



# PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM - 636011

**DEGREE OF BACHELOR OF SCIENCE**

*CHOICE BASED CREDIT SYSTEM*

*Syllabus for*

## **B.SC. ZOOLOGY**

( SEMESTER PATTERN )

( For Candidates admitted in the Colleges affiliated to  
Periyar University from 2021-2022 onwards )

## DEFINITION

### PROGRAMME:

“Programme” means core degrees offered in various disciplines.

### COURSE:

“Course” refers to the courses offered under the degree programme spread over the complete Programme of study as under.

- Part I** - means “Tamil/other languages” offered under the programme.
- Part II** - means “English” language offered under the programme.
- Part III** - means “the core subjects” related to the programme concerned including Practicals.
- Part III Allied** - means “Allied subjects” offered as allied, which is interdisciplinary in nature but related to the programme.
- Part III Electives** - means “Elective subjects” related to the core subjects of the programme concerned.
- Part IV (i)** - “Tamil” means basic orientation in Tamil language for those students who have not studied Tamil upto 12<sup>th</sup> standard.
- (ii)** - “Advanced Tamil” means, the subject is meant for students who have studied Tamil language upto 12<sup>th</sup> standard and chosen other languages in college but would like to advance their Tamil language skills.
- (iii)** - “Non-Major Electives” means option is being given to students who do not come under the above two categories (i & ii).
- (iv)** - Skill based subject means the courses offered under the programme related to Advanced Skill acquisition for industrial application for which a separate Diploma will be awarded along with the Degree.
- (iv)** - “Foundation Course” means courses offered as
  - 1) Environmental Studies ( 1<sup>st</sup> year)
  - 2) Value Education - Human Rights /Women's Rights (2nd year)
- Part V** - “Extension Activities” means all those activities which form part of NSS/NCC/Sports/YRC and other co and extracurricular activities.

A detailed explanation of the above with relevant credits are given under “Scheme of Examinationalong with Distribution of Marks and Credits”

**Duration:**

Means the stipulated years of study to complete a programme as prescribed by the University time totime. Currently for the undergraduate programme the duration of study is THREE years. These regulations apply to the regular course of study in approved institutions of the University.

**Credits:**

Means the weightage given to each course of study (subjects) attributed by the experts of the Boardof Studies concerned.

**Credit System:**

Means, the course of study under this pattern, where weightage of credits are spread over to different semesters during the period of study and the Cumulative Grade Point Average will be awarded based on the credits earned by the students. The following are the total credit points:

For Undergraduate Programme (Three years) : 148

**AIM AND SCOPE OF THE COURSE:**

1. To acquire knowledge in different areas of animal science.
2. The topics included in different units of different papers would enable the students to develop technicalskills in Zoological and applied branches.
3. Skill based subjects like Poultry Science, Diary Science, Human health and hygiene, Sericulture, Apiculture, Aquaculture, Biotechnology and Clinical Nutrition have been included in order to provide opportunities in employment and research in Government and Private Organizations.
4. There is also scope for self employment for the students.
5. Practicals included in the syllabus will improve the skills of the students in Microscopy, Observations, Drawing and Laboratory techniques.

**ELIGIBILITY FOR ADMISSION:**

Candidate for admission to the first year of the degree of Bachelor of Science Course shall be required tohave passed the Higher secondary examination (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an Examination accepted by the Syndicate, Subject to such conditions may be prescribed therefore shall be permitted to appear and qualify for B.Sc degree examination in Zoology.

**DURATION OF THE COURSE:**

The course for the degree of Bachelor of Science shall consist of three academic years divided in to six semesters. Each semester consists of 90 working days.

**PASSING MINIMUM:**

The candidate shall be declared to have passed the examinations if he /she secures not less than 40 marks.

**DISTRIBUTION OF MARKS:****THEORY**

University examination = 75 marks

Internal assessment = 25 marks

**INTERNAL ASSESSMENT STRUCTURE:**

Test = 15 marks

Assignments = 05 marks

Attendance = 05 marks

Passing minimum for Internal Assessment = 10 marks

Passing minimum of University examinations = 30 marks

**PRACTICALS**

University Examinations = 60

marks Internal Assessment = 40

marks

**INTERNAL ASSESSMENT STRUCTURE:**

Test = 15 marks

Observation record = 10

marks Regularity in Practical =  
15 marks

Passing minimum for internal assessment = 10

marks Passing minimum for University examinations  
= 30 marks

**CLASSIFICATION OF SUCCESSFUL CANDIDATES:**

- Candidates who secure not less than 60 % of the aggregate marks in the whole examinations shall be declared to have passed the examinations in First class.
- Candidates who secure above 50 % and below 60 % shall be declared to have passed the examinations in Second class.
- Other successful candidates who secure below 50% shall be declared to have passed the examination in Third class.

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**Course Structure (CBCS)**

**From Academic year 2021-2022 onwards**

Part	Course Code	Title of the Course	Hrs. / Week	Credits	Exam. Hrs.	Marks		
						CIA	ESE	Total
<b>SEMESTER I</b>								
I	Language I	Tamil	6	3	3	25	75	100
II	Language II	English	6	3	3	25	75	100
		Professional English	2	4	3	25	75	100
III	Core I	Invertebrates	5	5	3	25	75	100
III	Practical-I	Invertebrates & Chordata	3	-	-	-	-	-
III	Allied - I	Chemistry / Botany	4	4	3	25	75	100
III	Allied Practical	Chemistry / Botany	3	-	-	-	-	-
IV	Value Education	Yoga	1	2	3	25	75	100
<b>Total</b>			<b>30</b>	<b>21</b>		<b>150</b>	<b>450</b>	<b>600</b>
<b>SEMESTER II</b>								
I	Language II	Tamil II	6	3	3	25	75	100
II	Language II	English II	6	3	3	25	75	100
IV		Professional English	2	4	3	25	75	100
III	Core - II	Chordata	5	5	3	25	75	100
III	Practical-I	Invertebrates & Chordata	3	4	3	40	60	100
III	Allied II	Chemistry / Botany	4	3	3	25	75	100
III	Allied I Practical	Chemistry / Botany	3	3	3	40	60	100
IV	EVS	Environmental Studies	1	2	3	25	75	100
<b>Total</b>			<b>30</b>	<b>27</b>		<b>230</b>	<b>570</b>	<b>800</b>
<b>SEMESTER III</b>								
I	Language III	Tamil III	6	3	3	25	75	100
II	Language III	English III	6	3	3	25	75	100
III	Core III	Cell biology	5	5	3	25	75	100
III	Practical-II	Cell Biology, Genetics, Vermiculture & Vermicomposting & Aquaculture	3	-	-	-	-	-
III	Allied III	Chemistry / Botany	4	4	3	25	75	100
III	Allied Practical	Chemistry / Botany	3	-	-	-	-	-
IV	SBEC I	Vermiculture & Vermicomposting	2	3	3	25	75	100
IV	NMEC I	Human health & Hygiene (offered to other Dept. Students)	1	3	3	25	75	100
<b>Total</b>			<b>30</b>	<b>21</b>		<b>150</b>	<b>450</b>	<b>600</b>
<b>SEMESTER IV</b>								
I	Language IV	Tamil IV	6	3	3	25	75	100
II	Language IV	English IV	6	3	3	25	75	100
III	Core IV	Genetics	4	5	3	25	75	100

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III	Practical-II	Cell Biology, Genetics, Vermiculture & Vermicomposting & Aquaculture	3	4	3	40	60	100
III	Allied IV	Botany/Chemistry	4	4	3	25	75	100
III	Allied IV Practical	Botany/Chemistry	3	3	3	40	60	100
IV	SBEC II	Aquaculture	2	2	3	25	75	100
IV	NMEC II	Wildlife Management (offered to Other Dept. Students)	2	2	3	25	75	100
	Internship Programme	Dairy farm, Fish farm / Breeding centre, Poultry farm, Medical Lab, Natural Ecosystem, Natural History Museum, Sericulture farmhouse, Apiculture farms, Vermifarm.						
<b>Total</b>			<b>30</b>	<b>26</b>		<b>230</b>	<b>570</b>	<b>800</b>
<b>SEMESTER V</b>								
III	Core V	Animal Physiology	5	5	3	25	75	100
III	Core VI	Developmental Biology	5	5	3	25	75	100
III	Core VII	Immunology & Microbiology	5	5	3	25	75	100
III	Elective I	Medical Laboratory Techniques (MLT)	5	5	3	25	75	100
IV	SBEC III	Poultry Science	2	2	3	25	75	100
IV	SBEC IV	Ethology	2	2	3	25	75	100
IV	Practical	Practical – III & IV	6	-	-	-	-	-
<b>Total</b>			<b>30</b>	<b>24</b>		150	450	<b>600</b>
<b>SEMESTER VI</b>								
III	Core VIII	Environmental Biology	5	5	3	25	75	100
III	Core IX	Evolutionary Biology	5	4	3	25	75	100
III	Core X	Bioinformatics, Biostatistics and Computer Applications	5	5	3	25	75	100
III	Elective II	Sericulture	5	4	3	25	75	100
IV	SBEC V	Apiculture	2	2	3	25	75	100
IV	SBEC VI	Dairy Science	2	2	3	25	75	100
III	Practical - III	Animal Physiology, Developmental Biology, Immunology & Microbiology, Poultry Science, Ethology & MLT.	3	3	3	40	60	100
III	Practical - IV	Environmental Biology, Evolutionary Biology, Bioinformatics, Biostatistics and Computer Applications, Sericulture & Apiculture.	3	3	3	40	60	100
V		Extension Activities		1				
<b>Total</b>			<b>30</b>	<b>29</b>		<b>230</b>	<b>570</b>	<b>800</b>
<b>Total Credits: 148</b>						<b>Total Marks: 4200</b>		

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**SEMESTER - I**

### **Objectives**

On the successful completion of the course, students will be able to

- Describe the distinguishing characteristics of the major taxa
- Explain the basic aspects of classification details of invertebrates
- Understand biodiversity, habitat, adaptation organization and taxonomic status of invertebrates
- Recall certain morphological attributes and physiological processes that are distinct and significant to each Phyla
- Understand the systemic and functional morphology of various groups of invertebrates
- Explain the basic aspects of structural and functional details of Invertebrates

### **Unit I**

#### **Phylum: Protozoa**

**Type Study:** *Parameciumcaudatum* –External features, Nutrition, Locomotion- effective stroke, recovery stroke, Metachronal rhythm, Reproduction-Asexual- Binary fission, Sexual reproduction –Conjugation, Autogamy, Endomixis, Hemimixis and Cytogamy. **General Topic:** Protozoan human diseases

#### **Phylum: Porifera**

**Type Study:** *Leucosoleniabotryoides*- External features, Body wall, Spicules, Canal System, Nutrition, Reproduction. **General Topic:** Canal System in sponges.

### **Unit II**

#### **Phylum: Coelenterata**

**Type Study:** *Obelia geniculata* - External features, Histology of the colony, Cnidoblast and its functions, Life History of Obelia, Metagenesis. **General Topic:** Polymorphism in Coelentrates

#### **Phylum: Helminthes**

**Type Study:** *Taeniasolium*- External features, Body wall, Feeding, Respiratory system, Excretory system-flame cells, Nervous system, Reproductive system, Life cycle.

**General Topic:** Parasitic adaptation in Helminthes.

### **Unit III**

#### **Phylum: Annelida**

**Type Study:** *Megascolexmaurittii* - External features, Body wall, Coelom, Locomotion, Digestive system, Excretory system, Nervous system, Reproductive system. **General Topic:** Metamerism in annelids.

**Phylum: Arthropoda**

**Type Study:** *Macrobrachium rosenbergii* - External morphology, Appendages, Digestive system, Respiratory system, Reproductive system. **General Topic:** Larval forms of Crustacea

**Unit IV**

**Phylum: Arthropoda**

**Type study:** *Periplaneta americana* - External features, Body wall, Mouthparts, Digestive system, Respiratory system, Nervous system, Sense organs, Excretory system, Reproductive system.

**General Topic:** Peripatus- Affinities as a living fossil, Beneficial Insects.

**Unit V**

**Phylum: Mollusca**

**Type Study:** *Pilaglobosa* - External features, Shell, Digestive system, Respiratory system, Circulatory system, Nervous system, Sense organs- Eyes, Osphradium, Statocyst, Tentacles, Excretory system.

**General Topic:** Torsion in Mollusca.

**Phylum: Echinodermata**

**Type Study:** *Asterias rubens* - External features, Pedicellaria-Structure and Function, Digestive system, Water vascular system, Circulatory system-Perihaemal and Haemal system, Nervous system, Sense organs, Excretory system, Reproductive system.

**General Topic:** Larval forms of Echinoderms and their evolutionary significance.

**Course Outcomes:**

- To compare and understand the general and specific characteristics within each Phyla
- Interpret the affinities, evolutionary relationships and adaptation of the major taxa and to explain their economic importance with respect to Non-Chordates

**Reference Books**

- Jordan.E.L and Verma.P.S, Invertebrate Zoology Revised Edn., S.Chand and Co. Ltd. Ram Nagar, New Delhi, 2014.
- N. C. Nair, N. Soundara Pandian, S. Leelavathy, T. Murugan, A Text Book of Invertebrates, Saras Publications ,2013.
- Dhami P.S. and Dhami J.K, Invertebrate Zoology 5 th edition S. Chand & Co., New Delhi, 2012. EkambaranathaAyyar,M.&Ananthakrishnan,T.N Manual of Zoology Vol-I (Invertebrata) Part I & II Vishwanathan (p) Ltd.Chennai, 2010
- Kotpal R.L., Agarwal S.K and Ketarpal R.P.R, Modern Text Book of Zoology – Invertebrates, Rastogi Publications, 2011.

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**SEMESTER – II**

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SEMESTER II

CORE COURSE II

CHORDATA

## Course Objectives:

- To understand what the chordates are.
- To understand the taxonomic position of chordates.
- To understand different categories of chordates.
- To understand the general characters of chordates.
- To understand the level of organization in chordate subphylum.
- To understand the origin and evolutionary relationship in different subphylum of chordates.

## Unit I Introduction to Chordata:

General characters and Classification up to classes with the name of the examples. Prochordata: General characters and classification up to orders with the name of the examples. Type study: Amphioxus-External features-Digestive and Excretory system Agnatha: Petromyzon-External morphology; Ammocoetes Larva

**General topics:** Retrogressive Metamorphosis in Ascidian.

## Unit II Pisces:

General characters and classification up to sub-classes with the names of the examples.

**Type study:** Scoliodon (shark) -External characters- Placoid scales-Digestive system Respiratory system- Receptor Organs-Urinogenital system.

**General topics:** 1. Accessory respiratory organs in fishes 2. Migration of fishes

## Unit III Amphibia:

General characters and classification up to orders with the name of the example.

**Type study:** Frog -structure and organisation (Excluding skeletal system) General topics: 1. Parental care in amphibia. Reptilia: General characters and classification - Type study - Calotes -structure and organisation (Excluding skeletal system)

**General Topics:** 1. Identification of poisonous and non-poisonous snakes of South India  
2. Poison apparatus-Biting mechanism- venom- First aid for snake bite-Antivenom.

## Unit IV Aves:

General characters and classification up to subclasses with the names of the examples.

**Type study:** Columba livia (Pigeon)-External characters-Flight muscles-Digestive system, Respiratory system, Urinogenital system

**General topics:** 1. Migration of Birds 2. Flight adaptations in Birds

**Unit V Mammalia:**

General characters and classification up to subclasses with the names of the examples.

**Type study:** Rabbit –External morphology – Digestive system – Respiratory system-HeartStructure of Brain-Reproductive system.

**General topics:** 1. Egg laying mammals 2. Adaptations of aquatic mammals 3. Dentition in mammals

**Course outcomes:**

- This course will be helpful to student to have overall understanding of various chordates.
- Describe unique characters of urochordates, cephalochordates and fishes.
- Recognize life functions of urochordates to fishes.
- Understand the ecological role of different groups of chordates.
- The knowledge gained from this subject will be helpful for students to realize the significance of Animal Sciences.

**References:**

1. EkambaranathaAyyar,M. and T.N.Ananthakrishnan. A Manual of Zoology Vol.II (chordate).S.Viswanathan (Printers and Publishers) Pvt.Ltd.,Chennai. Alexander, R.M. The Chordates Cambridge University Press.
2. Jordan E.L. and P.SVerma.Chordata Zoology (11th Edition).S.Chand and Company Limited, 7361 Ram Nager,QutabRoad,New Delhi-110 055.
3. Kotpal.R.L.Modem Text Book of Zoology-vertebrates. Rastogi Publications, Gangotri,ShivajiRoad,Meerut-250 002.
4. Nigam, H.C.,1983. Zoology of Chordates,Vishal Publications, jalandhar -144 008, 942.
- 5.Newman H.H.1981The Phylum Chordata, Satish Book Enterprise, Agra -282 003,477 pp.
6. Parker and Haswell, 1964. Text Book of Zoology, Vol II (Chordata), A.Z.T,B.S. Publishers and Distributors, New Delhi - 110 051, 952 pp
7. Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan & Co., New York, 587 pp.

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### PRACTICAL - I

#### INVERTEBRATES & CHORDATA

#### Course Objectives:

The student will demonstrate an understanding of, and be able

- To identify in detail, the anatomical characteristics of members of Invertebrates and phylum Chordata.
- To classify of the ontogenic and phylogenic relationships of Invertebrates and phylum Chordata.

#### I - DISSECTION

##### A. Cockroach:

1. Digestive system
2. Nervous system

##### B. Prawn:

3. Nervous system

##### C. Any Bony Fish:

4. Digestive system

#### II - MOUNTING

- a. Mouth parts of House fly, Honey bee, Mosquito
- b. Sting apparatus of Honey bee
- c. Scoliodon: Placoid scales.

#### III SPOTTERS

##### A- Classify giving reasons up to order:

Paramecium, Aurelia, Fasciola, Ascaris, Lamellidens, Asterias,

*Balanoglossus, Herdmania (Ascidian), Branchiostoma (Amphioxus),*

*Petromyzon, Scoliodon sorrakowah, Rana hexadactyla, Calotes versicolor, Columbalivia.*

##### B- Draw labelled sketches:

Obelia medusa, Ephyra larva, Redia larva, Cercaria larva, Mysis larva, Alima larva, Bipinnaria larva

*Amphioxus*–T.S. through pharynx. *Doliolum, Salpa, Narcine, Cynoglossus, Alcedo atthis* (King-fisher)

##### C- Comment on Biological significance:

Plasmodium, Obelia colony, Physalia, Velella, Fasciola – Miracidium, Taenia – Mature proglottid,

Trochophore larva, Chaetopterus, Peripatus, Hirudinaria, Limulus, Chiton, Sepia, Octopus,

*Tornaria larva, Ascidian Tadpole larva, Anabass scandens, Clarias batrachus, Hippocampus, Echeneis,*

*Ichthyophis, Axolotl larva, Chamaeleon, Viperarusselli (Russel's viper), Dracovolans,*

*Dinopium (Woodpecker), Bat.*

##### D - Comment on Structure / Skeleton / Palate / Dentition:

Sponge – Spicules, Sponge – Gemmule, Taenia – Scolex, Neanthes – Parapodium, Penaeus – Petasma,

Scorpion – Book lung, Starfish – Pedicellaria, *Rana* – Pectoral girdle, *Rana* – Pelvic girdle, *Pigeon* – Palate,

*Rabbit* – Dentition.

**Course Outcomes.**

- Training experience in anatomy through simple dissection and mounting.
- Familiarization with conventional organ system in different animals.
- Identify and study preserved specimens of various economically important animals.

**Suggested manuals:**

1. Practical Zoology- Invertebrates S.S. Lal
2. Practical Zoology - Invertebrates P.S. Verma
3. Practical Zoology - Invertebrates K.P. Kur

**Suggested References:**

- Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
- Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home
- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons. 4 Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
- Cleveland P. Hickman et.al. (2008). Animal Diversity, McGraw-Hill Higher Education
- Kotpal (2015). Modern Textbook of Zoology Vertebrates, Rastogi publishers, New Delhi
- Saxena, R.K. and Saxena, S. (2015). Comparative Anatomy of Vertebrates, Viva Books, Delhi
- Jordan E.L. and Verma P.S. (2010). Chordate Zoology, S. Chand & Co, New Delhi.

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**SEMESTER – III**

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SEMESTER – III  
CORE COURSE -III  
CELL BIOLOGY

## Objectives

- To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- To understand how these cellular components are used to generate and utilize energy in cells
- To understand the cellular components underlying mitotic cell division.
- To understand responses to environmental or physiological changes, or alterations of cell function brought about by mutation.
- To understand the process of cell division in both somatic and germ cell.

## Unit I: Tools and Techniques of Cell Biology

Cell Fractionation, Homogenization Centrifugation, and Isolation of sub-cellular Components. Biochemical Techniques - Chromatography and their Application, Tissue Culture and Cell Culture Techniques. Histological Techniques - Staining - Vital Stains - Cytoplasmic and Nuclear Stains. Microscopes - Types - Light, Phase contrast, SEM, TEM - Units of measurement.

## Unit II: The Cell

Cell theory - Viruses -Types and Structure - Bacteria - Bacterial membrane - Ultra structure of Plant & Animal cell - Cytoplasm - Structure and Composition, Function - Extra Cytoplasmic Structure - Cilia Flagella - Cytoplasmic Inclusions.

## Unit III: Cell components

Plasma Membrane Ultra Structure - Different Models - Functions - Ultrastructure, Composition and Function of Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysosomes, Centrioles, Plastids, Chloroplasts, Microtubules & Microfilaments, Mitochondria, and Microsomes.

## Unit IV: Nucleus

Ultrastructure, Composition and Functions - Nuclear Membrane - Nucleoplasm - Chromosomes - Heterochromatin and Euchromatin - Nucleolus - Nucleolus Cycle - DNA and RNAs - Protein Synthesis & regulation.

## Unit V: Cell Divisions and Cell Cycle

Amitosis, Mitosis and Meiosis and their Significance - Cancer, Ageing of Cells and Stem cell studies.

## Course Outcomes:

- Able to Describe the function and the composition of the plasma membrane.
- Able to Explain the principles of the cell theory.
- Able to Differentiate between prokaryotes and eukaryotes.
- Able to Understand the importance of the nucleus and its components.

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- Able to Understand how the endoplasmic reticulum and Golgi apparatus interact with one another and know with which other organelles they are associated.
- Able to Identify the three primary components of the cell's cytoskeleton and how they affect cell shape, function, and movement.

### REFERENCE BOOKS

- **Ajay Paul.**, 2011. Cell and Molecular Biology. Books and Allied Pvt, Kolkata.
- **Powar, C.B.**, 2002. Cell Biology. Himalaya Publishing House.
- **Cohn, N.S.**, 1979, Elements of Cytology, Freeman Book Co., New Delhi.
- VeerBala Rastogi, Introductory cytology. Kedar Nath Ram Nath. Meerut 250 001.
- Bhaskaran, K.K. & Biju Kumar, A.: Cell Biology, Genetics & Molecular Biology.
- Vijayakumaran Nair, K. & Jayaprakash, M.: Cell Biology, Genetics, Molecular Biology. Academica, TVM.
- Verma & Agarwal (2006) Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, S. Chand publishers

**VERMICULTURE AND VERMICOMPOSTING**

**Course Objectives:**

- To recall and recognize earthworm diversity.
- To get knowledge on organic farming and waste management using vermitechnology.
- To understand the vermiculture techniques.
- To apply knowledge on vermicompost preparation.
- To aware the significance of sustainable agriculture and organic farming.
- To inoculate basic knowledge on recycling of biodegradable waste of different kinds.
- To understand the value of Vermitechnology and its significance.

**Unit-I: Vermi-technology**

Scope of vermiculture and vermicomposting – difference between vermiculture and vermicomposting.

Vermi-tech practices in India.

**Unit -II: Earthworm diversity**

Ecological groups of earthworms, biology of composting earthworms – *Eoisenafoeitida*, *Eudrilus lugeniae*.

**Unit -III: Soil & Organic waste sources**

Soil – Physical, chemical and biological features, Organic waste sources – problems in traditional composting, vermi-compositing, Types, small and large scale pit method, heap method.

**Unit: IV: Vermiculture techniques**

Vermiculture process – site selection - Selection and collection of species mono and poly culture - Essential parameters for vermiculture–bedding. Methods of harvesting worms’ general manual methods, self-harvesting method, mechanical method

**Unit -V: Vermicomposting**

Nutritive value of vermicompost, storing and packing of compost - Applications of vermicomposting in agricultural and horticultural practices - Economic of vermiculture, nationalized bank, NABARD support for vermiculture.

**Course Outcomes:**

- Get knowledge about the characteristics and role of earthworm in sustainable agriculture.
- Get knowledge on the significance of earthworms.
- Understand the importance of waste degradation by eco-friendly method.
- Apply the significance of Vermicomposting methods.
- Apply knowledge on commercialization of Vermiproducts.

- Expertise in Vermiculture Techniques
- Creating Opportunities for self employment

**Reference Books:**

- Earthworm ecology by LEE
- Biology of earthworm by Steven son
- Vermicomposting tech – soil health to human health by Ranganathan L.S.
- Tripathi G, Vermisource Technology, Discovery Publishing House, 2003
- Ranganathan, L.S., Vermicomposting Technology – From Soil Health to Human Health, 2006.
- Bhatnagar, R.K. and Palta, R.K., (1996). Vermiculture and Vermicomposting. Kalyani Publishers, New Delhi.
- Arun K. Sharma. (2002). A hand book of Organic Farming, Agrobios, Jodhpur, India
- The Earthworm book, S.A. Ismail. Other India press, Goa - 403 507, India (2005).
- Gupta P.K. (2008). Vermicomposting for Sustainable Agriculture. Agrobios. India.
- Edwards, C.A. and J.R. Lofty (1977) “Biology of Earthworms” Chapman and Hall Ltd., London.
- Lee, K.E. (1985) “Earthworms: Their ecology and Relationship with Soils and Land Use”, Academic Press, Sydney.
- Satchel, J.E. (1983). “Earthworm Ecology”, Chapman Hall, London

**Course Objectives:**

**On the completion of the course the learner will be able to,**

- understand the classification of nutrients
- gain knowledge on the intake of balanced diet and the significance of food
- list the common deficiency disorders, their causes, symptoms and recommended food sources
- evaluate the importance of a balanced diet
- understand the types of abuses and associated behavioural changes.
- know the causes for drug, tobacco and alcohol addiction and its effects on health.
- analyse the possible ways of de-addiction.
- know about the diseases and disorders associated with lifestyle modification.
- explain the underlying cause and symptoms for diabetes, obesity, cancer and AIDS.

**Unit I: Physical Health**

**Health & Hygiene:** Meaning, Definitions, Significance. **Nutrition:** Classification and functions of food, sources and requirement of Carbohydrates, Proteins, Fats, Vitamins and Minerals, Malnutrition, Balanced diet.

**Unit II: Water, Air, Light and Noise.**

**Water:** Criteria for water quality standards, household purification. **Air:** Health effects of air pollution, prevention and control. **Ventilation** – Standards of ventilation, **Light** – The requirements of good lighting, **Noise:** Effects of noise exposure.

**Unit III: Pathogens**

Dimensions and Determinants of health, Indicators of health – Characteristics of indicators, Types of indicators, Disease agents – Classification of disease agents- water, air, vector borne.

**Unit IV: Mental Health**

Conflicts and Frustration, Depression, Mental illness – Major and minor illnesses - Social pathological causes. Defense Mechanisms, Guidance and Counselling.

**Unit V: Personal Hygiene**

Dental Care, eye care, Ear care and skin care. Diabetes, Obesity and Cancer. Awareness on Alcoholism, Smoking, Tobacco chewing, Drug Abuse & Addiction, STDs - AIDS.

**Course Outcomes:**

**After the completion of the course the student will be to,**

- Get an opportunity to work in the field of health department, NGOs.
- Do higher learning in the area of Paramedical courses.
- Confirm the quality and standards of water, air, light, sound.
- Suggest remedial measures for prevention and control of these diseases and disorders.
- Create awareness among the individuals in the society to lead healthy life.

**Text Books:**

1. Park, J.E. and Park. 2000. Text book of preventive and social medicine, 17<sup>th</sup> Edition, Banarasidas Publishers, Jabalpur.
2. Muruges, N. 2002. Health education and community pharmacy, 3rd Edition, Sathya Publishers, Madurai.
3. Edward P Sarafino and Timothy W. Smith. 2012, Health Psychology, International Student Versio 7th Edition, Wiley India (P) Ltd, New Delhi.
4. Srilakshmi, B. Dietetics, 2014, 7th Multi-color Edition, New Age International Publishers, New Delhi.
5. Sathyanarayana U. Biochemistry – Revised Edition, Books and (P) Ltd, Kolkata.

**References:**

1. Swaminathan M (1995): “Food & Nutrition”, The Bangalore Printing & publishing co ltd., Vol I, Second Edition, Bangalore.
2. Srilakshmi (1997): “Food Science”, New Age International (P) Ltd, Publishers, Pune.
3. Mudambi .R. Sumathi & Rajagpal M.V (1983), “Foods & Nutrition”, Willey Eastern Ltd, Second Edition, New Delhi.
4. Thangam.E.Philip(1965): Modern Cookery, Orient Longman, II edition. Vol II, Bombay.
5. Shubhangini A. Joshi,(1992)’ “Nutrition and Dietetics”Tata Mc Grow- Hill publishing Company Ltd, New Delhi.
6. Srilakshmi. B – “Nutrition Science”, V Edn, New Age International (P) Ltd, Publishers, Chennai.
7. Tortora.J and Funk.R., (2008), Microbiology an Introduction, 9th edition, Pearson Education in South Asia.
8. Winwood R.S. and Smith J. L., Sear’s Anatomy and Physiology for Nurses, 6th Edition, Edward Arnold and Jaypee Brothers.

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**SEMESTER – IV**

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SEMESTER -IV

CORE COURSE - IV:

GENETICS

## Course objectives:

- To know how the behavior of chromosomes during meiosis can explain by Mendel's law.
- To understand how inheritance patterns are affected by position on chromosomes.
- To make out the similarities and differences between how genetic information is passed on in prokaryotes and eukaryotes.
- To understand gene interactions.
- To understand the chemical nature of heredity.

## UNIT – I:

Introduction to Genetics, Mendel's experiment, Alleles, Backcross, test cross, Laws of heredity. Monohybrid cross and Dihybrid cross. Interaction of genes – complementary, epistasis, lethal genes in man, Multiple alleles – A,B,O blood groups-Rh factors in man, Erythroblastosis foetalis. Multiple genes (polygenic inheritance) skin colour in man.

## UNIT-II

Linkage – complete, incomplete. Crossing over – Mechanism of Meiotic crossing over - coupling and repulsion. Chromosomes map; Sex determination in man and Drosophila. Genic Balance Theory. Non disjunction in man. Sex linked Inheritance in man – Haemophilia, colour Blindness, Holandric genes - hypertrichosis, sex limited genes. Extra chromosomal inheritance in paramecium, maternal coiling of shell. Animal breeding: – Inbreeding and out breeding, heterosis.

## UNIT III

Mutation - Types of mutation- gene mutation - mutagens – mode of action of chemical mutagens and ionizing mutagens – detection of mutation by CIBmethod. Chromosomal abnormalities – autosomal and sex chromosomes – klinefelters syndrome, Turner's syndrome and Down's syndrome.

## UNIT IV

Human chromosome, karyotypes, idiogram, Simple Mendelian traits in man– twins. Inborn errors of metabolism – phenylketonuria, Alkaptonuria, Albinism, Sickle – Cell anaemia. Pedigree Analysis.

## UNIT V

Bacterial genetics – structure of E-coli, bacterial recombination – transformation conjugation, transduction and sexduction. Genetic application of bacteria, structure and life history of T4 phage.

**Course outcomes:**

- Comprehensive and detailed understanding of the chemical basis of heredity.
- Understanding about the role of genetics in evolution.
- The ability to evaluate conclusions that are based on genetic data.
- The ability to understand results of genetic experimentation in animals.

**Reference Books:**

1. Strickberger : Genetics (MacMillan).
2. Farnsworth : Genetics (harper and Row).
3. P.K.Gupta: Genetics (Rastogi Publications)
4. P.S. Verma and Agarwal: Genetics (S.Chand & Co.Ltd.)
5. Altonburg,E: Genetics (Oxford & IBH publishing company)
6. Burns G.W.: The Science of Genetics (MacMillan)
7. A.C.Pai: Foundations of Genetics (Mc Gaw –Hill)
8. J.A.Serra: Modern Genetics (3 volumes)
9. Sinnott, Dunn and Dobzhansky: Principles of Genetics (McGrawHill)
10. Gardener: Principles of Genetics.

**Course objectives:**

- To know the basic principles of aquaculture farming.
- To acquire the knowledge about the water quality parameters.
- To understand the function of individual nutritive components.
- To know the cultivable fish production for sustainable aquaculture farming.
- To study the microbial infective defence mechanism and their disease management.

**Unit I: Introduction to Aquaculture**

Basics of Aquaculture: Scope and Definition, History of aquaculture, origin and growth. Types of aquaculture – Intensive, Semi-intensive, Extensive, Monoculture, Polyculture, Integrated fish farming (Composite fish culture, Paddy - fish culture, Duck - fish culture, Pig – fish culture), Pen and Cage Culture.

**Unit II: Farm Management**

Selection of sites - General considerations - water quality management (temperature, dissolved oxygen, pH, alkalinity, hardness, ammonia, and nitrites) - water supply and drainage - Construction of different ponds (Nursery, Rearing and Stocking ponds) - pond structure (size, shape, depth etc.).

**Unit III Feed Technology**

Live feeds - Rotifer and brine shrimp Artemia. Artificial feeds – formulation, types, and nutritive importance. Nutritional requirements of cultivable finfish and shellfish: larvae, juveniles and adults. Feed additives and preservatives.

**Unit IV Economic Importance of Fish**

Cultivable species-criteria for selection, Brooders, Spawning and fry production and grow out, Culture of fresh water fishes – Catla, Rohu and Mrigal. Mariculture – culture of shrimp (*Penaeus monodon*), edible oyster and pearl oyster. Induced breeding-Hypophysation. Transgenic fish production and their importance.

**Unit V Aquatic Diseases Management and Government Agencies**

Infectious bacterial and viral diseases: General characteristics, Epizootiology, and Epidemiology of Furunculosis disease is caused by *Aeromonas salmonicida* and Hemorrhagic Septicemia (VHS). Causes, symptoms, Prevention and treatment. Preservation of fish – Smoking, Canning, and Drying. Role of Government Agencies – CMFRI, MPEDA, CIBA, CIFA and NFDB. Funding agency – NABARD.

**Course outcomes:**

- Familiarize the importance of aquaculture practices.
- Acquired the technology enabled sustainable aquaculture farm management.
- Gained knowledge of nutritive importance in feed formulation
- Obtained knowledge in the economical aspects of the aquaculture.
- Relate the strategies learned for the development of Aquafarm management and sustainable production

**References:**

1. Jhingram, V. G., (1982), Fish and Fisheries in India, Hindustan Publishing Cooperation, New Delhi.
2. James E. Lannen, R. Onealsmitherman, George tchobanologous, (1983), principles and practices of Pond Aquaculture: A state of the art review, Pond Dynamics/ Aquaculture CRSP, program Management Office, Oregon state University, Marine Science Center, Newport, Oregon, USA.
3. Lucas, J.S., Southgate, P.C. and Tucker, C.S. eds. (2019) Aquaculture: farming aquatic animals and plants, John Wiley & Sons.
4. Austin, B., Austin, D. A, (2012), Bacterial fish pathogens, 2012., Vol. 481, p. 482. Dordrecht, The Netherlands: Springer.
5. Lim C.E., Sessa D.J, (1995), Nutrition and Utilization Technology in Aquaculture. AOCS Press, Illinois, USA.
6. Roberst R. J, (2012), Fish Pathology. Wiley – Blackwell.
7. Pillay, T.V.R. & M.A. Dill, (1979), Advances in Aquaculture. Fishing News (Books) Ltd., England.
8. [https://nsdcindia.org/sites/default/files/FG\\_AGRQ4904\\_Aquaculture-Worker\\_23-11-2017.pdf](https://nsdcindia.org/sites/default/files/FG_AGRQ4904_Aquaculture-Worker_23-11-2017.pdf)

**Course Objectives:**

**On the completion of the course the student will be able to**

- Know the basic concept and principles of Wildlife Management
- Understand the Evaluation of Wild life habitat
- Know population estimation
- Analyse Human – animal conflicts
- Realise Zoo's Zoological Parks, Wildlife sanctuaries, National Parks and Tiger reserves

**Unit I: Wildlife Management:**

Basic concepts and principles - Wildlife management before and after implementation of Wild Life (Protection) Act, 1972 – IUCN – CITES – NBA – IBA – Project Tiger – Project Elephant – Project Crocodile

**Unit II: Evaluation of Wildlife habitat:**

Define habitat – Forest habitat types - basic survey techniques of habitats – Vegetative analyses – Point centered quadrat, Quadrat, strip transect – Habitat manipulation: Food, Water, shade, impact and removal of invasive alien species

**Unit III: Population Estimation:**

Basic concepts and applications - Direct count (block count, transect methods, Point counts, visual encounter survey, waterhole survey). Indirect count (Call count, track and signs, pellet count, pugmark, camera trap, DNA finger printing and aerial photography).

**Unit IV: Human-animal Conflicts:**

Basic concepts, reason for conflicts, Identification of damages caused by wild animals and control measures. Case studies – Elephant, gaur, wild boar, monkey, tiger and leopard, Translocation of Wild animals – Principles, Methods and application.

**Unit V: Zoos, Zoological Parks, Wildlife Sanctuaries, National Parks & Tiger Reserves:**

Definition – in-situ and ex-situ conservation, formation, management and administration. Case studies (VOC park zoo, Arignar Anna Zoological Park, Srivilliputtur Wildlife Sanctuary, Vedanthangal bird sanctuary, Mukkuruthi and Guindy National Parks, Mudumalai and Periyar Tiger Reserves - Nilgiri Biosphere Reserve.

**Course outcomes:**

- Understand the various concepts of Wild life Management
- Write Competitive Examinations

**References:**

- Saharia, V.B. 1982 Wildlife in India, Nataraj Publishers, Dehra Dun
- Seshadri, B.1986 India's Wildlife reserves, Sterling Pub'rs Pvt. Ltd., New Delhi
- Giles, R.H. Jr. (Ed) 1984.Wildlife Management Techniques 3rd edition. The wildlife Society, Washington. D.C. NatarajPublishers,Dehradun. India
- Dasmann, Rf. 1964, Wildlife Biology. John and Wiley and sons Newyork. Pp231.
- Robinson, Wl. and Eric, G. Bolen, 1984. Wildlife Ecology and Management Mac Millan

**CELL BIOLOGY, GENETICS, VERMICULTURE & VERMICOMPOSTING & AQUACULTURE**

**Course Objectives:**

Students will be able,

- Measure through micrometry techniques.
- Count blood cells by using hemocytometer.
- Observe living cells
- Identification of drosophila mutants.
- Study about Normal Karyotyping
- Prepare and observe chromosomal arrangements during cell division.
- to compost in a limited space and describe the decomposing process.
- They will also turn towards organic farming,
- Will help to maintain the environment pollution free and
- Will get the knowledge of biodiversity of local earthworms.
- To successfully run a dairy farm enterprise by developing competencies concerning the selection and breeding of dairy cattle, management of animals of different physiological status, nutrition, health, housing and feeding.
- To provide hands-on experiences with the principles and practices essential in the production of clean milk for personal economic development.
- To give the students the necessary basic information about fishery and aquaculture.
- To discuss aquatic food primary production systems, fishery and aquaculture.
- To discuss important factors for performing a sustainable fishery and a sustainable aquaculture.

**I - Cell Biology**

- Micrometry-Use of Microscopes, Camera Lucida, Stage and Ocular Micrometer.
- Counting of RBC and WBC using Hemocytometer.
- Mounting of Buccal epithelium and observing living cells using vital staining.
- Mitosis in Onion root tip squash
- Study of prepared slides of histology
  - a) Columnar epithelium, b) Ciliated epithelium, c) Glandular epithelium, d) Areolar Connective tissue
  - e) Cartilage T.S., f) Bone T.S., g) Cardiac tissue, h) Striated muscle, i) Non striated muscle
  - j) Nervous tissue, k) Ovary T.S., l) Testis T.S.

## **II- Genetics**

- Study of Mendelian Inheritance and gene interactions (Non-Mendelian Inheritance) using suitable examples.
- Observation of Common mutants of *Drosophila*
- Human blood grouping.
- Study on Normal Karyotype - male and female, Down syndrome, Turner and Klinefelter syndrome
- Demonstration of inactive X-chromosome in buccal epithelial cells of human female.

## **III - Vermiculture & Vermicomposting**

- Study of Life stages & development of Earthworm.
- Preparation vermibeds, maintenance of vermicompost.
- Study the effects of vermicompost & vermish on any one short duration crop plant.
- Study of Vermiculture, Vermish & Vermicompost equipments, devices
- **Extension Activity:** Field trip & Report submission: Collection of native earthworms & their identification.

## **IV - Aquaculture**

- Identification and study of important cultivable and edible fishes.
- Identification and study of fish and shrimp diseases using specimens / pictures.
- Preparation of fish products.
- Identification and study of common aquarium fishes and maintenance of freshwater aquarium.
- **Extension Activity:** Visit to a fish / shrimp breeding centre / farms and submit a project report

## **Course Outcomes:**

- Basic knowledge on applications to different cell studies.
- Understands the fundamental genetic studies.
- Understands concepts of fisheries, fishing tools and site selection
- Knowledge on Aquaculture systems, induced breeding techniques, post harvesting techniques
- Provides knowledge of ornamental fish breeding which is highly professional and attractive avenue for youth

## **References:**

- Celis JE (ed) (1998) Cell Biology: A Laboratory Handbook, 2nd edn. San Diego: Academic Press.
- Paddock SW (ed) (1999) Methods in Molecular Biology, vol 122: Confocal Microscopy Methods and Protocols. Totowa, NJ: Humana Press.

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- Human Genetics and Genomics: A Practical Guide - Bahar Taneri, Esra Asilmaz, Türem Delikurt, Pembe Savas, Seniye Targen, Yagmur Esemem
- Bhatt J.V. & S.R. Khambata (1959) “Role of Earthworms in Agriculture” Indian Council of Agricultural Research, New Delhi
- Dash, M.C., B.K.Senapati, P.C. Mishra (1980) “ Verms and Vermicomposting” Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, Jyoti Vihar, Orissa.
- Kevin, A and K.E.Lee (1989) “ Earthworm for Gardeners and Fisherman” (CSIRO, Australia, Division of Soils)
- Wallwork, J.A. (1983) “Earthworm Biology” Edward Arnold (Publishers) Ltd. London.
- ICAR, 2013. Hand book of Animal Husbandry, 4th Ed.ICAR Publication, Pusa, New Delhi.
- Banerjee, G.C., 2006. Text book of Animal Husbandry 8th Ed.Oxford and IBH Publishing Company Ltd., New Delhi.
- Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.
- Sastry, N.S.R., C.K.Thomas and R.A.Singh, 2015. Livestock Production Management, 4th Ed.Kalyani Publishers, New Delhi.
- Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
- Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.

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**SEMESTER – V**

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SEMESTER -V

CORE COURSE- V:

ANIMAL PHYSIOLOGY

## Course Objectives:

- To understand the structure of the different organ systems in man/mammals.
- To understand the mechanisms involved in the functioning of the different systems.
- To study certain disorders that arise as a consequence of physiological malfunction.
- To understand the metabolic activities in mammalian body.
- To understand the gaseous transport and the structure involved in gaseous transport in mammalian body.
- To understand the various biomolecules in body.
- To understand the types mechanism of working of nerve cells.
- To understand the nature of endocrine glands and their secretion.

## UNIT – I

Nutrition: Proteins, Carbohydrates, lipids, Vitamins, minerals and water. – Food requirements – Balanced Diet. Digestive enzymes. Digestion and Absorption. Disorders of Digestive System- teeth decay, ulcer, appendix.

## UNIT – II

Respiration – Respiratory pigments and functions, Respiratory quotient, Bohr's effect, Chloride shift. Blood – Composition, Properties and Functions. Human Cardiac Cycle, Rhythm – Origin and Regulation of Heart Beat – ECG – BP – Heart Problems and coronary circulation.

## UNIT – III

Muscular System: Structure and types of muscle, Physiology of muscle contraction.

Excretion – Kidney – Structure and Function, Mechanism of Urine formation, Kidney Failure. Osmoregulation in mammals.

## UNIT – IV

Nervous tissue – Neuron – Structure, types of neurons, Nerve impulse. Synapse – Synaptic transmission, Neurotransmitters. Structure and functions of Brain. Receptors – Photoreceptor – Mammalian Eye – Physiology of vision. Phonoreceptors – Mammalian Ear.

## UNIT – V

Endocrine glands – Structure, secretions and functions of all endocrine glands of vertebrates. Antagonism and Synergism.

**Course Outcomes**

- Students are able to understand the physiology at cellular and system levels.
- Students are able to describe the role and functions of different systems.
- Able to describe the physiology of respiratory, renal, endocrine systems to define normal and abnormal functions.

**Reference Books**

- Verma, Tyagi and Agarwal. 1986. Animal Physiology. Chand & Co., New Delhi.
- William. S. Hoar. 1976. General and Comparative Physiology, Prentice Hall of India Pvt. Ltd., New Delhi-110 001.
- Wood. D. W. 1983. Principles of Animal Physiology. 3 rd edition.
- Prosser and Brown. 1985. Comparative Animal Physiology. Satish Book Enterprise, Agra-282 003.
- Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology, XI Edition., McGraw Hill
- Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books / Mc Graw3Hill.
- Singh. H.R, & Neeraj Kumar (2017) Animal Physiology and Biochemistry, Vishal Publishing Co
- Nagabhushanam, (2008), Textbook of Animal Physiology, Oxford & IBH
- Rastogi, S.C. (2007). Essentials of Animal Physiology, New Age International Publishers

**Course Objectives**

**On completion of the course, students should be able to**

1. Remember the basic concepts and definitions of modern developmental biology
2. Understand steps and advancements in the developmental biology
3. Comprehend embryonic formation and developmental stages with suitable examples
4. Apply functional knowledge on developmental biology into frontier sciences
5. Analyze animal embryonic development and possibilities of birth control

**Unit - I Gametogenesis**

Spermatogenesis – Definition – Process and significance - Structure of mammalian sperm.

Oogenesis – Definition – Process and Significance – Types of Eggs and Egg membranes – Polarity and symmetry

**Unit– II Fertilization and Parthenogenesis**

Fertilization – Definition – Process and Significance. Entry of sperm – egg activation, Post fertilization changes – Theories of fertilization Parthenogenesis: Definition and Significance – types of Parthenogenesis - Foetal membranes in chick - Placentation in mammals.

**Unit – III Cleavage and Gastrulation**

Planes and patterns of cleavage – Factors affecting cleavage – Cleavage infrog, Chick and Mammals. Morula and Blastulation - Morphogenetic movements - Fate maps –Gastrulation in frog, chick and mammal.

**Unit IV Organogenesis and Embryogenesis**

Origin and development of organs – Development of brain, eye and heart. Development of foetal membranes in chick. Placenta in Mammal – Definition – Significance and types.

**Unit – V Metamorphosis and Experimental Embryology**

Metamorphosis – definition and significance. Regressive and Progressive Metamorphosis – hormonal control of metamorphosis in Amphibians - Organizer – Regeneration –nuclear transplantation – Gradient theory – induced ovulation – Artificial insemination – IVF – Embryo transfer – birth control.

**Course Outcomes:**

**After the completion of the course, students should be able to**

- Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis.
- Understand how developmental processes and gene functions within a particular tissue or organism can provide insight into functions of other tissues and organisms.
- Realize that very similar mechanisms are used in very diverse organisms; and development is controlled through molecular changes resulting in variation in the expression and function of gene networks.
- Understand the relevance of developmental biology in medicine or its role in development of diseases.

**REFERENCE BOOKS**

- Balinsky, B.T. (1981) An introduction to Embryology, 5<sup>th</sup> Edition. W.B.Saunders Co.London.
- Patten (1971.) Fundamentals of Embryology — McGraw Hill Book Co. NewYork.
- Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.
- Verma.P.S.&.Agarwal V.K. Chordate Embryology. S.Chand& Company Ltd. Ram Nagar, New Delhi110055

**IMMUNOLOGY AND MICROBIOLOGY**

**Course Objectives:**

- To understand the concept of immunity and its constituent types.
- To study the lymphoid organs, the cells of the immune system and the effector molecules namely, antigens and antibodies.
- To study the clinical manifestations of immunological disorders.
- To appreciate the diversity of microbes and significance of certain microbes that are associated with man.

**UNIT - I: Immunity**

Innate immunity – Physical, Mechanical and Biochemical factors – Cellular factors –Genetic factor. Acquired immunity – Natural – Artificial –Active – Passive immunity Cell mediated immunity

**UNIT – II Lymphoid organs**

Primary Lymphoid organs – Thymus – Bursa of Fabricius –Bone marrow, Secondary Lymphoid organs – Lymph node – spleen – MALT – Payer’s patches Tonsils.  
Cell of the immune system – Lymphoid lineage –Myeloid lineage.

**UNIT- III: Antigens -Antibody**

Haptens - chemical nature of antigens – Antigenic determinants – factors of antigenicity, Antibody – Immunoglobulin – Types and functions of Immunoglobulins – Structure and biological properties of Immunoglobulin G. Immunizing agents – Vaccines – Types of Vaccines-Common Vaccines  
Auto immune disorders – Definition, Characteristics –Lupus erythematous, Rheumatoid arthritis.

**UNIT – IV: Classification& Diseases of Microorganisms.**

Whittaker’s five kingdom concept, Structure and Reproduction of Bacteria, Bacterial disease in Man –Typhoid, Cholera, Tuberculosis, Structure and Reproduction of T4 Phage, Viral disease in Man – AIDS, Polio, Rabies.

**UNIT –V: Applied Microbiology**

Structure and economic importance of yeast, Sterilization, Culture media and culture techniques, Microbiology of food poisoning.

**Course Outcomes**

- Imparts in depth knowledge of tissues, cells and molecules involved in host defense mechanisms
- Understanding of types of immunity
- Interactions of antigens, antibodies, complements and other immune components
- Understanding of immune mechanisms in disease control, vaccination, process of immune interactions
- Classification of microorganisms.
- Understanding of pathology of diseases caused by various microorganisms such as bacteria, virus, parasites and fungus

**REFERENCE BOOKS**

- Ananthanarayanan, K. & Jayaram Panicker, C.K. 1988. Text book of Microbiology, 3rd Edition.
- Dasgupta. A. 1982. Morden Immunology, 2nd Edition, Jaypee Brothers, Medical Publications, New Delhi.
- Pelczar, M.J. et al. 1993. Microbiology, McGraw Hill, New York.
- Stewart, F.S. 1968. Bacteriology and Immunology for students of Medicine. 9th edition. ELBS.
- Freeman Burrows. Text Book of Microbiology. 22nd Edition, Igaku-Shoin-Saunders International Edition.
- Khan, F.H. (2009). The elements of Immunology. Pearson Education India
- Abbas, A.K., Andrew H. H. Lichtman, and Shiv Pillai (2017). Cellular and Molecular immunology. Elsevier
- Peter J. Delves, Seamus J. Marti, Dennis R. Burton, Ivan M. Roitt. (2017). Roitt's Essential Immunology. Wiley-Blackwell
- Thomas J. Kindt, Barbara A. Osborne, and Richard Goldsby (2006). Kuby Immunology. W. H. Freeman
- Ramesh (2016). Immunology. McGraw Hill Education India Private Limited

# PERIYAR UNIVERSITY, SALEM – 636011

B.Sc., ZOOLOGY

ELECTIVE PAPER-I

## MEDICAL LABORATORY TECHNIQUES (MLT)

### Course Objective:

- To make the knowledge about medical laboratory instruments and its uses.
- To teach the method and collection of samples and its importance.
- To make aware the students during the emergency situation.
- To learn the blood sample collection and its cells counting.
- To learn the techniques used in the Clinical laboratory for sample analysis.
- To create knowledge on Self-Employment Opportunity.

### Unit I: Laboratory instruments:

General and personal care in the laboratory. Maintenance of Laboratory records. General principle, use and maintenance of Laboratory instruments: Balance, Autoclave, Hot air oven, Incubator, Water bath, Centrifuge, Refrigerator, Colorimeter, pH meter, hemocytometer, Hemoglobinometer, Sphygmomanometer and ECG,

### Unit II: Preparation of Laboratory Equipments and Chemicals:

Cleaning, maintenance and care of Glassware - Definition and methods of Sterilization. Heat, Radiation, Filtration, Chemical methods. Preparation and uses of Reagents – Normal Saline - Turkey's fluid, Hayem's fluid, Leishamn's stain, Wright stain, Carnoy's fluid and Bovin's fluid.

### Unit III: Clinical Hematology:

Blood and its Constituents, Collection of blood (Venous and Capillary) Anticoagulants and their uses, RBC, WBC, Total count and Erythrocyte Sedimentation rate (ESR), Platelet count, Clotting time, Bleeding time. Blood groups – ABO system, Blood grouping and Cross matching, Blood transfusion.

### Unit IV: Clinical Microscopic Examination:

Microscopic examination of bacteria smearing, Examination of Sputum, Urine and Faeces - Examination of throat Swab Collection and preparation of smears. Examination of Cerebrospinal fluid and Semen analysis. Sperm motility - Sperm coun.

### Unit V: Pathological Examination:

Examination of parasites - Malarial parasites, Plasmodium sp., Endameba histolytica, Ascaris lumbricoids, Taenia solium. Pathology of Vibrio cholera, Cornybacterium diphtheriae, Mycobacterium tuberculosis, Treponema palladium, Salmonella typhi and clostridium tetani.

**Course outcome**

- Understand fundamental analytical principles and processes used in clinical laboratory testing for various specimens.
- Understand the concepts and safety measures of clinical laboratory instruments.
- Acquired technical skills will help the students for collecting and processing biological specimens for analysis.
- Application of medical laboratory procedures will enable the students to distinguish normal and abnormal microscopic pathogens.
- Students enable their critical and analytical thinking in the detection of diseases.
- Interpretation will empower students to compare and contrast clinical laboratory procedures, interpret data and predict diagnosis.

**References:**

1. Kanai L. Mukherjee, Medical Laboratory Technology vol I, II, III –, Tata McGraw Hill Publishing Ltd., New Delhi.
2. RamanikSood, Medical Laboratory Technology – Jaypee Brother's Medical Publishers (P) Ltd., New Delhi.
3. MadhavanKutty,K Text Book of Medical Laboratory Technology, MedcenPoonthanam.
4. Mary Ellen Wedding, Sally A Toenjas Medical Laboratory Procedures Jaypee Brothers Medical Publishers.
5. Samuel,K.M Notes on Clinical Lab Techniques Published by M.K.Gopalan, Chrompet.
6. SathishGupte Short Textbook of Medical Laboratory for Technicians Jaypee Brothers, Medical Publishers.
7. Baker F.J. And Silverton R.E Introduction to Medical Laboratory Technology Hodder Education Publishers.

# PERIYAR UNIVERSITY, SALEM – 636011

B.Sc., ZOOLOGY

SBEC - III

## POULTRY SCIENCE

### Objectives

- To explore the cultivation of poultry
- To understand the methodology of construction of poultry house
- To create the aware the students for about the poultry disease and its treatment
- To make the learner well aware of various methods in Poultry Science and its management.
- To train the students to undertake Poultry farming as income source.

### UNIT: I

Introduction to poultry keeping –Poultry industry in India – Poultry breeds and classes of fowls – Poultry housing – general principles of building poultry house.

### UNIT: II

Rearing of fowls – growers. Layers and broilers – growth management – summer and winter management.

### UNIT: III

Poultry nutrition –Composition of poultry feed – nutrient requirements for fowls – nutritional deficiency symptoms.

### UNIT: IV

Poultry diseases: Ranikhet disease, New castle disease, Fowl pox, Birds flu. Vaccination schedules.

### UNIT: V

Poultry egg production – composition and nutritive value of egg - use of feathers and poultry manure. Economics of poultry. Field visit.

### Course Outcomes:

- Students in Poultry Science study the nutrition, marketing, management and business skills needed in poultry production.
- Poultry Science students receive a foundation in basic sciences and mathematics, as well as an understanding of the poultry industry.

### References:

- Prakash Malhotra (2008) Economic Zoology, Adhyayna Publishers & Distributors, New Delhi.
- Gnanamani A.R. Modern aspects of commercial Poultry keeping. Giri Publication, Madurai.
- Banerjee G.C. A text book of Animal Husbandry –Oxford & IBH publishing Co Pvt. Ltd., New Delhi.

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- Jawaid, A. and Sinha, S. P. (2008) A Handbook of Economic Zoology. S. Chand & Company, New Delhi.
- Upadhya, V.B. (2006) Economic Zoology. Rastogi Publications, Meerut, India.
- Biester, H.E. and Schwarte, L.H. (1969) Diseases of Poultry, 5th Edn. Oxford and IBH Publishing Co, NewDelhi.

**Course Objectives:**

- To understand why animals behave the way they do.
- To understand the cause of behavior.
- To understand how behavior develops.
- To explain both phylogenetically and physiologically the functional relationships of all factors involved in behavior.

**UNIT - I: Behavioral Patterns.**

Group behaviour, Individual behaviour, Stereotyped behaviour – Kineses, Taxes, Reflexes, Instincts, Motivation. Human behaviour - Fixed action pattern - sign stimulus - imprinting.

**UNIT - II: Communication in Animals.**

Visual, Olfactory, Auditory, Tactile and Language. Dances of honey bees, Alarm Calls, Echolocation in Bats.

**UNIT - III: Chemical Communication**

Pheromones – Types, functions and Examples. Mode of action and Economic uses.

**UNIT - IV: Biological Rhythm**

Circadian rhythm, Circalunar and Circannual rhythms and Biological Clocks.

**UNIT - V: Reproductive Behaviours**

Migratory behaviour - Orientation and Navigation, Courtship behaviour - Mating systems and parental care- Characteristics Brood care, aggression, attention.

**Course Outcomes:**

- The range of behavior prevalent in the animal kingdom starting from innate to learned behavior, from fighting to cooperating etc.
- For effective management of game animals.
- Must be aware of habits of his / her animals to get maximum benefit.
- The cattle breeding, poultry, piggery, fishery, sericulture etc. have been developed as industries for the benefit of mankind, only after understanding the behavior of the respective animals.
- Man may want to keep pets for recreation. For healthy pet management it is essential to understand the behavior.
- The information and the insight gathered in animal behavior can be used to understand human behavior.
- Behavioral studies can help in animal conservation. By understanding the nesting and territorial habits of the birds can help to create or preserve the habitats required by them. It can also help to increase the number of endangered and threatened animals

**References:**

- David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
- John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
- Chronobiology Biological Timekeeping: Jay. C. Dunlap, Jennifer. J.Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
- Vinod Kumar (2002) Biological Rhythms: Narosa Publishing House, Delhi / Springer-Verlag, Germany
- Agarwal V.K., Animal Behaviour (2013). S. Chand Publishing,

**B.Sc. ZOOLOGY**

**SEMESTER – VI**

# PERIYAR UNIVERSITY, SALEM – 636011

B.Sc., ZOOLOGY

SEMESTER -VI

CORE COURSE -VIII

ENVIRONMENTAL BIOLOGY

## Course Objectives:

- To understand the basic ecological concepts.
- To learn the importance of environment and its related components.
- To attain the knowledge about the ecosystem and its characteristics.
- To develop an awareness of pollution and importance of environmental resources.
- To obtain the knowledge about the conservation of biodiversity

## Unit I – Introduction of ecology

Concepts and definition – ecology, habitat, biosphere and biome; Biotic factors – animals, plants, bacteria and fungi; Abiotic factors – water, air, soil and sunlight.

## Unit II – Population and community

Population characteristics – natality, mortality, density, growth curve and age distribution; Community - species richness, dominance, diversity, abundance; Species interaction - Mutualism, commensalism, parasitism, competition and predation.

## Unit III – Ecosystem

Structure and function of ecosystem - Food chains, food web, ecological pyramids and energy flow; Ecological niche; Ecosystem types - forest, grassland, desert; Aquatic ecosystem – Lakes, rivers, marine and estuaries; Biogeochemical cycle – carbon, nitrogen and phosphorous.

## Unit IV – Pollution

Environmental Pollutions - air, water, soil and noise pollution - Sources and prevention; Solid waste – types, sources and control measures; Hazardous waste – types and treatment methods.

## Unit V – Biodiversity and Conservation

Biodiversity and hotspots of India; Wildlife conservation - National parks and Sanctuaries of India. Conservation of biodiversity - In-situ and Ex-situ conservation. Natural resources- renewable and non-renewable.

## Course Outcomes:

- ✓ Acquire the ecological knowledge and its biological significance.
- ✓ Understand the differences in the structure and function of ecosystems.
- ✓ Learn the ways of interactions of living and non-living organisms with the environment.
- ✓ Identify the problems of environment and analyzing its impact on biodiversity.
- ✓ The importance of hotspots, sanctuaries and their role in protecting biodiversity.

**REFERENCES:**

- Odum, E.P. (1971). Fundamentals of Ecology. W.B. Saunders Company, Phil. London.
- Kotpal,R.L. and Bali,N.P. (1986), Concepts of Ecology, Vishal Publication, New Delhi.
- Sharma, B.K. and Kaur, (1997). An Introduction to Environmental Pollution. Goel Publishing House, Meerut.
- Agarwal, K.C. (2001). Environmental Biology, Nidi Publication Ltd. Bikaner.
- <https://pib.gov.in/newsite/mbErel.aspx?relid=105134>
- N. Arumugam (), Concepts of Ecology, Saras Publication Pvt.Ltd, Nagercoil, Tamil Nadu, India.

**Course Objectives:**

**On the completion of the course the student will be able to**

- Identify the Origin of life.
- Relate the existing evidences of evolution with the process of evolution.
- Analyze critically the Evolutionary theories with examples.
- Understand the Patterns of Evolution.
- Summarize the concept of species, mechanisms of speciation.
- Appreciate the evolution of man.
- Defend Animal distribution.

**Unit 1: Origin of life**

History of Life: Abiogenesis, Biogenesis.

Biochemical Evolution: Concepts and Experiments.

Geological time scale.

**Unit 2: Evidences of Evolution**

Homologous organs, Analogous organs and vestigial organs.

Mass extinction - Causes, Major extinctions.

Fossils, Types of fossils, and Fossilization, Indian fossils, Dating of fossils.

Origin and evolution of horse, man - Culture evolution.

**Unit 3: Evolutionary theories**

Contributions of Lamarck, Darwin and De Vries.

Present status of Darwinism and Lamarkism.

Modern Synthetic Theory, Hardy Weinberg Law.

**Unit 4: Mechanism of Evolution & Speciation**

Organic variations; Isolating Mechanisms; Natural selection, Types of natural selection, Artificial selection. Polymorphism and mimicry in evolution.

Evolutionary & Biological species concept, Modes of speciation (Allopatric, Sympatric)

**Unit 5: Patterns of Evolution & Animal distribution**

Micro & Macro evolutionary Principles.

Zoogeographical distribution - Continental and island fauna - Continental drift - Discontinuous distribution, adaptive radiation.

**Course Outcomes:**

**After the completion of the course the student will be to**

- Students are able to describe various biological interactions.
- Able to describe evolutionary history of man.
- Able to describe origin of species on earth.
- Write competitive examinations like GATE / UPSC / TNPSC.
- Get an opportunity to work in the field of forensic science, Museum, Archeology.
- Do higher learning in the area of anthropology.

**Textbooks:**

1. Mohan P. Arora, Organic Evolution, Himalaya Publishing House, Mumbai.
2. Rostogi, V.B. Organic Evolution, Kedernath, Ramnath publishers, Meerut.
3. Verma P.S. & Agarwal, V.L. Concepts of Evolution S. Chand & Company.

**References:**

1. Eli C. Minkoff, 1984, Addison –Wesley Publishing Company, Canada.
2. Peter E. Rosenbaum ,2010. Volpe’s understanding evolution, McGraw-Hill, New York.
3. Theodosius Dobzhansky, Francisco J. Ayala, G. Ledyard Stebbins, James W. Valentine, 1977  
Evolution, W. H. Freeman & company, San Francisco.
4. G. Ledyard Stebbins, 1966. The process of organic evolution, Prentice – Hall, New Jersey.
5. Edward O. Dodson, 1960. Evolution: Process and Product , Reinhold Publishing Corporation, Newyork .

**Web links:**

<http://www.nhs.uk>

<http://www.eniscuola.net/en/2012/11/29/exobiology/>

<https://en.wikipedia.org/wiki/Astrobiology>

**BIO-INFORMATICS, BIOSTATISTICS AND COMPUTER APPLICATIONS**

**Course Objectives**

- To introduce the basics of bioinformatics- biological databases, retrieval tools and applications.
- To understand data collection, data handling and data analysis.
- To understand computer components, certain MS Office applications, internet search engines and computer viruses.

**Bio-Informatics**

**UNIT - I**

Definition, history, biological databases, Nomenclature of DNA sequence, protein sequence, Proteomics – Protein structure, PIR, entry of a SWISSPROT account, Genomics – Divisions, entry of Gen Bank account.

**UNIT - II**

Data retrieval tools- Entrez, BLAST, Bioinformatics in drug design, Phylogeny analysis in bioinformatics, Human genome project.

**Biostatistics**

**UNIT - III**

Data - types of data, collection of data, methods of collecting primary data, sources of secondary data. Classification and tabulation of data. Diagrammatic representation of data- line diagram, bar diagram (simple, component and percentage), pie diagram and pictogram. Graphic representation of data – histogram, frequency polygon, frequency curve and Ogive.

**UNIT - IV**

Measures of central tendency - Arithmetic mean. Measures of dispersion – Standard deviation and Standard error. Student's 't' test and Chi-square test.

**Computer Applications**

**UNIT - V**

Components of computer, MS Word, Excel, Power point, Internet – Search engines (Google, Yahoo), Applications, Computer virus, Storage Devices.

**Course Outcomes:**

- Basics of bioinformatics- biological databases, retrieval tools and applications.
- Collection, Handling, Analysis of biological data.
- Students gains knowledge about statistical methods like measures of central tendencies.
- Computer applications in biological data / statistical methods.

**Reference Books**

- Gupta, S.P. 1976. Statistical methods. Sultan Chand and Sons. New Delhi.
- Palanichamy, S. Manohar, Statistics for Biologists, Paramount Publications, Palani.
- Ignachimuthu S. Basic Bioinformatics –. NarosaPublising House, New Delhi, 2005.
- Mani, S. Bioinformatics Vol I, II, III. Centre for Cultural Studies Pub, Coimbatore.
- Rastogi S.C., Mendiratta, N .Bioinformatics – Methods and Applications., Rastogi Prentice New Delhi, 2005.
- Rajaraman. V. Fundamentals of computers.

**Course Objectives:**

- To know the history and socio-economical aspects of sericulture.
- To understand the classification and morphology of silkworm+.
- To obtain the knowledge about the description of Mulberry cultivation and pest management.
- To attain the knowledge about the disease management in sericulture.
- To understand the methodology followed for the reeling and rearing of sericulture

**UNIT I: Sericulture History & economics**

Origin and History of sericulture-environmental impacts of sericulture-Advantages and characteristics of sericulture-current status of sericulture in India-income and employment generation –National Sericulture Project (NSP)-overview-Future scope of sericulture.

**UNIT II: Biology of Mulberry and Planting**

Biology of Mulberry- Description and Eco-Mulberry cultivation in India - Selection of land and cultivation of mulberry –Mulberry varieties- Different methods of planting –Organic and in organic manure application-Mulberry pest Management- (Mealy bug - *Maconellicoccus hirsutus*), (hairy caterpillar- *Spilosoma obliqua*)-(Stem griddler-*Sthenias grisator*) : their preventive and control Measures.

**UNIT III: Silk worm Taxonomy and Classification**

Silkworm taxonomy, Classification of silk worms based on number of larval Moults, Moultnism and Voltinism – Tasar, Muga, and Eri. Morphology and life cycle of silk worm (*Bombyx mori*) and organization of larvae, Pupae and Moth- Structure of the silk gland and importance.

**UNIT IV: Farming and Disease Management:**

Silkworm rearing house models-Disinfection of rearing houses and appliances- Egg transportation and incubation –Egg handling – Hatching –Brushing. Silk worm Pests- Uzi fly, Ants and Demisted Beetles-diseases- Bacterial (Flecherie)-fungal (Muscardine) and viral (Grasserie) diseases of silk worm and its preventive measures.

**UNIT V: Reeling and Rearing Technologies:**

Reeling methods – Reeling and Re-reeling –Silk examination, cleaning, lacing, bookmaking and grading of silk. Rearing of silkworm-Chawki rearing or young age worm rearing- Harvesting of cocoon (stifling, storage and sorting) and quality assessment.

**Course Outcome:**

- Describe the economic impacts and income generation by sericulture.
- Educate the students about the basic biology of Mulberry culture.
- Expertise in the taxonomy, morphology and life cycle of the silkworm.

- Relate the strategies involved in the sericulture management system.
- Acquired the knowledge about the technologies in sericulture.

**REFERENCES:**

1. G.Ganga and Sulochanachetty (2018-19,Reprint )An Introduction to sericulture (II<sup>nd</sup> edition),Oxford & IBH Publishing Co.Pvt.Ltd, New Delhi, India.
2. CHARSLEY, S.R. (1982). CULTURE AND SERICULTURE. ACADEMIC PRESS INC., NEW YORK, U.S.A
3. RANGASWAMY .G. (1987) .Manual on sericulture FAO, Vol –IV, Agriculture service bulletin ,CSB , Bangalore , India .
4. DANDAN.S.B. (2004),Hand book of new sericulture technologies ,Central Silk Board Bangalore, pp 287.
5. <http://www.csrtimys.res.in/sites/default/files/ebooks/2019-1.pdf>
6. Mahadeveppa, D., Halliyal, V.G., Shankar, A.G. and Bhandiwad, R. (2000), Mulberry Silk Reeling Technology, Oxford and IBH Publishing Co. PVT. Ltd. New Delhi.

**Course Objectives**

The learner will...

- Understand the basic life cycle of the honeybee.
- Learn about beekeeping tools and equipment.
- Learn to manage beehives for honey production and pollination.
- Learn about bee diseases and pests.

**UNIT - I: Introduction**

Scope of Apiculture. Types of Honey Bees- Life Cycle.

Honey bee's species: *Apis dorsata* F., *Apis indica* F., *Apis florea* F., *Apis mellifera* F.

**UNIT –II: Social Organization**

Social Organization of Honey Bee - drones, queens, and workers. Bee Language and Communication - Temporal Polyethism, Superorganisms, Dancing, Swarming.

**UNIT - III: Bee Keeping and Bee Keeping Equipment**

Beehive, Tools for Bees Keeping: Comb foundation, Bee gloves, Bee veil, Smoker, Hive tool, Honey extractor.

**UNIT - IV: Products of Apiculture**

Honey-Chemical composition-Nutritional value and medicinal value.

Testing Methods to find adulteration in honey

Production of Bee wax and Uses. Bee venom and Uses.

**UNIT - V: Bee enemies and Diseases**

Bee enemies: Insects, Reptiles, birds, Mammals.

Bee Diseases: Nosema, Acarine, Septecamiea, Brood Foul, Isle of Wight, Amoeba disease.

**Course Outcomes:**

- Encourage Students' participation in scientific beekeeping.
- Maintain ecological balance in nature by way of domestication of honey bee species.
- Maintain small apiaries for demonstration, pollination, extraction and popularization of honey and other by-product of beekeeping.
- Motivation of students to adopt beekeeping as source of their livelihood.

**References:**

- Kumar, A. and Nigam, P. M., Economic and Applied Entomology.
- Backyard Beekeeping- Kim Flottum, ed. of Bee Culture magazine
- First Lessons in Beekeeping- Keith Delaplane
- Hooray for Beekeeping! – Bobbie Kalman
- How to Keep Bees and Sell Honey – Kelleys
- The Hive & the Honeybee - Dadant

**Course Objectives**

- To explore the Farming of Dairy Breeds
- To understand the methodology of construction of Dairy Farming
- To get employment in the Cooperative Milk Producers Union Limited and in private dairy product factories
- To provide knowledge to give them an opportunity and its socio-economic aspects
- To train and impart practical knowledge in clean milk production, processing of milk and preparation of milk products
- To Study of various diseases and disorders in Dairy breeds and First Aid Measures
- To create the aware the students about the Cattle disease and its treatment

**Unit I: Dairy Farming:**

Dairy Farming-Definition and Scope. Dairy breeds of India and its classification. Techniques adopted in cattle breeding - inbreeding, Outbreeding and Artificial insemination. Exotic cow breed- Jersey and Red Sindhi, Indian breed –Ongole and Kangayam, Buffalo-Murrah and Surti.

**Unit II: Cattle feed and it's Nutrition:**

Common cattle feed and nutritive values. Rations-its computational and qualities - Balanced ration for cattle. Importance of grassland and fodder in dairy farming. Physiology of mammary glands. Milk secretion and importance of Colostrum.

**Unit III: Milk and Milk products:**

Milk and its Composition – Nutritive value; milk collection; factors affecting the quality of milk; Dairy processing: Pasteurization; grading and packaging; transportation and distribution. Milk products – Butter, Ghee, Cheese.

**Unit IV – Diseases of Cattle:**

Viral diseases - Cow pox-Foot and mouth disease-Rinder pest. Bacterial diseases –Anthrax-Mastitis – Tuberculosis-Haemorrhagic septicemia. Non-contagious diseases-Milk fever, Parasites of dairy breeds

**Unit V: Marketing of Milk:**

Milk marketing - Dairy Co- operatives- Role of Co-operative societies in milk production and marketing. Dairy development in India, NDDB, NDRI; Merits and demerits of Dairy Business. Progressive plans to promote Dairy technology as a Self-employment Venture.

**Course Outcomes**

- On the successful completion of the course, students will be able to impart technical knowledge and skills required concerning the selection and breeding of dairy cattle, management of animals and different physiological status, nutrition, health, housing and feeding.
- Principles and practices essential in the production of clean milk. Able to classify feeds according to their nutritive values. Students will know the different types of microbes, and diseases.
- Completion of the programme may seek employment in private dairy farm, milk processing plants and dairy product factories.

**Reference Books:**

1. Principles of Dairy Science - G. H.Schmidt, L. D. Vivek and N. N. Pathak.
2. Milk and milk products - Harbonsing and Moore
3. Handbook of Dairy science - K. C. Mahanta
4. Milk Production and processing – C.IbraheemKutty and SheebaKhamer.
5. Farm animals and their management – J.A.S.Watson and W.J.Mills.
6. A text book of Animal Husbandry – G.C.Banerjee.
7. Animal Husbandry and dairy science - Jagdish Prasad

# PERIYAR UNIVERSITY, SALEM – 636011

B.Sc., ZOOLOGY

SEMESTER - VI

PRACTICAL – III

**ANIMAL PHYSIOLOGY, DEVELOPMENTAL BIOLOGY, IMMUNOLOGY & MICROBIOLOGY,  
BIOINFORMATICS, BIOSTATISTICS AND COMPUTER APPLICATIONS,  
POULTRY SCIENCE & MLT.**

## **Course Objectives:**

- To empower our students with practical skills to comprehend the Physiology and other functions of each and every vital systems.
- Identify experimental approaches in developmental biology.
- Recognise sources of error in experimental approaches in developmental biology.
- Analyse, compare, assess and evaluate experimental data in the field of developmental biology.
- To familiarize the student with principles of clinical microbiology, immunology, routine methods of identification of bacteria & study of common parasites of man
- To give the students a sound knowledge of pathogenic microbes, laboratory diagnosis, basic understanding of virology, mycology, & advanced serological techniques.
- Apply the knowledge to collect various Biological data and using statistical applications.
- Familiar with various Applications of Bioinformatics
- Understand practical knowledge on poultry science.
- Computer applications on biological data.

## **I – Animal Physiology**

- Study of activity of salivary amylase under optimum conditions
- Estimation of Oxygen consumption in a fish with reference to body weight.
- Detection of nitrogenous waste products in fish tank water, frog tank water, bird excreta and mammalian urine.
- Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
- Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
- Use of Kymograph unit, B.P. Apparatus, Respirometer.

## **II – Developmental Biology**

- Sections of testis and ovary showing the maturation stages of gametes.
- Slides of mammalian Sperm and Ovum.
- Slides of cleavage stages, blastula, gastrula and neurula of frog.
- Slides of different stages of chick embryo: 18 Hours, 24 Hours, 48 Hours, 72 hours and 96 Hours.
- Placenta of Sheep, Pig and Man.

**III - Immunology & Microbiology**

- Observation of slides of Primary and Secondary Lymphoid organs  
a. Thymus    b. Bone marrow    c. Spleen    d. Lymph node
- Separation of serum from the blood sample.
- Agglutination test to show antigen-antibody reaction.
- Study of Yeast cells in Curd, mycelium in Bread mould.
- Hanging drop experiment for observation of live Bacteria from any Sample

**IV - Bioinformatics, Biostatistics and Computer Applications**

- Browsing of different sites related to bioinformatics.
- Entry page of SWISS PROT and BLAST.
- Frequency distribution
- Representation of data – Histogram, Frequency polygon.
- Measures of central tendencies, Measures of dispersion.
- MS – Word., MS – Excel., MS – Power point.

**V - Poultry Science**

- Study of various breeds of layers and broilers (photographs)
- Estimation of albumen and yolk quantity in eggs
- Estimation of calcium in egg shell.
- Feeders and Waterers – Different types.
- **Extension Activity:** Visit to poultry farm. Submission of visit report

**VI - MLT**

- Perform total platelet count.
- Perform bleeding time.
- Perform clotting time.
- Urine-collection, processing, physical, chemical and microscopic examination.
- Analysis and examination of semen-physical examination, sperm motility, morphological study of sperms.
- **Extension Activity:** Visit to a Medical Lab. Submission of visit report

**Course Outcomes:**

- Students are able to do experiment on the role and functions of different systems.
- Able to describe the physiology of respiratory, renal, endocrine and reproductive systems to define normal and abnormal functions.
- Students are able to understand how physiological parameters are measured in mammals.

- Be able to list the types of characteristics that make an organism ideal for the study of developmental biology.
- Be familiar with the events that led up to fertilization.
- Be able to observe the first four rounds of cell division in different groups.
- Be able to identify the stages and cellular mechanisms for gastrulation.
- Demonstrate various types of Eggs
- Learn about various types of Placenta
- Develop skill in observing sperm motility
- Apply the computer knowledge to collect various Biological data
- Familiar with various Applications of Bioinformatics
- Get awareness about nature of the emerging digital knowledge society
- Students will gain skill to execute the roles of a biology teacher or medical lab technicians with training as they have basic fundamentals
- To impart awareness on Clinical Lab Technology
- To create knowledge on Self-Employment Opportunity by area of poultry science and MLT.

**References:**

- Agarwal, R.A., A.K. Srivastava and Kaushal Kumar. Animal Physiology and Biochemistry (3rd Edition). S. Chand & Company Limited, 7361 Ram Nagar, New Delhi-110 055.
- Arora, M.P Animal Physiology (6th Edition). Himalaya Publishing House, Ramdoot, Dr. Bhalerao Marg, Girgaon, Mumbai 400 004.
- Arora, M.P. Embryology. Himalaya Publishing House, Ramdoot, Dr. Bhalerao Marg, Girgaon, Mumbai- 400 004.
- Roitt, I. : Essential Immunology(ELBS).
- Kuby : Immunology(W.H.Freeman)
- Pelczar, Reid & Chan:Microbiology.
- Philip, L. Carpenter:Microbiology.
- Powar : GeneralMicrobiology.
- Burrows : Text Book of Microbiology.
- Lakshmanan, M : Laboratory manual in Microbiology.
- Moat & Foster : Microbial Physiology.
- Bal, H.P. Bioinformatics principles and Applications, Tata Mc Graw Hill Publishing company Limited, No. 444/1 Sri Ekambara Naicker Industrial Estate, Alkapakkam, Porur, Chennai – 600116

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- Ranga, M.M. Bioinformatics, Agrobios (India) Behind Nasrani cinema, Chopasani Road, Hodhpur – 342002.
- C.S.V. Murthy Bioinformatics- Himalaya Publishing House.
- Arora and Mathan. Bio Statistics (5th Edition). Himalaya Publishing House, Ramdoot, Dr. Bhalerao Marg, Girgaon, Mumbai – 400004.
- Daha, T.K. Biostatistics in Theory and Practice. EMKAY Publications, Post Box No.9410, B-19, East Akrishna Nagar, Swami Dayanand Marg, Delhi-110051.
- Gurumani. N, An Introduction to Biostatistics (computer Application included) 2nd Edition M.J.P. Publishers, Tamilnadu Book House, 47 Nallathambi street, Triplicane- 600 005.
- Satgurau Prasad, Elements of Biostatistics, Rastogi Publications Gangotri, Shivaji Road, Meerut 250002.
- Poultry keeping – M.R. Gnanamani
- Disease of Poultry – Biester Oxford & IBH
- Poultry, Meat and Egg Products – Parkhurst and Mountney. CBS Publishers
- Livestock and Poultry Production: Singh, Herbans and Earl Moore; Prentice Hall India.
- Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.
- Samuel, K.M. 1992: Notes on Clinical Lab Techniques. M.K.G. Iyyer & Sons Publ. Co., Chennai – India
- Dubey, R.C., and Maheswari, D.K. 2007: A text Book of Microbiology. S.Chand & Co. Publ. New Delhi – India
- Purohit, S.S. 2005 : Microbiology – Fundamentals and Applications (6th Edition) Student Edition – Jodhpur – India
- Mukherjee, 2006 : Medical Laboratory Technology Vol. I, II & III – Tata McGraw Hill Publ. Co. Noida – India.
- Ochei, 2000 : Medical Laboratory Science – Theory and Practice – Tata McGraw Hill Publ. Co., - Noida – India.
- Textbook of Microbiology – R. Anantharayan and CKJ. Paniker
- A hand book of Medical laboratory technology – V.H. Talib
- Medical Laboratory technology – (vol-I & vol-II) – Kanai.L. Mukherjee
- Medical Zoology-Sobti 5. Medical Laboratory Technology-Ramnik Sood
- Parasitology – Chatterjee
- Parasitology – Chakraborty

# PERIYAR UNIVERSITY, SALEM – 636011

B.Sc., ZOOLOGY

SEMESTER - VI

PRACTICAL – IV

## ENVIRONMENTAL BIOLOGY, ETHOLOGY, EVOLUTIONARY BIOLOGY, SERICULTURE, APICULTURE AND DAIRY SCIENCE

### Course Outcomes:

- To inculcate the practical knowledge on moriculture and sericulture
- To know the importance of silkworm rearing, pests and diseases of silkworms and their control measures
- To analyze the quality of silk through experiments
- To identify the honey bee species, races and castes
- To understand the behavior and physiology of honey bees
- To know the importance of honey bees and hive products
- To develop knowledge about value added products in honey

### I – Environmental Biology

- Estimation of Dissolved Oxygen, Salinity, pH, freeCO<sub>2</sub>, Carbonates and Bicarbonates, Calcium in water samples.
- Use of Rain Gauge, Maximum & Minimum Thermometer, Hygrometer, Anemometer and Barometer.
- Plankton study–Freshwater and marine planktons.
- Adaptations of aquatic and terrestrial animals based on a study of museum specimens. Such as rocky, sandy, muddy shore animals, flying and burrowing animals.
- **Extension Activity:** Study of natural ecosystem and field report of the visit.

### II - Ethology

- Study nests and nesting habits of the birds and social insects.
- Study geotaxis behaviour in earthworm.
- Study the phototaxis behaviour in insect larvae.
- Study of circadian functions in humans (daily eating, sleep and temperature patterns).
- **Extension Activity:** Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a short report.

### III - Evolutionary Biology

- Study of fossil evidences from plaster cast models and pictures
- Study of homology and analogy from suitable specimens/ pictures

- Charts:
  - a) Phylogeny of horse with diagrams / cut outs of limbs and teeth of horse ancestors
  - b) Darwin's Finches with diagrams / cut outs of beaks of different species
- **Extension Activity:** Visit to Natural History Museum and submission of report

#### **IV - Sericulture**

- Mulberry varieties
- Rearing equipments.
- Pests and diseases of silkworms.
- Estimation of renditta, denier, Estimation of shell ratio.
- **Extension Activity:** Visit to sericulture farmhouse and submission of report

#### **V - Apiculture**

- Identification of different bee species and castes.
- Hive inspection.
- Identification and management of bee enemies and diseases
- Value added honey product preparation.
- **Extension Activity:** Visit to apiculture farmstead and submission of report

#### **IV - Dairy Science**

- Identification of breeds of cattle and buffalo.
- Estimation of milk quality by any 5 parameters.
- Identification of cattle diseases and causative agents.
- Detection of adulterants in milk.
- **Extension Activity:** Field trip & Report submission - a Dairy farm.

#### **Course Outcomes:**

- Ability to Estimate of dissolved oxygen, Salinity, pH, free CO<sub>2</sub>, Carbonates and Bicarbonates, Calcium in water samples.
- Familiar with ecological adaptations
- Measure pH of different water samples using pH meter, pH paper and indicator solution.
- Demonstrate Alarm pheromones in ants.
- Identify the contributions of various evolutionists.
- Identify different zoogeographical realms with fauna.
- Apply knowledge on moriculture and sericulture

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## B.Sc., ZOOLOGY

- Observe the biology, rearing, pests and diseases of silkworm and their control measures
- Evaluate the quality of silk
- Supply knowledge in identifying honey bee species, races and castes
- Field visit to study the apiary management techniques and honey harvesting methods
- Demonstrate the students for value added products in honey
- Students will get the self-employment with the help of Dairy Science
- They can generate employments by Dairy Science.

### References:

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- Goldman – Limnology, 2nd Edition
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- Ganga & Sulochanachetty.G. (2006) An introduction to sericulture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
- Ullal.S.R and M.N Narasimhanna (1977) Hand book of Practical Sericulture Published by Shri .A.R S. Gopalachar Secretary ,Central silk board ,Meghdoot, Bombay.
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**B.Sc., ZOOLOGY**

**B.Sc.**

**ALLIED ZOOLOGY**

# PERIYAR UNIVERSITY, SALEM – 636011

B.Sc., ZOOLOGY

B.Sc. ALLIED ZOOLOGY

ODD SEMESTER

## PAPER – I: NON-CHORDATA AND CHORDATA

### Objectives:

- To appreciate the diversity of the animal kingdom.
- To understand characteristics of the non-chordate phyla and the chordate classes.
- To study the organization and life cycle of certain economically significant organisms.

### UNIT – I

General characters of the Phylum Protozoa -General organization and life cycle of Plasmodium -  
General characters of the Phylum Porifera -General characters of the Phylum Coelenterata.

### UNIT – II

General characters of the Phylum Platyhelminthes., General organization and life history of Fasciola hepatica., General characters of the Phylum Nematelminthes -Nematode parasites of man., General characters of the Phylum Annelida.General organization and reproduction in Earthworm.

### UNIT – III

General characters of the phylum Arthropoda - General organization and reproduction in Periplanata americana - General characters of the Phylum Mollusca- General characters of the Phylum Echinodermata - General organization and reproduction in Asterias.

### UNIT – IV

General characters of the Phylum chordate and outline classification up to class level - General characters of the class: Pisces - General organization of all systems except endoskeletal system of Shark - General characters of the class: Amphibia.

### UNIT – V

General characters of the class: Reptilia - General characters of the class: Aves - General characters of the class: Mammalia - General organization of all systems of Rabbit except endoskeleton.

### Course Outcomes:

- Get awareness on animal diversity
- Understand the affinities among the animals.
- Apply on zoology knowledge on further higher learning of other subjects.

### REFERENCE BOOKS

- M. EkambaranathaAyyar& T. N. Ananthakrishnan. Outlines of Zoology.
- M. EkambaranathaAyyar& T. N. Ananthakrishnan. Manual of Zoology, Vol I & II.
- R. L. Kotpal. Modern textbook of Zoology: Invertebrates.
- R. L. Kotpal. Modern textbook of Zoology: Vertebrates.

# PERIYAR UNIVERSITY, SALEM – 636011

B.Sc., ZOOLOGY

EVEN SEMESTER

B.SC. ALLIED ZOOLOGY

PAPER – II:

## GENERAL PRINCIPLES OF ZOOLOGY

### Course Objective

**On the completion of the course the student will be able to**

- Understand the structure of the cell and its functions
- Study the development of animals
- Analyse the physiology and functions of different organs
- Know environmental problems
- Deploy the concepts of evolution

### Unit -I: Cell Biology:

Structure of Animal Cell, Structure and functions of Plasma Membrane, Golgi Body & Mitochondria

**Genetics:** Mendelian laws - Sex linked inheritance - Turner's, Klinefelter's and Down syndrome - ABO Blood group and Rh factor – Phenylketonuria and Sickle cell anemia.

### Unit –II: Developmental Biology:

Types of Eggs - Fertilization - Cleavage and Gastrulation in Frog –fetal membranes in chick - Placentation in mammals.

### Unit –III Physiology:

Osmotic and ionic regulation in fishes – Digestion and Excretion in Man - Respiration - Types of Respiratory organs – Respiratory pigment - Hb - Transport of respiratory gases – types of Muscles.

### Unit-IV Ecology

Environmental factors – Temperature and Light - Pond Ecosystem – Water Pollution – Air Pollution – Animal Associations

### Unit-V Evolution:

**Evidences** – Morphological, Anatomical, Biochemical and Paleontological - Lamarckism – Neo Lamarckism, Darwinism – Neo-Darwinism, cultural evolution of Man.

### Course Outcomes:

**After the completion of the course, students should be able to**

- Realise the various cell structure, organelles,
- Gain Knowledge regarding genetic disorders, developmental process, physiological functions, Environmental aspects and evolutionary process.
- Applied knowledge for higher learning and occupational needs.

**REFERENCE BOOKS**

1. Verma.P.S.&Agarwal V.K (2006) Cell Biology, Genetics, Molecular Biology, Evolution and Ecology– S.Chand& Company LTD. Ram Nagar, New Delhi -110055
2. Verma.P.S.&Agarwal V.K. Chordate Embryology. S.Chand& Company Ltd. Ram Nagar, New Delhi - 110055
3. Verma P.S. & Tyagi B.S. Animal Physiology. VI Edition, S. Shand & Company Ltd, Ram Nagar, New Delhi -110055

# PERIYAR UNIVERSITY, SALEM – 636011

## B.Sc., ZOOLOGY

### B.SC. ALLIED ZOOLOGY PRACTICALS

#### ODD & EVEN SEMESTER

#### NON – CHORDATA, CHORDATA AND GENERAL PRINCIPLES OF ZOOLOGY

##### Course Objectives:

- To get anatomical knowledge and adaptations in animal group.
- To identify model animals as specimen / slides.
- To provide skill of drawing and labelling.
- To appreciate economic zoology for its importance.

##### DISSECTIONS

1. Cockroach – Alimentary canal.
2. Fish – Alimentary canal.

##### MOUNTINGS

1. Cockroach – Mouth parts.
2. Honey bee - Mouth parts.
3. Types of scales in Fish.

##### SPOTTERS – IDENTIFICATION

###### Identify, draw and write notes:

1. Paramecium: Entire.
2. Ascon: Entire.
3. Obelia: Colony, Medusa.
4. Fasciola hepatica: Entire.
5. Ascaris: Entire.
6. Penaeus: Entire.
7. Pila: Entire.
8. Starfish: Entire – Oral and Aboral view.
9. Shark: Entire.
10. Frog: Entire.
11. Calotes: Entire.
12. Pigeon: Entire.
13. Rat: Entire.

##### EMBRYOLOGY

1. Structure of egg and sperm of frog.
2. Blastula of Frog.

3. Gastrula of Frog.

4. Placenta of Mammals – Rabbit.

**ADAPTATIONAL SIGNIFICANCE**

1. Natatorial – Turtle.

2. Volant – Draco and Bat.

**ANIMAL BEHAVIOUR**

1. Parental care – Arius, Alytes.

**ECONOMIC ZOOLOGY**

1. Honey bee – Different castes.

2. Silkworm – Adult, Caterpillar, Pupa and Cocoon.

3. Pisciculture – Edible fishes.

**Course Outcomes:**

- Getting fundamental knowledge on animal groups.
- Acquired skill of dissection, drawing and labelling.
- Awareness on economic value in animals.

**REFERENCE BOOKS**

- M. Ekambaranatha Ayyar & T. N. Ananthkrishnan. Outlines of Zoology.
- M. Ekambaranatha Ayyar & T. N. Ananthkrishnan. Manual of Zoology, Vol I & II.
- R. L. Kotpal. Modern textbook of Zoology: Invertebrates.
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- Verma. P.S. &. Agarwal V.K. Chordate Embryology. S. Chand & Company Ltd. Ram Nagar, New Delhi -110055
- Verma P.S. & Tyagi B.S. Animal Physiology. VI Edition, S. Shand & Company Ltd, Ram Nagar, New Delhi -110055

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