

**Choice Based Credit System (CBCS) Scheme for 1<sup>st</sup> Semester  
(Batch-2021 onwards)**

Course Code	Course Title	Course Type	Hours / Week			Credits	Examinations / Marks	
			L	T	P		Internal Assessment	Term End Examination
ZOO21101CR	Animal Taxonomy and Phylogeny	Core	4	0	0	4	20 Marks	80 Marks
ZOO21102CR	Structure and Function of Invertebrates	Core	4	0	0	4	20 Marks	80 Marks
ZOO21103CR	Insect Anatomy and Physiology	Core	2	0	0	2	10 Marks	40 Marks
ZOO21104CR	Laboratory Course 01	Core	0	0	8	4	20 Marks	80 Marks
ZOO21105DCE	General and Medical Parasitology	Discipline Centric	3	0	0	3	15 Marks	60 Marks
ZOO21106DCE	Veterinary Parasitology	Discipline Centric	3	0	0	3	15 Marks	60 Marks
ZOO21107DCE	Laboratory Course 02	Discipline Centric	0	0	4	2	10 Marks	40 Marks
ZOO2101GE	Fundamentals of Wildlife	Generic Elective	2	0	0	2	10 Marks	50 Marks
ZOO2101OE	Fish Farming	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 Practical’s and Tutorials it is 32 hours.

Course No.: **ZOO21101CR**  
Total Credits: **4 (4 L + 0 T + 0 P)**

Course Title: **Animal Taxonomy and Phylogeny**  
Maximum Marks: **100 (20+80)**

**Course objective:** To learn the basics of taxonomy, to upgrade on new taxonomical concepts at molecular level, to infer the evolutionary significance & examine different phylogenetic methods.

**Course outcome:** The learner shall acquire a broad knowledge on taxonomy and phylogeny of animals. The students shall learn the concepts and terms along with modern systematic classifications.

**Unit I: Principles and Methods of Zoological Classification (16 Hours)**

Systematics: terms & definitions, strategies of research in systematics, future of systematics; taxonomic characters: definition and kinds - morphological, physiological, molecular, ecological, behavioral and geographical; curating of collections: preparation of material, housing, cataloging, arrangement of collection, curating of types, exchange of material and loans; taxonomic keys: definition and kinds- bracket key, indented key and pictorial key.

**Unit II: Principles and Application of Zoological Nomenclature (16 Hours)**

ICZN: historical background, overview of terms, principles and articles; homonymy, synonymy and law of priority; typification: definitions, kinds and significance; taxonomic publications.

**Unit III: Dimensions of Speciation (16 Hours)**

Species concepts: morphological, biological and phylogenetic species concept; variations and their evolutionary significance; mechanism of isolation & speciation: allopatric, sympatric, peripatric and parapatric; concept of evolution: Pre & post Darwin era.

**Unit IV: Trends in Taxonomy (16 Hours)**

Cytotaxonomy: back ground, chromosome evolution with specific reference to primates and grasshoppers; molecular taxonomy: concept of phylogenetic systematics; phylogenetic tree reconstruction; DNA bar coding concept and significance; tools for sequence annotation: NCBI (Genebank), Nucleotide BLAST, Alignment & sequence analysis, MEGA & Phylogenetic tree.

**Suggested Books / Reading Material**

1. An Introduction to Taxonomy by T. C. Narendran
2. Animal Taxonomy by V.C. Kapoor
3. Biology by Campbell and Reece Pearson Education
4. Biosystematics & Taxonomy by R. C. Tripathi
5. Genomes by T. A. Brown BIOS
6. Organic Evolution by N Arumugam Saras Publication
7. Principles of Systematic Zoology by Ernst Mayr Tata McGraw Hill Publishing Company
8. Principles of Systematic Zoology by Peter D. Ashlock & Ernst-Mayr, Tata McGraw H. Pub. Comp.
9. Strickberger's Evolution by Brian K. Hall & Benedikt Hallgrímsson Jones

Course No.: **ZOO21102CR**  
Total Credits: **4 (4 L + 0 T + 0 P)**

Course Title: **Structure and Function of Invertebrates**  
Maximum Marks: **100 (20+80)**

**Course objective:** The course is a walk for students to go through the amazing diversity of living forms from simple to complex one. It enlightens how each group of organisms establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

**Course outcome:** To develop understanding on the diversity of life with regard to protists, non-chordates. The learner will utilize the knowledge gained from these creatures for the economy and human welfare

**Unit I: Protozoa and Porifera (16 Hours)**

Classification of protozoa up to order level; nutrition, locomotion, reproduction and economic importance of protozoa; classification of porifera up to order level; canal system, skeleton in porifera, reproduction and development; economic importance of porifera.

**Unit II: Cnidaria and Helminths (16 Hours)**

Classification of cnidaria up to order level; polymorphism in cnidaria; corals and coral reefs; economic importance of cnidaria; classification of helminths upto order level; larval forms of cestodes, trematodes & nematodes; general account of acanthocephala.

**Unit III: Annelida and Arthropoda (16 Hours)**

Classification of annelida up to order level; adaptive radiation in polychaetes; nervous system in annelids; economic importance of annelids; classification of arthropoda upto order level; respiration in arthropods (aquatic & terrestrial); crustacean larvae & their evolutionary significance; economic importance of arthropoda.

**Unit IV: Mollusca and Echinodermata (16 Hours)**

Classification of mollusca upto order level; foot and its modifications; torsion in gastropods; respiratory and nervous system in cephalopoda; colouration and ink in cephalopoda; classification of echinodermata up to order level; larval forms and their significance; water vascular system; autotomy & regeneration in echinodermata; economic importance of echinodermata.

**Suggested Books / Reading Material**

1. Barnes: Invertebrate Zoology, Holt-Saunders International, 4th edition, 1980
2. Barnes: The Invertebrates – A synthesis, 3rd edition, Blackwell, 2001
3. Brusca, R. C., Brusca, G. J., & Haver, N. (1990). Invertebrates. ed
4. Hunter: Life of Invertebrates, Collier Macmillan Pub. 1979
5. Marshall: Parker & Haswell Text Book of Zoology, Vol. I, 7th edition, Macmillan, 1972
6. Modern Text Book of Zoology: Invertebrates R. L. Kotpal
7. Moore: An Introduction to the Invertebrates, Cambridge University Press, 2001
8. Non-chordate Zoology by Dhama, P. S. & Dhama, J. K., R. Chand & Co
9. Pechenik, J. A. (2000). *Invertebrates* (Vol. 193). Singapore." McGraw Hill
10. Textbook of Invertebrate Zoology G. S. Sandhu & H. Bhaskar, 2004

Course No.: **ZOO21103CR**  
Total Credits: **2** (2 L + 0 T + 0 P)

Course Title: **Insect Anatomy and Physiology**  
Maximum Marks: **50** (10+40)

**Course objective:** To impart knowledge about insect anatomy and physiology

**Course outcome:** The learner can utilize the knowledge in understanding different organ systems in one of most dominated and diverse creatures of nature.

**Unit I: Insect Anatomy (16 Hours)**

Digestive system, respiratory system, circulatory system and excretory system; nervous system & reproductive system.

**Unit II: Insect Physiology (16 Hours)**

Physiology of digestion; physiology of respiration; physiology of circulation; physiology of excretion.

**Suggested Books / Reading Material**

1. Entomology by Cedric Gillott Plenum Press, New York
2. Fundamentals of Entomology by Richard J. Elizinga
3. Imm's General Text Book of Entomology vol.I by O. W. Richards & R.G. Davis Springer
4. Introduction to Entomology by Comstock
5. Modern Entomology by D. B. Tembhare Himalaya Publishing House
6. The Insects: Structure and Function by R. F. Chapman Cambridge University Press

Course Code: **ZOO21104CR**

Course Title: **Laboratory Course 01**

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

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

**A. Presentation of field work by the students in presence of all faculty members (20 Marks)**

**B. Practical's. (80 Marks) Time: 128 Hours**

1. Construction of taxonomic keys (Bracket key & Indented key)
2. Slide/Specimen study of Protozoa
3. Permanent mount preparation Protozoa
4. Slide/Specimen study of Porifera
5. Slide/Specimen study of Cnideria
6. Permanent mount preparation of Cnidaria (Obelia / Hydra)
7. Slide/Specimen study of Helminths
8. Slide study of larval forms of Cestodes and Trematodes
9. Specimen study of Annelida
10. Nervous system in Annelida (Earthworm / Neries)
11. Specimen study of Arthropoda
12. Mouth parts and sting apparatus of honey bee
13. Slide study of Larval forms of Crustacea
14. Permanent mount preparations of Crustacean larvae
15. Specimen study of Mollusca
16. Nervous system of Mollusca – Loligo / Sepia / Octopus
17. Specimen study of Echinodermata
18. Dissection of Star Fish so as to expose its digestive system and water vascular system
19. Museum study of common insect species to study their morphology
20. Minor dissection/temporary mount preparation of mouthparts, wings, and legs of Grasshopper, Cockroach, Housefly, and honey bees
21. Collection and study of various insect eggs
22. Collection, preservation and identification of different types of insects and their larvae

**Suggested Books / Reading Material**

1. A Manual of Practical Entomology by M. M. Trigunayat
2. A Manual of Practical Zoology by P. S. Verma
3. A Textbook of Invertebrate Practical Zoology by Vivekanand Banerjee
4. Practical Zoology: Invertebrate (English, Rastogi Publications, S.S.Lal)

**(Value Added Course)**

Course Code: **ZOO21105DCE**

Course Title: **General and Medical Parasitology**

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

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

**Course objective:** To acquaint the students about the knowledge of parasites of medical importance. To understand the nature of the parasites and parasitism, emphasizing the influence of parasites on the ecology and evolution and the role of parasites in global public health.

**Course outcome:** The learner becomes aware about the parasitic diseases & the consequences thereof. To understand the disease-causing potential of parasites and the responses of the immune system. To learn the mechanisms of transmission and pathogenicity caused by the parasites. To diagnose the causative agents, to understand the prophylactic measures and treatment of important parasitic diseases like malaria, leishmaniasis, trypanosomiasis, toxoplasmosis, schistosomiasis, etc.

**Unit I: Introduction to Parasitology (16 Hours)**

Animal associations with special emphasis on parasitism; origin, evolution and distribution of parasites in animal kingdom; parasitic adaptations; host parasite relationships & zoonosis.

**Unit II: Protozoology (16 Hours)**

Morphology, life-cycle, pathogenicity & control of luminal protozoan parasites of man: *Entamoeba*, *Giardia* & *Trichomonas*; morphology, life-cycle, pathogenicity & control of blood protozoan parasites of man: *Leishmania* & *Trypanosoma*; pathogenicity & control of *Falciparum malaria* with special emphasis on immune-prophylaxis; opportunistic protozoan parasites of man: *Toxoplasma* & *Cryptosporidium*.

**Unit III: Helminthology (16 Hours)**

General organization, reproduction and development in helminths; trematode parasites of man with life cycle, pathogenicity & control of *Shistosome*; cestode parasites of man with life cycle, pathogenicity & control of *Taenia*; nematode parasites of man with life cycle, pathogenicity & control of *Enterobius vermicularis* & *Ancylostoma duodenale*.

**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 & Steve Nadler
4. General parasitology by Thomas C. Cheng
5. Georgis' Parasitology for Veterinarians 10<sup>th</sup> Edition Elsevier.
6. Helminthes Arthropods and Protozoa of Domesticated Animals by E.J.L. Soulsby
7. Introduction to Parasitology by A.S.A.C. Chandler & Clark P. Read
8. Monning's Veterinary Helminthology and Entomology by Geoffreg Lapage
9. Parasitology (Protozoology & Helminthology) K.D. Chatterjee
10. Parasitology by Elmer R. Nobel and Glenn A. Noble

**(Value Added Course)**

Course Code: **ZOO21106DCE**  
Total Credits: **3** (3 L + 0 T +0 P)

Course Title: **Veterinary Parasitology**  
Maximum Marks: **75** (15+60)

**Course objective:** To impart knowledge about the parasites of veterinary importance viz., parasites of Fishes, Poultry, Ruminants like sheep, goat cattle etc.

**Course outcome:** The learner gain expertise in dealing with diseases of fish, poultry and ruminants. To assess the importance of prevalence and epidemiology of these diseases in domestic animals. Know how resistance development and resistance transfer occur. Understand the mechanisms for transmission, virulence and pathogenicity of the diseases. To diagnose the causative agents, suggest the prophylactic measures and treatment of important parasitic diseases.

**Unit I: Protozoa** **(16 Hours)**

Protozoan parasites of fishes with special reference to *Cryptobia & Myxosoma*; protozoan parasites of poultry with special reference to *Eimaria & Histomonas*; epidemiology, lifecycle, pathogenicity and control of *Toxoplasma & Sarcocystis* in sheep; epidemiology, lifecycle, pathogenicity and control of *Trichomonas & Babesia* in cattle

**Unit II: Trematoda** **(16 Hours)**

Trematode parasites of fishes with special reference to the morphology, biology and control of *Diplozoon & Clinostomum*; trematode parasites of aves with special reference to life cycle, pathogenicity and control of *Echinostomum & Trichobilharzia*; trematode parasites of ruminants with reference to the life cycle, pathogenicity and control of *Fasciola & Dicrocoelium*; general account of antihelminthics and antihelminthic resistance.

**Unit III: Cestoda** **(16 Hours)**

Cestode parasites of fishes with special reference to morphology, life cycle, pathogenicity and control of *Adenoscolex & Bothriocephalus*; cestode parasites of aves with special reference to life cycle, pathogenicity and control of *Davainea & Raillietina*; cestode parasites of ruminants with special reference to life cycle, pathogenicity and control of *Moneizia & Stilesia*; diseases caused by larval cestodes in ruminants.

**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 & Steve Nadler
4. General parasitology by Thomas C. Cheng
5. Georgis' Parasitology for Veterinarians 10<sup>th</sup> Edition Evolve Elsevier.
6. Helminthes Arthropods and Protozoa of Domesticated Animals by E.J.L Soulsby
7. Introduction to Parasitology by ASA C. Chandler & Clark P. Read
8. Monning's Veterinary Helminthology and Entomology by Geoffrerg Lapage
9. Parasitology and Vector Biology by William C. Marquardt, Richard S. Demaree & Robert B. Grieve
10. Parasitology by Elmer R. Nobel and Glenn A. Noble
11. Veterinary Parasites By G M Urquhart & J Armour Published by Blackwell Science

**(Skill Development Course)**

Course Code: **ZOO21107DCE**

Course Title: **Laboratory Course 02**

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

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

**A. Field Survey: (10 Marks)**

Visit to various local fish farms, poultry farms, sheep & cattle farms and different slaughter houses for demonstration & collection of faecal samples and parasites. Students are required to present a detailed report of the survey.

**B. Practical's: (40 Marks)**

Duration: **64 Hours**

**List of Practicals:**

1. Slide study of protozoan parasites of Man: *Entamoeba*, *Balantidium*, & *Leishmania*
2. Slide study of protozoan parasites/ oocysts of Ruminants: *Eimeria*, *Toxoplasma* & *Babesia*
3. Preparation of permanent mounts of parasitic protozoans
4. Slide study of Trematode parasites of Man: *Schistosoma*, *Paragonimus*, *Clonorchis*
5. Slide study of Trematode parasites of Ruminants: *Fasciola*, *Dicrocoelium*, *Paramphistomum*
6. Slide study of Cestode parasites of Man: *Taenia solium*, *Taenia saginata*, *Hymenolepis*
7. Slide study of Cestode parasites of Ruminants: *Moniezia* & *Stilesia*
8. Slide study of Nematode parasites of Man: *Enterobius* & *Ancylostoma*
9. Slide study of Cestode parasites of Ruminants: *Haemonchus* & *Trichuris*
10. Slide study of acanthocephalans
11. Slide study of arthropod vectors
12. Methods of collection, fixation and preservation of ecto and endoparasites from different hosts viz., fish, fowl, sheep and cattle
13. Methods of permanent mount preparation of ecto and endoparasites
14. Faecal, Blood and Urine Examinations for diagnosis of parasitic diseases
15. Microtomy -cryostat
16. Micrometry

**Suggested Books / Reading Material**

1. Manual of Practical Microbiology and Parasitology by Pal Chakraborty
2. Parasitology Easy to Learn by Chandra T Jaya, Jaypee Brothers Medical Publishers
3. Practical Exercises in Parasitology by D. W. Halton
4. Practical Guide to Diagnostic Parasitology by Lynne S. Garcia.



**(Value Added Course)**

Course Code: **ZOO2101GE**

Course Title: **Fundamentals of Wildlife**

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

Maximum Marks: **50**

**Course objective:** To sensitize the students about different aspects and issues of Wildlife at national and regional level

**Course outcome:** The students can utilize the knowledge in educating the people about the importance of wildlife and their role in conservation

**Unit I: Wildlife-I**

**(16 Hours)**

Wildlife: introduction, importance and conservation; amphibia: general account and parental care; reptilia: general account, biology of Indian crocodiles, identification of poisonous & non-poisonous snakes; birds and mammals: aquatic and terrestrial adaptations, bird migration.

**Unit II: Wildlife-II**

**(16 Hours)**

Biogeographical zones of India; human- wildlife conflict: causes, consequences and its management; status and distribution of hangul, markhor and snow leopard; conservation projects: crocodile, tiger and snow leopard.

**Suggested Books / Reading Material**

1. Ecology and Field Biology, Robert. L. Smith (1966) Harper & Row Publishers New York
2. Fundamentals of wildlife Management -2<sup>nd</sup> edition) Rajesh Gopal (2012) Natraj Publishers, Dehradun India
3. Handbook of Bird Biology by Irby J. Lovette and John W. Fitzpatrick
4. Herpetology: An Introductory Biology of Amphibians and Reptiles by Laurie J. Vitt
5. Indian mammals a field guide by Vivek Menon
6. Mammalogy by Nicholas J. Czaplewski, James M. Ryan, Terry A. Vaughan
7. Wilderness Wildlife G. A. Bhat (2008) Book Vision Hazratbal Srinagar
8. Wildlife Biology by Raymond F. Dasmann

**(Skill Development Course)**

Course Code: **ZOO2101OE**

Course Title: **Fish Farming**

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

Maximum Marks: **50**

**Course objective:** The culture techniques of locally available fishes, air-breathing, brackish water fishes, prawn culture and idea about integrated and composite fish culture.

**Course outcome:** The course will be helpful to students by making them aware about the farming of fishes, their feeding requirement and their management. The course will help the students to have an idea how fish can be cultured and reared.

**Unit I: Culture Technique –I**

**(16 Hours)**

Culture of air breathing fishes; brackish water fish culture; prawn culture; pearl culture.

**Unit II: Culture Technique –II**

**(16 Hours)**

Carp culture; trout culture; composite fish culture; integrated fish farming.

**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. Aquaculture: Principles and Practices by TVR Pillay, Blackwell publications
4. Fish and Fisheries by B.N. Yadav Daya Publishing House
5. Fresh Water Fish Pond and Culture and Management by Chakroff M. Scientific Publishers,
6. Fundamentals of Ichthyology by S.P. Biswas
7. Textbook of Fish Culture- Breeding and Cultivation of Fish Huet, M. Fishing News (Books) Ltd.