#### POOMPUHAR COLEGE (AUTONOMOUS) (HR&CE Admin. Dept. Tamil Nadu)

## MELAIYUR-609107

### P.G. & Research Department of Zoology

#### B.Sc., Zoology-Course structure under CBCS

(Applicable to the candidates admitted from the academic year 2023 - 2024 onwards)

Somostor	ester Part Course Title Cr		Credit	Hours/	Maximum Marks			
Semester	1 41 1	Course The		Week	Internal	External	Total	
	Ι	Language - I	3	6	25	75	100	
	II	General English – I	3	6	25	75	100	
Ι		Core - I:Invertebrata	5	5	25	75	100	
	III	Core - II: Practical – I: Invertebrata Practical	5	4	25	75	100	
		Elective - I Botany - I	2	3	25	75	100	
		Botany Practical - I	1	2	25	75	100	
	IV	Skill Enhancement Course -I (NME-I) (Economic Zoology)	2	2	25	75	100	
		Foundation Course: (Ornamental Fish Farming and Management)	2	2	25	75	100	
		Total	23	30			800	
	Ι	Language – II	3	6	25	75	100	
	II	General English – II	3	6	25	75	100	
П		Core - III: Chordata	5	5	25	75	100	
	ш	Core - IV: Practical – II: Chordata Practical	5	4	25	75	100	
		Elective - II Botany - II	2	3	25	75	100	
		Botany Practical – II	1	2	25	75	100	
		Skill Enhancement Course -II (NME-II) (Ornamental Fish Farming and Management)	2	2	25	75	100	
	IV	Skill Enhancement Course – III: (Internet and its Applications) (Subject to change) – NMS (Nan Mudhalvan scheme)	2	2	25	75	100	
		Total	23	30			800	

#### Non-Major Elective Courses (NME) to other Departments)

IV	Economic Zoology	2	2	25	75	100
	Ornamental Fish Farming & Management	2	2	25	75	100

\* PART-IV: NME / Basic Tamil / Advanced Tamil (Any one)

Students who have not studied Tamil upto 12th Standard and have taken any Language other than Tamil in Part-I, must choose Basic Tamil-I in First Semester & Basic Tamil-II in Second Semester.

Students who have studied Tamil upto 10th & 12th Standard and have taken any Language other than Tamil in Part-I, must choose Advanced Tamil-I in First Semester and Advanced Tamil-II in Second Semester.

#### Elective Courses offered to other Science Department in I and II Semesters

	Elective - I:					
	(General/Discipline Specific)					
	Allied Zoology - I	2	3	25	75	100
	Allied Zoology Practical - I	1	2	25	75	100
III	Elective - II:					
	(General/Discipline Specific)					
	Allied Zoology - II	2	3	25	75	100
	Allied Zoology Practical - II	1	2	25	75	100

## POOMPUHAR COLLEGE (AUTONOMOUS) OF THE TAMIL NADU HR & CE DEPARTMENT MELAIYUR 609107

COURSE STRUCTURE FOR FIRST YEAR UG DEGREE COURSE

(Applicable to the candidates admitted from the academic year 2023 - 2024 onwards)

PART	NAME OF PAPERS	NUMBER OF PAPERS	CREDITS
I	TAMIL	02	06
II	ENGLISH	02	06
III	CORE (Including Practical)	04	20
	ALLIED	04	06
IV	NON MAJOR ELECTIVE	02	04
	SKILL ENHANCEMENT	01	02
	FOUNDATION COURSE	01	02
	TOTAL	16	46

Head of the Department

Principal

Semester	CORE – I	H/W	С
Ι	Course Title: Invertebrata	5	5

#### **Course Objective :**

1	To understand the basic concepts of invertebrates and observe the structure and functions
2	To illustrate and examine the systemic and functional morphology of various group of invertebrates
3	To differentiate and classify the various groups of animals, modes of life and to estimate the biodiversity
4	To compare and distinguish the general and specific characteristics of reproduction in invertebrates
5	To infer and integrate the parasitic and economic importance of invertebrates

#### Unit – 1: Protozoa and Porifera

**Protozoa:** Introduction to Classification, taxonomy and nomenclature. General characters and classification of Phylum Protozoa up to classes. Type study - *Paramecium* and *Plasmodium* - Parasitic protozoans (*Entamoeba* & *Trypanasoma*) - Economic importance - Nutrition and Locomotion in protozoa.

**Porifera:** General characters and classification up to Classes. Type study - Ascon - Canal system in sponges - Skeleton in sponges, Reproduction in sponges Economic importance of sponges.

#### **Unit – 2: Coelenterata and Platyhelminthes**

**Coelenterata :** General characters and classification up to classes – Type study – *Obelia colony* – Corals, coral reefs and its economic importance - Polymorphism in Hydrozoa.

Platyhelminthes: General characters and classification up to classes. Type study - Fasciola hepatica.

**Nematyhelminthes**: *Taenia solium*– Parasitic adaptations. Host-parasitic interactions of Helminthes parasites.Nematode Parasites and diseases – *Wuchereria bancrofti*.

Aschelminthes : General characters and classification of up to classes - Type study - Ascaris lumbricoides.

#### Unit-3: Annelida and Arthropoda

**Annelida:** General characters and classification up to Classes. Type study – *Nereis*. Nephridium and coelomoducts - Modes of life in Annelids. Reproduction in polychaetes.

Arthropoda: General characters and classification of Phylum Arthropoda up to Classes. Detailed study: *Penaeus indicus*. Affinities of *Peripatus* – Larval forms in Crustacea.

#### Unit – 4: Mollusca

**Mollusca:** General characters and classification of Phylum Mollusca up to Classes. Detailed study: *Pila globosa*. Torsion in Mollusca, Economic importance of Molluscs – Cephalopoda as the most advanced invertebrate.

#### Unit – 5: Echinodermata

**Echinodermata:** General characters and classification of Phylum Echinodermata up to Classes. Detailed study: *Asterias.* Water vascular system in Echinodermata – Larval forms of Echinoderms.

#### **Expected Course Outcomes (CO)**

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

1	Understand the basic concepts of invertebrate animals and recall its structure and functions.
2	Illustrate and examine the systemic and functional morphology of various groups of invertebrata.
3	Differentiate and classify the animal's mode of life in various taxa and estimate the biodiversity.
4	To compare and distinguish the various physiological processes and organ systems in lower animals.
5	Infer and integrate the parasitic and economic importance of invertebrate animals.

#### TEXT BOOKS

- 1. Arumugam, N., T. Murugan, B. Ramanathan and M.G Ragunathan. (2019). *A Text Book of Invertebrates,* Saras Publications, Nagercoil, Tamil Nadu.
- 2. EkambaranathaAyyar .M., (1973). A Manual of Zoology Part I, Invertebrata. S. Viswanathan Printers and Publishers Pvt., Ltd., Madras.
- 3. Jordon, E.L. and P.S Verma, (2014). Invertebrate Zoology. S. Chand and Co. Ltd., New Delhi.
- 4. Adam Sedgwick, (1960). A student's text book of Zoology, Vol. I & III, General Book Depot, Allahabad.
- 5. Hyman, L.H. (1951). The Invertebrates,. Vol. I, McGraw Hill Book Co., New York.
- 6. Kotpal.R.L., (2017). *Modern Text book of Zoology-Invertebrata, (Animal Diversity- I).* Rastogi Publications, New Delhi.

#### **REFERENCE BOOKS**

- 1. Arumugam, N. (2014). *Animal diversity Volume -1 Invertebrata*. SarasPublication, Nagercoil, Tamil Nadu.
- 2. FatikBaran. (2012). Invertebrate Zoology. Prentice Hall of India Pvt Ltd., New Delhi.
- **3**. Barrington E.J.W. (2012). *Invertebrate structure and function*. Affiliated East West Press Pvt. Ltd., New Delhi.
- 4. Richard C. Brusca, Wendy Moore and Stephen M. Shuster. (2016). *Invertebrates. Oxford University Press*, USA.
- 5. Clarkson E.N.K. (2011). Invertebrate Palaeontology and Evolution. Wiley India Pvt. Ltd., New Delhi.

#### 6. Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	
CO 1	S								
CO 2	Μ	S							
CO 3				S		S			
CO 4				S	S	Μ			
CO 5			S					S	

7. S-Strong M-Medium L-Low

Semester	CORE – II: Practical- I	H/W	С
Ι	Course Title: Invertebrata	4	5

#### **Course Objective :**

1	To identify the different groups of invertebrate animals by observing their external
	characteristics.
2	To understand the organs, organ system and their functions in lower animals.
3	To get knowledge about the different modes of life and their adaptation based on the
	environment.
4	Able to dissect and display the internal organs and mount the mouthparts and scales of
•	invertebrates.

Unit - 1: Major Dissection: Cockroach: Nervous system. Earthworm: Nervous system. Prawn: Nervous system (including appendages).

Unit – 2: Minor Dissection: Cockroach: Digestive system. *Pila globosa*: Digestive system.

Unit - 3: Mounting: Earthworm: Body setae; Pineal setae. Pila globosa: Radula.

Unit - 4: Mounting: Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts.

Unit - 5: Spotters (i) Protozoa: Amoeba, Paramecium, Paramecium Binary fission and Conjugation, *Entamoeba histolytica, Plasmodium vivax* (ii) Porifera: Sycon, Sycon - T.S & L.S, Spicules, Gemmule (iii) Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Gorgonia (iv) Platyhelminthes: Planaria, Fasciola hepatica, Fasciola larval forms –Cercaria, *Echinococcus granulosus, Taenia solium*, (v) Nemathelminthes: Ascaris (Male & Female), *Drancunculus, Ancylostoma, Wuchereria* (vi) Annelida: Nereis, Chaetopteurs, Hirudinaria, Trochophore larva (vii) Arthropoda: Crab, Palaemon, Scorpion, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. (viii) Mollusca: Chiton, Pila, Sepia, Octopus, Nautilus, Glochidium larva (ix) Echinodermata: Asterias, Echinus, Cucumaria, Bipinnaria larva.

#### **Expected Course Outcomes (CO)**

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

1	Identify and label the external features of different groups of invertebrate animals.
2	Illustrate and examine the circulatory system, nervous system and reproductive system of invertebrate animals.
3	Differentiate and compare the structure, function and mode of life of various groups of animals.
4	To compare and distinguish the dissected internal organs of lower animals.
5	Prepare and develop the mounting procedure of economically important invertebrates.

#### **Text Books**

#### (Latest Editions)

- 1. EkambaranathaIyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai.
- 2. Ganguly, Sinha and A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
- 3. Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
- 4. Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
- 5. Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 4 97pp.

#### **References Books**

#### (Latest editions, and the style as given below must be strictly adhered to)

- 1. 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.
- 2. Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
- 3. Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson .
- 4. Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students. Asia Publishing Home.
- 5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	М	S						
CO 3				S		S		
CO 4				S	S	М		
CO 5			S					S
S-Strong: M-Medium: L-Low								

### Mapping with Programme Outcomes:

S-Strong;

wi-weatum;

L-LOW

Semester	Foundation Course	H/W	С
Ι	Ornamental Fish Farming and Management	2	2

#### **Course Objective (LO):**

1	To highlight the importance of ornamental fish culture in relation to entrepreneurship development.
2	To enable the identification, culture and maintenance of commercially important ornamental fishes.
3	To provide the knowledge on the techniques of ornamental fish breeding, rearing, disease control and economics of ornamental fish farming.

**Unit I** Introduction to ornamental fish farming. Scope and importance of ornamental fish culture. Domestic and global scenario of ornamental fish trade and export potential. Commercially important ornamental fishes - Indigenous and exotic varieties.

**Unit II** Biology of egg layers and live bearers.Food and feeding in ornamental fishes. Formulated fish feed and Live feed; Live feed culture.Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg.Guppy).

**Unit III** Aquarium design and construction; Accessories - aerators, filters and lighting. Aquarium plants and their propagation.Maintenance of aquarium and water quality management.

**Unit IV** Disease management of Ornamental fishes (Symptoms, Treatment, Control and their Prevention Methods). Protozoan diseases, Bacterial diseases, Crustacean diseases, Fungal diseases and Helminthic diseases.

**Unit V** Conditioning, packing, transport methods. Economics, trade regulations, domestic and export marketing strategies.

#### **References:**

- 1. Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi.
- 2. Living Jewels A handbook on freshwater ornamental fish, MPEDA, Kochi.
- 3. Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.
- 4. Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquariculture. Daya Publishing House, New Delhi.

#### Web links:

1. http://ecoursesonline.iasri.res.in/course/view.php?id=297

- 2. https://www.ofish.org/
- 3. https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/
- 4. https://99businessideas.com/ornamental-fish-farming/

## **Expected Course Outcomes (COs)**

1	The students will be able to identify, culture, maintain and market the commercially important ornamental fishes.
2	The knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employment.

## **Outcome Maping**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S				М			S
CO 2	М	S					S	
CO 3				S		S		
CO 4	М			S	S	М		
CO 5			S				М	S

S-Strong

M-Medium

L-Low

Semester	CORE – III Course Titles Chandata	H/W	С
Π	Course Hue: Chordata	5	5

**Course Objective** 

1	To understand the structures and distinct features of Phylum Chordata.
2	To understand and able to distinguish the characteristic features of each subphylum and class.
3	To understand the economic importance of vertebrates
4	To know about the adaptations of vertebrates
5	To understand the evolutionary position of different groups of vertebrates

**Unit** – 1: General Characters and Classification of Phylum Chordata: Origin of Chordata, Differences between non-chordates and chordates, General characters, Affinities and Systematic position of Hemichordata (*Balanoglossus*), Urochordata (*Ascidia*), Cephalochordata (*Amphioxus*).

**Unit - 2: Prochordates and Agnatha**: Characteristics of subphylum vertebrata, Classification of Vertebrata upto Class level, Agnatha (*Petromyzon*), - Pisces (*Scoliodon sorrakowah*) General characters and classification, Origin of fishes, Affinities of Dipnoi - Types of scales and fins - Accessory respiratory organs - Air bladder - Parental care - Migration - Economic importance.

**Unit - 3: Amphibia** : General characters and classification - Origin of Amphibia - Type study - *Ranahexadactyla* - Adaptive features of Anura, Urodela and Apoda- Parental care in Amphibia.

**Unit - 4: Reptilia** : General characters and classification - Type study – (*Calotes versicolor*- Origin of reptiles and effects of terrestrialisation, Extinct reptiles. Snakes of India. Poison apparatus and biting mechanism of poisonous snakes.

**Unit - 5: Aves and Mammalia :** Aves: General characters and classification – Type study - *Columba livia* - Origin of birds, Flight adaptations, Migration. Mammalia: General characters and classification - Type study - Rabbit - Adaptive radiation in mammals - Egg laying mammals, Aquatic mammals, Dentition in mammals.

#### **Expected Course Outcomes (CO)**

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

1	Classify, Identify and recall the name and distinct features of different subphylum belonging to
	phylum Chordata.
2	Explain, and relate the origin, structural organization and evolutionary aspects of vertebrates.
3	Analyze, compare and distinguish the developmental stages and describe the important
_	biological process.
4	Correlate the different modes of life and parental care among different vertebrates.
5	Summarise the morphology and ecological adaptations in vertebrates and list out the economic
_	importance.

#### Text Books (Latest Editions)

- 1. Ayyar, E.K. and T.N. Ananthakrishnan, 1992. Manual of Zoology Vol. II (Chordata), S. Viswanathan (Printers and Publishers) Pvt Ltd., Madras, 891p.
- 2. Jordan, E.K. and P.S. Verma, 1995. Chordate Zoology and Elements of Animal Physiology, 10th edition, S. Chand & Co Ltd., Ram Nagar, New Delhi, 1151 pp.
- 3. Nigam, H.C., 1983. Zoology of Chordates, Vishal Publications, Jalandhar 144008, 942.
- 4. Ganguly, Sinha, BharatiGoswami and Adhikari, 2004. Biology of animals Vol.II New central book Agency (p) Ltd.
- 5. Kotpal. R.L. A, Modern text book of Zoology Vertebrates- Rastogi publications. 2009

2.

#### **References Books**

#### (Latest editions, and the style as given below must be strictly adhered to)

- 1. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
- 2. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
- 3. Hickman, C.P. Jr., F.M.Hickman and L.S. Roberts, 1984. Integrated Principles of Zoology, 7th Edition, Times Merror/Mosby College Publication. St. Louis. 1065 pp.
- 4. Newman, H.H., 1981. The Phylum Chordata, Satish Book Enterprise, Agra 282 003, 477 pp.
- 5. 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.
- 6. Pough H. Vertebrate life, VIII Edition, Pearson International.
- 7. Waterman, Allyn J. et al., 1971. Chordate Structure and Function, Mac Millan & Co., New York, 587 pp.
- 8. Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.

#### Web Resources

- 1. <u>http://tolweb.org/Chordata/2499</u>
- 2. <u>https://www.nhm.ac.uk/</u>
- 3. <u>https://bit.ly/3Av1Ejg</u>
- 4. <u>https://bit.ly/3kqTfYz</u>
- 5. <u>https://biologyeducare.com/aves/</u>
- 6. https://www.vedantu.com/biology/mammalia

	PO 1	PO 2	<b>PO 3</b>	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	М	S						
CO 3		S	S	S	S	S		S
CO 4			S	S	S	Μ		
CO 5			S		S			S

## Mapping with Programme Outcomes:

S – Strong; M – Medium; L - Low

Semester	CORE – IV: Practical- II	H/W	С
II	Course Title: Chordata	4	5

#### **Course Objective**

1	To understand the structures and distinct features of phylum chordata.
2	To understand and able to distinguish the characteristic features of each subphylum and class.
3	To understand and compare the structure of various internal organs in different classes of vertebrates.
4	To know about the classification, adaptations and affinities of chordate animals.

Unit-1: Dissections: Frog- Arterial and Venous system (Demo) Fish - Digestive system and Reproductive system.

Unit – 2: Mounting: Fish – Placoid and Ctenoid scales, Frog - Hyoid apparatus and Brain (Demo).

**Unit–3: Osteology**: Frog – Skull, Vertebral column, Pectoralgirdle, Pelvicgirdle, Forelimb, Hindlimb. Chelonia -Anapsid skull, Pigeon - skull, synsacrum.

Unit - 4: SpecimenandSlides:(i) Hemichordata: Balanoglossus, Tornaria larva (ii) Protochordata: Amphioxus, Amphioxus T.S. through pharynx, (iii) Urochordata; Asidian (iv) Cyclostomata:Petromyzon, Ammocoetus larva (v) Pisces: Channa, Pleuronectes, Hippocampus, Exocoetus, Echieneis, Labeo, Catla, Clarius, Auguilla, Scales: Placoid, Cycloid, Ctenoid(vi) Amphibia: Ichthyophis, Amblystoma, Hyla, Bufo, Rana, Axolotal larva (vii). Reptilia: Draco, Chemaeleon, *Vipera russelli*, Naja, Bungarus, Enhydrina, Typhlops, Testudo, Trionyx, Ptyas. (viii) Aves: Archaeopteryx, Passer, Bubo, Columba, Corvus, Collection and study of different types of feathers: Quill, Filoplume, Down (ix) Mammalia: Ornithorhynchus, Tachyglossus, Pteropus, Manis, Hedgehog.

**Unit - 5: Embryology**: Stages in the development of Frog (Cleavage- 2, 4, 8, 16, Blastula and Gastrula) and Chick- (24hrs, 48hrs and 72hrs). Placenta in shark and mammals.

#### **Expected Course Outcomes (CO)**

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

1	Identify and recall the name and distinct external and internal features of animals belonging to
-	phylum Chordata.
2	Explain the structural organization of various organs and systems in different classes of
2	vertebrates.
3	Analyse, compare and distinguish the morphological features and developmental stages of
5	chordates
4	Dissect and explain various organs and internal systems in different vertebrates and correlate its
-	function.
5	Summarise the morphology and ecological adaptations in vertebrates and list out the economic
	importance.
1	

#### Text Books

(Latest Editions)

- 1. Lal S S, 2009. Practical Zoology Vertebrate, Rajpal and Sons Publishing, 484pp.
- 2. VermaP.S,2000.AManualofPracticalZoology:Chordates,S.ChandLimited, 627pp.

#### **References Books**

#### (Latest editions, and the style as given below must be strictly adhered to)

- 1. Robert William Hegner, 2015. Practical Zoology, BiblioLife, 522pp.
- 2. Young, J,Z., 1972. The life of vertebrates. OxfordUni. London.

#### Web Resources

- 1. <u>https://www.youtube.com/watch?v=b04hc\_kOY10</u>
- 2. <u>https://bit.ly/3CzTEy8</u>
- 3. http://tolweb.org/Chordata/2499
- 4. <u>https://www.nhm.ac.uk/</u>
- 5. <u>https://bit.ly/3Av1Ejg</u>

## Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	М	S						
CO 3				S		S		
CO 4				S	S	М		
CO 5			S					S
	C Ctropper M Madiumer I Law							

S-Strong;

M-Medium; L-Low

## Elective Courses offered to other Science Department in I and II Semesters

Semester	Elective - I	H/W	С
I	Course Title : Allied Zoology – I	3	2

## **Course Objectives**

The main objectives of this course are:

1	Toacquireabasicknowledgeofdiversity and organization of Protozoa, Coelenterata, Helminthes and Annelida
2	Toacquireabasicknowledgeofdiversity and organization of Arthropoda, Mollusca and Echinodermata
3	To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia
4	To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia
5	To acquire detailed knowledge of selected invertebrate and chordate forms

### Unit - I: Diversity of Invertebrates-I

Principles of taxonomy.Criteria for classification–Symmetry and Coelom– Binomial nomenclature. Classification of Protozoa,Porifera,Coelenterata, Helminthesand Annelida upto classes with one example.

## Unit – II: Diversity of Invertebrates–II

Classification of Arthropoda, Mollusca and Echinodermata upto class level with one example.

## Unit – III: Diversity of Chordates–I

Classification of Prochordata, Pisces and Amphibia upto orders giving one example.

## Unit – IV: Diversity of Chordates–II

Classification of Reptilia, Aves and Mammalia upto orders giving one example.

## Unit –V: Animal organization

Structure and organization of (i) Earthworm, (ii) Rabbit/Rat, (iii) Prawn/Fish

## **Expected Course Outcomes**

On completion of this course, students will:

1	Recall the characteristic features invertebrates and chordates.
2	Classify invertebrates up to class level and chordates up to order level
3	Explain and discuss the structural and functional organisation of some invertebrates and chordates
4	Relate the adaptations and habits of animals to their habitat
5	Analyse the taxonomic position of animals.

### Text Books (Latest Editions)

1. Ekambaranathalyer, - Outlines of Zoology, Viswanathan Publication.

### **References Books**

## (Latest editions, and the style as given below must be strictly adhered to)

- 1. Ekambaranatha Iyar and T.N.Ananthakrishnian A Manual of Zoology Invertebrata–Vol. I: Viswanathan Publishers.
- 2. Ekambaranatha Iyar and T.N. Ananthakrishnan, A Manual of Zoology Invertebrata–Vol. II: Viswanathan Publishers.
- 3. Ekambaranatha Iyar and T.N.Ananthakrishnan, A Manual of Zoology: Chordata Viswanathan Publishers.
- 4. Jordan E.L. and P.S. Verma-Invertebrate Zoology, S. Chand & Co.

### Web Resources

- 1. www.sanctuaryasia.com
- 2. www.iaszoology.com

### **Outcome Maping**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
CO 1	S							
CO 2	М	S						
CO 3				S		S		
CO 4				S	S	М		
CO 5			S					S

S-Strong

**M-Medium** 

L-Low

Semester	Elective - I	H/W	С
I	Course Title : Allied Zoology Practical – I	2	1

**Course Objectives** 

	To identify the different groups of invertebrate animals by observing their
1	external characteristics.
2	To understand the organs, organ system and their functions in lower animals.
3	To get knowledge about the different modes of life and their adaptation based on
	the environment.
4	Able to dissect and display the internal organs and mount the mouthparts and
	scales of invertebrates.

## UNIT – I: Major Dissection :

Cockroach: Circulatory system, Nervous system, Reproductive system. Leech: Nervous System, Reproductive system. Earthworm: Nervous System, Reproductive system. *Pila globosa*: Nervous system. Prawn: Nervous system (including Appendages).

## **UNIT – II: Minor Dissection:**

Cockroach: Digestive system. Earthworm: Viscera, Lateral hearts.

Pila globosa: Digestive system (Including radula). Freshwater Mussel: Digestive system.

## **UNIT – III: Mounting:**

Earthworm: Body setae; Pineal setae. *Pila globosa*: Radula. Freshwater muscle: Pedal ganglia.

## **UNIT - IV: Mounting:**

Cockroach: Salivary apparatus, Mouth parts - Honey Bee, House fly and Mosquito mouth parts.

## **UNIT - V: Spotters:**

**Protozoa:** Amoeba, Paramecium, Paramecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, *Plasmodium vivax* (ii). **Porifera:** Sycon, Spongilla, Euspongia, Sycon - T.S & L.S, Spicules, Gemmule (iii). **Coelenterata:** Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula (iv). **Platyhelminthes:** Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium, Redia, Cercaria, *Echinococcus granulosus*, *Taenia solium, Schistosoma haematobium* (v). **Nemathelminthes:** Ascaris (Male & Female), Drancunculus, Ancylostoma, Wuchereria (vi). **Annelida:** Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva (vii). **Arthropoda:** Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. (viii). **Mollusca:** Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva (ix). Echinodermata: Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva

## **Expected Course Outcomes**

On completion of this course, students will;

1	Identify and label the external features of different groups of invertebrate
	Illustrate and examine the circulatory system, nervous system and
2	reproductive system of invertebrate animals.
3	Differentiate and compare the structure, function and mode of life of various groups of animals.
4	To compare and distinguish the dissected internal organs of lower animals.
5	Prepare and develop the mounting procedure of economically important invertebrates.

## **Text Books**

## (Latest Editions)

- 1. EkambaranathaIyyar and T. N. Ananthakrishnan, 1995 A manual of Zoology Vol.I (Part 1, 2) S. Viswanathan, Chennai.
- 2. Ganguly, Sinha an d A dhikari , 2 0 11 . Biology of Animals: Volume I, New Central Book Agency; 3rd revised edition. 1008 pp.
- Sinha, Chatterjee and Chattopadhyay, 2 0 1 4. Advanced Practical Zoology, Books & Allied Ltd; 3rd Revised edition, 1 07 0 pp.
- 4. Lal ,S. S, 2016 . Practical Zoology Invertebrate, Rastogi Publications.
- 5. Verma, P. S. 2010. A Manual of Practical Zoology: Invertebates, S Chand, 4 97pp.

## **References Books**

- 1. 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.
- 2. Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition. Holt Saunders International Edition.
- 3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
- **4.** Boradale, L.A. and Potts, E.A. (1961). *Invertebrates: A Manual for the use of Students*. Asia Publishing Home.
- 5. Lal, S.S. 2005. A text Book of Practical Zoology: Invertebrate, Rastogi, Meerut

## Web Resources

- 1. <u>https://nbb.gov.in/</u>
- 2. <u>http://www.agshoney.com/training.htm</u>
- 3. <u>https://icar.org.in/</u>
- 4. http://www.csrtimys.res.in/
- 5. <u>http://csb.gov.in/</u>
- 6. <u>https://iinrg.icar.gov.in/</u>

## 7. https://www.nationalgeographic.com/animals/invertebrates/

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
CO 1	S			S	S	S	М	
CO 2	М	S			М		L	
CO 3			М	S		S		
CO 4	S			S	S	М	S	
CO 5			S			S		S
	S	S-Strong(3)	)	M-Mediu	n (2)	L-Low (1	)	

## Mapping with Programme Outcomes:

Semester	Elective - II	H/W	С
II	Course Title: Allied Zoology– II	3	2

## **Course Objectives**

1	To enable students to learn basic concepts relating to aspects of respiratory, circulatory, excretory, nervous and sensory physiology.
2	To enable students to comprehend the processes involved during

	development
3	To enable students to learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination schedule
4	To enable students to comprehend the basic concepts of human genetics and patterns of inheritance
5	To enable students to learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning

- **Unit I**: Respiration- Respiratory pigments and transport of gases. Mechanism of bloodclotting.Types of excretory products Ornithine cycle.
- Unit II: Fertilization, Cleavage, Gastrulation and Organogenesis of Frog.
- **Unit III**: Immunity Innate and Acquired, Active and Passive; Antigens, Antibodies with types; Lymphoid organs; Vaccination schedule.
- **Unit IV**: Human Genetics: Human Chromosomes Sex Determination in Humans; Patterns of Inheritance: X-linked, Y-linked; Genetic Counseling
- **Unit V**: Animal Behaviour: Foraging, Courtship Behaviour, Shelter and Nest Construction, Parental Care, Learning Behaviour.

#### **Expected Course Outcomes**

On completion of this course, students will be able to:

1	Recall the parts and working of body organs and developmental stages, name the patterns of inheritance and list different types of animal behaviour
2	Analyse the different developmental stages
3	Analyse the working of body and immune systems
4	Analyse the different patterns of inheritance
5	Relate the behaviour of animals to physiology. Analyse the different types of
	Denavior

### **Text Books (Latest Editions)**

1. Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.

### **References Books**

### (Latest editions, and the style as given below must be strictly adhered to)

- 1. Owen, J. A., Punt, J. & Stranford, S. A. Kuby Immunology. New York: W.H. Freeman & Company.
- 2. Klug, W. S., Cummings, M. R. & Spencer, C Concepts of Genetics. (12th ed.). New Jersey: Pearson Education.
- 3. Mathur, R. Animal Behaviour. Meerut: Rastogi.
- 4. VermaP.S. & Agarwal Developmental Biology, Chordata embryology. S.Chand& Co.

## **Outcome Mapping**

	PO 1	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
CO 1	S		S		М		S	S
CO 2	М	S						
CO 3		S	М	S		S	М	
CO 4	S			S	S	М		
CO 5			S					S

S-Strong

**M-Medium** 

L-Low

Semester	Elective - II	H/W	С
II	Course Title: Allied Zoology Practical – II	2	1

## **Course Objectives:**

1	To learn basic concepts relating to various physiological aspects of animals.
2	To comprehend the processes involved during development
3	To learn basic concepts of immunity and familiarize on immune organs.
4	To know the basic concepts of human genetics and patterns of inheritance
5	To learn about aspects of animal behaviour.

## Practicals:

#### **UNIT I: MAJOR**

- 1. Qualitative detection of excretory products (Ammonia or Urea or Uric acid).
- 2. Identification of ABO blood groups.

### UNIT II: MINOR

- 1. Demonstration of lymphoid organs.
- 2. Study of behavioural adaptations of animals
- 3. Y-linked inheritance (Hairy Pinna in human)
- 4. X-linked inheritance (Colour blindness)
- 5. Vital staining of chick blastoderm

### **UNIT III: Spotters**

Immunological organs –Lymph node, Spleen, Thymus and Bone marrow

### **UNIT IV: Spotters**

Frog egg, Cleavage - 2-cell, 4-cell & 8-cell, Blastula, Gastrula

#### **UNIT V: Spotters**

Identification of Human syndrome- Turner's syndrome, Kleinfelter's Syndrome and Down's Syndrome. Nest types.

### Expected Course Outcomes

On completion of this course, students will be able to:

1	Recall the parts and working of body organs
2	Analyse the different developmental stages
3	Analyse the functioning of body and immune systems
4	Analyse the different patterns of inheritance
5	Understand the different types of behaviour

### Text Book(s)

- 1 Arumugam N. (2013). Developmental Zoology, Saras Publication, Nagercoil, Tamilnadu, India.
- 2 Das S. (2020). Microbiology Practical Manual, CBS Publication, Delhi.
- 3 Jayasurya, Arumugam N, Dulsy Fatima. (2013). Practical Zoology Vol 3, Saras Publication, Nagercoil, Tamilnadu, India.
- 4 Singh HR and Neerajkumar. (2014). Animal Physiology and Biochemistry, Vishal Publishing Co. Jalandhar, Delhi.

#### **Outcome Mapping**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	PO 4	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
CO 1	S	М		М	М	S		S
CO 2	М	S	М		S		М	
CO 3	S	М		S		S		М
<b>CO 4</b>	S	S		S	S	М		
CO 5	S	S	S				S	S
		S-Strong		M-Med	ium	L-Low		

S-Strong

M-Medium

### SKILL ENHANCEMENT COURSES (NME)

Semester	NME – I	H/W	С
Ι	COURSE TITLE: Economic Zoology	2	2

#### **Course Objective**

- 1. To understand the culturing techniques and production methods of different farm animals.
- 2. To know the life history of animals and disease control methods used in farming.
- 3. To understand the concept of breeding, cross breeding and the importance of high yield varieties.
- 4. To know about the marketing strategies.

Unit I: Economic Entomology: Apiculture: Species of honey bees - Social organization of honey bee - selection of bees and location for apiary - Newton's bee hive - products of bee keeping – enemies and diseases of honey bees.

**Unit II: Sericulture**: Species of silkworm – life cycle of mulberry silkworm – Rearing of silkworm – pests and diseases of silkworm.

**Unit III: Vermiculture & Aquaculture:** Introduction: Types of earthworms – Physical, chemical and biological changes caused by earthworms in the soil. Vermicompost: Production and applications. Aquaculture – Fresh water fish culture, types of ponds-Harvesting and marketing, byproducts of fishing and its commercial values.

**Unit IV: Poultry Farming:** Poultry industry in India –Commercial poultry farming – Nutritive value of egg and meat- Poultry management – Brooder, Marketing of eggs and meat. Poultry diseases.

**Unit V: Dairy Farming:** Dairy farming – advantages of dairying – classification of breeds of cattle – Indigenous and exotic breeds – Common contagious diseases. Role of milk and milk products in human nutrition.

## **Text Books**

- Sastry, N.S.R., C.K.Thomas and R.A.Singh, 2015. Livestock Production Management, 4<sup>th</sup>Ed.Kalyani Publishers, New Delhi. Mary violet Christy, A. 2014. Vermitechnology, MJP Publishers, Chennai.
- ICAR, 2013. Hand book of Animal Husbandry, 4<sup>th</sup> Ed., ICAR Publication, Pusa, New Delhi.
- 3. Awasthi, V.B., 2012. Introduction to General and Applied Entomology, third edition, Scientific publishers, India.
- 4. Vasanthraj David, B and Ramamurthy, VV., 2012. Elements of Economic Entomology, Seventh edition, Namrutha publications, Chennai.
- Shukla &Upadhyay, 2014. Economic Zoology, 5<sup>th</sup> edn. Rastogi Publication, Meerut New Delhi.
- 6. Gupta, S.M., 2010. Text book of fishery, Ann Backer, Mumbai.
- 7. ShailendraGhosh, 2009. Fisheries and aquaculture management, Adhyayan, New Delhi.
- 8. David, B and Ananthakrishnan, T. N., 2006. General and Applied Entomology, Second edition, Tata McGraw hill publishing company Ltd., New Delhi, India.
- Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3<sup>rd</sup> Ed. Kalyani Publishers, Ludhiana.
- 10. Sukumar, D.E., 2002. Outline of Dairy Technology, Oxford University, New Delhi.
- 11. Rath, R.K., 2000. Freshwater Aquaculture. Scientific Publishers (India), Jodhpur.

- 12. Ismail, S.A., 1997. Vermitechnology, The biology of earthworms, Orient Longman, India.
- 13. Prabakaran, R. 1998. Commercial Chicken production. Published by P. Saranya, Chennai.
- 14. Hafez, E. S. E., 1962. Reproduction in Farm Animals, Lea & Fabiger Publisher.

### **Suggested Readings**

- 1. Glenn Munroe, 2017. Manual of on-Farm vermicomposting and vermiculture, Holdanca Farms Ltd, Wallace, Nova Scotia.
- 2. Hanifa, M.A., 2011. Aquatic resources and aquaculture, Dominent, New Delhi.
- 3. Gupta, P.K., 2008. Vermicomposting for sustainable agriculture, 2<sup>nd</sup> Edition, Agrobios, India.
- 4. Talashikar, S.C., 2008. Earthworms in Agriculture, Agrobios, India.
- 5. Abishek Shukla, D., 2009. A Hand Book of Economic Entomology, Vedamse Books, New Delhi.
- 6. Banerjee, G.C., 2006. Text book of Animal Husbandry 8<sup>th</sup>Ed.Oxford and IBH Publishing Company Ltd., New Delhi.
- 7. Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.
- 8. Dunham, R.A., 2004. Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.
- 9. Donald.D Bell and William. D. Weaver, 2002. Commercial chicken meat and egg production, Springer, New York.
- 10. Eckles C.H. and Anthony, E.L., 2001. Dairy Cattle and milk production, Biotech. Tata McGraw Hill Publishing Co.Pvt.Ltd., New Delhi.
- 11. Edwards, C.A., and Bother, B., 1996. Biology of earthworms, Chapman Hall Publication company.
- 12. ICAR, 1997. Handbook of Animal Husbandary– The Indian Council of Agricultural Research, New Delhi.
- 13. Banerjee G.C., 1992. Poultry, Oxford and IBH, New Delhi.
- 14. Jhingran, AVG, 1991. Fish and Fisheries of India. Hindustan Publishing Co. New Delhi.
- 15. James. N. Marner, 1975. Principles of dairy processing, wiley eastern limited, New Delhi.
- 16. Baradach, JE. Ryther. JH. and, MC larney WO., 1972. Aquaculture. The farming and Husbandry of Freshwater and Marine Organisms. Wiley InterScience, NewYork.

## Web Resources

- 1. https://bit.ly/3tXHjk8
- 2. <u>https://bit.ly/3tUTHBu</u>
- 3. <u>https://bit.ly/3hVv96q</u>
- 4. <u>https://bit.ly/39nztH1</u>

- 5. https://bit.ly/3CzasVO
- 6. <u>https://agritech.tnau.ac.in/org\_farm/orgfarm\_vermicompost.html</u>
- 7. <u>https://bit.ly/3nYvgSF</u>
- 8. <u>http://caa.gov.in/farms.html</u>
- 9. <u>http://www.csrtimys.res.in/</u>
- 10. <u>http://www.agshoney.com/training.htm</u>

## **Course Outcomes (COs)**

- 1. To identify the breeds and varieties of poultry, fish, bees, and cattle and understand the basic aspects of farming.
- 2. To assess and integrate the available tools and techniques to increase the productivity in farms.
- 3. To analyse the pros and cons of different methods of farming and marketing strategies of products.
- 4. To evaluate the use of available resources in improving the breeds, vermicomposting, farm products etc.
- **5.** To design new methods to improve farm animals with increased productivity and disease resistance and to construct new methods in vermicomposting.

Semester	NME - II	H/W	С
II	Ornamental Fish Farming & Management	2	2

## **Course Objective (LO):**

1	To highlight the importance of ornamental fish culture in relation to
2	To enable the identification, culture and maintenance of commercially important ornamental fishes.
3	To provide the knowledge on the techniques of ornamental fish breeding, rearing, disease control and economics of ornamental fish farming.

## Unit I:

Introduction to ornamental fish farming.

Scope and importance of ornamental fish culture.

Domestic and global scenario of ornamental fish trade and export potential.

Commercially important ornamental fishes - Indigenous and exotic varieties.

## Unit II:

Biology of egg layers and live bearers.

Food and feeding in ornamental fishes. Formulated fish feed and Live feed; Live feed culture. Breeding, hatchery and nursery management of egg layers (eg. Goldfish) and live bearers (eg.Guppy).

## Unit III:

Aquarium design and construction; Accessories - aerators, filters and lighting. Aquarium plants and their propagation. Maintenance of aquarium and water quality management.

## Unit IV:

Disease management of Ornamental fishes (symptoms, Treatment, control and their preventive methods). Protozoan diseases, Bacterial diseases, crustacean diseases, Fungal diseases, and Helminth diseases

## Unit IV:

Conditioning, packing, transport methods.

Economics, trade regulations, domestic and export marketing strategies.

## **References**:

- 1. Swain SK., Sarangi N. and Ayyappan S. 2010. Ornamental fish farming. ICAR, New Delhi.
- 2. Living Jewels A handbook on freshwater ornamental fish, MPEDA, Kochi.
- 3. Dey V.K.A. 1997. A handbook on aquafarming ornamental fishes. MPEDA, Kochi.
- 4. Ahilan, B., Felix N. and Santhanam R. 2008. Text book of aquariculture. Daya Publishing House, New Delhi. Web links:
- 1. http://ecoursesonline.iasri.res.in/course/view.php?id=297
- 2. https://www.ofish.org/
- 3. https://krishijagran.com/agripedia/income-generation-by-ornamental-fish-culture/
- 4. https://99businessideas.com/ornamental-fish-farming/

## **Expected Course Outcomes (COs)**

1	The students will be able to identify, culture, maintain and market the commercially important ornamental fishes.
2	The knowledge and skills gained on the different aspects of ornamental fish keeping will enable the students to develop entrepreneurship potential and help in self employment.

### **Outcome Mapping**

	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>
CO 1	S				М			S
CO 2	М	S					S	
CO 3				S		S		
CO 4	М			S	S	М		
CO 5			S				М	S

S-Strong M-Medium L-Low

# Question paper pattern (for part I, II, III)

## PART – A

Ten questions		10x2 = 20 marks
(Two questions from each unit – No choice	)	
PART – B		
Five questions (either or type)		5x5 = 25 marks
(One question from each unit)		
PART – C		
Three questions out of five		3x10 = 30 marks
(One question from each unit)		
	Total	75 marks
Question paper pattern (for pa	rt IV only)	
PART – A		
Three questions (either or type)		3x10 = 30 marks
(One question from each unit)		
PART – B		
Three questions out of five		3x15 = 45 marks
(Atleast One question from each unit,		
Not more than two questions from each uni	t,	
No unit shall be omitted)		
	Total	75marks

Head of the Department

Principal