## POST GRADUATE DEPARTMENT OF ZOOLOGY
### UNIVERSITY OF KASHMIR
### CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME FORMAT SEMESTER—2\textsuperscript{nd}

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Paper Category</th>
<th>Hours/Week</th>
<th>Credits</th>
<th>Theory Marks</th>
<th>Practical Marks</th>
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<tr>
<td>Zoo-201-CR</td>
<td>Anatomy and Physiology of Mammals</td>
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<td>Generic Elective</td>
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<td>Contact hours= 42</td>
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### GENERAL INSTRUCTIONS FOR THE CANDIDATES

1. A candidate has to obtain a minimum of 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 obtain 12 credits compulsorily from “Core Courses” while the remaining 12 credits can be obtained from the “Electives” in the following manner:
   - A candidate can obtain a maximum of 6 credits within his/her own Department out of the specializations offered by the Department as Discipline Centric Electives.
   - 6 credits shall be obtained by a candidate from the Electives offered by the Departments other than his/her own. The candidate shall be free to obtain these 6 credits from the Generic or Open Electives or a combination of both.
3. A candidate can go with a slow pace and obtain only 20 credits in a semester or 32 credits at a high pace per semester, so as to maintain a total score of 96 credits or above in a 2-year programme (4 semesters).
ZOO-201-CR: ANATOMY AND PHYSIOLOGY OF MAMMALS

Total Credits: 4 (3 Lecture + 0 Tutorial + 1 Practical)

Maximum Marks: 100 (25/Credit)*  [Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)

*Note: One unit is equivalent to one credit

UNIT I: ANATOMY AND PHYSIOLOGY – 1

1.1 Digestive system: Physiology of digestion, absorption, energy balance, BMR
1.2 Respiratory system: Comparison of respiration in land and aquatic mammals, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration
1.3 Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of the above
1.4 Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, human blood groups, haemostasis

UNIT II: ANATOMY AND PHYSIOLOGY – 2

2.1 Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance.
2.2 Nervous system: Neurons, gross anatomy of the brain and spinal cord, peripheral and autonomous nervous system, nerve conduction
2.3 Sense organs: Vision and hearing
2.4 Physiology of muscle contraction

UNIT III: ANATOMY AND PHYSIOLOGY – 3

3.1 Skeleton system: Pectoral and pelvic girdles and limbs
3.2 Endocrinology: Endocrine glands and their functions
3.3 Neuroendocrine regulation and hormonal disorders
3.4 Thermoregulation in Animals: Homoeotherms, Poikilotherms; Aestivation and Hibernation

UNIT IV: PRACTICAL WORK

4.1 Study of histological slides – T. S. of Stomach, Intestine, liver, lungs, testis and ovary
4.2 Determination of the bleeding time and TLC and DLC of human blood
4.3 Study of various organ systems through dissection of Rat
4.4 Study of skeletal elements of Rabbit
4.5 Study of various endocrine glands through prepared slides
4.6 Study of various organs of sheep – brain/ eye/ heart/ kidney

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. Jurid
8. Animal Physiology by Richard W. Hill, Gorden 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
P. G. Department of Zoology  
Syllabus CBCS 2015  
University of Kashmir, Srinagar  
2nd Semester

12. Comparative Physiology by B. T. Scheer  
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

ZOO-202-CR: ETHOLOGY AND DEVELOPMENTAL BIOLOGY 
Total Credits: 4 (3 Lecture + 0 Tutorial +1 Practical) 
Maximum Marks: 100 (25/Credit)*  
[Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.] 
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate) 
*Note: One unit is equivalent to one credit

UNIT I: ECOLOGICAL AND SOCIAL BEHAVIOUR  
1.1 Home range, Territoriality and Dispersal, Habitat and food selection, optimal foraging theory  
1.2 Genetic and environmental components in the development of behaviour  
1.3 Social organization in insects and primates  
1.4 Parental care and nesting habits in amphibians and birds

UNIT II: REPRODUCTIVE AND LEARNING BEHAVIOUR  
2.1 Courtship, mating system and role of pheromones in behaviour  
2.2 Parental investment and reproductive strategies  
2.3 Learning behaviour in vertebrates  
2.4 Migration in insects, fishes and mammals

UNIT III: DEVELOPMENTAL BIOLOGY  
3.1 Gametogenesis, process of blastulation, gastrulation and fate map construction in mammals  
3.2 Implantation of blastocyst and formation of foetal membranes (in humans)  
3.3 Role of hormones in pregnancy and parturition and maternal-foetal interactions  
3.4 Regeneration phenomenon in animals, Histomorphological changes in regeneration of limbs in amphibians and tail in lizards

UNIT IV: PRACTICAL WORK  
4.1 Study of various types of bird nests  
4.2 Investigation of hydrotaxis, chemotaxis and phototaxis in earthworm  
4.3 Field exercises to study various types of behaviour in animals  
4.4 Study of gametogenesis through prepared slides  
4.5 Study of invertebrate and vertebrate egg specimens (insects, fishes, frog and hen)  
4.6 Study of preserved specimens of human foetus of three trimesters

SUGGESTED BOOKS/READING MATERIAL  
3. Animal Behaviour by Anbery  
4. Principles and Animal Development by S.C. Goel
ZOO-203-CR: ICHTHYOLOGY

Total Credits: 4 (3 Lecture + 0 Tutorial +1 Practical)
Maximum Marks: 100 (25/Credit)* [Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)
*Note: One unit is equivalent to one credit

UNIT I:  SYSTEMATICS AND MORPHOLOGY
1.1 Outline classification of fishes with distinguishing characters and important examples of principal subdivisions
1.2 General account and adaptive radiation of Elasmobranchii and Actinopterygii
1.3 Structure and function of fins and scales
1.4 Colouration in fishes

UNIT II:  DIGESTION AND CIRCULATION
2.1 Digestion and absorption in fishes: gastric and intestinal enzymes and their mode of action; digestion in stomachless fishes; adaptation of digestive enzymes in fishes
2.2 Nutritional energetics and feed conversion ratio
2.3 Respirations in fishes; structure and function of gills
2.4 Heart and blood vessels in fishes; regulation of heart activity

UNIT III:  STRUCTURE AND PHYSIOLOGY
3.1 Kidney structure and functions
3.2 Endocrine organs in fishes
3.3 Structure and function of nervous system
3.4 Sense organs and their functions

UNIT IV:  PRACTICALS
4.1 General survey of Elasmobranchiii, Holocephali, Dipnoi and Teleostei; identification and classification of fishes of Jammu & Kashmir
4.2 Study of feeding habits of herbivorous, carnivorous and omnivorous fish by gut content analysis of fishes: Schizothorax, Trout, Carp
4.3 Histological study of different organ systems of fish from prepared slides
4.4 Study and mounting of scales of fishes (Carp, Schizothorax and Scoliodon)
4.5 Dissection of nervous system of Dasyatis (Sting ray), cranial nerves of Wallago
4.6 External characters and dissection of fish for internal anatomy: structure of alimentary canal, gill rackers (carp/ or any other available fish)

SUGGESTED BOOKS/READING MATERIAL
1. Biology of Fishes by Quentin Bone et al Springer
4. *An Introduction to Fishes* by H.S. Bhamrah, Kavita Juneja Anmol Publications Pvt Ltd
5. *An introduction to fishes* by G.S. Sandhu Campus Books International
6. *Fish and Fisheries* by B.N. Yadav Daya Publishing House
7. *A History of Fishes* by J.R. Norman & P.H. Greenwood Ernest Benn Limited
9. *Anatomy of Fishes Part I* by Whihelm Harder E. Schweizerbar’t’sche Verlagsbuchhandlung Stuttgart
10. Fish and Fisheries by Pandey and Shukla Rostogi Publication

ZOO-204-DCE: VETERINARY PARASITOLOGY
Total Credits: 3 (3 Lecture + 0 Tutorial +0Practical)

Maximum Marks: 75 (25/Credit)*  [Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)

*Note: One unit is equivalent to one credit

UNIT I: PROTOZOA
1.1. Protozoan parasites of fishes with special reference to *Trypanosoma*
1.2. Protozoan parasites of poultry with special reference to *Eimaria*
1.3. Epidemiology, life-cycle, pathogenicity and control of *Babesia* in cattle
1.4. Epidemiology, life-cycle, pathogenicity and control of *Toxoplasma* in sheep

UNIT II: PLATYHELMINTHS
2.1 Trematode and cestode parasites of fishes with special reference to the morphology, biology and control of *Diplozoon* and *Adenoscolex*.
2.2 Trematode and cestode parasites of aves with special reference to life cycle, pathogenicity and control of *Echinistomum* and *Davania*
2.3 Trematode and cestode parasites of ruminants with reference to the life cycle, pathogenicity and control of *Dicrocoelium* & *Moniezia*
2.4 Anthelmintics: General account

UNIT III: PARASITOLOGY TECHNIQUES
3.1 Methods of collection, fixation and preservation of helminth parasites
3.2 Methods of permanent mount preparation of helminth parasites
3.3 Faecal, blood and urine examinations for diagnosis of parasitic diseases
3.4 Microtomy
3.5 Micrometry

SUGGESTED BOOKS/READING MATERIAL
1. *Animal Parasitology* by J. D. Smyth
2. *Parasitology (Protozoology & Helminthology)* by K. D. Chatterjee
3. *Foundations of Parasitology* by Gerald D. Schmidt and Larry S. Roberts
4. Besides, the students are asked to visit www.springer & www.biomed for latest advances
ZOO-205-DCE: AQUACULTURE AND FISH NUTRITION

Total Credits: 3 (2 Lecture + 0 Tutorial +1 Practical)

Maximum Marks: 75 (25/Credit)*  
[Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]

Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)

*Note: One unit is equivalent to one credit

UNIT I:  AQUACULTURE

1.1 Aquaculture; criteria, aquaculture practices and applications of biotechnology in aquaculture

1.2 A general account of breeding cycle, breeding season and spawning and induced breeding in fish (Carp)

1.3 Importance of fish health in aquaculture; parasitic and non parasitic diseases in fishes; Symptoms, etiology, prophylaxis and treatment

1.4 Site Selection, construction and management of fish ponds

UNIT II:  FISH NUTRITION

2.1 Protein, amino acid, lipid, carbohydrate, vitamins and minerals requirements of fishes

2.2 General consideration of diet formulation and fish feed ingredients; feed formulation and nutritional values of fish feed ingredients

2.3 Types of feed: wet or moist feed, mixed or semi-moist feed, dry feed, compressed dry pellets, rolled pellets, crumbles, flake feed and microencapsulated feed

2.4 Use of probiotics and herbal medicine in aquaculture, use of RNA/DNA ratio in evaluating the performance of feeds

UNIT III:  PRACTICALS

3.1 Visit to a fish farm/ feed manufacturing units for studying the culture and breeding activities and feed preparation of trout and carp

3.2 Study of different stages of fish life cycle through preserved material

3.3 Study of various fish diseases through diseased specimen and slides

3.4 Proximate analysis of fish feed ingredients (moisture, crude protein, fat and ash contents)

3.5 Formulation and preparation of artificial feed (moist, pelleted and crumbled feed)
SUGGESTED BOOKS/READING MATERIAL

2. *Fish and Fisheries of India* by V. G. Jhingran Hindustan Publishing Corporation
3. *Aquaculture and Fisheries* by N Arumugam Saras Publication
4. *Fish in Nutrition* by Eirik Heen and Rudolf Kreuzer Fishing News (Book) Ltd Ludgate house London
5. *Fish Nutrition and Feed Technology* by S. Athithan, N. Felix & N. Venkatasamy Daya Publishing House, New Delhi

ZOO-206-DCE: MEDICAL AND VETERINARY ENTOMOLOGY

Total Credits: 3 (2 Lecture + 0 Tutorial +1 Practical)

Maximum Marks: 75 (25/Credit)*  [Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)

*Note: One unit is equivalent to one credit

UNIT I: MEDICAL ENTOMOLOGY

1.1 Insect-born bacterial and protozoan diseases of man
1.2 Insect-born viral and rickettsial diseases of man
1.3 Insect causing diseases of man– myiasis (types and causes)
1.4 Life-cycle and control of major insect vectors of human diseases viz. Sand fly, Tsetse fly, Mosquito

UNIT II: VETERINARY ENTOMOLOGY

2.1 Insects as vectors of bacterial and viral diseases of domestic animals
2.2 Insects as vectors of helminthic diseases of domestic animals
2.3 Life-cycle and control of major insect vectors of animal diseases viz. *Tabanus, Chrysops*
2.4 Life-cycle and control of *Hypoderma lineatum* and *Stomoxys calcitrans* causing major animal diseases

UNIT III: PRACTICAL WORK

3.1 Collection and laboratory study of major insect vectors of medical importance viz. House fly, Mosquito, Fleas, Bed bug, Cockroach
3.2 Collection and laboratory study of major insect vectors of veterinary importance viz. Dipteran flies, Sucking lice, Chewing lice
3.3 Study of mouthparts of blood sucking insects– Mosquito, Bed bug
3.4 Permanent mount preparation of Body louse, Mosquito, Chewing lice, Fleas
3.5 Collection and laboratory study of myiasis causing Dipteran flies

SUGGESTED BOOKS/READING MATERIAL
1. *Medical & Veterinary Entomology* by D. S. Kettle
5. *A text  book of Applied Zoology* by Pradip V. Jabde

ZOO-207-DCE: BIODIVERSITY AND HABITAT ECOLOGY
Total Credits: 3 (2 Lecture + 0 Tutorial +1 Practical)

Maximum Marks: 75 (25/Credit)* [Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)

*Note: One unit is equivalent to one credit

UNIT I: BIODIVERSITY: COMPONENTS, VALUES AND LAWS
1.1 Concept and levels of biodiversity: species diversity, genetic diversity and ecosystem diversity; values of biodiversity
1.2 Biodiversity hotspots and loss of biodiversity: causes and factors
1.3 Convention on biological diversity (CBD) and issues under the CBD
1.4 Biological diversity Act, 2002 main provisions and rules

UNIT II: HABITAT ECOLOGY
2.1 Ecology of major wildlife habitats: deserts, grasslands, forests and aquatic
2.2 Wildlife habitats of J & K, their important floral and faunal elements
2.3 Wetlands: threats and management with special reference to J & K
2.4 Physical and anthropogenic factors affecting wildlife habitats

UNIT III: PRACTICAL WORK
3.1 Study of vegetation by quadrat method to determine frequency, density, abundance and distribution pattern
3.2 Study of species diversity by various methods
3.3 Comparative study of structural adaptations of some birds and mammals
3.4 Survey of herpetofaunal elements preserved in the museum
3.5 Visit to any wetland for studying bird diversity

SUGGESTED BOOKS/READING MATERIAL


ZOO-208 GE: INTRODUCTION TO PARASITOLOGY

Total Credits: 3 (2 Lecture + 0 Tutorial +1 Practical)
Maximum Marks: 75 (25/Credit)* [Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)

*Note: One unit is equivalent to one credit

UNIT I: BASIC PARASITOLOGY AND PROTOZOOLOGY

1.1 Basic concepts and definitions in parasitology
1.2 Host parasite relationships- general account
1.3 Important protozoan diseases of Man with special reference to life cycle, pathogenicity and control of *Entamoeba histolytica*
1.4 Opportunistic protozoan parasites of man with special reference to *Pneumocystis carinii* and *Cryptosporidium parvum*

UNIT II: HELMINTHOLOGY

2.1 Trematode parasites of man with special reference to life cycle, pathogenicity and control *Schistosomes haematobium*
2.2 Cestode parasites of man with reference to life-cycle, pathogenicity, and control of *Taenia saginata*
2.3 Nematode parasites of man with special reference to life- cycle, pathogenicity and control of *Entrobius vermicularis*
2.4 Anthelmintics: general account

UNIT III: PRACTICAL WORK
3.1 Study of slides of protozoan parasites: *Entamoeba*, *Balantidium*, *Trypanosoma* & *Plasmodium*
3.2 Preparation of permanent mounts of any parasitic protozoan
3.3 Study of slides of helminth parasites: *Fasciola*, *Taenia*, *Entrobius* & *Ancylostoma*
3.4 Processing, staining and mounting of *Dicrocelium* and *T. saginata*
3.5 Processing and mounting of nematode (*Trichuris*)

SUGGESTED BOOKS/READING MATERIAL
1. *Animal Parasitology* by J. D. Smyth
2. *Parasitology (Protozoology & Helminthology)* by K. D. Chatterjee
3. *Foundations of Parasitology* by Gerald D. Schmidt and Larry S. Roberts
4. Besides, the students are asked to visit www.springer & www.biomed for latest advances

ZOO-209-GE: BASICS OF WILDLIFE SCIENCE
Total Credits: 3 (2 Lecture + 0 Tutorial + 1 Practical)
Maximum Marks: 75 (25/Credit)*
[Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)
*Note: One unit is equivalent to one credit

UNIT 1: MAMMALOGY AND ORNITHOLOGY
1.1 Wildlife: introduction and importance
1.2 Mammals: introduction, morphological adaptations (aquatic and amphibious, aerial and cursorial) and physiological adaptations
1.3 Distribution of important mammalian taxa in different biogeographical zones of India
1.4 Birds: Introduction, morphological and flight adaptations, migration, migratory pathways, threats to migrant population

UNIT II: HERPETOLOGY, HUMAN-WILDLIFE CONFLICT AND WILDLIFE OF JAMMU & KASHMIR
2.1 Detail description, status and distribution of some important Indian amphibian species, parental care in amphibians.
2.2 Status and distribution of some important Indian species of turtles, crocodiles, lizards and snakes, adaptations in reptiles, sexual dimorphism and sex determination.
2.3 Human-wildlife conflict and its management
2.4 An overview of wildlife of Jammu & Kashmir with detailed description on status and distribution of Markhore, Snow leopard, Hangul deer and Tibetan antelope

UNIT III: PRACTICAL WORK
3.1 Comparative study of structural adaptations of some birds and mammals
3.2 Identification of poisonous and non-poisonous snakes
3.3 Study of wetland avifauna (waterfowl) through preserved museum specimens
3.4 Preparation of reference slides of hair samples of different mammals
3.5 Examination and drawing of museum materials: beaks, claws and feathers

SUGGESTED BOOKS/READING MATERIAL
2.2 Insects in industry– Sericulture
2.3 Insects in industry– Lac culture

SUGGESTED BOOKS/READING MATERIAL

ZOO-211-OE: ELEMENTARY ICHTHYOLOGY
Total Credits: 2(2 Lecture + 0 Tutorial +0 Practical)

Maximum Marks: 50 (25/Credit)*  [Marks Distribution: 20% Internal Assessment & 80% End Semester Exam.]
Minimum Marks: 40% (Internal Assessment and End Semester Exam. to be Qualified Separately, not in Aggregate)
*Note: One unit is equivalent to one credit

UNIT I: FISH
1.1 General account on characteristics of pisces
1.2 Setting up and maintenance of aquaria
1.3 Larvivorous fishes and ornamental fishes
1.4 Nest building and parental care in fishes

UNIT II: SPECIAL ORGANS IN FISHES
2.1 Electric organs in fishes
2.2 Poison and venom in fishes
2.3 Colouration in fishes
2.4 Bioluminescence in fishes

SUGGESTED BOOKS/READING MATERIAL
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