Sir P. T. Sarvajanik College of Science

Autonomous

Affiliated to Veer Narmad South Gujarat University, Surat

Re-Accredited 'A^{+}' with CGPA 3.35

SYLLABUS

FOR

SEM I

Program: M.Sc.

Course: ZOOLOGY

For

Academic year

2024-25

(NEP-2020)

Effective from June 2024

Content

Sr. No	Semester	Course	Course number	Course Code	Course title
1	I	Core Course - I	CC I	ZOO MSC--S1P1- 4CR 24	Biology of Non- Chordates [Invertebrates]
2		Core Course - II	CC II	ZOO MSC -S1P2- 4CR 24	Biology of Chordates [vertebrates]
3		Core Course - III	CC III	ZOO MSC -S1P3- 4CR 24	Ecology and Ethology
4		Elective Course-I	EC-I	ZOO MSC -S1E1- 4CR 24	Apiculture
			EC-II	ZOO MSC-S1E2- 4CR 24	Animal Science in Pharmaceuticals
5		Skill Based Elective Cousre-I	SEC-I	ZOO MSC -S1SEC1- 2CR 24	Aquaculture
6		PRACTICAL	CCP-I	ZOO MSC -S1PR1 - 6CR 24	Experimental Zoology
1	**II**	Core Course - IV	CC IV	ZOO MSC—S2P1- 4CR 24	Animal physiology
2		Core Course - V	CC V	ZOO MSC –S2P2- 4CR 24	Wildlife Biology and Conservation
3		Core Course - VI	CC VI	ZOO MSC –S2P3- 4CR 24	Developmental Biology
4		Elective Course-II	EC-III	ZOO MSC –S2E3- 4CR 24	Sericulture
			EC-IV	ZOO MSC-S2E4- 4CR 24	Food and Nutrition
5		Skill Based Elective Cousre-II	SEC-II	ZOO MSC –S2SEC2- 2CR 24	Economic Entomology
6		PRACTICAL	CCP-II	ZOO MSC –S2PR1 - 6CR 24	Experimental Zoology

Programme Outcomes

PO Number	PO Statement
PO1	To impart basic knowledge of various branches of Zoology and to understand the unity of life with the rich diversity of organisms and their ecological and evolutionary significance.
PO2	To appreciate the complexities of biological organisation and address scientifically controversial issues in a rational way. To acquire basic skills in the observation and study of nature, biological techniques, experimental skills and scientific investigation
PO3	To assess the scope of animal biology and select particular areas for further study. To address the socio-economical challenges related to animal sciences and to facilitate students for taking up and shaping a successful career in Zoology and its related subjects
PO4	To inculcate transformational impact on the quality of education and to inspire the students to adopt scientific temper and live with scientific values.
PO5	To make the students aware of applications of Zoology and to highlight the potential of various branches to become an entrepreneur.

M. Sc. (Zoology) SEMESTER I

Core Course-I (CC-1)

ZOOLOGY PAPER ZOO MSC--S1P1- 4CR 24 THEORY

Course Title : Biology of Non- Chordates [Invertebrates] (Credits -4)

Course Learning Outcome		
At the end of this course, Students will be able to: • Enlist the salient features of non-chordates • Classify and describe non-chordates up to class level. • Divide invertebrate • Study origin of Metazoa • Understand Filter feeding in different animals • Study Minor Phyla • Study Reproduction –Larval lives		
Module 1	**The General Principles of Systematics and Animal Classification upto class**	**[15L]**
Learning Objectives: This module is intended to • Introduce learner to detailed classification of non chordates.		
Learning Outcome: After the successful completion of the module, the learner will be able to • Understand the basic concepts of lower animals and observe the structure and functions. • Differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.		
1.1	Origin and Development of Systematics; Taxonomy; Systems of Classification;	5L
1.2	Significance of Classification; Brief history of Classification;	5L
1.3	Nomenclature of Organisms; Systematic Herarchy; Modern Molecular Methods in Taxonomy	5L
Module 2	**The Invertebrates**	**[15L]**
Learning Objectives: This module is intended to • To discuss about Minor phyla general characters. • Discuss salient features of various phyla with examples		
Learning Outcome:		

After the successful completion of the module, the learner will be able to

- Understand the evolutionary significance of different functional adaptations in different groups of invertebrates.
- Understand salient features of various phyla with examples

2.1	Define invertebrates, importance of invertebrates,Invertebrate phyla,Invertebrata versus Non- Chordata, Diversity of invertebrates, Phylogeny of invertebrates, Outline classification of invertebrates.	5L
2.2	Origin of Metazoa: Define metazoa, Metazoan versus Metaphyla, Lower and Higher Metaphyla , metazoan Organization, Symmetry and its Significance,Cephalization and polarity, Body Cavity or Coelom, Level or Grades of organization.	5L
2.3	Organization of Metazoa: Introduction, Premetazoan Ancestors, Theories of origin of metazoan. Organization of Bilateria : - Bilateral Phyla, -Theories of origin of Bilateria.	5L
Module 3	**Aspects of Metabolism**	**[15L]**

Learning Objectives:

This module is intended to

- Show Filter feeding among the small- to medium-sized invertebrates.

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Learn different method of obtaining food in which food particles or microscopic creatures are randomly filtered from the water.

3.1	**Filter Feeding:** Filter Feeding in polychates, Filter Feeding and Digestion in molluscs, Filter Feeding and Digestion in Deuterostomia, Filter Feeding in Crustacea.	8L
3.2	**Information and Control:** Sources of Information: Coded signals, properties of Recepters, Mechanoreception, Chemoreception, photoreception.	7L
Module 4	**Reproduction: Larval Lives**	**[15L]**

Learning Objectives:

This module is intended to

- Different forms of larval forms of free-living invertebrates.
- Discuss the evolutionary significance of larval forms of invertebrates

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Understand larval forms, affinities and their behavior.

4.1	**Reproduction: Larval Lives**- Competition and Cooperation, Marine larvare and habitat selection, Larval life in fresh water.	5L
4.2	**Minor Phyla:** Pseudocoelomate-Rotifera : Historical, - Derivation of name, Definition, Ecology, general morphology, Reproduction, Importance, Distinctive characters, Classification, Affinites.	5L
4.3	**Coelomate-Brachiopoda** : Historical, Derivation of name, Definition : General account, Distinctive characters, Classification, Affinites. Invertebrata versus Non- Chordata, Diversity of invertebrates, Phylogeny of invertebrates, Outline classification of invertebrates.	5L

References:

1. Hyman, L.H. The invertebrates, Nol. Protozoa through Ctenophora, McGraw Hill Co., New York
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson & Sons Ltd., London.
3. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York.
4. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York and London.
5. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.
6. Russel-Hunter, W.D. A biology of higher invertbrates, the Macmillan Co. Ltd., London.
7. Read, C.P. Animal Parasitism. Parasitism prentice Hall Inc., New Jersey.
8. Sedgwick, A.A. Student text book of Zoology. Vol. I,II& III. Central Book Depot, Allahabad.
9. Parker, T.J., Haswell W.A. Text book of Zoology, Macmillan Co., London.

Mapping of CO- PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• Enlist the salient features of non-chordates	X					
• Classify and describe non-chordates upto Class level.		X				
• Divide invertebrate	X					
• Study origin of Metazoa	X					
• Understand Filter feeding in different animals		X				

• Study Minor Phyla	X					
• Study Reproduction –Larval lives	X					

M. Sc. (ZOOLOGY) SEMESTER I

Core Course-II (CC II)

ZOOLOGY PAPER ZOO MSC -S1P2- 4CR 24 THEORY

Course Title : Biology of Chordates [Vertebrates] (Credits -4)

Course Learning Outcome

At the end of this course, Students will be able to:

- Describe Phylogeny, salient features, classification up to order of Hemichordate-Mammals.
- Explain Methods of Vertebrate Taxonomy.
- Describe respiration and structure of Air bladder.
- Explain Neoteny and Metamorphosis
- Know structure of carapace and plastron
- Compare and explain anatomy of Brain, Aortic Arch and Heart of vertebrates.
- Describe human osteology

Module 1	Taxonomy	**[15L]**

Learning Objectives:

This module is intended to

- Evolutionary significance of different functional adaptations in different groups of Vertebrates.
- Classification of chordates.
- Salient features of different class.

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Understand the basic concepts of lower vertebrates and observe the structure.
- Differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.

1.1	Zoological nomenclature – ICZN	5L
1.2	**Classification up to orders of** Protochordates, Cyclostomata, Pisces, Amphibia, Reptilia, Aves, Mammals	5L

1.3	Nomenclature of Organisms; Systematic Herarchy; Modern Molecular Methods in taxonomy	5L
Module 2	**The Vertebrates**	**[15L]**
Learning Objectives: This module is intended to • Salient features of different class.		
Learning Outcome: After the successful completion of the module, the learner will be able to • Analyze, compare and distinguish the developmental stages and describe the important biological process. • Correlate the different modes of life among different vertebrates.		
2.1	**Cyclostomata** – Phylogenetic Status, Parasitic adaptation **Pisces** – Respiration and Air Bladder	5L
2.2	**Amphibia** - Neoteny, Metamorphosis **Reptilia** – Carapace and Plastron, Jacobson's Organ	5L
2.3	**Aves** – Affinities of Birds, Archaeopteryx and its significance **Mammals** – Sweat gland, Oil gland structure and function	5L
Module 3	**Comparative Anatomy**	**[15L]**
Learning Objectives: This module is intended to • Anatomy of Brain, Aortic Arch and Heart of vertebrates		
Learning Outcome: After the successful completion of the module, the learner will be able to • Compare and explain anatomy of Brain, Aortic Arch and Heart of vertebrates.		
3.1	Brain of Vertebrates	5L
3.2	Aortic arch of Vertebrate	5L
3.3	Heart of Vertebrate	5L
Module 4	**Human Osteology**	**[15L]**
Learning Objectives: This module is intended to • Human Osteology include skull, vertebral column, fore limbs, Hind limbs and Girdles.		

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Explain human bones and structures which include skull, vertebral column, Fore limbs, Hind limbs and Girdles.
- Explain the structure of vertebrate axial and appendicular skeleton and its significance.

4.1	Skull, Vertebral Column	5L
4.2	Fore limbs and Hind Limbs	5L
4.3	Pectoral and Pelvic Girdles	5L

References:

1. Modern Text Book of Zoology, Vertebrates by R.L. Kotpal
2. Chordate Zoology by E.L. Jordan
3. Chordate Zoology – Majupuria
4. Text Book of Chordates – Thangamani, S. Prasanna Kumar
5. Young, J.Z. (2004) The Life of Vertebrates, III Edition, Oxford University Press
6. Outline of comparative anatomy of Vertebrate- Kingesley J.S. , Central Book depot, Allahabad
7. Vertebrate Zoology – An Experimental field Approach – Nelson G.Hairston, Cambridge University Press,1994
8. Chordate Zoology – Agrawal and Dalela, JayprashNath& co. Meerut
9. Text Book ofZoology – R. D. Vidhyarthi, S. Chand
10. Practical Zoology Vertebrate – S.S. Lal, Rastogi publication Meerut

Mapping CO_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Describe Phylogeny, salient features, classification up to order of Hemichordate- Mammals.		X				
Explain Methods of Vertebrate Taxonomy.		X				
Describe respiration and structure of Air bladder.		X				
Explain Neoteny and Metamorphosis		X				
Know structure of carapace and plastron	X					
Compare and explain anatomy of Brain, Aortic Arch and Heart of vertebrates.				X		
Describe human osteology		X				

M. Sc. (Zoology) SEMESTER I

Core Course-III (CC III)

ZOOLOGY PAPER ZOO MSC -S1P3- 4 CR 24 THEORY

Course Title : Ecology and Ethology (Credits-4)

Course Learning Outcome		
At the end of this course, Students will be able to: • To understand the major principles of evolutionary theory, and ranges from the origins of life through the evolution of animals to the evolution of behaviour. • Explain population ecology. • Analyse biological data mathematically and statistically. • Define Ecology and its component. • Understand and can explain different behavioural pattern and its Neuroenocrine control.		
Module 1	**Ecology**	**[15L]**
Learning Objectives: This module is intended to • Interacts of two closely related species with their environments.		
Learning Outcome: After the successful completion of the module, the learner will be able to • Studying population growth gives scientist insite into how organism interacts with each other and with their environments. • Differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.		
1.1	Basic concepts of ecology, Concept of productivity, Ecological succession and niches.	7L
1.2	Concept of Limiting factors, Ecological footprints, Carbon footprints.	8L
Module 2	**Population Ecology**	**[15L]**
Learning Objectives: This module is intended to • About population, Natality, Mortality etc		
Learning Outcome: After the successful completion of the module, the learner will be able to • Can define population ,population size , density , geographic range, exponential growth , logistic		

growth and carrying capacity		
2.1	Population density and indices of Relative abundance, Population Demographicunits; Life Tables and Survivorship curves, Age distribution, Population growth forms and "carrying capacity".	8L
2.2	Population dispersal and fluctuations, Population selection - Life history strategies, r and K selection, Clutch size and sex ratios in populations, Types of interspecific interactions.	7L
Module 3	**Methods of Studying Animal Behaviour**	**[15L]**
Learning Objectives: This module is intended to • Different methods of studying animal behavior		
Learning Outcome: After the successful completion of the module, the learner will be able to • . Can understand and can explain different behavioural pattern and its Neuroenocrine control.		
3.1	• Methods of Studying Sensation and Perception. • Study of the Neural Mechanism • Role of Hormones in Behaviour	5L
3.2	• Methods for the Study of Exploratory Behaviour • Study of Conflict Behaviour, Agonistic Behaviour	5L
3.3	• Study of Communication – Correlation technique • Experimental technique • Training	5L
Module 4	**Neuroendocrine control of Behaviour**	**[15L]**
Learning Objectives: This module is intended to • Different Methods (Patterns) of Behaviour.		
Learning Outcome: After the successful completion of the module, the learner will be able to • Interpret the evolutionary process associate with theories, and molecular tools to assess animal behaviour like communication, aggression, cooperation while interacting with the environment. • Explain different pattern of behaviour.		
4.1	Introduction Hypothalamic- Hypophyseal Relations	5L
4.2	Neuroendocrine control Mechanisms:	5L

	Neuroendocrine control of reproduction Neuroendocrine control of mammalian reproduction.	
2.3	Behavioural Patterns as examples of Neuro-Endocrine Integrations - Maternal Behaviour - Domestication - Migration - Aggression and fear - Sexual Behaviour	5L

References:

1. Animal Behaviour –Vinod Kumar, Himalaya Publishing House
2. Animal Behaviour – Mohan P. Arora, Himalaya Publishing House
3. Evolution and Behaviour – Mathur, Tomar, Singhand Co. San Francisco. U.S.A.
4. Hobart M. Smith,1960Evolution of Chordate Structure, Holt, Rinehart & Winston Inc. New York
5. Hyman L.H.1966 Comparative Vertebrate Anatomy. The University of Chicago Press, Chicago
6. Colinvaux, P. A. (Latest edition) Ecology (2nd edition) Wiley, John and Sons, Inc.
7. Krebs, C. J. (Latest edition) Ecology (6th edition) Benjamin Cummings. 57
8. Odum, E.P., (Latest edition) Fundamentals of Ecology. Indian Edition. Brooks/Cole.
9. Ecology and Environment. Seventh Edition. Rastogi Publication. Meerut. Kormondy, E. J. (Latest edition)
10. Concepts of Ecology. Latest Edition. Prantice Hall of India Pvt. Ltd., New Delhi.
11. Ricklefs, R.E. (2000) Ecology (5th edition) Chiron Press.
12. Southwood, T.R.E. and Henderson, P.A. (2000) Ecologial Methods (3rd edition) Blackwell Sci.
13. Kendeigh, F C. (1984) Ecology with Special Reference to Animal and Man. Prentice Hall Inc.
14. Stiling, P. D. (2012) Ecology Companion Site: Global Insights and Investigations. McGraw HillEducation.

Mapping CO_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Understand the major principles of evolutionary theory, and ranges from the origins of life through the evolution of animals to the evolution of behaviour.		X				
Explain population ecology.		X				
Describe respiration and structure of Air bladder.		X				
Analyse biological data mathematically and statistically.				X		
Define Ecology and its component.	X					
Understand and can explain different behavioural pattern and its Neuroenocrine control.		X				

M. Sc. (Zoology) SEMESTER I

Elective Course-I (EC-I)

ZOOLOGY PAPER ZOO MSC -S1E1- 4CR 24 THEORY

Course Title : EC-I-Apiculture (Credits -4)

Course Learning Outcome		
At the end of this course, Students will be able to: • Identification of honey bee Species • Explain morphology, Individuals, Caste and life cycle. • Know behaviour and communication in honey bee. • Explain Diseases & enemies of Honey bee. • Understand position of Honey Bee species among the insects. • Identify, weather its behavior is social or solitary. • Acquire knowledge about distribution of species of honey bees. • Apply, practical and theoretical concept to identify species and casts of bees. • Get acquaint about communication system among the casts in the colony		
Module 1	**Honey bee Species**	**[15L]**
Learning Objectives: This module is intended to • Identification, General morphology, and behaviour.		
Learning Outcome: After the successful completion of the module, the learner will be able to • Differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.		
1.1	Identifying characters: A. *dorsata,* A. *cerana,* A *florae*, A. *trigona*, A . *mellifera.*	7L
1.2	Comparative morphology of Apis species, & individual castes in Apis species, life cycle.	8L
Module 2	**Behavior and communications in bees**	**[15L]**
Learning Objectives: This module is intended to • Behaviour and communication in honey bee.		
Learning Outcome: After the successful completion of the module, the learner will be able to		

- Understand position of Honey Bee species among the insects.
- Describe social behaviour of honey bee.

2.1	Sense organs,	5L
2.2	Division of labour, Social behavior	5L
2.3	Bee dance, Chemical communication- pheromones	5L
Module 3	**Nesting behavior**	**[15L]**

Learning Objectives:

This module is intended to

- Explain different castes of honey bee.
- Their behavior

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Explain formation of honey hive.
- Describe function of each caste and their importance.

3.1	Colony and organization of honey bees.	5L
3.2	The castes- queen, drone and workers.	5L
3.3	Bee foraging.	5L
Module 4	**Diseases and Enemies of Honey-bee**	**[15L]**

Learning Objectives:

This module is intended to

- **Diseases and Enemies of Honey-bee**.

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Understand different Diseases and Enemies of Honey-bee.
- Learn the pests of bee's colonies.
- Analyze the diseases associated with honey bee.

4.1	A. Diseases of honey-bee:	8L
4.2	B. Enemies of bees.	7L

References:

1. Apiculture, 1987 (Translated from French in English by R.K.Kauls 1994),
2. P.Jean-Prost, Oxford and IBH Publication, New Delhi.
3. Bee Genetica and Breeding 1986, T.E.Reinderer, Academic Press Inc., London.
4. Bees and Bee Keeping Science, Prentice & World Resources, 1990 – Eva Crane, Heinemann Newnes, Oxford, UK.

5. Bees and Mankind 1982, J.B.Free, George Allen &Unwin (Pub.), Limited London, UK. 25. Biogeography and Taxonomy of Honeybees 1985, F.Ruttnar, Springer-Verlag, Berlin, Jermany.
6. Bee Biology of the Honey Bee, 87, M.Winston, Harvard University Press, Cambridge, England.
7. Manual of Practical Zoology Vol. I, II, III – P.K.G. Nair, Himalaya Publishing House

Mapping CO_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Identification of honey bee Species		X				
Explain morphology, Individuals, Caste and life cycle.		X				
Know behaviour and communication in honey bee.		X				
Understand position of Honey Bee species among the insects. .		X				
Acquire knowledge about distribution of species of honey bees.	X					
Identify, weather its behavior is social or solitary.		X				
Explain Diseases & enemies of Honey bee.		X				

M. Sc. (Zoology) SEMESTER I

Elective Course-I (EC-II)

ZOOLOGY PAPER ZOO MSC-S1E2- 4CR 24 THEORY

Course Title : EC-II Animal Science in Pharmaceuticals (Credits -4)

Course Learning Outcome		
At the end of this course, Students will be able to: • Know Scope of Animal science in Pharmaceuticals • Explain animal oriented medicine. • Know use of animal Products in traditional medicine • Understand animal source for perfume formation.		
Module 1	**Introduction**	**[15L]**
Learning Objectives: This module is intended to • Introduction about Pharmaceuticals of animals.		

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Know Scope of Animal science in Pharmaceuticals
- Explain animal oriented medicine.

1.1	Introduction & Scope of Pharmaceuticals animals.	7L
1.2	Background & Religious restrictions.	8L
Module 2	**Animal oriented Medicines**	**[15L]**

Learning Objectives:

This module is intended to

- Application of animal for certain treatment

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Understand how animals are used for treatment directly/ indirectly.

2.1	Animal oriented Medicines- Invertebrates	7L
2.2	Animal oriented Medicines- Vertebrates	8L
Module 3	**Use of animal products in traditional medicines**	**[15L]**

Learning Objectives:

This module is intended to

- Basic formulation of medicine from animal.

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Know use of animal Products in traditional medicine
- Understand animal source for perfume formation.

3.1	Ecological Approach & Cultural Approach.	5L
3.2	Economic Approach.	5L
3.3	Sanitary Approach.	5L
Module 4	**Animal source for perfume formation**	**[15L]**

Learning Objectives:

This module is intended to

- Products from animal (scents).

Learning Outcome:

After the successful completion of the module, the learner will be able to

• Specification of organ/gland/waste used for perfume		
4.1	Source & Castoreum	8L
4.2	Civet & Hyraceum	7L

Zoology Practicals (Elective Paper Animal Science in Pharmaceuticals **)**

1. Study of drugs prepared from animals.
2. Study of animal oriented Medicines.
3. Study of animal products in traditional medicines.
4. Animal source for perfume

Reference :

1. Carté BK. 1996. Biomedical potential of marine natural products. BioScience 46: 271–286. 2. Clarke BT. 1997. The natural history of amphibian skin secretions, their normal functioning and potential medical applications. Biol Rev 72: 365–379.
2. Colwell RR. 1997. Microbial biodiversity and biotechnology. In: Reaka-Kudla ML et al. (Ed), Biodiversity II: understanding and protecting our biological resources, Washington, D.C.: Joseph Henry Press, p. 77–78.
3. Costa-Neto EM. 1999a. Healing with animals in Feira de Santana city, Bahia, Brazil. J Ethnopharm 65: 225–230.
4. Costa-Neto EM. 1999b. Recursos animais utilizados na medicina tradicional dos índios Pankararé que habitam no nordeste do estado da Bahia, Brasil. Actual Biol 21: 69–79.
5. Costa-Neto EM. 2004. Implications and applications of folk zootherapy in the State of Bahia, Northeastern Brazil. Sust Dev 12: 161–174.
6. Costa-Neto EM and Marques JGW. 2000. Faunistic resources used as medicines by artisanal fishermen from Siribinha Beach, State of Bahia, Brazil. J Ethnobiol 20: 93–109.
7. Costa-Neto EM and Oliveira MVM. 2000. Cockroach is good for asthma: zootherapeutic practices in Northeastern Brazil. Hum Ecol Rev 7: 41–51.
8. Daly JW. 1998. Thirty years of discovering arthropod alkaloids in amphibian skin.
9. J Nat Prod 61: 162–172. DePrekel M. 2002. Applications of animal assisted therapy. Available at: http://www.pan-inc.org/html/ fall9902.html

Mapping CO_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• Know Scope of Animal science in Pharmaceuticals	X					
• Explain animal oriented medicine.		X				
• Know use of animal Products in traditional medicine		X				
• Understand animal source for perfume formation.	X					

M. Sc. (ZOOLOGY) SEMESTER I

COURSE CODE: ZOO MSC -S1SEC 1- 2CR 24

Course Title: SEC-I Aquaculture

Skill Enhancement Course [CREDITS - 02]

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: 1. Define Aquaculture: 2. Explain prawn fishery. 3. Know importance of prawn culture. 4. Understand different method of prawn preservation and processing. 5. Explain fish culture. 6. Understand different method of fish preservation and processing.		
Module 1	**Prawn Fishery**	**[15L]**
Learning Objectives: This module is intended to 1. Complete culture of prawn.		
Learning Outcome: After the successful completion of the module, the learner will be able to 1. Explain different types of prawn fishery and species of prawn.		
1.1	Introduction, Types of Prawn Fishery, Species of Prawn, Prawn as a food.	7L
1.2	**Culture of Prawn:** Culture of Fresh water prawn, Culture of Marine Prawn, Preparation of farm: -Method of Prawn Fishing, Preservation and Processing	8L
Module 2	**Fish culture**	**[15L]**
Learning Objectives: 1. Types of fish culture		
Learning Outcome: After the successful completion of the module, the learner will be able to 1. Identify different types of pond for fish culture		
2.1	Introduction**:** Aim of fish culture, Qualities of cultivable fish, Types of cultivable fish.	8L
2.2	Breeding pond, Method of Fishing, Preservation of Fish	7L
References: • A textbook on Fish biology and fisheries by H.R. Singh • Aquaculture: Farming aquatic animals by Olando Martin		

- Aquaculture Principles and Practices by TVR Pillay& MN Kutty

Mapping CO_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Define Aquaculture	X					
Explain prawn fishery		X				
Know importance of prawn culture.		X				
Understand different method of prawn preservation and processing.		X				
Understand different method of fish preservation and processing.		X				
Explain fish culture.		X				

M. Sc. (ZOOLOGY) SEMESTER I

PRACTICAL CCP-I

COURSE CODE: ZOO MSC -S1PR1 - 6 CR 24

Course Title: Experimental Zoology- I (Credits -6)

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: • Develop practical knowledge of Invertebrates & Vertebrate by museum study, and display of dissections by LCD as dissection of animals is banned.		
Module 1	(Biology of Non- Chordates [Invertebrates])	**[3L]**
Learning Objectives: This module is intended to • Classification of lower phyla. • Specification of filter feeding.		
Learning Outcome: After the successful completion of the module, the learner will be able to • Learn an idea about certain specific features of different animals of lower phyla. • Understand the evolutionary aspect of animals through the growing hierarchy.		
1.1	**1. Classification of different phylum of invertebrates**	3L

	a) Protozoa : Trypanosoma, Vorticella b) Porifera : Grantia, Leusillia c) Cnidaria : Pericolpa, Porpita d) Platyhelminthes : Rhabditophora e) Aschelminthes : Horse hair worm, Hookworm f) Annelida : Tomopteris, Syllis g) Mollusca : Murex, Mya h) Arthropoda : Gryllus, Aranea i) Echinodermata : Luidia, Antedon 2. To study the filter feeding appendages: Terebella, Sabella, Mytilus, Ostrea, cephalodiscus, Daphnia and Calanus. 4. To study the Different type of symmetry in different animal with the help of charts. 5. Observation of Larvae Marine water and fresh water . 6. Different types of receptors and effector neuron 7. To study the receptor organ in different animals - Mechanoreceptor : Insects, Crustancean - Chemoreceptor : Mollusca -Photoreceptor : Inscets, Mollusca	
Module 2	**Biology of Vertebrates**	**[3L]**

Learning Objectives:

This module is intended to

- Phylogeny, salient features, classification up to order of Hemichordate to Mammals.
- Methods of Vertebrate Taxonomy.
- Neoteny and Metamorphosis
- Structure of carapace and plastron.

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Describe Phylogeny, salient features, classification up to order of Hemichordate-Mammals.
- Explain Methods of Vertebrate Taxonomy.
- Describe respiration and structure of Air bladder.

2.1	1. Classification of following animals up to orders Salpa, Dolilum, Maxine, Electric Ray, Sea horse, Labeo, Salamander, Ichthyophis, Calotes, Chaemeleon, Kingfisher, Ostrich, Duckbilled platypus, Bat, Whale 2. Study of Difference between Lamprey and Myxine 3. Types of Air bladder in Pisces. 4. Study of Metamorphosis in frog by charts/Photographs. 5. To Study plastron and carapace with the help of charts or photographs. 6. Study of Archaeopteryx as connecting link 7. To Study comparative Anatomy of Brain, Heart and Aortic arch of Vertebrates 8. To Study Human Osteology with the help of harts/photographs or Models. (a) Skull (b) Vertebral Column (c) Fore limbs and Hind Limbs (d) Pectoral and Pelvic Girdles	3L

Course Learning Outcome

After the successful completion of the Course, the learner will be able to:

- To understand the major principles of evolutionary theory, and ranges from the origins of life through the evolution of animals to the evolution of behaviour.
- Explain population ecology.
- Analyse biological data mathematically and statistically.

Module 3	Ecology and Ethology	**[3L]**

Learning Objectives:

This module is intended to

- Interaction of two closely related species with their environments.

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Define Ecology and its component.
- Understand and can explain different behavioural pattern and its Neuroendocrine control.

3.1	1. To Study the population density by Quadrate method 2. To Study the interspecific interaction in milk bacteria	3L

	3. To Study the carbon footprints by Model. 4. To Study Exploratory Behaviour with the help of charts /Photographs 5. Study of Conflict and Agonistic Behaviour by charts /Photographs 6. Study of Hypothalamic – Hypophyseal Relations by Photographs/Charts 7.To Study Neuroendocrine Control of Mammalian Reproduction (Male- Female) By charts/Photographs	
Module 4	**Apiculture**	**[3L]**

Learning Objectives:

This module is intended to

- Identification, General morphology, and behaviour.

Learning Outcome:

After the successful completion of the module, the learner will be able to

- Identify, weather its behavior is social or solitary.
- Acquire knowledge about distribution of species of honey bees.
- Apply, practical and theoretical concept to identify species and casts of bees.
- Get acquaint about communication system among the casts in the colony.
- Evaluates the strength of colony, brood, food condition.

4.1	1. Study of bee species and castes. 2. Comparative measurement of body size of various bee species. 3. Study of nesting behavior of bee species. 4. Observe behavior and communication in bees.	3L

References:

1. A manual Zoology Practical Zoology Chordates - Dr. P.S. Verma, S. Chand Publications
2. Practical Vertebrate Zoology ByAgrawl& Jindal, PragatiPrakashan.
3. Manual of Practical Zoology Vol. I, II, III – P.K.G. Nair, Himalaya Publishing House
4. Principles of systematic Zoology (2 nd Edition) by E. Mayr and P.D. Ashlock
5. A Textbook of Zoology Vol. I by Parker and Haswell (Revised)
6. The Invertebrates Vol. I to Vol. VI by L. H. Hyman 4 Invertebrate structure and function by E. J. W. Barrington
7. Invertebrate Zoology by P. A. Meglitsch (Oxford Press)
8. Life of Invertebrates by Russel Hunte

Mapping CO_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• Learn an idea about certain specific features of different animals of lower phyla.	X					
• Understand the evolutionary aspect of animals through the growing hierarchy.		X				
• Describe Phylogeny, salient features, classification up to order of Hemichordate- Mammals.		X				
• Explain Methods of Vertebrate Taxonomy.		X				
• Describe respiration and structure of Air bladder.		X				
• Explain neoteny and Metamorphosis		X				
• Know structure of carapace and plastron	X					
• To understand the major principles of evolutionary theory, and ranges from the origins of life through the evolution of animals to the evolution of behaviour.		X				
• Explain population ecology.		X				
• Analyse biological data mathematically and statistically.				X		
• Identify, weather its behavior is social or solitary.		X				
• Acquire knowledge about distribution of species of honey bees.	X					
• Apply, practical and theoretical concept to identify species and casts of bees.			X			
• Evaluates the strength of colony, brood, food condition					X	