

**Choice Based Credit System (CBCS) Scheme for 2nd Semester
(Batch-2021 onwards)**

Course Code	Course Title	Course Type	Hours / Week			Credits	Examinations / Marks	
			L	T	P		Internal Assessment	Term End Examination
ZO021201CR	Anatomy and Physiology of Mammals	Core	4	0	0	4	20 Marks	80 Marks
ZO021202CR	Animal Behaviour and Developmental Biology	Core	4	0	0	4	20 Marks	80 Marks
ZO021203CR	Wildlife Management	Core	2	0	0	2	10 Marks	40 Marks
ZO021204CR	Laboratory Course 03	Core	0	0	8	4	20 Marks	80 Marks
ZO021205DCE	Morphology, Anatomy and Physiology of Fishes	Discipline Centric	3	0	0	3	15 Marks	60 Marks
ZO021206DCE	Aquaculture and Nutrition	Discipline Centric	3	0	0	3	15 Marks	60 Marks
ZO021207DCE	Laboratory Course 04	Discipline Centric	0	0	4	2	10 Marks	40 Marks
ZO02102GE	Laboratory Course 04	Generic Elective	2	0	0	2	10 Marks	50 Marks
ZO02102OE	Parasitology in Relation to Public Health	Open Elective	2	0	0	2	10 Marks	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 14 credits from **“Core Courses” (CR)** while the remaining 10 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)**.
 - ▶ 2 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 2 credits from the **Generic or Open Electives**.
 - ▶ A candidate has the option to opt for **MOOC's** in place of **GE/OE**.
3. Maximum Marks per Credit are 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.: **ZOO21201CR**

Course Title: **Anatomy and Physiology of Mammals**

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

Maximum Marks: **100 (20 + 80)**

Course objective: To understand the structure and functional aspects of different organ systems in mammals especially digestive, circulatory, excretory & neuro-endocrine systems and sense organs.

Course outcome: The students shall utilise the knowledge in understanding the working of different organ systems of mammals and the mechanisms of disorders in these organ systems.

Unit I: Digestive & Respiratory System (16 Hours)

Structure of digestive system & associated glands; physiology of digestion, absorption and assimilation; structure of lungs, transport & exchange of respiratory gases & regulation of respiration; cell respiration: glycolysis, TCA cycle and etc.

Unit II: Circulatory & Excretory System (16 Hours)

Structure and function of heart; composition and function of blood, haemostasis; structure of kidney; physiology of excretion-urine formation, micturition, regulation of water balance.

Unit III: Neuro- Endocrine System (16 Hours)

Central nervous system: brain and spinal cord; peripheral nervous system: cranial and spinal nerves; structure, function, regulation and disorders of endocrine glands: pituitary, thyroid, parathyroid, pineal, thymus; structure, function, regulation and disorders of partly endocrine glands: pancreas, gonads, placenta.

Unit IV: Sense Organs and Receptors (16 Hours)

Receptors- general account; gustatory and olfactory receptors with their physiology; eye and physiology of vision; ear and physiology of hearing.

Suggested Books / Reading Material

1. Animal Physiology – Adaptation and Environment by Knut Schmidt Nielsen
2. Animal Physiology by Eckert & Randall
3. Animal Physiology by James Anderson
4. Comparative Physiology by B. T. Scheer
5. Essentials of anatomy and physiology by Seeley, Stephans and Tate
6. Essentials of Animal Physiology by S. C. Rastogi
7. General & Comparative Physiology by William S. Hoar
8. Textbook of Animal Physiology by R. Nagabhushanam

Course No.: **ZOO21202CR** Course Title: **Animal Behaviour and Developmental Biology**
Total Credits: **4** (4 L + 0 T + 0 P) Maximum Marks: **100** (20 + 80)

Course objective: To understand behavioural attributes and developmental aspects of animals

Course outcome: The students will utilize the knowledge in understanding various patterns of behaviour in a variety of taxa and different stages that occur in the development of animals

Unit I: Behaviour Development (16 Hours)

Home range, territoriality, dispersal, habitat selection; food selection and optimal foraging theory, criticisms of optimal foraging theory; genetic and environmental components in the development of behaviour; neural basis of behavior: stimulus filtering, biological rhythms.

Unit II: Social and Parental Behaviour (16 Hours)

Social organization in insects and primates; parental care and nesting habits in birds; parental care in mammals; communication in animals: auditory, visual, chemical and tactile.

Unit III: Reproductive and Learning Behaviour (16 Hours)

Courtship and mating systems; parental investment and reproductive strategies; learning behaviour in vertebrates; migration in insects; migration in mammals with special reference to aerial and aquatic mammals.

Unit IV: Developmental Biology (16 Hours)

Cleavage and formation of morula; formation and implantation of blastocyst; gastrulation in mammals; extra embryonic membranes– formation, structure and function; natural and artificial parthenogenesis; significance of parthenogenesis;

Suggested Books / Reading Material

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

(Value Added Course)

Course No.: **ZOO21203CR**

Course Title: **Wildlife Management**

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

Maximum Marks: **50** (10 + 40)

Course objective: To endow knowledge about management of threatened wildlife fauna at national and regional level

Course outcome: The students can work in various government and non government organizations and can act as leaders in animal conservation.

Unit-I: Wildlife Management I (16 Hours)

Introduction and importance of wildlife; protected area network in India; control and management of forest fire and soil erosion; human- wildlife conflict: causes, consequences and management.

Unit-II: Wildlife Management II (16 Hours)

Protected area network in j&k; conservation status of hangul, markhor and tibetan antelope; wetlands: introduction, types, threats and management; threatened fauna of jammu and kashmir.



Suggested Books / Reading Material

1. Fundamentals of Wildlife Management (2nd edition) by Rajesh Gopal Natraj Publishers, Dehradun India
2. Managing our Wildlife resources by S. A. Anderson
3. Wilderness Wildlife by G. A. Bhat, Book Vision Hazratbal Srinagar
4. Biodiversity of the Himalaya: Jammu and Kashmir State by G.H. Dar & Anzar A. Khuroo, Springer Nature Singapore Pte Ltd
5. Indian Mammals by Vivek Menon, Wildlife Trust of India

Course Code: **ZOO21204CR**
Total Credits: **4** (0 L + 0 T + 4 P)

Course Title: **Laboratory Course 03**
Maximum Marks: **100** (20 + 80)

A. Field Survey: (20 Marks)

One-week field study cum collection trip within the UT's of J&K and Ladakh. Each student/group of students shall have to submit the collection of specimens for the departmental museum along with survey report.

B. Practical's: (80 Marks)

Duration: 128 Hours

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 and estimation of haemoglobin
4. Determination of TLC & DLC, Total Erythrocyte Count (TEC) & ESR of human blood
5. Study of various organ systems through dissection of Rat
6. Study of skeletal elements of Rabbit
7. Study of various endocrine glands through prepared slides
8. Study of various organs of sheep – brain/ eye/ heart/ kidney
9. Study of various types of bird nests
10. Investigation of hydrotaxis, chemotaxis and phototaxis in earthworm
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 fetus of three trimesters
14. Study of fetal membranes through prepared slides / charts
15. Identification and survey of museum specimens of Amphibia
16. Identification and survey of museum specimens of Reptilia
17. Identification and survey of museum specimens of Aves
18. Identification and survey of museum specimens of Mammalia
19. Field exercises to study various types of behaviour in animals

Suggested Books / Reading Material

1. A Manual of Practical Zoology by P. S. Verma
2. A laboratory manual and text-book of embryology. (1918) W.B. Saunders Company, Philadelphia and London.
3. A Textbook of Vertebrate Practical Zoology by Vivekan and Banerjee
4. Clinical Physiology y, Banerjee Ashis
5. Practical Zoology: Vertebrate (English, Rastogi Publications, S.S.Lal)

Course Code: **ZOO21205DCE** Course Title: **Morphology, Anatomy and Physiology of Fishes**
Total Credits: **3** (3 L + 0 T + 0 P) (Maximum Marks: **75** (15 + 60))

Course objective: Classification and evolution of fishes, modification of various body structures, knowledge about the structure and function of various organs

Course outcome: The course will be helpful to students by providing in-depth knowledge to taxonomy of major groups of fishes, evolutionary history, their morphology, physiology and anatomy. Specifically, the students will become familiar with fish taxonomy and fish identification (especially regional freshwater fishes) and will be provided knowledge about local aquatic habitats besides the students will also know the anatomy and physiology of fishes their mode of feeding and digestion, respiration, circulation, excretion as well as sensory system.

Unit I: Systematics and Morphology (16 Hours)

Introduction to ichthyology; tools of fish classification; outline classification of fishes with distinguishing characters up to principal sub-divisions with special emphasis on berg's scheme; general account on adaptive radiation in elasmobranchii and actinopterygii; structure, types and modification of scales and fins.

Unit II: Fish Anatomy and Physiology-I (16 Hours)

Digestive system and physiology of digestion; structure and function of gills; structure and function of heart and blood vessels; structure and function of kidneys (excretion and osmoregulation).

Unit III: Fish Anatomy and Physiology-II (16 Hours)

Structure and function of nervous system (teleost); structure and function of endocrine organs; sense organs and their functions, lateral line and neuromast; reproductive organs in fishes (teleost).

Suggested Books / Reading Material

1. A Text Book of Fish Biology & Fisheries by S S Khanna and H R Singh Narendra Publishing House
2. An Introduction to Fishes by H.S. Bhamrah, Kavita Juneja, Anmol Publications Pvt. Ltd
3. An Introduction to Ichthyology by Peter B. Moyle, Joseph J., Cech Jr.
4. Fish and Fisheries by B.N. Yadav Daya Publishing House
5. Fish Physiology, Series I-XIV by Hoar and Randall Academic Press
6. Fundamentals of Ichthyology by S. P. Biswas
7. Ichthyology handbook by Kapoor, B. G., & Khanna, Springer Science
8. Talwar, P. K. (1991). Inland fishes of India and adjacent countries CRC Press.
9. The Physiology of Fishes by Evans
10. The Physiology of Fishes Vol. I & II by Brown.

(Value Added Course)

Course Code: **ZOO21206DCE**

Course Title: **Aquaculture and Nutrition**

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

Maximum Marks: **75** (15 + 60)

Course objective: Basic knowledge about the aquaculture, construction of ponds and their management, Culture techniques of some commercially important organisms, basic knowledge about the feeds, formulation and feeding.

Course outcome: The course will give a theoretical basis and practical experience for understanding of the principles in aquatic food production especially important ones. Fish health management is one of the important sustainability goals for aquaculture industry. It will also cover introduction to various nutritional requirements for better growth and production and formulation of fish feed for aquaculture. This course will be helpful in generation of self-employment by rearing of fishes in backyard ponds on small as well as large scale.

Unit I: Aquaculture

(16 Hours)

Aquaculture: status and prospects, criteria and practices (types of farming systems); application of biotechnology in aquaculture; site selection, construction and management of fish ponds; induced breeding: hypophysation and use of different synthetic hormones, significance of induced breeding, wet and dry bundh technique for breeding of indian major carps; pathogenic (bacterial, viral and fungal) and other diseases in fishes.

Unit II: Culture Techniques

(16 Hours)

Trout and carp culture; brackish water fish culture; prawn culture: culture method of giant freshwater prawn- *Macrobrachium rosenbergii*; pearl culture technique with special emphasis on *Pinctada spp.*; composite fish culture and integrated fish farming.

Unit III: Fish Nutrition

(16 Hours)

Macronutrients: protein, amino acids, lipid and carbohydrate requirement of fishes; micronutrients: vitamins and mineral requirement and their deficiency signs; fish feed ingredients, antinutritional factors, proximate composition and formulation of fish feed; types of fish feed: moist, semi-moist, dry; use of probiotics in aquaculture.

Suggested Books / Reading Material

1. A Text Book of Fish Biology & Fisheries by S.S Khanna and H.R Singh.
2. Aquaculture by John E. Bardach
3. Fish and fisheries of India by Jhingran, V. G. (1975).
4. Fish diseases and disorders by Woo, P. T. & Leatherland, J. F.
5. Fish in Nutrition. Eirik Heen and Rudolf Kreuzer, Fish News Book Ltd. FAO 1962
6. Fish Nutrition & Feed Technology by S. Athithan N. Felix & N. Venkatasany
7. Fish Nutrition in Aquaculture. Y.S.Chandrasekhar Swatik Publication New Delhi
8. Aquaculture: principles and practices by Pillay, T. V. R. & Kutty, M. N.
9. Text Book of Fish Culture by Marcel Heut

(Value Added Course)

Course Code: **ZOO21207DCE**
Total Credits: **2 (0 L + 0 T+2 P)**

Course Title: **Laboratory Course 04**
Maximum Marks: **50 (10+40)**

A. Field Survey: (10 Marks)

Visit to various local water bodies, fish hatcheries and aquaria for demonstration, study and collection of specimens. Students are required to present a detailed report of the survey.

B. Practical's: (40 Marks)

Duration: **64 Hours**

1. General survey of Elasmobranchi, Holocephali, Dipnoi and Teleostei
2. Study of morphometric and meristic characters of fish
3. Identification and classification of fishes of Jammu and Kashmir
4. Gut content analysis to study feeding habits of fish
5. Dissection of accessory respiratory organs in fishes (*Anabus / Clarias / Heteropneustes*)
6. Dissection of fish to study internal anatomy
7. To study different organs of fish through histological slides
8. Preparation of temporary and permanent slides of various organs of fishes Physico-chemical parameters of water viz., Temperature, pH, conductivity, transparency, Total alkalinity, Dissolved oxygen, Free CO₂
9. Study of fish scales and determination of age
10. Determination of fecundity in fishes (Carp and *Schizothorax*)
11. Study of different adaptations in hill stream fishes
12. Extraction of Weberian ossicles and otolith from fish
13. Study of the electric organs and their nervous innervations in Torpedo
14. Estimation of hemoglobin, hematocrit and TLC and DLC
15. Estimation of moisture and ash from fish and available feed ingredients
16. Estimation of protein and fat in fish and available feed ingredients
17. Estimation of fat in fish and available feed ingredients
18. Collection and preservation of local fauna.

Suggested Books / Reading Material

1. Fish and Fisheries of India by Jhingran, V. G. (1975).
2. Practical Manual on Fish Nutrition and Feed Technology by S. Vinodh M. Kannan, P. Ranchana
3. Practical Manual of Fish Biology by AK Jaiswar

(Value Added Course)

Course Code: **ZOO21002GE**
Total Credits: **2 (2 L+ 0 T +0 P)**

Course Title: **Basic & Applied Entomology**
Maximum Marks: **50**

Course objective: To aware the students about the fundamentals of applied entomology

Course outcome: The imparted knowledge will be utilized for human welfare

Unit I: Basic Entomology

(16 Hours)

Gross external morphology of insects; mouthparts of cockroach; structure of insect antennae and its types; structure of insect leg and its modifications

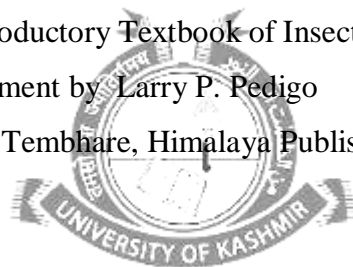
Unit II: Applied Entomology

(16 Hours)

Pheromones-types and uses; Insect resistance to chemical pesticides; IPM: concept, strategies and tools in pest management; Role of IPM in insect pest control.

Suggested Books / Reading Material

1. A text book of Applied Entomology-vol II by K.P. Shrivastava Kalyani Publishers
2. A text book of Applied Zoology by Pradip V. Jabde
3. Applied Entomology: An Introductory Textbook of Insects by Henry Torsey Fernald
4. Entomology and pest management by Larry P. Pedigo
5. Modern Entomology by D.B. Tembhare, Himalaya Publishing House



(Value Added Course)

Course Code: **ZOO21002OE**

Course Title: **Parasitology in relation to Public Health**

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

Maximum Marks: **50**

Course objective: To aware the students about the nature of parasitic diseases their pathogenicity, mode of transmission and diagnosis of local parasitic diseases.

Course outcome: The knowledge will be utilized for the prevention/control of parasitic diseases

UNIT 1: Introduction to Parasitology

(16 Hours)

Introduction to animal associations; distribution of parasites in animal kingdom; introduction to protozoa with special reference to protozoan parasites of man in Kashmir valley; description, life-cycle, pathogenicity and control of *Entamoeba histolytica* & *Giardia intestinalis*.

UNIT 2: Medical Helminthology

(16 Hours)

Cestode parasites of man with reference to life-cycle, pathogenicity and control of *Taenia saginata*; trematode parasites of man with special reference to life-cycle, pathogenicity and control of *Schistosoma haematobium*; nematode parasite of man with special emphasis on description, life-cycle, pathogenicity and control of *Enterobius vermicularis*; life-cycle, pathogenicity and control of *Ascaris lumbricoides*.

Suggested Books / Reading Material

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