



SIR P. T. SARVAJANIK COLLEGE OF SCIENCE, SURAT.

Autonomous

(Affiliated with Veer Narmad South Gujarat University)

Reaccredited 'A+' 3.35 CGPA by NAAC, College with Potential for Excellence



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Re-Accredited 'A+' with CGPA 3.35

SYLLABUS

For

SEM I & II

Program: M.Sc.

Course: ZOOLOGY

For

Academic year

2026-27

(NEP 2020)

Effective from June 2026



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Board of Studies in Zoology

Undergraduate and Post Graduate

	Name	Designation	Institute/Industry
Head of the Department			
1	Dr. Jaya Patel	Chairperson	Sir P. T. Sarvajani College of Science
Two experts from other than the parent University			
1	Dr. Nikunj Bhatt	Associate Professor	Department of Zoology, V. P. & R. P. T. P. Science College, (Autonomous), Vallabh Vidyanagar, Anand
2	Dr. Amol Patwardhan	Assistant Professor	K. J. Somaiya College of Science and Commerce (Autonomous), Mumbai
Subject Expert nominated by Vice-Chancellor			
1	Dr. Krupal Patel	Assistant Professor	Department of Zoology, Govt. Arts, Commerce & Science College, Limbayat, Surat
Meritorious Alumnus			
1	Mr. Bhavesh Chevli	Chief of Manufacturing	Envision Scientific Pvt. Ltd Sachin-Hazira Road
Experts from outside the Autonomous College, whenever special courses of studies are to be formulated, to be nominated by the Principal.			
1	Dr. Arun Dholakia	Retd. Associate Professor	Department of Zoology, Sir P. T. Sarvajani College of Science, Surat
Representative from Industry/corporate sector/allied area			
1	Ms. Pinal Patel	Board of Member	TINSA, Ecological Foundation Bhopal, Madhya Pradesh
Faculty of the specialization			
1	Dr. Jaya Patel	Associate Professor & Head	Sir P. T. Sarvajani College of Science
2	Dr. Nitin Solanki	Assistant Professor	Sir P. T. Sarvajani College of Science
3	Dr. Neelam Mishra	Adhyapak Sahayak	Sir P. T. Sarvajani College of Science



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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-economic 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.



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Acknowledgement

At the outset, I would like to thank Principal Dr. Pruthul R Desai for his guidance and support during the curriculum restructuring process. I am also grateful to all the esteemed members of the Board of Studies for their constructive suggestions and contributions.

Above all, I am deeply indebted to all the young and vibrant colleagues in the Department of Zoology for the long and arduous work they have put in during the compilation of the restructured syllabus.

Chairperson

Board of Studies in Zoology



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Course Content

Sr. No	Semester	Course Type	Course Code	Course Name
1	I	CC - I	ZOOMSC-S1P1-4CR26	Biology of Non Chordates
2		CC - II	ZOOMSC-S1P2-4CR26	Biology of Chordates
3		CC - III	ZOOMSC-S1P3-4CR26	Ecology and Ethology
4		Practical CC - I	ZOOMSC-S1PR1-2CR26	Zoology Practical - I
5		Practical CC - II	ZOOMSC-S1PR2-2CR26	Zoology Practical - II
6		Practical CC - III	ZOOMSC-S1PR3-2CR26	Zoology Practical - III
7		Indian Knowledge System (IKS)	ZOOMSC-S1IKS-2CR26	Ancient Health Science
8		Skill Enhancement Course (SEC)	ZOOMSC-S1SECPR-2CR26	Apiculture
1	II	CC - IV	ZOOMSC-S2P4-4CR26	Animal Physiology
2		CC - V	ZOOMSC-S2P5-4CR26	Wildlife Biology and Conservation
3		CC - VI	ZOOMSC-S2P6-4CR26	Developmental Biology
4		Practical CC - IV	ZOOMSC-S2PR4-2CR26	Zoology Practical - IV
5		Practical CC - V	ZOOMSC-S2PR5-2CR26	Zoology Practical - V
6		Practical CC- VI	ZOOMSC-S2PR6-2CR26	Zoology Practical -VI
7		Vocational course	ZOOMSC-S2VOC-2CR26	Fisheries
			ZOOMSC-S2VOCPR-2CR26	Practical -Vocational Course



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M.Sc. Syllabus with effect from the Academic year 2026-27 Distribution of Credit M.Sc. Zoology Syllabus

Course types	Course Name	Course Code	Credits	Hour	Module	Lectures per module (1 Hr)	Examination		
							Internal Marks	External Marks	Total Marks
SEMESTER I									
THEORY									
CC-I	Biology of Non Chordates	ZOOMSC-S1P1- 4CR26	4	60	4	15	50	50	100
CC-II	Biology of Chordates	ZOOMSC-S1P2- 4CR26	4	60	4	15	50	50	100
CC-III	Ecology and Ethology	ZOOMSC-S1P3- 4CR26	4	60	4	15	50	50	100
IKS-1	Ancient Health Science	ZOOMSC-S1IKS1- 2CR26	2	30	2	15	25	25	50
PRACTICAL									
SEC-1	Apiculture (Practical)	ZOOMSC-S1SECPR-2CR26	2	60	-	-	25	25	50
PCC1	Biology of Non Chordates Zoology Practical- I	ZOOMSC-S1PR1- 2CR26	2	60	-	-	25	25	50
PCC2	Biology of Chordates Zoology Practical- II	ZOOMSC-S1PR2- 2CR26	2	60	-	-	25	25	50
PCC3	Ecology and Ethology Zoology Practical- III	ZOOMSC-S1PR3- 2CR26	2	60	-	-	25	25	50
Total			22						550



SEMESTER II									
THEORY									
CC-IV	Animal Physiology	ZOOMSC- S2P4- 4CR26	4	60	4	15	50	50	100
CC- V	Wildlife Biology and Conservation	ZOOMSC- S2P5- 4CR26	4	60	4	15	50	50	100
CC-VI	Developmental Biology	ZOOMSC- S2P6- 4CR26	4	60	4	15	50	50	100
VOC	Fisheries	ZOOMSC- S2VOC- 2CR26	2	30	2	15	25	25	50
PRACTICAL									
PCC IV	Animal Physiology Zoology Practical- IV	ZOOMSC- S2PR4- 2CR26	2	60	2	15	20	30	50
PCCV	Wildlife Biology and Conservation Zoology Practical- V	ZOOMSC- S2PR5- 2CR26	2	60	-	-	25	25	50
PCCVI	Developmental Biology Zoology Practical- VI	ZOOMSC- S2PR6- 2CR26	2	60	-	-	25	25	50
PVOC1	Practical- Fisheries	ZOOMSC- S2VOCPR- 2CR26	2	60	-	-	25	25	50
Total			22						550



M.Sc. (Zoology) SEMESTER I

CC- I

Course Code: ZOOMSC-S1P1-4CR26

Course Name: Biology of Non Chordates (Credits: 4)

Course Learning Outcome		
At the end of this course, students will be able to: • Define Non-Chordates • Enlist the salient features of Non-Chordates • Classify and describe Non-Chordate up to orders • Explain origin of Metazoa • Describe the Comparative Anatomy of Acoelomate and Coelomates • Explain Minor Phyla		
Module 1	General Principles of Systematics and Animal Classification	[15L]
Learning Objectives: This module is intended to • Origin and development of Taxonomy • 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 Origin and development of Systematic. • Differentiate and classify the various groups of animals.		
1.1	Origin and development of Systematic; Utility of Taxonomy; Systems of classification; Nomenclature; Recommendations	
1.2	Systematic Hierarchy; Taxonomic Categories; Species as a Category; Outline Classification of Animals	
1.3	Significance of Classification; Brief history of Classification; Modern Classification of Animal Kingdom Modern molecular methods in taxonomy	
Module 2	Invertebrates	[15L]



Learning Objectives:

This module is intended to

- Discuss Invertebrate versus Non Chordata
- Discuss Origin and Organization of Metazoan

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

- Understand the Phylogeny of Invertebrates,
- Illustrate the salient features and outline classification of Invertebrates.
- Understand the Origin and Organization of Metazoan and Coelom

2.1	Define Invertebrates, Significance of Invertebrates, Invertebrate phyla, Invertebrate versus Non Chordata, Diversity of Invertebrates, Phylogeny of Invertebrates, Outline classification of Invertebrates.	
2.2	Origin of Metazoan, Define Metazoa, Theories of origin of Metazoa; Metazoa versus Metaphyla, Lower and Higher Metazo, Metazoan Organization, Symmetry and its Significance, Cephalization and Polarity,	
2.3	Organization of Metazoa: Introduction, Coelom, Level or Grades of Organization. Organization of Bilateria, Bilateral Phyla, Theories of Origin of Bilateria.	
Module 3	Comparative Anatomy	[15L]

Learning Objectives:

This module is intended to

- Understand Comparative Anatomy of Digestive System, Nervous System, Reproductive System in Phylum Cnidaria, Annelida, Arthropoda, Mollusca and Echinodermata.

Learning Outcome:

- After the successful completion of the module, the learner will be able to: Explain Comparative Anatomy of Digestive System, Nervous System and Reproductive System in Phylum Cnidaria, Annelida, Arthropoda, Mollusca and Echinodermata.

3.1	Comparative Anatomy of Digestive System : Phylum Cnidaria[Acoelomata]-Hydra, Phylum Annelida [Schizocoelomata-Protostomia]-Leech, Phylum Arthropoda[Schizocoelomata-Protostomia]--Scorpion, Phylum Mollusca[Schizocoelomata-Protostomia]--Sepia and Phylum Echinodermata[Schizocoelomata-Deuterostomia]--Sea Star.	
3.2	Comparative Anatomy of Nervous System:	



	Phylum Cnidaria[Acoelomata]-Hydra, Phylum Annelida [Schizocoelomata-Protostomia]-Leech, Phylum Arthropoda[Schizocoelomata-Protostomia]--Scorpion, Phylum Mollusca[Schizocoelomata-Protostomia]--Sepia and Phylum Echinodermata[Schizocoelomata-Deuterostomia]--Sea Star.	
Module 4	Minor Phyla	[15L]
Learning Objectives: This module is intended to: • Explain Minor Phyla.		
Learning Outcome: After the successful completion of the module, the learner will be able to: • Understand different systems, classification and affinities with examples.		
4.1	Ctenophora [Acoelomata]: Historical, Derivation of Name, Definition, Habits and Habitat, External Features, Internal Anatomy, Economic Importance, Distinctive Characters, Classification, Affinities and Examples: <i>Pleurobranchia, Beroe</i>	
4.2	Rotifera [Pseudocoelomate]: Historical, Derivation of Name, Definition, Habits and Habitat, External Features, Internal Anatomy, Economic Importance, Distinctive Characters, Classification, Affinities and Examples: <i>Rotifer, Epiphanes</i>	
4.3	Chaetognatha[Coelomate]: Historical, Derivation of Name, Definition, Habits and Habitat, External Features, Internal Anatomy, Economic Importance, Distinctive Characters, Classification, Affinities and Examples: <i>Sagitta</i>	
References: 1. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia. 2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson & Sons Ltd., London. 3. Hyman, L.H. The invertebrates, Vol. Protozoa through Ctenophora, McGraw Hill Co., New York 4. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York. 5. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York and London. 6. Parker, T.J., Haswell W.A. Text book of Zoology, Macmillan Co., London. 7. Read, C.P. Animal Parasitism. Parasitism prentice Hall Inc., New Jersey. 8. Russel-Hunter, W.D. A biology of higher invertebrates, the Macmillan Co. Ltd., London. 9. Sedgwick, A.A. Student text book of Zoology. Vol. I, II& III. Central Book Depot, Allahabad.		



M.Sc. (Zoology) SEMESTER I

CC- II

Course Code: ZOOMSC-S1P2-4CR26

Course Name: Biology of Chordates (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 - Discuss the 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: - Describe evolutionary significance of different groups of vertebrates. - Classify the chordates. - Explain the salient features of different classes.		
Learning Outcome: After the successful completion of the module, the learner will be able to: - Understand the basic structure of protochordates. • Differentiate and classify the various vertebrate animals. - Understand nomenclature methods		
1.1	Zoological nomenclature – ICZN	
1.2	Classification up to orders of protochordates, cyclostomata, pisces, amphibia, reptilia, aves and mammals	
1.3	Nomenclature of organisms: Systematic hierarchy and modern molecular methods in taxonomy.	



Module 2	Vertebrates	[15L]
Learning Objectives: This module is intended to: □ Understand salient features of different class.		
Learning Outcome: After the successful completion of the module, the learner will be able to: • Explain phylogenetic status and parasitic adaptation of cyclostomata • Describe structure of air bladder in pisces • Understand neoteny and metamorphosis. • Sketch and explain carapace and plastron.		
2.1	Cyclostomata: Phylogenetic Status, Parasitic adaptation Pisces – Respiration and Air Bladder, Types of scales	
2.2	Amphibia - Neoteny, Metamorphosis, Parental care Reptilia – Carapace and Plastron, Jacobson's Organ	
2.3	Aves – Phylogenetic relationship of of aves, Archaeopteryx and its significance Mammals – Structure and functions of Sweat gland, Oil gland, Dentition of mammals	
Module 3	Comparative Anatomy	[15L]
Learning Objectives: This module is intended to □ Understand 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 Vertebrate	
3.2	Aortic arch of Vertebrate	
3.3	Heart of Vertebrate	



Module 4	Comparative Osteology of Vertebrates	[15L]
Learning Objectives: This module is intended to understand vertebrates osteology from pisces to mammals		
Learning Outcome: • After the successful completion of the module the learner will be able to • Explain vertebrates bones and its structure • Explain structure of vertebral column, fore limbs and hind limbs and girdles of vertebrates		
4.1	Vertebral Column- Pisces to Mammal	
4.2	Fore limbs and Hind Limbs - Pisces to Mammal	
4.3	Pectoral and Pelvic Girdles - Pisces to Mammal	
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		



**M. Sc. (Zoology) SEMESTER I
CC-III**

Course Code: ZOOMSC-S1P3-4CR26

Course Name: 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 Neuroendocrine 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 insight 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.	
1.2	Concept of Limiting factors, Ecological footprints, Carbon footprints.	
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 Demographic units; Life Tables and Survivorship curves, Age distribution, Population growth forms and “carrying capacity”.	
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.	
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 Neuroendocrine control.		
3.1	• Methods of Studying Sensation and Perception. • Study of the Neural Mechanism • Role of Hormones in Behaviour	
3.2	• Methods for the Study of Exploratory Behaviour • Study of Conflict Behaviour, Agonistic Behaviour	
3.3	• Study of Communication – Correlation technique • Experimental technique • Training	
Module 4	Neuroendocrine control of Behaviour	[15L]
Learning Objectives	: This module is intended to understand different methods of animal behaviour	
Learning Outcome:	After completion of the module the learner will be able to • Understand the evolutionary process associate with theories and molecular tools to assess animal behaviour like communication, aggression, cooperation etc. • Explain different patterns of behaviour	
4.1	Introduction Hypothalamic- Hypophyseal Relations	



4.2	Neuroendocrine control Mechanisms: 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	

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, 1960 Evolution of Chordate Structure, Holt, Rinehart & Winston Inc. New York
5. Hyman L.H. 1966 Comparative Vertebrate Anatomy. The University of Chicago Press, Chicago
6. Colinviaux, 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) Ecological 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 Hill Education.



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 Neuroendocrine control.		X				

M.Sc. (Zoology) SEMESTER I IKS

Course Code: ZOOMSC-S1IKS-2CR26

Course Name: Ancient Health Science (Credits: 2)

Course Learning Outcome		
At the end of this course, Students will be able to: - Understand the concepts, foundations, and significance of the Indian Knowledge System (IKS) and appreciate the importance of India's intellectual and cultural heritage. - Identify various facets of traditional knowledge, understand their relevance, and explore their application in day-to-day life.		
Module 1	Indian Knowledge System	[15L]
Learning Objectives: This module is intended to Introduce students to the concept, origin, and significance of the Indian Knowledge System.		
Learning Outcome: After the successful completion of the module, the learner will be able to: - Define and explain the Indian Knowledge System (IKS) and its significance. - Describe the importance and major components of ancient Indian knowledge.		



• Explain the concept, nature, scope, and importance of Traditional Knowledge. • Identify and describe the Vedic Corpus and the Four Vedas. • Recognize the relevance of traditional Indian knowledge in modern society and everyday life.		
1.1	Defining Indian Knowledge System. Importance of Ancient Knowledge, The IKS Corpus.	
1.2	Introduction to Traditional Knowledge: Concept & Definition, Nature, Scope and Importance of Traditional Knowledge.	
1.3	The Vedic Corpus: Introduction to Vedas, The Four Vedas.	
Module 2	Humanities and Social Sciences	[15L]
Learning Objectives: This module is intended to • Introduce students to the concepts of health and wellness and their importance in daily life.		

After the successful completion of the module, the learner will be able to: • Define health and wellness and explain their importance in everyday life. • Explain the concept and significance of emotional intelligence. • Describe the relevance and benefits of Yoga for health and wellness.		
	Health and Wellness: Definition of Health, Emotional Intelligence, Yoga & its Relevance to Health & Wellness, Benefits of Meditation Happiness, Peace, Personality development through meditation.	



M. Sc. (Zoology) SEMESTER I
SEC
Course Code: ZOOMSC-S1SECPR-2CR26
Course Name: Apiculture
Practical (Credits:2)

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, whether 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 acquainted about communication system among the casts in the colony

Practical

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. Study of bee species
2. Comparative measurement of body size of various bee species.
3. Life cycle and Bee castes.
4. Study of Social behaviour of bees.
5. Communication in bees.
6. Study of bee Bionomics
7. Study the bee hive formation
8. Modern method of Apiculture
9. Study of seasonal management of apiculture
10. Study of Accessory equipment



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, Germany.
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 PRACTICAL
COURSE CODE: ZOOMSC-S1PR1-2CR26
Course Name: Zoology Practical- I (Credits:2)

Course Learning Outcome		
After the successful completion of the Course, the learner will be able to: Develop practical knowledge of Invertebrates and Vertebrate by museum study, and display of dissections by LCD as dissection of animals is banned.		
	Biology of Non Chordates	
Learning Objectives: This module is intended to - Systematics of Major and Minor phyla. - Comparative Anatomy of Digestive System and Nervous System of Invertebrates Animals		
Learning Outcome: After the successful completion of the module, the learner will be able to - Classification of Major and Minor phyla. - Comparative Anatomy of Digestive System and Nervous System of Invertebrates Animals		
	1. Classification of different phylum of Invertebrates 1. Protozoa : Trypanosoma, Vorticella Porifera : Grantia, Leusillia 2. Cnidaria : Pericolpa, Porpita Platyhelminthes : Rhabditophora	



	3. Aschelminthes : Horse hair worm, Hookworm Annelida : Tomopteris, Syllis 4. Mollusca : Murex, Mya Arthropoda : Gryllus, Aranea 5. Echinodermata : Luidia, Antedon Ctenophora: Pleurobranchia, Beroe 6. Chaetognathae: Sagitta Rotifera: Rotifer 7. To study the Comparative Anatomy of Digestive System of Hydra, Leech, Scorpion, Sepia and Sea Star 8. To study the Comparative Anatomy of Nervous System of Hydra, Leech, Scorpion, Sepia and Sea Star	
Course Code : ZOOMSC-S1PR2-2CR26 Course Name: Zoology Practical- II (Credits:2) Biology of Chordates		
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. 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. Difference between Lamprey and Myxine	



	2.Types of Air bladder in Pisces. 3. Types of scales in pisces 4. Metamorphosis in frog by charts/Photographs. 5.Parental care in amphibia 6.To Study plastron and carapace with the help of charts or photographs. 7.Study of Archaeopteryx as connecting link 8. Dentition in mammals 9. To Study comparative osteology of Vertebrate with the help of charts/photographs or models. (a)Vertebral Column- Pisces to Mammal (b)Fore limbs and Hind Limbs - Pisces to Mammal (c)Pectoral and Pelvic Girdles - Pisces to Mammal 10. To Study Comparative Anatomy of Brain, Heart and Aortic arch of Vertebrates by charts/ Photographs	
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.
Course Code: ZOOMSC-S1PR3-2CR26 Course Name: Zoology Practical- III Ecology and Ethology
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.



	1. To Study the population density by Quadrature method 2. To Study the interspecific interaction in milk bacteria 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	
References:	1. A manual Zoology Practical Zoology Chordates - Dr. P.S. Verma, S. Chand Publications 2. Practical Vertebrate Zoology By Agrawal & Jindal, Pragati Prakashan. 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	