

**Choice Based Credit System (CBCS) Scheme for 3rd Semester
(Batch-2021 onwards)**

Course Code	Course Title	Course Type	Hours / Week			Credits	Examinations / Marks	
			L	T	P		Internal Assessment	Term End Examination
Z0021301CR	Molecular Biology & Genetics	Core	4	0	0	4	20 Marks	80 Marks
Z0021302CR	Biostatistics & Biotechniques	Core	4	0	0	4	20 Marks	80 Marks
Z0021303CR	Veterinary and Agricultural Nematology	Core	2	0	0	2	10 Marks	40 Marks
Z0021304CR	Laboratory Course 05	Core	0	0	8	4	20 Marks	80 Marks
Z0021305DCE	Wildlife Biology, Conservation and Techniques	Discipline Centric	3	0	0	3	15 Marks	60 Marks
Z0021306DCE	Biogeography, Wildlife Ecology and Management	Discipline Centric	3	0	0	3	15 Marks	60 Marks
Z0021307DCE	Laboratory Course 06	Discipline Centric	0	0	4	2	10 Marks	40 Marks
Z002103GE	Basics of Aquaculture	Generic Elective	2	0	0	2	10 Marks	50 Marks
Z002103OE	Beneficial and Harmful Insects	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 MOOCs 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.: **ZOO21301CR**
Total Credits: **4(4L + 0 T + 0 P)**

Course Title: **Molecular Biology & Genetics**
Maximum Marks: **100 (20 + 80)**

Course objective: To understand principles of molecular biology and genetics

Course outcome: This knowledge will be utilized to elucidate disease mechanisms and biology along with the pedigree and knowledge of recombinant DNA technology. The students will be able to have an insight how rDNA technology is revolutionizing our modern world.

Unit I: Molecular Biology (16 Hours)

DNA structure and replication in prokaryotes and eukaryotes; DNA damage and repair; genetic code; transcriptional regulation in prokaryotes and eukaryotes; translation and post translational modifications in eukaryotes.

Unit II: Cell Regulation (16 Hours)

Signaling molecules and modes of cell-cell signaling; cell surface receptors; signal transduction pathways: MAP kinase and JAK/STAT pathways; apoptosis and cell renewal; cancer biology: cancer and its classes, transforming agents, cellular and viral oncogenes.

Unit III: Genetics (16 Hours)

Mendelian and non-mendelian inheritance; non-allelic gene interactions; sex determination and sex-linked characteristics; dosage compensation in mammals, drosophila and *c. elegans*; transposable elements; cytoplasmic inheritance.

Unit IV: Genomics (16 Hours)

Concept of genomics and human genome project, molecular markers: RFLP, AFLP; genetic polymorphism; gene mapping: linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids; human genetics: pedigree analysis, lod score for linkage testing, karyotyping, genetic disorders.

Suggested Books/Reading Material

1. Genes IX by Benjamin Lewin Jones and Bartlett Publishers
2. Genomes by Brown, T.A Garland Science Publishing, London, UK
3. Molecular Biology of Gene by Watson et al Pearson Education, Delhi, India
4. Molecular Biology of the Cell by Alberts et al. Garland Science
5. Molecular Cell Biology by Lodish et. al.
6. Principle of Genome Analysis and Genomics by Primrose, S.B. and Twyman R.M. Blackwell Publishing
7. Principles of Genetics by Gardner et al John Wiley
8. Science of Genetics by Atherlay
9. The Cell: A Molecular Approach by Cooper & Hausman, Sunderland publishers

(Value Added Course)

Course No.: **ZOO21302CR**

Course Title: **Biostatistics & Biotechniques**

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

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

Course objective: To understand the role of statistical methods and biological techniques in animal science

Course outcome: The knowledge can be utilized in experimentation and data analysis.

Unit I: Biostatistics (16 Hours)

Methods of sampling; diagrammatic and graphic representation of data; measures of central tendency: mean, median and mode; measures of dispersion: standard deviation and standard error; probability and probability distribution: poisson, binomial, and normal distributions; tests of significance: chi square test, students t test and ANOVA (one way analysis).

Unit II: Microscopy & Morphometry (16 Hours)

Techniques for the preparation of fixatives, preservatives and stains; light Microscopy; electron microscopy; SEM & TEM; micro-morphometry; spectroscopy: UV & visible.

Unit III: Biophysical and Molecular Techniques (16 Hours)

Centrifugation and its applications; Electrophoresis and its applications; Blotting techniques and their applications; PCR: variants and applications.

Unit IV: Chromatography and Immunoassays (16 Hours)

Ion exchange chromatography; gel-filtration chromatography; HPLC and GC; immunoassays: ELISA, radioimmunoassay and immunofluorimetry.

Suggested Books/Reading Material

1. An Introduction to Biostatistics by N. Gurumani
2. Biotechniques Theory and Practice by S. V. S. Rana, Rastogi publishers
3. Fundamentals of Biostatistics by Khan and Khanum, Ukaaz Publications
4. Principles and techniques of Biochemistry and Molecular Biology by Wilson and Walker

(Value Added Course)

Course No.: **ZOO21303CR**

Course Title: **Veterinary and Agricultural Nematology**

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

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

Course objective: To understand the nature & damage caused by nematode parasites in domestic animals and Plant parasitic nematodes in agricultural plants

Course outcome: The learner gain expertise in dealing with these parasites to check their population by breaking their life cycle and therefore minimise their damage and save the economy.

Unit I: Nematyhelminths and Acanthocephala

(16 Hours)

Nematode parasites of fishes with special reference to life cycle, pathogenicity and control of *Rhabdochona guptii* and *Camallinus fottadarii*; nematode parasites of aves with special reference to life cycle, pathogenicity and control of *Heterakis gallinarum* and *Capillaria sp.*; nematode parasites of sheep with special reference to life cycle, pathogenicity and control of *Haemonchus contortus* and *Trichostrongylus sp.*; acanthocephalan parasites of fishes with special reference to *Pomphorhynchus kashmiriensis* and *Neo-echinorhynchus*.

Unit II: Agricultural Nematology

(16 Hours)

Introduction to plant parasitic nematodes with special reference to morphology, pathogenicity and control of *Meloidogyne* and *Heterodera*; general account on entomopathogenic nematodes; plant resistance to phytoparasitic nematodes; management and control of plant parasitic nematodes.

Suggested Books/ Reading Material

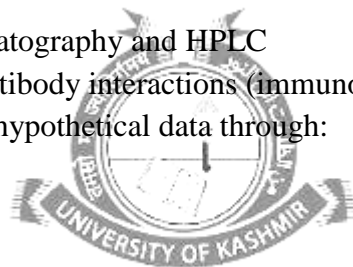
1. Animal Parasitology by J. D. Smyth
2. Parasitology (Protozoology & Helminthology) by K. D. Chatterjee
3. Foundations of Parasitology by Gerald D. Schmidt and Larry S. Roberts
4. Plant Nematology by N.G. Ravichandra
5. Plant Nematology 2nd Edition by Roland N. Perry & Maurice Moens
6. Textbook of introductory plant nematology (revised 2nd edition). Raman K. Walia Harish K. Bajaj.

Course Code: **ZOO21304CR**
Total Credits: **4(0 L+ 0 T+4 P)**

Course Title: **Laboratory Course 05**
Maximum Marks: **100(20 + 80)**

List of Practicals: (128 H)

1. Preparation of temporary stained mount of the onion root for various mitotic stages
2. Preparation of temporary stained mount of the grasshopper testis for various meiotic stages
3. Slide study of various stages of mitotic and meiotic divisions
4. Study of Barr body through stained slides of squamous epithelial / neutrophil cells
5. Rearing of fruit fly and study of red and white character after crossing
6. Structure and working of different Microscopes
7. Preparation of Histological sections of vertebrate tissues viz., liver, gut, lungs
8. Localization of nucleic acids in tissue sections
9. Localization of proteins in tissue sections
10. PCR and gel electrophoresis
11. Demonstration of gel chromatography and HPLC
12. Demonstration of antigen antibody interactions (immunoassay)
13. Representation of collected/hypothetical data through:
 - i. Histogram
 - ii. Bar chart
 - iii. Pie charts
14. Statistical analysis on hypothetical data:
 - i. Chi square analysis
 - ii. Students t test
 - iii. ANOVA
15. Study of prepared slides/specimens of nematode and acanthocephalan parasites of animals
16. Collection, preservation and preparation of permanent mounts of nematode parasites collected from fishes, fowl and sheep gut
17. Methods of extraction of nematodes from soil
18. Isolation of DNA, Qualitative and quantitative analysis, PCR using suitable primers.



Suggested Books / Reading Material

1. A Manual of Practical Zoology by P. S. Verma
2. Biotechniques : Theory and Practice by S. V. S. Rana, Rastogi Publishers
3. Manual of Practical Microbiology and Parasitology by Pal Chakraborty
4. Practical Exercises in Parasitology by D. W. Halton
5. Practical Guide to Diagnostic Parasitology by Lynne S. Garcia.
6. Principles and techniques of Biochemistry and Molecular Biology by Wilson and Walker

(Value Added Course)

Course Code: **ZOO21305DCE** Course Title: **Wildlife Biology, Conservation and Techniques**
Total Credits: **3(3 L+ 0 T +0 P)** Maximum Marks: **75(15 + 60)**

Course objective: To understand various aspects of biology of wildlife, conservation biology and application of techniques in wildlife study

Course outcome: The students can utilize the knowledge in framing conservation plans of wild fauna and their habitat.

Unit I: Wildlife Biology (16 Hours)

General account and parental care in amphibians; biology of crocodiles and lizards; adaptations in reptiles; migration in birds; important bird areas (IBAs) of Jammu & Kashmir; adaptations (aquatic and terrestrial) and thermoregulation in mammals.

Unit II: Wildlife Conservation (16 Hours)

In situ and ex situ conservation; keystone species: concept and its relevance for conservation IUCN red list categories and criteria; Conservation projects: tiger, hangul, snow leopard and musk deer.

Unit III: Wildlife Techniques (16 Hours)

Remote sensing and GIS: concept and applications in wildlife; methods of studying wildlife census capture of wildlife: live trapping, mist netting, chemical capture (equipments & tranquilizers); bird ringing and banding, use of radio transmitters in wildlife study.

Suggested Books/Reading Material

1. Conservation Biology. Richard B. Primack (2017). Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, U.S.A
2. Handbook of Bird Biology by Irby J. Lovette and John W. Fitzpatrick
3. Important Bird Areas of Jammu and Kashmir by A. R. Rahmani, Khurshid A., I. Suhail, P. Chandan and Ashfaq A. Zarri
4. Mammalogy by Nicholas J. Czaplewski, James M. Ryan, Terry A. Vaughan
5. Managing our Wildlife Resources by S. A. Anderson
6. Manual of Wildlife Techniques of India, Sale and Berkmuller. Wildlife Institute of India, Dehradun.
7. Remote Sensing and Image Interpretations, Lillesand, T.M.; Kiefer, R.W.; Chipman, J.W. (2004) John Wiley and Sons, Inc
8. Wildlife Biology by Raymond F. Dasmann

Course Code: **ZOO21306DCE** Course Title: **Biogeography, Wildlife Ecology & Management**
Total Credits: **3(3 L + 0 T+0 P)** Maximum Marks: **75 (15 + 60)**

Course objective: To provide knowledge on ecology and distribution of wild fauna

Course outcome: After completing the course the students can utilize the knowledge in understanding the distribution and aspects of ecology of fauna which is key to conservation and mapping.

Unit I: Biogeography (16 Hour)

Biogeographic realms of the world and their fauna; island biogeography; biological dispersal: mechanisms and barriers; biogeographical zones of India with reference to distribution of wild fauna.

Unit II: Wildlife Ecology (16 Hours)

Wildlife habitat types and their significance; major diseases of wild fauna (viral and bacterial); predation- concept, problems and principles; prey base of carnivores in wild habitat.

Unit III: Wildlife Resource Management (16 Hours)

Wildlife conservation strategies in India; wildlife protection act of India (1972), its brief structure and recent amendments; wildlife conventions: Ramsar, Bonn, CITES; national and international wildlife organizations: BNHS, WWF and IUCN

Suggested Books/Reading Material

1. Biogeography, Fourth Edition by Mark V. Lomolino, Brett R. Riddle, Robert J. Whittaker, James H. Brown (2010) Sinauer Associates, Inc.; Fourth edition
2. Zoogeography: The Geographic Distribution of Animals, Philip J. Darlington (1957)
3. Basics of Wildlife Health Care & Management, Rajesh Jani, Narendra Publishing House
4. An Introduction to Applied Biogeography by Spellerberg & Sawyer, Cambridge University Press
5. Wildlife Ecology & Management by Bolen and Robinson Printice Hall International (UK)
6. Animal Ecology and Distribution of Animals by Rastogi and Jayaraj
7. Managing our Wildlife Resources by S. A. Anderson
8. Fundamentals of Wildlife Management by Rajesh Gopal Natraj Publishers, Dehradun

(Value Added Course)

Course Code: **ZOO21307DCE**
Total Credits: **2 (0 L + 0 T+2 P)**

Course Title: **Laboratory Course 06**
Maximum Marks: **50 (10+40)**

A. Field Survey: (10 Marks)

1. Visit to important wildlife habitats of J & K to study different habitat aspects and to identify the animals in the field. Students are required to present a detailed report of the survey.

B. Practical's: (40 Marks)

Duration: **64 Hours**

1. Methods for studying behaviour of wild animals in the field
2. Monitoring of wild animals and demonstration of Census methods in the field
3. Operation of GPS, range finder, field binoculars and digital camera
4. Mapping distribution of primates, carnivores and ungulates
5. Study and preparation of pugs and hooves of wild animals in the field
6. Study of vegetation by quadrat method to determine frequency, density, abundance and distribution pattern
7. Reference slide preparation of hair samples of different wild and domestic mammals
8. Diet analysis of wild carnivores through scat analysis
9. Diet analysis of wild herbivores through pellet analysis
10. Examination of faecal matter of wild animals for helminth infection
11. Ecological distribution of some birds and mammals
12. Comparative study of structural adaptations of some mammals, birds, reptiles and amphibians
13. Comparative studies of dentition and skull of different mammals
14. Identification of poisonous and non-poisonous snakes
15. Examination and drawing of museum materials: beaks, claws, feathers and nests of characteristic species

Suggested Books / Reading Material

1. A Manual of Practical Zoology by P. S. Verma
2. A Textbook of Vertebrate Practical Zoology by Vivekanand Banerjee
3. Handbook of Bird Biology by Irby J. Lovette and John W. Fitzpatrick
4. Manual of Wildlife Techniques of India, Sale & Berkmuller. Wildlife Institute of India, Dehradun.
5. Practical Zoology: Vertebrate (English, Rastogi Publications, S.S.Lal)
6. Remote Sensing and Image Interpretations, Lillesand, T.M.; Kiefer, R.W.; Chipman, J.W. (2004) John Wiley and Sons, Inc

(Skill Development Course)

Course Code: **ZOO2103GE**

Course Title: **Basics of Aquaculture**

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

Maximum Marks: **50**

Course objective: To provide basic knowledge about the aquaculture its types and practices, pond construction, technique of induced breeding and the selection, biochemical composition and formulation of fish feed

Course outcome: The course will give a theoretical and practical experience for understanding of the principles in aquatic food production. 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 criteria and practices; site selection, construction and management of fish pond; induced breeding and its significance in aquaculture; procurement of stocking material for aquaculture.

Unit II: Fish Nutrition

(16 Hours)

Food and feeding habits of fish; types of fish feed; classification of fish feed ingredients; fish feed formulation; protein and carbohydrate requirement in fishes; vitamin and mineral requirement in fishes.

Suggested Books / Reading Material

1. An Introduction to Fishes by H.S. Bhamrah, Kavita Juneja Anmol Publications Pvt Ltd
2. Aquaculture: Principles and Practices by TVR Pillay, Blackwell publications
3. Fish and Fisheries by B.N. Yadav Daya Publishing House
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.

(Skill Development Course)

Course Code: **ZOO2103OE**

Course Title: **Beneficial and Harmful Insects**

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

Maximum Marks: **50**

Course objective: To understand the role of insects in day-to-day life

Course outcome: The learner can deal with beneficial and harmful insects

Unit I: Beneficial Insects

(16 Hours)

Insects in agriculture: pollinators and bio-control agents; insects in industry: apiculture, sericulture, lac culture.

Unit II: Harmful Insects

(16 Hours)

Insect as vectors of human diseases-general account; disease causing insects-myiasis; general account of polyphagous pests- cutworm and aphids; insect pests of vegetables (brassicas) with emphasis on life cycle and control of any one major pest.

Suggested Books / Reading Material

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