

Environment Related Paper: -

I. Course Code: - ZOOC1

Course title: - Animal Diversity I

Semester: - B.Sc. 1st Semester (FYUGP)

DETAILED SYLLABUS OF 1st SEMESTER

Title of the Course	:	Animal Diversity I
Course Code	:	ZOOC1
Nature of the Course	:	Core
Total Credits	:	04
Distribution of Marks	:	80 (End Sem) + 20 (In-Sem)

COURSE OBJECTIVES:

- To introduce the concept of various forms of chordates and non-chordates
- To explain their classification
- To analyze their structural anatomy.

UNITS	CONTENTS	L	T	P	Total Hours
1 (12 marks)	Section A: Non-Chordates –I Protista, Parazoa and Metazoa General characteristics and Classification up to Classes Structural organization & nutrition of <i>Euglena</i> , <i>Amoeba</i> and <i>Paramecium</i> . Locomotion and Reproduction in Animal protista (Protozoa)	6	1	-	7
2 (12 marks)	Porifera, Cnidaria & Ctenophora General characteristics and Classification up to classes. Canal system in sponges. General characteristics and Classification up to classes. Polymorphism in Cnidaria. Corals and coral reefs. General characteristics and Evolutionary significance	7	1	-	8
3 (12 marks)	Platyhelminthes & Nematelminthes General characteristics and Classification up to classes Life cycle of <i>Taenia solium</i> . General characteristics and Classification up to classes. Life cycle of <i>Ascaris lumbricoides</i> Parasitic adaptations in helminthes	6	1	-	7
4 (12 marks)	Section B: Chordates I Introduction to Chordates & Protochordata General characteristics and outline classification General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata Origin of Chordata and Agnatha Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata. General characteristics and classification of cyclostomes up to class	12	2	-	14
5 (12 marks)	Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms	7	1	-	8

6 (20 marks)	Identification: Protochordata: <i>Balanoglossus</i> , <i>Herdmania</i> , <i>Branchiostoma</i> . Colonial Urochordata Sections of <i>Balanoglossus</i> through proboscis and branchiogenital regions, Sections of <i>Amphioxus</i> through pharyngeal, intestinal and caudal regions. Permanent slide of <i>Herdmaniaspicules</i> Agnatha <i>Petromyzon</i> , <i>Myxine</i> Study of <i>Sycon</i> (T.S. and L.S.), <i>Hyalonema</i> , <i>Euplectella</i> , <i>Spongilla</i> Identification of museum specimen: <i>Obelia</i> , <i>Physalia</i> , <i>Millepora</i> , <i>Aurelia</i> , <i>Tubipora</i> , <i>Corallium</i> , <i>Alcyonium</i> , <i>Gorgonia</i> , <i>Metridium</i> , <i>Pennatula</i> , <i>Fungia</i> , <i>Meandrina</i> , <i>Madrepora</i> and One specimen/slide of any ctenophore Study of whole mount of <i>Euglena</i> , <i>Amoeba</i> and <i>Paramecium</i> , Binary fission and Conjugation in <i>Paramecium</i> Examination of pond water collected from different places for diversity in Animal protista (Protozoa) Study of adult <i>Fasciola hepatica</i> , <i>Taenia solium</i> and their life cycles (Slides/micro- photographs) Study of adult <i>Ascaris lumbricoides</i> and its life stages (Slides/micro-photographs) To submit a Project Report on any related topic based on theory syllabus.	-	-	30	30
TOTAL		39	6	30	75

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT: (20 Marks)

- One Internal Examination - 10 Marks
- Others (Any one) - 10 Marks
 - Submission of Project report on larval forms
 - Presentation on the larval forms

LEARNING OUTCOMES:

After the completion of this course, the learner will be able to:

- Understand the different groups of animals under chordates and non-chordates and their importance.
- Understand the zoogeographical distribution of animals
- Analyze and examine the structural differences between different groups of animals.

SUGGESTED READINGS:

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt Saunders International Edition.
2. 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
3. Barrington, E.J.W. (1979). *Invertebrate Structure and Functions*. II Edition, E.L.B.S. and Nelson
4. Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
5. Pough H. *Vertebrate life*, VIII Edition, Pearson International.

II. Course Code: - SEC111
 Course title: - Freshwater Aquaculture
 Semester: - B.Sc. 1st Semester (FYUGP)

Title of the Course : Freshwater Aquaculture
 Course Code : SEC111
 Nature of the Course : SEC
 Total Credits : 03
 Distribution of Marks : 80 (End Sem) + 20 (In-Sem)

COURSE OBJECTIVES:

- To introduce the concept of freshwater aquaculture.
- To understand the technique of fish rearing, transportation and the technique of induced breeding.
- To explain the maintenance of fish health.

UNITS	CONTENTS	L	T	P	Total Hours
1 (15 marks)	Introduction to Aquaculture, Basic concept of extensive, intensive and superintensive aquaculture, monoculture, polyculture and integrated farming.	7	-	-	7
2 (15 marks)	Rearing of Larval and brood fishes, Traditional and Chinese hatcheries, feed preparation for carps and catfishes, Live food culture, Transportation of fish seeds and brooders.	7	-	-	7
3 (15 marks)	Concept of induced breeding, ornamental fish, Captive breeding of carp, catfishes, Diagnostic characters of brood fishes and ornamental fishes, Breeding of carps and catfishes in simulated environments, Standardisation of hormonal doses.	8	-	-	8
4 (15 marks)	Maintenance of fish health and prophylactic measures, Diagnostic of common fungal, bacterial, protozoan and ectoparasites, Control measures for common fish diseases, Role of immunostimulants in aquaculture.	8	-	-	8
5 (20 marks)	Practicals: 1) Study of fishing gears 2) Basic symptoms of fish diseases 3) Demonstration of Induced Breeding	-	-	30	30
	TOTAL	30	-	30	60

Where, *L: Lectures* *T: Tutorials* *P: Practicals*

MODES OF IN-SEMESTER ASSESSMENT:

- One Internal Examination - (20 Marks)
- Others (Any one) - 10 Marks
- Project report submission - 10 Marks
- Presentation
- **LEARNING OUTCOMES:**

After the completion of this course, the learner will be able to:

- Rear fishes under different environmental conditions
- Prepare fish feeds.

- Diagnosis of fish health and take prophylactic measures.

SUGGESTED READINGS

- D. Kapoor, R. Dayal and A.G. Ponniah: Fish Biodiversity of India, NBFGR Publication, Lucknow.
- R.H. McConnell: Ecological Studies in Tropical Fish Communities, Cambridge University Press.
- Matty: Fish Endocrinology.
- T.K. Govindan: Fish Processing Technology, Oxford & IBH, New Delhi
- Fish and Fisheries - S.S. Khanng
- Fresh Water Aquaculture – Rath
- Hand Book of fish and Fisheries - ICAR

III. Course Code: - GEZOO1
 Course title: - Natural Resource Management
 Semester: - B.Sc. 1st Semester (FYUGP)

Title of the Course : Natural resource management
 Course Code : **GEZOO1**
 Nature of the Course : Generic Elective Course-I
 Total Credits : 03
 Distribution of Marks: 80 (End Sem) + 20 (In-Sem)

COURSE OBJECTIVES: *The objective of this course is to provide knowledge to the students on importance, sustainable utilization, conservation and management of natural resources.*

UNITS	CONTENTS	L	T	P	Total Hours
I 15 MARKS	Natural resources: Definition and types. Natural resources of NE India. Renewable and non-renewable sources of energy.	8	01	-	09
II 25 MARKS	Sustainable utilization of land and water resources: Soil degradation and management; water resources (Freshwater, marine, estuarine) wetlands; Threats and management strategies and their management.	10	01	-	13
III 15 MARKS	Biodiversity: Definition, types, significance, threats, management strategies, CBD, Bioprospecting	10	02	-	10
IV 25 MARKS	Contemporary practices in resource management: EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management. National and international efforts in resource management and conservation	11	02	-	13
Total		39	06	-	45

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT:

- One Internal Examination - (20 Marks)
- Others (Any one) - 10 Marks
 - Sessional Examinations
 - Assignment

LEARNING OUTCOMES:

1. Know about the natural resources, its types, sustainable utilization and management practices.

SUGGESTED READINGS:

1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

IV. Course Code: - ZOOC2
 Course title: - Animal Diversity II
 Semester: - B.Sc. 2nd Semester (FYUGP)

Title of the Course : Animal Diversity II
 Course Code : **ZOOC2**
 Nature of the Course : Core
 Total Credits : 04
 Distribution of Marks : 80 (End Sem) + 20 (In-Sem)

COURSE OBJECTIVES:

- To introduce the concept of various forms of chordates and non-chordates
- To explain their classification
- To analyze their structural anatomy.

UNITS	CONTENTS	L	T	P	Total Hours
1 (12 marks)	Non-Chordates II Introduction to Coelomates, Annelida and Arthropods Evolution of coelom and metamerism General characteristics and Classification up to classes Excretion in Annelida General characteristics and Classification up to classes Social life in bees and termites	8	1	-	9
2 (12 marks)	Onychophora& Mollusca and Echinodermata General characteristics and Evolutionary significance Classification up to classes Torsion and detorsion in Gastropoda Water-vascular system in Asterozoa Affinities with Chordates Study of the following specimens: Echinoderms - <i>Pentaceros/Asterias, Ophiura, Chyaster, Echinus, Cucumaria and Antedon</i>	12	2	-	14
4 (12 marks)	Chordates II Pisces: General characteristics of Chondrichthyes and Osteichthyes,classification upto order Migration, Osmoregulation and Parental care in fishes	5	1	-	6
5 (12 marks)	Amphibia &Reptilia: Origin of <i>Tetrapoda</i> (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians General characteristics and classification up to order; Affinities of <i>Sphenodon</i> ; Poison apparatus and Biting mechanism in snakes	7	1	-	8
6 (12 marks)	Aves and Mammals: General characteristics and classification up to order <i>Archaeopteryx</i> -- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds	7	1	-	8

	General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages				
(20 marks)	<p>Practical: Study of the following specimens:</p> <p>Annelids - <i>Aphrodite</i>, <i>Nereis</i>, <i>Heteronereis</i>, <i>Sabella</i>, <i>Serpula</i>, <i>Chaetopterus</i>, <i>Pheretima</i>, <i>Hirudinaria</i></p> <p>Arthropods - <i>Limulus</i>, <i>Palamnaeus</i>, <i>Palaemon</i>, <i>Daphnia</i>, <i>Balanus</i>, <i>Sacculina</i>, <i>Cancer</i>, <i>Eupagurus</i>, <i>Scolopendra</i>, <i>Julus</i>, <i>Bombyx</i>, <i>Periplaneta</i>, termites and honey bees: <i>Onychophora</i> - <i>Peripatus</i></p> <p>Molluscs - <i>Chiton</i>, <i>Dentalium</i>, <i>Pila</i>, <i>Doris</i>, <i>Helix</i>, <i>Unio</i>, <i>Ostrea</i>, <i>Pinctada</i>, <i>Sepia</i>, <i>Octopus</i>, <i>Nautilus</i></p> <p>Fishes <i>Scoliodon</i>, <i>Sphyrna</i>, <i>Pristis</i>, <i>Torpedo</i>, <i>Chimaera</i>, <i>Mystus</i>, <i>Heteropneustes</i>, <i>Labeo</i>, <i>Exocoetus</i>, <i>Echeneis</i>, <i>Anguilla</i>, <i>Hippocampus</i>, <i>Tetodon</i>/ <i>Diodon</i>, <i>Anabas</i>, Flat fish</p> <p>Amphibia <i>Ichthyophis/Ureotyphlus</i>, <i>Necturus</i>, <i>Bufo</i>, <i>Hyla</i>, <i>Alytes</i>, <i>Salamandra</i></p> <p>Reptilia <i>Chelone</i>, <i>Trionyx</i>, <i>Hemidactylus</i>, <i>Varanus</i>, <i>Uromastix</i>, <i>Chamaeleon</i>, <i>Ophisaurus</i>, <i>Draco</i>, <i>Bungarus</i>, <i>Vipera</i>, <i>Naja</i>, <i>Hydrophis</i>, <i>Zamenis</i>, <i>Crocodylus</i></p> <p>Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm Mount of mouth parts and dissection of digestive system and nervous system of <i>Periplaneta</i>*</p> <p>Study of six common birds from different orders. Types of beaks and claws. Dissection of weberian ossicles of <i>Mystus</i>, pecten from Fowl head Identification: <i>Sorex</i>, Bat (Insectivorous and Frugivorous), <i>Funambulus</i>, <i>Loris</i>, <i>Herpestes</i>, <i>Erinaceous</i></p>	-	-	30	30
	TOTAL	39	6	30	75

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT:

- | | | |
|--|---|----------|
| • One Internal Examination | - | 10 Marks |
| • Others (Any one) | - | 10 Marks |
| • -To submit a Project Report on any related topic to larval forms | | |
| • - To study and prepare a chart of keys of identification of poisonous and non- poisonous snakes. | | |

LEARNING OUTCOMES:

After the completion of this course, the learner will be able to:

- Understand the different groups of animals under chordates and coelomates and their importance.
- Analyze and examine the structural differences between different groups of animals.

SUGGESTED READINGS:

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford universitypress.
- Pough H. *Vertebrate life*, VIII Edition, PearsonInternational.
- Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger PubCo.
- Hall B.K. and Hallgrímsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett PublishersInc.
- Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII

V. Course Code: - SEC212
 Course title: - Aquarium Fish Keeping
 Semester: - B.Sc. 2nd Semester (FYUGP)

Title of the Course : AQUARIUM FISH KEEPING
 Course Code : SEC212
 Nature of the Course : SEC
 Total Credits : 03
 Distribution of Marks : 80 (End Sem) + 20 (In-Sem)

COURSE OBJECTIVES:

- To introduce the concept of aquarium fish keeping.
- To study ornamental fishes and their importance.
- To learn the technique of fish feed preparation.
- To learn acclimatization of fish.

UNITS	CONTENTS	L	T	P	Total Hours
1 (15 marks)	Introduction: The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes	6	-	-	6
2 (15 marks)	Biology: Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish, Botia, Gourami, <i>Channa bleheri</i> , <i>Channa barca</i>	10	-	-	10
3 (15 marks)	Food and feeding : Use of live fish feed organisms. Preparation and composition of formulated fish feeds Live fish transport - Fish handling, packing and forwarding techniques	7	-	-	7
4 (15 marks)	Transportation and maintenance: General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry, Scope of aquarium fish industry in NE India	7	-	-	7
5 (20 marks)	Practicals 1) Management of aquarium environment 2) Collection of ornamental fishes 3) Acclimatization of fish 4) Preparation of feed and Feeding of aquarium fish	-	-	30	30
	TOTAL	30	-	30	60

Where, L: Lectures T: Tutorials P: Practicals
MODES OF IN-SEMESTER ASSESSMENT:
 • One Internal Examination - (20 Marks)
 • Others (Any one) - 10 Marks
 • Collection of Ornamental Fish 10 Marks

- Project Report Submission
- Presentation
- **LEARNING OUTCOMES:**

After the completion of this course, the learner will be able to:

- Rear fish in aquariums for entrepreneurship.

SUGGESTED READINGS

1. G. Helfman, Bruce B. Collette, D.E. Facey, B. W. Bowen: The Diversity of Fishes: Biology, Evolution, and Ecology, John Wiley & Sons
2. R. J. Wootton: Fish Ecology, Springer
3. W. Vishwanath, W.S. Lakra and U.K. Sarkar: Fishes of North East India, NBFGR Publication, Lucknow
4. Handbook of Fisheries and Aquaculture – ICAR
5. Ornamental Fish culture and Aquarium Maintenance – AO Dholakia

VI. Course Code: - GEZOO2

Course title: - Wildlife Conservation and Management

Semester: - B.Sc. 2nd Semester (FYUGP)

Title of the Course : WILD LIFE CONSERVATION AND MANAGEMENT
 Course Code : **GEZOO2**
 Nature of the Course : GE
 Total Credits : 03
 Distribution of Marks : 80 (End Sem) + 20 (In-Sem)

COURSE OBJECTIVES:

- To introduce the concept wildlife and its management
- To explain the importance of wildlife and its conservation
- To understand conservation tools and methods

UNITS	CONTENTS	L	T	P	Total Hours
1 (14marks)	Introduction to WildLife Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.	5	1	-	6
2 (13 marks)	Evaluation and management of wildlife Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.	9	1	-	10
3 (13 marks)	Management of habitats Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats	7	1	-	8
4 (13)	Population estimation Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.	7	1	-	8
5 (13 marks)	Management planning of wild life in protected areas Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Ecology of perturbation. Care of injured and diseased animal; Quarantine	5	1	-	6
6 (14 marks)	Protected areas National parks & sanctuaries, Community reserve; Important features of protected areas in India with special reference to NE India.	7	-	-	7

	TOTAL	3	6	-	45
		9			

Where, L: Lectures T: Tutorials P: Practicals

MODES OF IN-SEMESTER ASSESSMENT:

- | | | | |
|----------------------------|---|------------|----------|
| • One Internal Examination | - | (20 Marks) | 10 Marks |
| • Others (Any one) | - | | 10 Marks |
| • Presentation | | | |
| • Project assignment | | | |

LEARNING OUTCOMES:

After the completion of this course, the learner will be able to:

Have a clear understanding of wildlife, habitats, threats and conservation measures.

SUGGESTED READINGS:

- Wildlife Ecology, Conservation and Management by John M. Frysell
- Wildlife Conservation and Management By Reena Mathur
- Textbook of Wildlife Management by SK Singh

VII. Course Code: - ZC3505T
Course title: - Diversity of Chordata
Semester: - B.Sc. 3rd Semester (CBCS)

CBCS Undergraduate Program, 2018: Zoology Honours (Last updated on 08-04-2019)

Course Code: ZC305T

CORE COURSE V: DIVERSITY OF CHORDATA

**The objective of the course is to expose the students to various forms of chordates, their classification and structural anatomy.*

THEORY	(Credits 4) (Lectures=60)
Unit 1: Introduction to Chordates	2 Lectures
General characteristics and outline classification	
Unit 2: Protochordata	8 Lectures
General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata	
Unit 3: Origin of Chordata	3 Lectures
Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata	
Unit 4: Agnatha	2 Lectures
General characteristics and classification of cyclostomes up to class	
Unit 5: Pisces	8 Lectures
General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes	
Unit 6: Amphibia	6 Lectures
Origin of <i>Tetrapoda</i> (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians	
Unit 7: Reptilia	7 Lectures
General characteristics and classification up to order; Affinities of <i>Sphenodon</i> ; Poison apparatus and Biting mechanism in snakes	
Unit 8: Aves	8 Lectures
General characteristics and classification up to order <i>Archaeopteryx</i> – a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds	
Unit 9: Mammals	8 Lectures
General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages	
Unit 10: Zoogeography	8 Lectures
Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms	

Course Code: ZC305P

DIVERSITY OF CHORDATA

PRACTICAL

(Credits 2)

I. Identification :

(i) Protochordata

Balanoglossus, Herdmania, Branchiostoma, Colonial Urochordata Sections of *Balanoglossus* through proboscis and branchiogenital regions, Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions. Permanent slide of *Herdmania* spicules

(ii) Agnatha

Petromyzon, Myxine

(iii) Fishes

Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish

(iv) Amphibia

Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

(v) Reptilia

Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus
Key for Identification of poisonous and non-poisonous snakes

(vi) Aves

Study of six common birds from different orders. Types of beaks and claws

(vii) Mammalia

Sorex, Bat (Insectivorous and Frugivorous), *Funambulus, Loris, Herpestes, Erinaceous*.

2. Dissection of weberian ossicles of *Mystus*, pecten from Fowl head

3. Dissection of Fowl head (Dissections and mounts subject to permission)

Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)

4. To study and prepare a chart of keys of identification of poisonous and non-poisonous snakes. Classification from Young, J. Z. (2004) to be followed

SUGGESTED READINGS

- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Darlington P.J. *The Geographical Distribution of Animals*, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrímsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

VIII. Course Code: - ZD501T
Course title: - Animal Behaviour and Chronobiology
Semester: - B.Sc. 5th Semester (CBCS)

DISCIPLINE CENTRIC ELECTIVE COURSES

Course Code: ZD501T

DSE Course I:

ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

THEORY	(Credits 4)
	(Lectures=60)
Unit 1: Introduction to Animal Behavior	7 Lectures
Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behavior.	
Unit 2: Patterns of Behaviour	10 Lectures
Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.	
Unit 3: Social and Sexual Behaviour	14 Lectures
Social Behaviour: Concept of Society; Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.	
Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.	
Unit 4: Introduction to Chronobiology	9 Lectures
Historical developments in chronobiology; Biological oscillation: the concept of Average, amplitude, phase and period. Adaptive significance of biological clocks	
Unit 5: Biological Rhythm	13 Lectures
Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Concept of synchronization and masking; Photic and non-photic zeitgebers; Circannual rhythms; Photoperiod and regulation seasonal reproduction of vertebrates; Role of melatonin.	
Unit 8: Biological Clocks	7
Relevance of biological clocks; Chronopharmacology, Chronomedicine, Chronotherapy.	

Course Code: ZD501P
ANIMAL BEHAVIOUR AND CHRONOBIOLOGY

PRACTICAL

(Credits 2)

1. To study nests and nesting habits of the birds and social insects.
2. To study the behavioural responses of wood lice to dry and humid conditions.
3. To study geotaxis behaviour in earthworm.
4. To study the phototaxis behaviour in insect larvae.
5. Visit to Forest/ Wild life Sanctuary/Biodiversity Park/Zoological Park to study behavioural activities of animals and prepare a shortreport.
6. Study of circadian functions in humans (daily eating, sleep and temperature patterns).

SUGGESTED READINGS

- David McFarland, *Animal Behaviour*, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, *An Introduction to Animal Behaviour*, Cambridge, University Press, UK.
- John Alcock, *Animal Behaviour*, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, *Exploring Animal Behaviour*, Sinauer Associate Inc., Massachusetts, USA.
- *Chronobiology Biological Timekeeping*: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
- *Insect Clocks* D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.)R.D. Lewis. (3rdEd) 2002 Baren and Noble Inc. New York, USA
- *Biological Rhythms*: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

IX. Course Code: - ZD504T
Course title: - Biology of Insecta
Semester: - B.Sc. 5th Semester (FYUGP)

CBCS Undergraduate Program, 2018: Zoology Honours (Last updated on 08-04-2019)

Course Code: ZD504T

DSE Course IV: BIOLOGY OF INSECTA

THEORY	(Credits 4) (Lectures=60)
Unit I: Introduction	4 Lectures
General Features of Insects	
Distribution and Success of Insects on the Earth	
Unit II: Insect Taxonomy	4 Lectures
Basis of insect classification; Classification of insects up to orders	
Unit III: General Morphology of Insects	8 Lectures
External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits	
Thorax: Wings and wing articulation, Types of Legs adapted to diverse habitat	
Abdominal appendages and genitalia	
Unit IV: Physiology of Insects	28 Lectures
Structure and physiology of Insect body systems - Integumentary, digestive, excretory, circulatory, respiratory, endocrine and reproductive.	
Sensory receptors and nervous system	
Growth and metamorphosis	
Unit IV: Insect Society	6 Lectures
Group of social insects and their social life	
Social organization and social behaviour (w.r.t. any one example)	
Unit V: Insect Plant Interaction	4 Lectures
Theory of co-evolution, role of allelochemicals in host plant mediation	
Host-plant selection by phytophagous insects, Insects as plant pests	
Unit VI: Insects as Vectors	6 Lectures
Insects as mechanical and Biological vectors, Brief discussion on houseflies and mosquitoes as important insect vectors	

**Course Code: ZD504P
BIOLOGY OF INSECTA**

PRACTICAL

(CREDITS 2)

1. Study of one specimen from each insect order
2. Study of different kinds of antennae, legs and mouth parts of insects
3. Study of head and sclerites of any one insect
4. Study of insect wings and their venation.
5. Prepare permanent slide of insect spiracles
6. Methodology of collection, preservation and identification of insects.
7. Morphological studies of various castes of *Apis*, and *Odontotermes*
8. Study of any three insect pests and their damages
9. Study of any three beneficial insects and their products

Field study of insects and submission of a project report on the insect diversity

SUGGESTED READINGS

- A general text book of entomology, Imms , A. D., Chapman & Hall, UK
- The Insects: Structure and function, Chapman, R. F., Cambridge University Press, UK
- Principles of Insect Morphology, Snodgrass, R. E., Cornell Univ. Press, USA
- Introduction to the study of insects, Borror, D. J., Triplehorn, C. A., and Johnson, N. F., M Saunders College Publication, USA
- The Insect Societies, Wilson, E. O., Harward Univ. Press, UK
- Host Selection by Phytophagous insects, Bemays, E. A., and Chapman, R. F., Chapman and Hall, New York, USA
- Physiological system in Insects, Klowden, M. J., Academic Press, USA
- The Insects, An outline of Entomology, Gullan, P. J. , and Cranston, P. S., Wiley Blackwell, UK
- Insect Physiology and Biochemistry, Nation, J. L., CRC Press, USA