

**Choice Based Credit System (CBCS) Scheme for 2<sup>nd</sup> Semester**

Course Code	Course Title	Course Type	Hours / Week			Credits	Examinations / Marks		
			L	T	P		Continuous Assessment I	Continuous Assessment II	Term End Examination
ZO17201CR	Anatomy and Physiology of Mammals	Core	4	0	0	4	25 marks	25 marks	50 marks
ZO17202CR	Ethology and Developmental Biology	Core	4	0	0	4	25 marks	25 marks	50 marks
ZO17203CR	Seminar (1 credit) + Practical (3 credits)	Core	0	2	6	1+3	25 marks	-	75 marks
ZO17204DCE	Morphology, Anatomy and Physiology of Fishes	Discipline Centric	3	0	0	3	25 marks	-	50 marks
ZO17205DCE	Aquaculture and Nutrition	Discipline Centric	3	0	0	3	25 marks	-	50 marks
ZO17206DCE	Lab course & Field study	Discipline Centric	0	0	4	2	-	-	50 marks
ZO17003GE	Basic and Applied Entomology	Generic Elective	2	0	0	2	-	-	50 marks
ZO17004GE	Conservation Biology and Wildlife Resource Management	Generic Elective	2	0	0	2	-	-	50 marks
ZO17002OE	Parasitology in relation to Public Health	Open Elective	2	0	0	2	-	-	50 marks

**GENERAL INSTRUCTIONS**

1. A candidate has to obtain 24 credits per semester *i.e.*, 96 credits in two year programme (4 semesters).
2. Out of 24 credits in a semester, a candidate has to compulsorily obtain 12 credits from “**Core Courses**” (CR) while the remaining 12 credits can be obtained from the “**Electives**” in the following manner:
  - ▶ A candidate has to obtain 8 credits from his/her own Department as **Discipline Centric Electives (DCE)**.
  - ▶ 4 credits shall be obtained by a candidate from the **Electives** offered by the Departments other than his/her own. A candidate shall be free to obtain these 4 credits from the **Generic** or **Open Electives** or a combination of both; however, all 4 credits can be obtained from Generic Electives, but a maximum of 2 credits can be obtained from Open Electives.
3. Maximum Marks per Credit = 25 (One unit is equivalent to one credit).
4. One Credit in Theory is 16 hours direct teaching learning; where as in Practicals and Tutorials it is 32 hours.

Course No.: ZO17201CR

Course Title: Anatomy and Physiology of Mammals

Total Credits: 4 (4 L + 0 T + 0 P)

Maximum Marks: 100 (25 + 25 + 50)

### Unit I: Digestive & Respiratory Systems

- 1.1 Structure of digestive system & associated glands
- 1.2 Physiology of digestion, absorption, energy balance, BMR
- 1.3 Structure of Lungs. Transport & exchange of respiratory gases and regulation of respiration
- 1.4 Cell Respiration: Glycolysis, TCA Cycle and ETC

### Unit II: Circulatory & Excretory systems

- 2.1 Structure and function of heart
- 2.2 Structure and functions of blood, haemostasis
- 2.3 Ultra-structure of kidney; conducting system
- 2.4 Physiology of excretion-urine formation, micturition, regulation of water balance

### Unit III: Neuro- Endocrine System

- 3.1 Nervous tissue, structure and types of neurons and neuroglia; Physiology of nerve conduction
- 3.2 Gross anatomy of brain and spinal cord, peripheral and autonomous nervous system
- 3.3 Endocrine glands and their functions
- 3.4 Neuro-endocrine regulation and hormonal-disorders

### Unit IV: Receptor physiology

- 4.1 Receptors- general account
- 4.2 Gustatory and Olfactory receptors with their physiology
- 4.3 Structure and function of ear
- 4.4 Structure and function of eye

### Suggested Books / Reading Material

1. Animal Physiology by Fred Hainsworth
2. Animal Physiology – Adaptation and Environment by Knut Schmidt Nielsen
3. Animal Physiology – Adaptations & Principles by Malcoms S. Gordon
4. Animal Physiology by Eckert & Randall
5. Animal Physiology by James Anderson
6. Animal Physiology by Kent
7. Animal Physiology by Richard D. Jurd
8. Animal Physiology by Richard W. Hill, Gordon A. Wyse & Magarat Anderson
9. Biological Science by Tylor *et al.*
10. Biology Today by Sandra S. Gottfried
11. Comparative Animal Physiology by Philip C. Withers
12. Comparative Physiology by B. T. Scheer
13. Essentials of Animal Physiology by S. C. Rastogi
14. General & Comparative Physiology by William S. Hoar
15. Invertebrate Structure & Function by E. J. W. Barrington
16. Physiology of marine Animals by Winona B. Vernberg & F. John Vernberg
17. Textbook of Animal Physiology by R. Nagabhushanam

Course No.: ZO17202CR

Course Title: **Ethology and Developmental Biology**

Total Credits: **4** (4 L + 0 T + 0 P)

Maximum Marks: **100** (25 + 25 + 50)

### **Unit I: Behavioural Development**

- 1.1 Home range, Territoriality, Dispersal and Habitat selection
- 1.2 Food selection and optimal foraging theory
- 1.3 Genetic and environmental components in the development of behaviour
- 1.4 Neural basis of behavior: Stimulus filtering, Biological rhythms

### **Unit II: Social Behavior and Behavioral Adaptations**

- 2.1 Social organization in insects and primates
- 2.2 Parental care and nesting habits in birds
- 2.3 Behavioural adaptations in mammals and birds
- 2.4 Communication in animals: auditory, visual, chemical and tactile

### **Unit III: Reproductive and Learning Behaviour**

- 3.1 Courtship and mating systems
- 3.2 Parental investment and reproductive strategies
- 3.3 Learning behaviour in vertebrates
- 3.4 Migration in insects and fishes

### **Unit IV: Developmental Biology of Birds and Mammals**

- 4.1 Gametogenesis, Fertilization and Cleavage
- 4.2 Blastulation and implantation of blastocyst (Mammals)
- 4.3 Extra embryonic foetal membranes – formation, structure and function.
- 4.3 Natural and artificial parthenogenesis. Significance of parthenogenesis.

### **Suggested Books / Reading Material**

1. *Animal Behaviour- an Evolutionary Approach* by **John Alcock** Sinauer Associates, Inc Publishers Sunderland, Massachusetts
2. *Animal Behaviour* by **M.P. Arora** Himalaya Publishing House
3. *Animal Behaviour* by **Anbery**
4. *Principles and Animal Development* by **S. C. Goel**
5. *Mechanism of Animal Behaviour* by **Peter Marker and J. Hamilton**, Jhon Wiley & Sons USA
6. *An introduction to Animal Behaviour* by **Manning and Dawkins**, Cambridge University Press

Course Code: ZO17203CR

Course Title: Practicals based on 201CR & 202CR

Total Credits: 4 (0 L + 1T\* + 3 P)

Maximum Marks: 100 (25 + 75)

**a. Seminar\***

**b. List of practicals**

1. Study of histological slides– T. S. of Stomach, Intestine, liver, and lungs
2. Demonstration of enzyme action on starch
3. Determination of blood groups, bleeding time, TLC and DLC of human blood
4. Study of various organ systems through dissection of Rat
5. Study of skeletal elements of Rabbit
6. Study of various endocrine glands through prepared slides
7. Study of various organs of sheep– brain/ eye/ heart/ kidney
8. Study of various types of bird nests
9. Investigation of hydrotaxis, chemotaxis and phototaxis in earthworm
10. Field exercises to study various types of behaviour in animals
11. Study of gametogenesis through prepared slides
12. Study of invertebrate and vertebrate egg specimens (insects, fishes, frog and hen)
13. Study of preserved specimens of human foetus of three trimesters
14. Chick embryology

**\*Seminar:**

- ✓ A Seminar lecture on a topic of Zoological interest, carrying 1 credit, shall be allotted at the start of M. Sc. 2<sup>nd</sup> semester. The students shall be allotted a teacher under whose supervision they shall have to prepare the seminar lecture. A schedule shall be notified for delivering the seminar lectures by the students to be attended by all students and the faculty.
- ✓ The seminar lecture shall carry 20 marks to be evaluated on the basis of three criteria viz., content, presentation and interaction. The seminar lecture shall be evaluated by the concerned teacher and in case the concerned teacher is not present, then the senior most teacher present in the seminar shall evaluate the student.
- ✓ 5 marks shall be given on the basis of attendance of the students in all the seminar lectures delivered.

Course Code: ZO17204DCE

Course Title: **Morphology, Anatomy and Physiology of Fishes**

Total Credits: **3** (3 L + 0 T + 0 P)

Maximum Marks: **75** (25 + 50)

### **Unit I: Systematics and Morphology**

- 1.1. Outline classification of fishes with distinguishing characters upto principal subdivisions
- 1.2. General account on adaptive radiation in Elasmobranchii and Actinopterygii
- 1.3. Structure types and modification of scales
- 1.4. Structure types and modification of fins

### **Unit II: Fish Anatomy and Physiology I**

- 2.1. Digestive system and physiology of digestion
- 2.2. Structure and function of gills
- 2.3. Structure and function of Heart and blood vessels
- 2.4. Structure and function of Kidneys (Excretion and Osmoregulation)

### **Unit III: Fish Anatomy and Physiology II**

- 3.1. Structure and function of nervous system (Teleost)
- 3.2. Structure and function of Endocrine Organs
- 3.3. Sense organs and their functions
- 3.4. Reproductive organs in fishes (Teleost)

### **Suggested Books / Reading Material**

1. Fishes: An Introduction to Ichthyology by Peter B. Moyle, Joseph J., Cech Jr. Prentice Hall India Learning Private Limited
2. A Text Book of Fish Biology & Fisheries by S S Khanna and H R Singh Narendra Publishing House
3. An Introduction to Fishes by H.S. Bhamrah, Kavita Juneja Anmol Publications Pvt Ltd
4. Fish and Fisheries by B.N. Yadav Daya Publishing House
5. Fundamentals of Ichthyology by S. P. Biswas
6. Fish in Nutrition. Eirik Heen and Rudolf Kreuzer, Fish News Book Ltd. FAO 1962 Ludgate House London.
7. Fish Nutrition & Feed Technology. S. Athithan N. Felix & N. Venkatasany. Daya Publishing House, New Delhi 2012.
8. Fish Nutrition in Aquaculture. Y. S. Chandrasekhar Swatik Publication New Delhi 2014.

Course Code: ZO17205DCE  
Total Credits: **3** (3 L + 0 T + 0 P)

Course Title: **Aquaculture and Nutrition**  
Maximum Marks: **75** (25 + 50)

### **Unit I: Aquaculture**

- 1.1. Aquaculture criteria and practices, role of aquaculture in food supply, application of biotechnology in aquaculture
- 1.2. Principle of organic aquaculture, procurement of stocking material for aquaculture
- 1.3. Site selection, construction and management of fish pond
- 1.4. Induced breeding in fishes

### **Unit II: Culture Techniques**

- 2.1. Trout and carp culture
- 2.2. Brackish water fish culture
- 2.3. Prawn and pearl culture
- 2.4. Integrated fish farming, composite/polyculture

### **Unit III: Fish Nutrition**

- 3.1. Macronutrients: Protein, lipid and carbohydrate requirement of fishes
- 3.2. Micronutrients: Vitamins and mineral requirement and their deficiency symptoms
- 3.3. Fish feed ingredients, proximate composition and formulation of fish feed
- 3.4. Types of fish feed: Moist, semi-moist, dry, crumbles, flakes and micro encapsulated feed

### **Suggested Books / Reading Material**

1. Fish Physiology, Series I-XIV by Hoar and Randall Academic Press
2. The Physiology of Fishes CRC Press by Evans
3. The Physiology of Fishes Vol. I & II Academic Press by Brown

Course Code: **ZO17206DCE**

Course Title: Practicals course based on 204 & 205 DCE

Total Credits: **2** (0 L + 0 T + 2 P)

Maximum Marks: **50**

### **I. Field work**

Visit to various local water bodies, fish hatcheries and aquarium for demonstration, study and collection of specimens.

### **II. List of Laboratory Practicals**

1. Study of morphometric and meristic characters of fish
2. Study of fish scales and determination of age
3. Gut content analysis to study feeding habits of fish
4. Dissection of accessory respiratory organs in fishes (*Anabus* / *Clarias* / *Heteropneustes*)
5. Extraction of Weberian ossicles and Otolith from fish
6. Dissection of fish to study internal anatomy
7. Determination of fecundity in fishes (Carps and *Schizothorax*)
8. To study different organs of fish through histological slides
9. Preparation of temporary and permanent slides of various organs of fishes
10. Estimation of haemoglobin and TLC and DLC
11. Estimation of moisture and ash from fish and available feed ingredients
12. Estimation of protein and fat in fish and available feed ingredients



Course Code: ZO17003GE

Course Title: **Basic and Applied Entomology**

Total Credits: **2** (2 L+ 0 T + 0 P)

Maximum Marks: **50**

**Unit I: Basic Entomology**

- 1.1 Gross external morphology of insects
- 1.2 Mouthparts of Cockroach
- 1.3 Antennae of insects
- 1.4 Insect leg and its modifications

**Unit II: Applied Entomology**

- 2.1 Pheromones-types and uses
- 2.2 Insect resistance to chemical pesticides
- 2.3 Genetic control of Insects- methods and successful examples
- 2.4 Role of IPM in insect pest control

**Suggested Books / Reading Material**

1. *Modern Entomology* by **D. B. Tembhare** Himalaya Publishing House
2. *A text book of Applied Entomology –Vol. II* by **K. P. Srivastava** Kalyani Publishers
3. *A text book of Applied Zoology* by **Pradip V. Jabde**



Course Code: **ZO17004GE**      Course Title: **Conservation Biology and Wildlife Resource Management**  
Total Credits: **2** (2 L + 0 T + 0 P)      Maximum Marks: **50**

**Unit I: Conservation Biology**

- 1.1 IUCN protected area categories, Marine protected areas
- 1.2 Protected area network in India
- 1.3 Key stone species: the concept and its relevance for conservation
- 1.4 *In situ* and *ex situ* conservation

**Unit II: Wildlife Resource Management**

- 2.1 Wildlife Protection Act (1972), its brief structure and recent amendments
- 2.2 Wildlife protection act of J & K– An overview
- 2.3 Conservation projects in India: Tiger, Hangul and Crocodile
- 2.4 Wildlife conventions: Ramsar, Bonn, CITES.

**Suggested Books / Reading Material**

1. Fundamentals of wildlife Management - 2nd edition) Rajesh Gopal (2012) Natraj Publishers, Dehradun India
2. Wilderness Wildlife G. A. Bhat (2008) Book Vision Hazratbal Srinagar
3. Conservation Biology. Richard B. Primack( 2017). Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, U.S.A
4. A Primer of Conservation Biology. Richard B. Primack (2012). Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, U.S.A

Course Code: ZO17002OE

Course Title: Parasitology in Relation to Public Health

Total Credits: 2 (2 L + 0 T +0 P)

Maximum Marks: 50

### Unit I: Introduction to Parasitology

- 1.1 Introduction to animal associations
- 1.2 Distribution of parasites in animal kingdom
- 1.3 Introduction to Protista with special reference to protistan parasites of man in Kashmir valley
- 1.4 Description, life-cycle, pathogenicity and control of *Entamoeba histolytica*

### Unit II: Medical Helminthology

- 2.1 Cestode parasites of man with reference to life cycle, pathogenicity and control of *Taenia saginata*
- 2.2 Trematode parasites of man with special reference to life-cycle, pathogenicity and control of *Schistosoma haematobium*
- 2.3 Nematode parasite of man with special emphasis on description, life- cycle, pathogenicity and control of *Enterobius vermicularis*

### Suggested Books / Reading Material

1. *Parasitology* by Elmer R. Nobel and Glenn A. Noble
2. *Animal Parasitology* by J. D. Smyth
3. *Parasitology (Protozoology & Helminthology)* by K. D. Chatterjee
4. *Foundations of Parasitology* by Gerald D. Schmidt and Larry S. Roberts
5. *General parasitology* by Thomas C. Cheng
6. *Foundations of Parasitology* by Larry S. Roberts, John Janovy and Steve Nadler

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