BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620 024.

ALLIED ZOOLOGY

(FOR B.Sc. BOTANY and CHEMISTRY)

SEMESTER - I
ALLIED COURSE 1: BIOLOGY OF INVERTEBRATA AND CHORDATA

Course Code		Course Type	Core	L	T	P	C	Academic Year	2026-2027
				4	-	-	4		
Pre-requisite	Basic knowledge in Animal Kingdom								

Course Objectives:

- To provide the principle and rules for taxonomic position of any species.
- To impart knowledge on body organization, its evolutionary relationship relating examples.
- To give a preliminary idea of basic characteristics of invertebrates and chordates.
- To enlighten the students on extant and extinct form of invertebrates and chordates.
- To make them realize the importance of diversity of a species in an ecosystem.

Detailed Course Content:

Unit I **PHYLUM - PROTOZOA, PORIFERA AND COELENTERATA** **8 Lectures**	General characters and classification of Phylum Protozoa, Porifera and Coelenterata (upto class) with suitable examples. Type study: Amoeba, Ascon sponge, Sea anemone. General Topic: Corals and coral reefs.
Unit II **PHYLUM - PLATYHELMINTHES, NEMATHELMINTHES, ANNELIDA AND ARTHROPODA** **8 Lectures**	General characters and classification of Phylum Platyhelminthes, Nemathelminths, Annelida and Arthropoda. Types study: Tapeworm, Ascaris - Earthworm and Cockroach. General topic: Parasitic adaptation of Ascaris. Mouth parts of insects.
Unit III **PHYLUM - MOLLUSCA AND ECHINODERMATA** **7 Lectures**	General characters and classification of Phylum Mollusca and Echinodermata. Type of study: Pila and Star fish. General topic: Torsion in Gastropods. Water vascular system of Echinodermata.
Unit IV **CLASS – PISCES, AMPHIBIA AND**	General characters and classification of Class Pisces, Amphibia and Reptilia. Type study: Shark, Frog and Calotes. General topic: Migration in fishes. Parental

REPTILIA **8 Lectures**	care in amphibia. Poisonous and non-poisonous snakes in India.
Unit V **CLASS - AVES AND MAMMALIA** **8 Lectures**	General characters and classification of Class Aves and Mammalia. Types study: Pigeon, Rabbit. General topic: Flightless birds (Ratitae). Dentition in Mammals.

Defining the Course Outcomes (NOT Unit-wise)

At the end of the course, the students will have the ability to		
CO1	Learn the classification and evolution of invertebrates and chordates.	Disciplinary Knowledge/ Analytical Reasoning/ Research-related Skills/ Scientific Reasoning/ Self-directed learning
CO2	Gain knowledge on the general structure of invertebrates and vertebrates.	Disciplinary Knowledge/ Analytical Reasoning/ Research-related Skills/ Scientific Reasoning/ Self-directed learning
CO3	Develop and relate the functional physiology of species.	Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
CO4	Know the economic, ecological importance of invertebrates and chordates.	Disciplinary Knowledge/ Communication Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
CO5	Analyse by observing various organisms using microscopes.	Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
K1 - Knowledge; K2 - Understanding; K3 - Practice; K4 – Analysis; K5 - Synthesis; K6 – Creation; K7- Evaluation		

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	M	S	S	M	M	S	M	S	L	S
CO2	S	M	M	S	S	S	S	M	M	M
CO3	M	S	M	M	S	S	M	S	L	S
CO4	M	S	S	L	M	M	M	S	S	S
CO5	S	M	M	L	M	S	M	S	M	S
S-Strong; M-Medium; L-Low										

Recommended References:

1. Jordon, E. L. and Verma, P. S. (1995). Invertebrate Zoology. S. Chand and Co, Zoology Delhi.
2. EkambaranathaAyyar and Ananthakrishnan, T. N. (2009). Manual of Zoology Vol – II. S. ViswanathanPvt. Ltd. Chennai.
3. Kotpal, R. L., Agarwal, S. K. and Khetarpal, R. P. R. (1990). Modern text Book of Zoology;Invertebrates. Rastogi Publication.
4. Nair, NC.,Leelavathy, S., SoundaraPandian, N., Murugan, T., and Arumugam, N. (2017). Text book of Invertebrates. Saras Publication, Nagercoil.
5. Majupuria, T.C. (1978). Invertebrate Zoology. S.Nagin Company.
6. Prasad, S.N. (1961). A Text Book of Invertebrate Zoology, III edition, EitabMahalPvt. Ltd, Allahabad.

7. Kotpal, R.L. (2019-20). A Modern Text Book of Zoology; Invertebrates, Rastogi publications XI Edition.
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9. Hyman, L.H. (1940). The Invertebrates, Vol. I to VII (M.C.Graw Hill Book Co.)
10. Mary Gardiner, S. (1972). Biology of Invertebrates, McGraw-Hill.
11. De Beer, G. (2018). Vertebrate Zoology - An Introduction to the Comparative Anatomy, Embryology and Evolution of Chordate Animals: Creative Media Partners, LLC.
12. Kingsley, J. S. (2015). Text Book of Vertebrate Zoology. United States: FB&C Limited.

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SEMESTER – I & II

ALLIED COURSE PRACTICAL 1: BIOLOGY OF INVERTEBRATA AND CHORDATAAND OCCUPATIONAL ZOOLOGY

Course Code		Course Type	Core	L	T	P	C	Academic Year	2026-2027
				4	-	-	4		
Pre-requisite	Basic knowledge in biology								

Course Objectives:

- To make them familiarize with basic laboratory techniques in related to Zoology.
- To make them understand the taxonomic position, body organization and evolutionary relationship of species.
- To inculcate the significance of various invertebrates and chordates in their ecosystem.
- To highlight the information on economic aspects of Zoology.
- To comprehend the theoretical and practical applications of species diversity.

Detailed Course Content:

DISSECTION / DEMO / CD / VIRTUAL

1. Earthworm - Digestive and Nervous system.
2. Cockroach- Digestive and Nervous system.
3. Fish - Digestive and Nervous system.

MOUNTING

1. Mouth parts – honeybee, cockroach and mosquito.
2. Earthworm – body setae and penial setae.
3. Fish – cycloid scale and placoid scale.
4. Pila – Radula

SPOTTERS

Invertebrata: Amoeba, Paramecium, Trypanosoma, Euglena, Plasmodium, Leucosolenia, Sycon sponge, Aurelia, Obelia, planaria, Liver fluke, Tapeworm, Cockroach, Planaria, Earthworm, Nereis, Leech, Prawn/Shrimp, Scorpion, Grasshopper, Fresh water mussel, Pila, Starfish.

Protochordata and Vertebrata: Amphioxus, Shark, Catla, Frog, Salamander, Calotes, Chamaeleon, Turtle, Cobra, Viper, Pigeon, Rat, Bat, Rabbit.

Commercial important species:

1. Apiculture (Apiary devices): Newton's beehive, honey extracting devices, honey, wax.
2. Sericulture: *Bombyxmori*, cocoons, silk thread, rearing appliances.

3. Aquaculture: Catla, Rohu, Mrigal, fresh water prawn (*Macrobrachiumrosenbergii*), marine shrimp – (*Penaeusmonodon/ Litopenaeusvannamei*).
4. Poultry: Eggs of different types of poultry birds, broiler chicks, layer chicks.
5. Vermiculture - Vermicompost and earthworm species – types.

Defining the Course Outcomes (NOT Unit-wise)

At the end of the course, the students will have the ability to		
CO1	Practically identify species (fresh and preserved) along with its larval forms.	Disciplinary Knowledge/ Analytical Reasoning/ Research-related Skills/ Scientific Reasoning/ Self-directed learning
CO2	Analyze the relationship among animals to their habitat.	Disciplinary Knowledge/ Analytical Reasoning/ Research-related Skills/ Scientific Reasoning/ Self-directed learning
CO3	Recognize the diversity of invertebrate species from Protozoa to Echinodermata.	Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
CO4	Recognize the significance and economic value of sericulture and apiculture.	Disciplinary Knowledge/ Communication Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
CO5	Gain knowledge on significance of aquaculture and their economic role.	Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
K1 - Knowledge; K2 - Understanding; K3 - Practice; K4 – Analysis; K5 - Synthesis; K6 – Creation; K7- Evaluation		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	M	S	M	S	L	S
CO2	S	M	M	S	S	S	S	M	M	M
CO3	M	S	M	M	S	S	M	S	L	S
CO4	M	S	S	L	M	M	M	S	S	S
CO5	S	M	M	L	M	S	M	S	M	S
S-Strong; M-Medium; L-Low										

Recommended References:

1. Verma, P. S. (2013). A Manual of Practical Zoology of Invertebrates. S. Chand of company Ltd, New Delhi.
2. EkambaranathaAyyar and Ananthakrishnan, T. N. (2009). Manual of Zoology Vol – II. S. ViswanathanPvt. Ltd. Chennai.
3. Poddar, T., Mukhopadhyay and Das, S. K. (2003). An Advanced Laboratory Manual of Zoology. Rajiv Beri for MacMillan Indian limited, Delhi.
4. Wallis, C. J. (2013). Practical Biology: For Advanced Level, Medical and Intermediate Students. Netherlands: Elsevier Science.

5. Lal, S. S. (2015). Practical Zoology. India: Rastogi Publications.
6. King, T., Reiss, M. and Roberts, M. (2001). Practical Advanced Biology. United Kingdom: Nelson Thornes Ltd.
7. Barnes, R. D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
8. Ganga, G. and Sulochanachetty, J. (2019). Introduction to Sericulture. Oxford &Ibh Publishing Co Pvt Ltd.
9. De Iuliis, G. and Pulera, D. (2006). The Dissection of Vertebrates: A Laboratory Manual. Netherlands: Elsevier Science.
10. 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.
11. David Cramp. (2008). A practical manual of Beekeeping. Spring Hill publications.
12. Judith Betsy, C. and Felix, S. (2019), Principles of Aquaculture: Practical Manual. Narendra publishing house.
13. Abrol, D. P. (2013). Beekeeping: A Compressive Guide to Bees and Beekeeping. India: Scientific Publishers (India).
14. Ghosh, N. (2020). Livestock Production Management. India: Prentice Hall India Pvt., Limited.
15. Edwards, C.A., Arancon, N.Q. Sherman, R.L. (2010). Vermiculture Technology: Earthworms, Organic Wastes, and Environmental Management. I edition. CRC Press

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SEMESTER - II
ALLIED COURSE 2: OCCUPATIONAL ZOOLOGY

Course Code		Course Type	Core	L	T	P	C	Academic Year	2026-2027
				4	-	-	4		
Pre-requisite	Basic knowledge in biology								

Course Objectives:

- To encourage young learners to take up small-scale industries.
- To generate motivation for self- employment.
- To impart information on economic aspects of Zoology.
- To inculcate knowledge on economically important species.
- To satisfy the learners with modern techniques/advancements in aquaculture, apiculture, sericulture, poultry and vermiculture.

Detailed Course Content:

Unit I APICULTURE 8 Lectures	Apiculture - introduction - scope - species of honeybee – colony organization and life cycle – bee keeping equipments - Newton's bee hive - honey extraction – production and economic value - marketing of quality honey - medicinal value of honey.
Unit II SERICULTURE 7 Lectures	Sericulture - introduction - scope - rearing of silkworm – voltinism and moultinism – study of different types of silk and silkworms in India - life cycle of silkworm. Moriculture - mulberry cultivation – recent techniques in rearing - harvesting and storage.
Unit III FISH CULTURE 7 Lectures	Fish culture - introduction - scope - commercial culture of Indian major carps. Techniques of induced breeding in fish - Farm design - construction, culture - Water quality and disease management. Culture technique of fresh water prawn (*Macrobrachiumrosenbergii*) - culture technique of marine shrimp (*Penaeusmonodon/ Litopenaeusvannamei*).
Unit IV POULTRY 8 Lectures	Poultry culture - introduction - scope - types of poultry - management - brooding and rearing – poultry nutrition. Disease management and their prevention methods - economic importance of poultry production.
Unit V VERMICULTURE 10 Lectures	Vermiculture - introduction - scope - classification of earthworm – methods of collection of earthworms – mechanism of vermicomposting – nutritive value of vermicomposting. Economic importance of vermicomposting.
CURRENT CONTOUR (For continuous internal assessment only)	Modern bee keeping management – robotic bee - hive tracks - buzz box. Recent articles on introduction and conservation of new species into economics - agro-based technological opportunities for rearing - disease free production / culture of economic species - present scenario of silk production in India - Blue revolution and its economic importance.

Defining the Course Outcomes (NOT Unit-wise)

At the end of the course, the students will have the ability to		
CO1	Understand the significance and economic value of sericulture and apiculture.	Disciplinary Knowledge/ Analytical Reasoning/ Research-related Skills/ Scientific Reasoning/ Self-directed learning
CO2	Gain knowledge on agro-based rearing like aquaculture and their economic importance.	Disciplinary Knowledge/ Analytical Reasoning/ Research-related Skills/ Scientific Reasoning/ Self-directed learning
CO3	Introduce new strategies on the poultry farm management and its principles.	Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
CO4	Perform vermiculture and make up value added products in a small scale.	Disciplinary Knowledge/ Communication Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
CO5	Conclude the importance of regionally available rearing techniques and can learn advanced training for better sericulture.	Disciplinary Knowledge/ Communication Skills/ Critical Thinking/ Analytical Reasoning/ Research-related Skills
K1 - Knowledge; K2 - Understanding; K3 - Practice; K4 – Analysis; K5 - Synthesis; K6 – Creation; K7- Evaluation		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	M	S	M	S	L	S
CO2	S	M	M	S	S	S	S	M	M	M
CO3	M	S	M	M	S	S	M	S	L	S
CO4	M	S	S	L	M	M	M	S	S	S
CO5	S	M	M	L	M	S	M	S	M	S
S-Strong; M-Medium; L-Low										

Recommended References:

1. Shanmugam, K. (1990). Fishery Biology and Aquaculture. Leo Publications.
2. KameshwarPandey, and Sukla, J.P. (2019). Fish and Fisheries, IV Edition revised. Rastogi Publications.
3. G.S.Shukla, G.S. and Upadhyay, V.B. (2017).Economic Zoology, V Edition, Rastogi Publications.
4. David, B.V. and Ananthakrishnan, T.N. (2004). General and Applied Entomology. Tata McGraw-Hill Publishing Company Limited, New Delhi.

5. Ahsan, J. and Sinha, S.P. (2010). A hand book on Economic Zoology. S. Chand & Co.,
6. Sardar Singh. (1962). Bees Keeping in India. SreeSaraswathi Press Limited, Calcutta.
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8. Ganga, G. and Sulochanachetty, J. (2019). Introduction to Sericulture. Oxford &Ibh Publishing Co Pvt Ltd.
9. Ullal, S.R. and Narasimhanna, M.N. (1978).Handbook of Practical Sericulture. Central Silk Board, Government of India, Bangalore.
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