
- *Vertebrates, their Structure and Life*, Library of Congress Catalogue
- J.Z.Young, *Life of Vertebrates*.

**Programme: B.Sc.,**

**Subject: Zoology**

**Semester: II**

**Course: Invertebrata & Chordata**

**Course Type: Core Practical-I**

**Course Code: MUZP1**

**Contact Hours: 3 hours/Week**

**Credits: 4**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To be able to dissect and examine various organ systems.
- To know the methods of preservation of animals for examination.
- To acquire basic skills in animal dissections.
- To be familiar with the external morphology of animals.
- To know the salient features of animals by observing them.

**COURSE CONTENT**

**Dissection Charts:**

Earthworm: Nervous system.

Cockroach: Digestive system and Nervous system.

Frog: Arterial system and Venous system.

**Mounting Charts:**

Earth worm – Body setae and penial setae.

Cockroach – Mouth parts, salivary apparatus.

Pila-Radula.

Shark –Placoid scales.

Frog – Brain.

**Spotters:**

Protozoa- Paramecium-Entire, Paramecium binary fusion and conjugation.

Porifera – Ascon sponge, Gemmules, Spicules.

Coelenterata – Obelia colony, medusa of Obelia, Physalia and Madrepora.

Helminthes- Liver fluke, Cercaria larva, Ascaris male and female.

Annelida – Earthworm, Nereis and Trochophore larva.

Arthropoda – Prawn, Zoea larva and Peripatus.

Mollusca - Pila, Sepia and Octopus.

Echinodermata – Star fish – Oral, Aboral View and Bipinnaria Larva.

Prochordata – Amphioxus, Balanoglossus, and Ascidian.

Pisces – Shark, Saccobranchus and Hippocampus.

Amphibian – Frog, Bufo and Rhacophorus.

Reptilia – Calotes, Najanaja, Draco and Chameleon.

Birds – Pigeon and Archaeopteryx

Mammalia – Bat and Rabbit

**Programme: B.Sc.,**

**Subject: Botamy**

**Semester: II**

**Course Code: MUBA2**

**Course: Animal Physiology, Immunology, Evolution & Developmental Biology**

**Course Type: Ancillary - II**

**Credits: 3**

**Contact Hours: 3 hours/Week**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To introduce physiological aspects of animals
- To give an insight to immunology and developmental biology

### **COURSE CONTENT**

**Unit - I:**

Digestion of carbohydrates, proteins and Lipids.

Respiration –Transport of respiratory gases.

Respiratory pigment-Structure and function of haemoglobin.

Excretion- structure of nephron, ultrafiltration.

**Unit – II:**

Types of Immunity- Innate and acquired immunity

Lymphoid organs (Primary and secondary).

Structure and functions of Immunoglobulins.

**Unit – III:**

Lamarckism, Darwinism, Mimicry and Colouration.

**Unit – IV:**

Gametogenesis - Spermatogenesis, Oogenesis, Types of egg

**Unit V:**

Development of frog-Sperm,egg,Grey crescent, cleavage, blastulation, Gastrulation only

**Prescribed Text:**

- A.MariaKuttikan&N. Arumugam - *Animal Physiology*
- Dulsy Fatima &N.Arumugam - *Immunology*
- N.Arumugam - *Embryology*
- N. Arumugam –*Organic Evolution*

**Reference books:**

- William S. Hoar, *General and Comparative Physiology* Prentice - Hall of India (private) Ltd, New Delhi.
- I.Kannan., (2007), *Immunology* I Ed., - MJP Publisher .
- Theodosius Dobzhansky, Francisco J. Ayala, G. Ledyard Stebbins, James W. Valentine, 1973, *Evolution*, Surject Publications, New Delhi.
- E.Peter Volpe, 1989, *Understanding Evolution*, Universal Book Stall, New Delhi.
- P.S.Verma and V.K. Agarwal (1975) *Chordate Embryology* X Ed., S.Chand& Co Pvt Ltd, Ramnager, New Delhi.

**Programme: B.Sc.,**

**Subject: Botany**

**Semester: I & II**

**Course:** Animal diversity, Genetics, Animal Physiology, Immunology, Evolution &  
Developmental Biology

**Course Type:** Ancillary Practical - I

**Course Code:** MUBAP

**Credits:** 4

**Contact Hours:** 2 hours/Week

**CIA:** 25

**CE:** 75

**Course Outcomes:**

- To remember and distinguish animals with their morphology and anatomy.
- To gain experimental knowledge on developmental aspects
- To gain practical understanding of subject
- To know about the microscopic and macroscopic concept of developmental biology
- To understand the Evolutionary concept

**COURSE CONTENT**

**Identification Charts**

Invertebrata- Cockroach

- External morphology (male & female)
- Digestive system
- Nervous system
- Mouth parts
- Salivary apparatus

Chordate-Frog

External morphology

Reproductive system

**Classification Giving Reason**

Paramecium, obelia, Fasciola hepatica, ascaris, earthworm, starfish, amphioxus, ascidian, balanoglossus, shark, calotes, pigeon.

**Experiment**

ABO blood grouping in man

Blood smear preparation.



Detection of protein, lipid & carbohydrate

**Spotters**

Structure of Immunoglobulins, counter shading in shark, stick insect, blastula and gastrula.

**Programme: B.Sc.,**

**Semester: II**

**Course Type: SBC**

**Credits: 2**

**CIA: 25**

**Subject: Zoology**

**Course: Poultry Farming**

**Course Code: MUZPF2**

**Contact Hours: 2 hours/Week**

**CE: 75**

**Course Outcomes:**

- To provide a living environment for indigenous poultry birds
- To gain knowledge of broilers and layers rearing
- To gain knowledge of the cage system and Deep litter system
- To know about bacterial and viral diseases associated with poultry farming
- To be enabled to get self-employment as poultry is an agro based cottage industry

**COURSE CONTENT**

**Unit - I: Introduction to Poultry Keeping**

Introduction of Poultry keeping – choosing commercial layers, broilers – White leghorn, Black Minorca, Australorp, sexing of one day old chick.

**Unit – II: Construction of Poultry house**

Construction of Poultry house – principle for the construction of Poultry house. Deep litter system component advantages and disadvantages. Cage system – Cage birds – Californian cages. Management of cage birds – advantages and disadvantages.

**Unit – III: Rearing and Management of Chick**

Poultry nutrition – Different types of feed –Layers feed, Growers feed, essential Vitamins and minerals, Management of chicks – growers, layers and broilers, summer and winter management

**Unit - IV: Poultry Products**

Poultry product – Eggs – Nutritive value of eggs, cleaning of egg, Preservation, Marketing. By products of poultry –feathers, farm waste management, Preparation Poultry manure.

**Unit V - : Poultry Diseases**

Poultry diseases and prevention –Fowl pox ,Vaccination schedule of poultry birds

**Prescribed Text:**

- M.R.Gnanamani, *Poultry Keeping*.

**Reference Books:**

- Arumugam, D.S.Murugan, Dr.Johnson Rajeshwar and Dr.R.Ramprabha,(2005), *Applied Zoology*, Saras Publications, Nagercoil.
- Ravindranathan. K.r.92005), *A Prescribed Text: of Economic Zoology*, Dominant Publishers and Distributors, Delhi.
- *The Rearing of Pullets* – Bulletin no.54, Her majesty’s Stationary office, London.
- *Intensive Poultry Management for Egg Production*, Bulleting No.152. He majresy’s stationary office, London.

## **SEMESTER - III**

**Programme: B.Sc.,**

**Semester: III**

**Course Type: Core - IV**

**Credits: 4**

**CIA: 25**

**Course Outcomes:**

**Subject: Zoology**

**Course: Developmental Biology**

**Course Code: MUZC4**

**Contact Hours: 6 hours/Week**

**CE: 75**

- To get acquainted with the theories of Developmental Biology.
- To gain in-depth knowledge on the developmental stages of Embryogenesis.
- To comprehend the process of organogenesis.
- To acquire better understanding of scientific reasoning exhibited in experimental life Science.
- To have an Enhanced knowledge and appreciation of life cycle transitions like Metamorphosis and Regeneration.

### **COURSE CONTENT**

#### **Unit - I: Basic concepts of Developmental Biology**

History of Embryology: Theories - Preformation - Epigenetic - Mosaic - Regulative and Gradient Theories. Von Baer's and Biogenetic Laws. Gametogenesis - Origin of Primordial Germ cells - Spermatogenesis - Oogenesis - Structure of Mammalian Sperm and Egg - Types of Egg based on the amount and distribution of yolk - presence and absence of shell - types of development

#### **Unit - II: Fertilization and Cleavage**

Fertilization : Physical - Chemical - Cytological - Physiological changes - Theories of Fertilization - Significance. Parthenogenesis - Natural and Artificial. Cleavage - Planes and Patterns of cleavage. Cleavage in Frog.

#### **Unit - III: Blastulation and Gastrulation.**

Blastulation : Types of Blastula. Gastrulation- Construction of Fate map - Morphogenetic movements – Gastrulation in Frog.

#### **Unit - IV: Organogenesis**

Formation of Primary organ rudiments - Neurogenesis - Notogenesis - Mesogenesis - Enterogenesis. Development of Heart and Eye in Frog. Development and Significance of Foetal

membranes in Chick. Placentation in Mammals - Classification - Functions. Teratogen and its effects

### **Unit V : Experimental Embryology**

Organizer concept - Spemann experiment- Neural induction-Theories of Organizer. Types-regeneration of limb in Newt - Factors influencing Regeneration-Types - Physiological changes during regeneration - Wolffian regeneration. Metamorphosis in Frog – Ecological - Morphological - Biochemical - Physiological changes - Hormonal control on Amphibian Metemorphosis. Applied embryology - IVF - Methods - Procedure - Advantages and disadvantages.

### **Prescribed Text:**

1. Dr.N. Arumugam,(2013), *Developmental Zoology*, Saras Publication, Nagarcoil. A Prescribed Text :

### **Reference Books:**

1. P.S.Verma and Agarwal, (1975), *Chordate Embryology*, X Ed.,S.Chand& Company Pvt .Ltd. Ramnager, New Delhi.
  2. Dr.R.C.Dalela and Verma, (1986-1987), *A Prescribed Text: of Chordate Embryology*, VI Ed., Jai Prakashnath& Co., Meerut city, India.
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**Programme: B.Sc.,**

**Semester: III**

**Course Type: NME**

**Credits: 2**

**CIA: 25**

**Course Outcomes:**

**Subject: Zoology**

**Course: Sericulture**

**Course Code: MUZVC3**

**Contact Hours: 2 hours/Week**

**CE: 75**

- To identify and know the importance of silkworm
- To comprehend the methodologies involved in silkworm rearing
- To execute self-employment in sericulture
- To validate different rearing techniques and its by-products
- To understand and control the diseases of silkworm.

### **COURSE CONTENT**

#### **Unit - I:**

Introduction to Sericulture- History and present status of Sericulture Silkworm morphology, life cycle of Silkworm

#### **Unit - II:**

Grainage - Reproductive seeds & industrial seeds – Voltinism - Univoltine, Bivoltine, Multivoltine eggs

#### **Unit - III:**

Rearing- Rearing house, Rearing appliances, Types of brushing and bed cleaning. Rearing of Chawkiworm, Rearing of Late age worms-Shelf rearing, Shoot rearing and Floor rearing, care during Moulting

#### **Unit - IV:**

Feeding and Optimum Environmental conditions during rearing, Selection of ripe worms, spinning, mounting, harvest, storage and transport of cocoons, Uses of Silk.

#### **Unit V:**

Silkworm diseases. Flacherie, Muscardine, Causative agent, Symptoms, Prevention and control measures.

#### **Prescribed Text:**

- *Comprehensive Sericulture*, G. Ganga (2003) Volume - 1 & Volume - 2, Oxford & IBH

Pub., Co., Pvt., Ltd.,

**Reference Books:**

- S.Krishnaswamy et al (1972).*Sericulture Manual - 1(Mulberry Cultivation), manual - 2 (Silkworm rearing) & manual -2 (Silk reeling)*.Food and Agriculture Organisation of the United Nations, Rome.
- *Prescribed Text: of Tropical Sericulture* (1975) Japan Overseas Corporation Volunteers 4 - 2, Hiroo, Sibuya Ku,Tokyo, Japan.
- *Sericulture in India*, Venkata Narasaiah (2003), Ashish Publishing House New Delhi.



**Programme: B.Sc.,**

**Semester: III**

**Course Type: SBC**

**Credits: 2**

**CIA: 25**

**Subject: Zoology**

**Course: Vermiculture**

**Course Code: MUZVC3**

**Contact Hours: 2 hours/Week**

**CE: 75**

**Course Outcomes:**

- To analyze the role of earthworm in organic farming.
- To know about environmental protection through solid waste management.
- To adopt new techniques in maintaining soil health.
- To deploy vermitechnology for sustainable agriculture
- To understand primary, secondary degradation and vermibed preparation.

**Unit - I:** Vermitechnology-Definition, history, selection of suitable species, Basic characters of suitable species.

**Unit - II:** Systematic position of Earthworm – Habit and Habitat, Commercial varieties of Earthworm for Vermicomposting, Economic importance of vermiculture, difference between compost and vermicompost.

**Unit - III:** Life cycle of Earthworm, Diseases and Predators of Earthworm Control measures, effect of earthworm on the physical features of soil.

**Unit - IV:** Preparation of Vermibed, Maintenance of Composting pit, Collection of vermi compost, substrate for vermicompost, Nutrient value of vermicompost, Vermiwash, Marketing of vermin compost.

**Unit V:** Effect of Vermicompost on Plant growth, soil microbes and earthworm, Therapeutic values of earthworm

**Prescribed Text:**

1. Seethlakshmi. M. and Santhi. R. (2012) *Vermitechnology*, Saras publication, Nagercoil, Tamilnadu.

2. Nair N.C., Leelavathy S., Soundarapandian N and Arumugam, N. (2018) *A Prescribed Text: of Invertebrates* – Saras Publication, Nagercoil, Tamilnadu

**Reference Books:**

1. Arun.K.Sharma, (2004), *Biofertilizers for sustainable Agriculture, Agro bios, Jodhpur*
2. Gupta, P.K., (2004), *Vermicomposting for sustainable Agriculture, Agro bios, Jodhpur*

## **SEMESTER - IV**

**Programme: B.Sc.,**

**Semester: IV**

**Course Type: Core V**

**Credits: 4**

**CIA: 25**

**Course Outcomes:**

**Subject: Zoology**

**Course: Genetics**

**Course Code: MUZC5**

**Contact Hours: 4 hours/Week**

**CE: 75**

- To get acquainted with genetic Terminologies and Mendelian inheritance.
- To be able to sort out gene interactions in man and animals
- To gain knowledge of the concepts of Linkage and Crossing over
- To analyse the hereditary disorders
- To know to apply the laws of genetics for future welfare of mankind

### **COURSE CONTENT**

**Unit - I:** Mendel's Law of Inheritance : Gregor Mendel's life – Monohybrid cross and Law of Segregation – Dihybrid cross and Law of Independent Assortment – Alleles – Homozygote and Heterozygote – Genotype and Phenotype – Back Cross and Test Cross.

**Unit - II:** Gene interactions: Allelic interaction - Incomplete dominance -Co-dominance -Lethal genes. Coding and non coding regions. Non-allelic gene interaction - Complementary Gene interaction. Supplementary Gene interaction - Epistasis - Dominant and Recessive.

**Unit - III:** Multiple alleles: ABO and Rh blood group – Polygenic Inheritance – Inheritance of Skin Colour in Man. Linkage – Definition - Types of Linkage - Complete and Incomplete Linkage in Drosophila. Crossing over - Definition - Mechanism of Crossing over -Theories of Crossing over - Kinds of Crossing over - Cytological basis of Crossing over- Stern's experiment - Tetrad - analysis.

**Unit - IV:** Sex Determination in Man. Sex Linked Inheritance in Man - Colour Blindness and Haemophilia. Extra Chromosomal Inheritance- Kappaparticles in Paramecium and Shell coiling (torsion) in Snail. Twin studies – Monozygotic and Dizygotic Twins.

**Unit V:** Mutation types only, Syndromes: Non-disjunction - Down's Syndrome - Klinefelter's Syndrome - Turner's Syndrome. Pedigree chart. Eugenics - Positive and Negative measures. Inbreeding and out breeding.

**Prescribed Text:**

1. R.P.Meyyan, (2013). *Genetics*, Saras Publications, Nagerkoil , VII Ed.

**Reference Books:**

1. P.S.Verma and T.K. Agarwal., (2007) S.Chand &Co., New Delhi.
2. McKusick, V.A., (1968) *Human Genetics*, Prentice - Hall of India Private Limited, New Delhi.

**Programme: B.Sc.,**

**Subject: Zoology**

**Semester: IV**

**Course: Biostatistics & Bioinformatics**

**Course Type: Core paper VI**

**Course Code: MUZC6**

**Credits: 4**

**Contact Hours: 4 hours/Week**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To understand the basic concept and application of biostatistics and bioinformatics.
- To know about the methods of data collection and techniques of sampling.
- To understand the process of classification and tabulation of data.
- To know about the diagrammatic and graphic presentation of data, measures of central tendency and dispersion.
- To be able to communicate the results of statistical analysis accurately and effectively

**COURSE CONTENT**

**Unit - I: Introduction to Biostatistics**

Introduction to Biostatistics, basic concepts of biostatistics- data, sample, variable. Collection of data-methods of data collection. Processing of data-classification and tabulation –types of classification, tabulation of data, parts of a table.

**Unit - II : Presentation of Data**

Diagrammatic presentation of Data-rules for drawing a diagram, kinds of diagrams. Graphic presentation of Data-technic of constructing graphs of time series, graphs of frequency distribution.

**Unit - III: Measures of Central Tendency**

Measures of central tendency- Mean, Median, Mode- for individual observations, discrete series, and continuous series.

**Unit - IV: Measures of Dispersion**

Measures of dispersion: Range, Standard deviation, Standard error, variance & Coefficient of variation and mean deviation.

**Unit V: Bioinformatics**

Aims, Tasks and Applications of bioinformatics .Structural, functional and comparative genomics, Genome Mapping, Human Genome Project. Internet and email. Nucleic Acid Sequencing Data bases – Gene Bank, EMBL, DDBJ & NCBI, Protein Sequence Databases –

TrEMBL, PiR& SWISSPROT. Sequence Alignment-Pair wise Alignment – FASTA, BLAST,  
Multiple Alignment – CLUSTA

**Prescribed Text:**

1. *Biostatistics* –P.Ramakrishnan (2010) Saras Publication.
2. *Basic Bio informatics* - S.Ignacimuthu

**Reference book:**

1. S.P. Gupta - *Statistical Methods*
2. Norman T.J. Bailey - *Statistical Methods in Biology*
3. S.S. Palanisamy & M.Manoharan - *Statistical Methods for Biologists*
4. *Introduction to bioinformatics* -T.K. Attwood & D.J.Parry - Smith
5. *Developing Bioinformatics & Computer Skills* – Cynthia Gibas & Per Jamback

**Programme: B.Sc.,**

**Subject: Zoology**

**Semester: II & III**

**Course: Developmental Biology, Genetics & Bioinformatics**

**Course Type: Core Paper II**

**Course Code: MUZP2**

**Credits: 4**

**Contact Hours: 3 hours/Week**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To understand the Mendelian Laws through Experiments.
- To identify the developmental stages of Frog and Chick.
- To acquaint with Biological Data Bases.

### **COURSE CONTENT**

**Developmental Biology:**

1. Temporary Mounting of Chick Blastoderm
2. Observation and study of prepared Micro slide – Frog
  - Two Cell Stage
  - Four Cell Stage
  - Blastula
  - Gastrula
3. Observation of Chick Blastoderm  
24 Hours, 48 Hours, 72 Hours and 96 Hours

**Genetics:**

1. Mendal' s Law of Segregation with beads of two different colours.
2. Observetion of Simple Mendelian Traits
3. Spotter
  - Sex Linked Inheritance in Man - Colour Blindness and Haemophilia.
  - Cytoplasmic Inheritance - Kappa particles in Paramecium and Shell coiling in Snail.



- Syndromes: Down's Syndrome - Klinefelter's Syndrome - Turner's Syndrome

**Bioinformatics:**

1. Internet Browsing – e.mail, Search engines.

2. Biological Data Bases:

- Nucleic acid sequence Data Bases : NCBI, EMBL
- Protein sequence Data Bases : SWISS – PROT, Tr-EMBL
- Sequence alignment : BLAST

**Programme: B.Sc.,**

**Semester: IV**

**Course Type: SBC**

**Credits: 2**

**CIA: 25**

**Subject: Zoology**

**Course: Sericulture**

**Course Code: MUZSC4**

**Contact Hours: 2 hours/Week**

**CE: 75**

**Course Outcomes:**

- To identify and know the importance of silkworm.
- To comprehend the methodologies involved in silkworm rearing
- To execute self-employment in sericulture
- To validate different rearing techniques and it's by products
- To understand and control the diseases of silkworm

**COURSE CONTENT**

**Unit - I:** Introduction to Sericulture- History and present status of Sericulture Silkworm morphology, life cycle of Silkworm

**Unit - II:** Grainage - Reproductive seeds & industrial seeds – Voltinism - Univoltine, Bivoltine, Multivoltine eggs

**Unit - III:** Rearing- Rearing house, Rearing appliances, Types of brushing and bed cleaning. Rearing of Chawkiworm, Rearing of Late age worms-Shelf rearing, Shoot rearing and Floor rearing, care during Moulting.

**Unit - IV:** Feeding and Optimum Environmental conditions during rearing, Selection of ripe worms, spinning, mounting, harvest, storage and transport of cocoons, Uses of Silk.

**Unit V:** Silkworm diseases. Flacherie, Muscardine, - Causative agent, Symptoms, Prevention and control measures.

**Prescribed Text:**

1. *Comprehensive Sericulture*, G. Ganga (2003) Volume - 1 & Volume - 2, Oxford & IBH Pub., Co., Pvt., Ltd.,

**Reference Books:**

1. S.Krishnaswamy et al (1972) *Sericulture manual - 1(Mulberry Cultivation), manual - 2 (Silkworm rearing) & manual -2 (Silk reeling).* Food and Agriculture Organisation of the United Nations, Rome.
2. *Prescribed Text: of Tropical Sericulture* (1975) Japan Overseas Corporation Volunteers 4 -

- 2, Hiroos, SibuyaKu, TOKYO, Japan.
3. *Sericulture in India*, VenkataNarasaiah(2003), Ashish Publishing House New Delhi.

**Programme: B.Sc.,**

**Semester: IV**

**Course Type: Core Paper VII**

**Credits: 5**

**CIA: 25**

**Subject: Zoology**

**Course: Biochemistry**

**Course Code: MUZSC4**

**Contact Hours: 6 hours/Week**

**CE: 75**

**Course Outcomes:**

- To gain basic knowledge on various bio-molecules and their role in metabolism.
- To know about Metabolism of carbohydrates, Protein and Lipid
- To be able to classify Enzymes and Hormones
- To understand the chemical nature of life and life process.
- To be able to illustrate various Biochemical pathways.

**COURSE CONTENT**

**Unit - I: Carbohydrate and Carbohydrate Metabolism**

Carbohydrates: Basic structure, Properties and Biological importance.

Classification of monosaccharides, oligosaccharides, polysaccharides with examples

Carbohydrate metabolism: Glycolysis, Kreb's cycle, Oxidative phosphorylation.

**Unit - II: Protein and Protein Metabolism:**

Proteins: Structure, Properties, Classification and Biological importance.

Protein metabolism: Deamination, Transamination & Transmethylation

Aminoacids : Structure, Properties and Classification

**Unit - III: Lipid and Lipid Metabolism**

Lipid: Structure of Fatty acid, saturated and unsaturated fatty acid, properties, biological importance and classification of fatty acids with examples.

Lipid metabolism: Biosynthesis of fatty acids,  $\beta$  - Oxidation of Palmitic acid and its Energetics.

**Unit - IV Hormones**

Hormones: Classification and Mechanism of Protein hormone action.

Major Endocrine glands and their hormones, function and disorders.

**Unit V: Enzymes, Coenzymes and Pigments**

Enzymes: Classification, Nomenclature, Mechanism of Enzyme action. Factors affecting Enzyme activity.

Coenzymes: Salient features of Coenzymes, Classification and mechanism of coenzyme action.

Pigments: Flavinoids, Carotenoids and Bile Pigment

**Prescribed Text:**

1. N. Arumugam *et al.*, *Prescribed Text: of Biochemistry*, Saras publications.
2. Ambika Shanmugam, 1998, *Fundamentals of Biochemistry for Medical students*, Published by the Author, Madras.
3. Satyanarayana, U. and Chakrapani, U. 2009. *Biochemistry*, Books and Allied Pvt. Ltd., Kolkata.
4. Deb-Biochemistry.

**Reference Books:**

1. Lehninger, Nelsons & co – *Principles of Biochemistry*
2. Lubertstryer - *Bio chemistry*
3. Bell, Davidson & Scarborough – *Prescribed Text: of Physiology and biochemistry*.
4. Jeyaraman, J.J., 1981. - *Laboratory manual of Biochemistry*

## **SEMESTER - V**

**Programme: B.Sc.,**

**Subject: Zoology**

**Semester: V**

**Course: Cell & Molecular Biology**

**Course Type: Core paper VIII**

**Course Code: MUZC8**

**Credits: 5**

**Contact Hours: 6 hours/Week**

**CIA: 25**

**CE: 75**

**Course Outcomes:**

- To understand different types of microscopic techniques and sample processing to label and identify sub cellular structures in fixed and live cells.
- To be able to portray the intricate relationship between various cellular structures and their corresponding functions
- To be familiar with the external morphology of animals.
- To be able to describe the structure and functions of nucleus with reference to special chromosomes
- To march towards the fundamental functional status.

**COURSE CONTENT**

**Unit - I:**

Discovery of cell & Cell theory, Prokaryotes (E.coli), Eukaryotes (Animal cell).

Microscopy: Compound and Electron microscopes.

Cytological techniques-Fixation and Fixatives, types of Stains and Staining techniques.

**Unit - II:**

Ultrastructure and functions – Plasma membrane, Endoplasmic reticulum, Lysosomes, Ribosomes, Golgi complex and Mitochondria.

**Unit - III:**

Nucleus, Nucleolus and Chromosome. Cell division – cell cycle- Mitosis and Mitotic apparatus, Meiosis and Synaptonemal complex .Significance of cell division.

**Unit - IV:**

Nucleic acids – Structure of DNA (Watson & Crick Model), Replication of DNA- Semi conservative replication, RNA – Types (mRNA, rRNA, & tRNA) and functions.

**Unit -V:**

Central Dogma of Protein synthesis-Transcription and Translation. Cancer- types, causes, properties, apoptosis, treatment and Oncogenes.

**Prescribed Text:**

1. Arumugam(2005) - *Cellbiology and MolecularBiology* .SarasPublications.Nagarcoil.

**Reference Books :**

1.P.S.Verma and V.K.Agarwal (2011),*Cytology*,S.Chand and Co., New Delhi

2. S.C.Rastogi (1988), *Cell Biology*, Tata Mc Graw Hill Publishing Co., New Delhi



**Programme: B.Sc.,**

**Semester: V**

**Course Type: Major Elective Paper - I**

**Credits: 5**

**CIA: 25**

**Course Outcomes:**

**Subject: Zoology**

**Course: Immunology**

**Course Code: MUZE1**

**Contact Hours: 5 hours/Week**

**CE: 75**

- To enable the students to understand the basic concepts of defense mechanism.
- To expose the students to the field of medicine with powerful preventive, therapeutic and diagnostic tools.

### **COURSE CONTENT**

**Unit - I:** History and scope of Immunology – Types of Immunity – Innate and Acquired Immunity. Innate – Physical and Mechanical factors, Biochemical, Cellular, Genetic factors and other factors. Acquired Immunity – Active & Passive Immunity – Natural and Artificial Immunity.

**Unit - II:** Antigen – Epitopes & Paratopes, Chemical nature of Antigen, Cross Reactive antigen, Heterophil Antigen. Immunoglobulin G, A, M, D & E – Structure and Functions.

**Unit - III:** Lymphoid organs – Primary (Thymus, Bone Marrow and Bursa of Fabricius). Secondary (Spleen, Lymph node, Tonsil and Payer's patches). Cells of the Immune System – T cell and its sub populations, B cell. Immune Responses – Cell mediated Immunity (CMI) and Antibody Mediated Immunity (AMI).

**Unit - IV :** Major Histocompatibility Complexes – MHC restriction Phenomenon, MHC antigen, Human Leucocyte Antigen (HLA) and functions. Transplantation Immunology – Graft Rejection. Hypersensitivity reactions – Types : I, II, III, IV, & V.

**Unit V:** Tumour Immunology – Properties, Causes, Tumour antigens, Factors, Immune responses and Immunotherapy. Autoimmune Disease – Haemolytic anaemia, Myasthenia gravis and Lupus erythematosus. Immunodeficiency disease – AIDS

**Prescribed Text:**

1. Dr. N.Arumugam et al., (2013) – *Prescribed Text: of Immunology*, Saras Publication.

**Reference Books :**

1. Kuby1., (1992), *Immunology*, IV Ed.,-W.H. Freeman and company.
2. Evan M.Roitt., (1988), *Essentials Immunology* – VI Ed., ELBS imprint.

**Programme: B.Sc.,**

**Semester: V**

**Course Type: Elective**

**Credits: 5**

**CIA: 25**

**Course Outcomes:**

- To enable the students to understand the diagnosis of diseases.
- To gain knowledge of the diagnostic tools

**Subject: Zoology**

**Course: Medical Diagnostics**

**Course Code: MUZE1**

**Contact Hours: 5 hours/Week**

**CE: 75**

### **COURSE CONTENT**

**Unit - I:** Introduction to Medical Diagnostics and its Importance Diagnostics Methods Used for Analysis of Blood , Blood composition

**Unit - II:** Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

**Unit - III:** Diagnostic Methods Used for Urine Analysis Urine Analysis: Physical characteristics; abnormal constituents

**Unit - IV :** Non-infectious and Infectious Diseases, Non-infectious diseases - causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer /Kit , Infectious diseases - causes, types, symptoms, complications, diagnosis and prevention of Tuberculosis and Hepatitis

**Unit V:** Tumours and Medical imaging Tumors: Types (Benign/Malignant), Detection and metastasis. Medical imaging: X-Ray of bone fracture, PET, MRI and CT Scan (using photographs).

**Reference Books:**

Prakash, G. (2012). *Lab Manual on Blood Analysis and Medical Diagnostics*. S. Chand and Co. Ltd., New Delhi

**Programme: B.Sc.,**

**Semester: V**

**Course Type: Major Elective**

**Credits: 5**

**CIA: 25**

**Course Outcomes:**

**Subject: Zoology**

**Course: Microbiology**

**Course Code: MUZE2**

**Contact Hours: 5 hours/Week**

**CE: 75**

- To gain knowledge of the microbial diversity
- To be able to sort cellular organisms and their biological activities
- To apply microbial metabolism in industrial production.
- To gain scope to apply the microbes in environmental waste management
- To gain knowledge of food preservation

### **COURSE CONTENT**

**Unit - I: Introduction** History and scope of microbiology. Virus - Characteristics of virus, Structure of viruses, bacteriophage-multiplication, life cycle. Bacterial growth – methods of bacterial growth, Growth Rate, Growth Curve Culture Media-Types of medium, Preparation culture media, techniques involved in culture of bacteria, culture of E.Coli.

#### **Unit - II : Food Microbiology**

Food spoilage (Meat, Milk, egg, Fruits and Vegetable) Food Poisoning – Food intoxication- Botulism & Food infection- *salmonellosis* Food Preservation – methods of food preservation.

#### **Unit - III : Agricultural & Environmental Microbiology**

Biofertilizer – *Rhizobium*, *azobacter*, *VAM*, *Azolla*. Biopesticide – *Bacillus thuringiensis*, SCP, Sewage treatment-aerobic and anaerobic process sludge treatment aerobic digestion.

#### **Unit - IV : Industrial Microbiology**

Fermentation process – stages of fermentation process, types of fermentation, methods of fermentation Industrial production of ethanol, penicillin microbial production of enzymes and its application.

#### **Unit V: Environmental and Medical Microbiology**

Bacterial disease – Tuberculosis. Virus Disease – Hepatitis – B.. Sexually Transmitted Diseases- AIDS. Fungal diseases – Mycosis.

**Prescribed Text:**

1. N.Arumugam *et al.*, (2011), *Microbiology*, Saras Publication

**Reference Books**

1. Dr.R.C.Dubey .Dr.D.K.Maheswari, (2010), *A Prescribed Text: of Microbiology*, S.Chand& CO Ramnager, New Delhi.
2. Samuel Baron, *Medical microbiology*, II Ed., Wesley publishing company, California.

**Programme: B.Sc.,**

**Semester: V**

**Course Type: Elective - II**

**Credits: 5**

**CIA: 25**

**Course Outcomes:**

- To gain basic knowledge of software for transcription.
- To learn about human anatomy.
- To study the basics of computer.
- To understand human life process.

**Subject: Zoology**

**Course: Medical Transcription**

**Course Code: MUZE2**

**Contact Hours: 5 hours/Week**

**CE: 75**

### **COURSE CONTENT**

**Unit - I:** Medical terminology Pharmacology and Anatomy of humans , General medical terms, surgical terms, diseases , Human body parts, systems and functions , Medication terminology, treatments, drug reactions, pharmacology legalities, medication handling and doctor's orders.

**Unit - II:** Medical Theories and Techniques Ethical and Legal Responsibilities Medical Transcription Equipment and Technology, Diagnostic and therapeutic procedure terms and practices, Surgical procedure terms and practices, Lab procedures: patient preparation and blood drawing techniques.

**Unit - III:** Basic Transcription, Medical Grammar and Style, Medical Reports Formatting, Transcribing audio files into typed format. Healthcare Documentation formats, American Medical Association stylistic standards.

**Unit - IV:** Computer Information Systems, Speech Recognition Editing, Basics of Microsoft Office software, including Word, PowerPoint, Excel, Basic formatting practices and e-mail and Internet usage and file organization.

**Unit V:** Speech recognition software to transcribe dictation and taking dictation with background noise.

**Programme: B.Sc.,**

**Semester: V**

**Course Type: SBC**

**Credits: 2**

**CIA: 25**

**Subject: Zoology**

**Course: Ornamental Fish Culture**

**Course Code: MUZOF5**

**Contact Hours: 2 hours/Week**

**CE: 75**

**Course Outcomes:**

- To gain knowledge of the ornamental fishes
- To apply modern methods on aquarium culture.
- To know the techniques to overcome fish diseases
- To maintain natural habitat of fishes
- To gain knowledge on aquarium fishes.

**COURSE CONTENT**

**Unit - I:** Equipments used in ornamental fish culture, Steps involved in setting up of fresh water, Design and Construction of Aquarium tank, Accessories used in Aquarium tank., Aquarium plants.

**Unit - II:** Taxonomy and Biology of Popular Ornamental fishes: Live bearers (ovo-viviparous)- Guppy and Molly. Egg layers (oviparous)- Gold fish and Angelfish.

**Unit - III:** Nutritional requirements of Ornamental fishes- different kinds of feeds (Live food & artificial food).

**Unit - IV:** Cleaning the Aquarium, Control of Snail and Algal growth. Common diseases of Aquarium fishes.

**Unit V:** Commercially important Marine Ornamental fishes, Entrepreneurship Development in Ornamental Fish Culture.

**Prescribed Text:**

1. Arumugam, N. (2018) *Aquaculture*, SARAS Publications, Nagercoil, Tamilnadu.

**Reference Book**

1. J.D.Jameson and R. Santhanam. (1996). *Manual of Ornamental Fishes and Farming Technologies*- Fisheries College & Research Institute TANVASU, Tuticorin-628008.
2. R.Santhakumar et al., (2007). *Manual on fresh water Ornamental Fish Culture*, Dept.of Fisheries extension, Fisheries College and Research Institute, TANVASU, Tuticorin-628008.

3. V.K.Venkataramani et al., (2004). *Biodiversity and stock assessment of Marine Ornamental fishes*. Dept of Fisheries biology & Capture fisheries, Fisheries College & Research Institute, TANVASU, Tuticorin-628008.



## **SEMESTER - VI**

**Programme:** B.Sc.,

**Semester:** VI

**Course Type :** Core IX

**Credits:** 5

**CIA:** 25

**Subject:** Zoology

**Course:** Animal Physiology

**Course Code:** MUZC9

**Contact Hours:** 6 hours/Week

**CE:** 75

**Course Outcomes:**

- To understand the mechanisms that work to keep the human body alive and functioning.
- To comprehend the detailed concepts of Digestion, Respiration, Excretion the functioning of Nerves and Muscles.
- To gain knowledge of various metabolic and physiological mechanisms of the human body.
- To understand neurophysiology, Receptors and Hormones.
- To gain fundamental knowledge of Animal Physiology.

**COURSE CONTENT**

**Unit - I: Historical Background, Food & Nutrition**

Food : Balanced Diet, malnutrition Nutrition: Types of nutrition and types of feeding

Digestive system: Alimentary canal & Digestive glands, Salivary, Gastric and Intestinal digestion with reference to man Absorption of Proteins, Carbohydrates and Lipids.

**Unit - II : Respiration and Circulation**

Respiration: Respiratory organs, Mechanism of Respiration in Man, Transport of respiratory gases, Respiratory pigments, RQ, Respiratory disorders and effects of smoking.Circulation: Arterial & Venous circulation. Pulmonary and Portal circulation. Structure & Function of Human heart, Origin and conduction of Heart Beat, ECG.Cardiac Cycle, Origin and Conduction of Heart beat

**Unit - III: Excretion, Osmoregulation Andthermoregulation:**

Excretory organs, Excretory products, Ammonotelic, Ureotelic and Uricotelic animals.Structure of kidney and Nephron. Mechanism of urine formation. Counter – current mechanism.Normal and abnormal constituents of urine; causes of kidney stone, Elementary idea of dialysis

Osmoregulation – Poikilosmotic and Homeosmoticanimals.Osmoregulation in freshwater, marine, estuary and terrestrial animals.Thermoregulation.

#### **Unit - IV: Nervous Co-ordination and Muscle**

Structure of neuron, Types of Neuron

Nerve impulse - Nerve impulse - Resting potential and Action potential and Conduction of Nerve impulse, Synapse, Types of Synapses and Synaptic transmission. Properties of Nerve impulse, Neuromuscular junction and Reflex action

Muscle: Ultra structure of striated muscle, Sliding filament theory of muscle contraction. Properties of muscles (Twitch, Tetanus, Tonus, Summation, All or None Principle)

#### **Unit V: Receptors and Endocrine Glands**

Receptors: Photoreceptor, Mechanoreceptor, Chemoreceptor and Thermo receptor. Male and female sex hormones. Causes of infertility in male and female

Contraceptives – Mechanical and hormonal. Endocrine control on reproductive cycle: Oestrous cycle & Menstrual cycle, Pregnancy, Parturition and Mammary glands.

#### **Prescribed Text:**

1. Verma and Agarwal – *Animal physiology*

#### **Reference Books:**

1. Gordon, S. Maleonet. *al– Animal function – principles and adaptation.*
2. Hoar S. William – *General and Comparative physiology*

**Programme: B.Sc.,**

**Semester: VI**

**Course Type : Core IX**

**Credits: 5**

**CIA: 25**

**Subject: Zoology**

**Course: Bio Technology**

**Course Code: MUZC10**

**Contact Hours: 7 hours/Week**

**CE: 75**

**Course Outcomes:**

- To know about the tools and methods of Cloning by using Bio techniques.
- To elucidate transgenic animals and their importance.
- To acquire knowledge on tissue culture and IVF technology and learn the fundamentals of patenting of biological products.
- To be familiar with microbial degradation of Xenobiotics, Bio remediation, Bio leaching process.
- To understand the production and application of r-DNA proteins and Nano particles in Bio medical science.

**COURSE CONTENT**

**Unit : I Recombinant DNA Technology:**

Introduction – Scope, Trends and current Scenario of Biotechnology in India Tools for Gene cloning : DNA manipulative enzymes : Restriction enzymes and DNA ligases. Gene cloning vectors: Plasmids, Bacteriophage (Lambda), Cosmids and Shuttle vector. Major steps involved in cloning of human insulin gene. Molecular biology techniques - Microinjection, Electroporation, Polymerase chain reaction (PCR). Blotting techniques : Southern and Northern blots.

**Unit : II Animal Biotechnology**

Hybridoma technology : Production and Applications of monoclonal antibodies. Cloning of animals : Methods and uses. In vitro fertilization and Embryo transfer. Transgenic Animals : Transgenic fish, mice and cow. Application of transgenic animals. Sheep as a bioreactor.

**Unit – III Animal Tissue Culture**

Cell culture technique, Primary and Secondary culture. Stem cell Culture – Embryonic stem cell and Adult stem cell. Organ culture – Skin and Cartilage. Intellectual property rights and patent. Human genome project. (Basic knowledge only).

#### **Unit – IV Environmental and Industrial Biotechnology**

Biodegradation : Degradation of Xenobiotics, Super bug – Construction of super bug to control oil pollution. Bioremediation : In situ bioremediation, Composting, Landfarming and Digestion in above ground reactors. Bioleaching : Direct and Indirect leaching. Biopesticides : Bt toxins – Transgenic killer cotton. Biosensors : Principle and Application of Glucose Biosensor only. Biochips : Principle and uses.

#### **Unit – V Application of R-DNAa Technique in Human Health**

Recombinant DNA proteins and their uses: Interferon, Interleukin, Factor VIII, Urokinase, Tissue plasminogen activator. Recombinant vaccines : Hepatitis – B, Rabies and FMD Vaccine. Commercial production of penicillin. DNA finger printing and its use in Forensic science. Nano technology : Drug delivery system, Protheses and implants

#### **Text Book:**

1. V. Kumaresan, (2015), Biotechnology – Saras Publication

#### **Reference Books:**

1. R.C Dubey, (1993), A Text book of Biotechnology. III Ed., S.Chand & company Ltd.
2. H.K.Das, (2004), Text book of Biotechnology . III Ed., Wiley India (P) Ltd.
3. S.C.Rastogi, (2007), Biotechnology – Principles and Applications – I Ed., Narosa Publishing house.