## POST GRADUATE DEPARTMENT OF ZOOLOGY
### UNIVERSITY OF KASHMIR

### CHOICE BASED CREDIT SYSTEM (CBCS) SCHEME FORMAT SEMESTER–3rd

<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>
</tr>
</thead>
<tbody>
<tr>
<td>Zoo-301-CR</td>
<td>Genetics and Evolution</td>
<td>Core</td>
<td>3 2 0</td>
<td>4</td>
<td>60(24)</td>
<td>15(6)</td>
</tr>
<tr>
<td>Zoo-302-CR</td>
<td>Cell and Molecular Biology</td>
<td>Core</td>
<td>3 0 2</td>
<td>4</td>
<td>60(24)</td>
<td>15(6)</td>
</tr>
<tr>
<td>Zoo-303-CR</td>
<td>General Entomology</td>
<td>Core</td>
<td>3 0 2</td>
<td>4</td>
<td>60(24)</td>
<td>15(6)</td>
</tr>
<tr>
<td>Zoo-304-DCE</td>
<td>Veterinary and Agricultural Nematology</td>
<td>Discipline Centric</td>
<td>3 0 0</td>
<td>3</td>
<td>60(24)</td>
<td>15(6)</td>
</tr>
<tr>
<td>Zoo-305-DCE</td>
<td>Limnology and Inland Fisheries</td>
<td>Discipline Centric</td>
<td>2 0 2</td>
<td>3</td>
<td>40(16)</td>
<td>10(4)</td>
</tr>
<tr>
<td>Zoo-306-DCE</td>
<td>Economic Entomology</td>
<td>Discipline Centric</td>
<td>2 0 2</td>
<td>3</td>
<td>40(16)</td>
<td>10(4)</td>
</tr>
<tr>
<td>Zoo-307-DCE</td>
<td>Conservation Biology, Ecotourism &amp; Captive breeding</td>
<td>Discipline Centric</td>
<td>2 0 2</td>
<td>3</td>
<td>40(16)</td>
<td>10(4)</td>
</tr>
<tr>
<td>Zoo-308-GE</td>
<td>Clinical Parasitology and Immunology</td>
<td>Generic Elective</td>
<td>2 0 2</td>
<td>3</td>
<td>40(16)</td>
<td>10(4)</td>
</tr>
<tr>
<td>Zoo-309-GE</td>
<td>Conservation Biology &amp; Wildlife Resource Management</td>
<td>Generic Elective</td>
<td>2 0 2</td>
<td>3</td>
<td>40(16)</td>
<td>10(4)</td>
</tr>
<tr>
<td>Zoo-310-OE</td>
<td>Fish and Fish Feeding</td>
<td>Open Elective</td>
<td>2 0 0</td>
<td>2</td>
<td>40(16)</td>
<td>10(4)</td>
</tr>
<tr>
<td>Zoo-311-OE</td>
<td>Beneficial &amp; Harmful Insects</td>
<td>Open Elective</td>
<td>2 0 0</td>
<td>2</td>
<td>40(16)</td>
<td>10(4)</td>
</tr>
</tbody>
</table>

Total credits= 34
Contact hours= 42

### 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).
P. G. Department of Zoology
syllabus
University of Kashmir, Srinagar
M.Sc
3rd Semester

ZOO-301-CR: GENETICS AND EVOLUTION
Total Credits: 4 (3 Lecture + 1 Tutorial +0 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: INHERITANCE BIOLOGY
1.1 Mendelian principles: Dominance, segregation, independent assortment: Deviation from Mendelian inheritance (Codominance, incomplete dominance)
1.2 Gene interactions: Complementary and supplementary ratios; pleiotropy
1.3 Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests
1.4 Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes; maternal inheritance

UNIT II: GENOMICS AND MAPPING
2.1 Genomics, proteomics and human Genome
2.2 Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders and genetically inherited diseases
2.3 Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids
2.4 Gene manipulation: An overview of DNA cloning, transgenic animals; Recombinant DNA technology– basics and applications

UNIT III: EVOLUTION
3.1 Origin of life on earth
3.2 Modern synthetic theory of organic evolution
3.3 Convergent and divergent evolution
3.4 Speciation: isolating mechanisms

UNIT IV: SEMINAR/ TUTORIALS
Seminar topics will be allotted to the students under the supervision of concerned faculty members and it is mandatory for them to make a presentation of the same.

SUGGESTED BOOKS/READING MATERIAL
1. Principles of Genetics by Gardner et al John Wiley
3. Genes IX by Benjamin Lewin Jones and Bartlett Publishers
4. Molecular Biology of Gene by Watson et al Pearson Education, Delhi, India
5. Organic Evolution by N Arumugam Saras Publication
ZOO-302-CR: CELL AND MOLECULAR 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: CELL BIOLOGY
1.1 Cellular diversity: Structural features of prokaryotic & eukaryotic cells
1.2 Membrane structure and function: Structure of model membranes, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport
1.3 Cytoskeleton: Microtubules, microtubular organelles and microfilament
1.4 Cell division & cell cycle: Mitosis and meiosis, their regulation & control

UNIT II: CELL SIGNALING AND TRANSDUCTION
2.1 Cell signaling: Signaling molecules and modes of cell-cell signaling
2.2 Cell surface receptors: G-protein coupled receptors, receptor protein-tyrosine kinases, cytokine–receptors and non-receptor protein tyrosine kinases
2.3 Signal transduction pathways: MAP kinase and JAK/STAT pathways
2.4 Cell transduction and cytoskeleton: Integrins and signal transduction, regulation of the actin cytoskeleton

UNIT III: MOLECULAR BIOLOGY
3.1 Mechanism of DNA biosynthesis in prokaryotes
3.2 DNA damage and repair
3.3 Structure & types of RNA and mechanism of its synthesis in prokaryotes
3.4 Protein synthesis and processing

UNIT IV: PRACTICAL WORK
4.1 Preparation of temporary stained mount of the onion root for various mitotic stages
4.2 Preparation of permanent stained mount of the grasshopper or cockroach testis for the various stages of meiotic division
4.3 Isolation and study of giant chromosomes of Chironomus larva and Drosophila larva
4.4 Slide study of various stages of mitotic and meiotic divisions
4.5 Preparation of stained slides of squamous epithelial/ neutrophil cells and study of Barr body
4.6 Rearing of fruit fly and study of red and white character after crossing

SUGGESTED BOOKS/READING MATERIAL
ZOO-303-CR: GENERAL ENTOMOLOGY
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: INSECT MORPHOLOGY
1.1 Integument – structure, composition and modification
1.2 Head – structure and appendages
1.3 Thorax – structure and appendages
1.4 Abdomen and its modifications

UNIT II: INSECT CLASSIFICATION
2.1 Classification of Apterygota with important orders and families
2.2 Classification upto family level of the orders, viz. Odonata, Orthoptera, Dictyoptera, Hemiptera and Phthiraptera
2.3 Classification of Insect orders, viz. Lepidoptera and Diptera, with economically important families
2.4 Classification of Insect orders, viz. Coleoptera and Hymenoptera, with economically important families

UNIT III: INSECT ECOLOGY
3.1 Effects of High-altitude environment on morphology, physiology and development of insects
3.2 Effects of temperature, humidity and light on the activities of insects
3.3 Population dynamics
3.4 Insect-plant interaction

UNIT IV: PRACTICAL WORK
4.1 Taxonomy and identification of insects of economic importance belonging to following insect orders: Collembola, Thysanura, Odonata, Orthoptera, Dictyoptera, Hemiptera and Phthiraptera
4.2 Taxonomy and identification of economically important insects of the orders: Coleoptera, Lepidoptera, Hymenoptera and Diptera
4.3 Permanent whole mount preparation of the following insects: Aphids, Sucking lice, Mosquitoes
4.4 Minor dissection/ permanent mount preparation of head, mouthparts, wings, spiracles, genitalia, pretasus and legs of the following: Grasshopper, Housefly, Mosquito, Honey-bee, Moth and Butterfly.
4.5 Isolation and permanent mount preparation of halters and arista of House fly
4.6 Collection of insects from different localities of Kashmir

SUGGESTED BOOKS/READING MATERIAL
4. *Imm’s General Text Book of Entomology* vol. I by O. W. Richards and R.G. Davis Springer
P. G. Department of Zoology
syllabus
University of Kashmir, Srinagar
M.Sc
3rd Semester

6. Fundamentals of Entomology by Richard J. Elizinga
7. Introduction to Entomology by Comstock

---

**ZOO-304-DCE:**

**VETERINARY AND AGRICULTURAL NEMATOLOGY**

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

Maximum Marks: 75 (25/Credit)*

[Mark 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: VETERINARY NEMATOLOGY & ACANTHOCEPHALA**

1.1 Nematode parasites of fishes with special reference to life cycle, pathogenicity and control of *Rhabdochona guptii*

1.2 Nematode parasites of Aves with special reference to life cycle, pathogenicity and control of *Heterakis gallinarum*

1.3 Nematode parasites of Sheep with special reference to life cycle, pathogenicity and control of *Haemonchus contortus*

1.4 Acanthocephalan parasites of fishes with special reference to *Pomphorhynchus kashmieriensis*

**UNIT II: AGRICULTURAL NEMATOLOGY**

2.1 Introduction to plant parasitic nematodes with special reference to pathogenicity and control of *Meloidogyne* and *Heterodera*

2.2 Introduction to entomopathogenic nematodes

2.3 Plant resistance to phytoparasitic nematodes

2.4 Management and control of plant parasitic nematodes

**UNIT III: PRACTICAL WORK**

3.1 Study of prepared slides/specimens of nematode and acanthocephalan parasites of animals

3.2 Collection, preservation and preparation of permanent mounts of trematodes and cestodes collected from fishes

3.3 Collection, preservation and preparation of permanent mounts of trematodes and cestodes collected from domestic fowl

3.4 Collection, preservation and preparation of permanent mounts of trematodes and cestodes collected from ruminant gut

3.5 Methods of extraction of nematodes from soil

**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
ZOO-305-DCE: LIMNOLOGY AND INLAND FISHERIES

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: LIMNOLOGY

1.1 A general account on high altitude lakes of Jammu and Kashmir; eutrophication in valley lakes
1.2 Fate of heat in water: thermal stratification
1.3 Macro and micro nutrients in water bodies
1.4 Biological communities in inland water bodies (planktonic and benthic)

UNIT II: INLAND FISHERIES

2.1 Riverine fisheries- ecology and effects of dams
2.2 Cold water fisheries- present status and scope for development
2.3 Reservoir fisheries- ecology, development, exploitation and management
2.4 Estuarine Fisheries- present status, potential and management

UNIT III: PRACTICALS

3.1 Determination of temperature, pH and transparency of water bodies
3.2 Determination of dissolved oxygen, free carbon dioxide, total alkalinity of water bodies/ water sample
3.3 Qualitative and quantitative analysis of zooplankton local water bodies
3.4 Permanent slide preparation of planktons from local water bodies
3.5 General characters and classification of important riverine, reservoir and estuarine fishes

SUGGESTED BOOKS/READING MATERIAL

3. Fundamentals of Limnology by Arvind Kumar Ashish Publishing House
4. Advances in Limnology by H.R. Singh Narendra Publishing House
5. Fish and Fisheries of India by V. G. Jhingram Hindustan Publishing Corporation
6. Ecology and Field Biology by Robert Leo Smith Harper & Row, Publisher
ZOO-306-DCE: ECONOMIC 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: AGRICULTURAL ENTOMOLOGY
Insect pests with emphasis on the occurrence, economic importance, life cycle and control of only one major pest of
the following crops
1.1 Vegetables-brassicas
1.2 Food crops- Paddy, Wheat and Maize
1.3 Stored-grains
1.4 Fodder and Forage

UNIT II: HORTICULTURAL AND FOREST ENTOMOLOGY
Insect pests with emphasis on the occurrence, economic importance, life cycle and control of only one major pest of
the following crops
2.1 Temperate fruits (Pome and Stone)
2.2 Forest pests
2.3 Salix and poplars
2.4 General polyphagous pests– Locusts, termites and aphids

UNIT III: PROJECT WORK
A survey project related to economic entomology (agricultural, horticultural and sylvicultural) will be allotted to each
student which is mandatory and has to be submitted by the student up to the end of August.

SUGGESTED BOOKS/READING MATERIAL
1. Modern Entomology by D. B. Tembhare Himalaya Publishing House
3. A text book of Applied Zoology by Pradip V. Jabde
P. G. Department of Zoology
syllabus
University of Kashmir, Srinagar
M.Sc
3rd Semester

ZOO-307-DCE: CONSERVATION BIOLOGY, ECOTOURISM AND CAPTIVE BREEDING
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: CONSERVATION BIOLOGY
1.1 IUCN protected area categories, Marine protected areas, Transfrontier Protected areas
1.2 Important National parks, Sanctuaries and Biosphere reserves of India and their characteristic wildlife
1.3 Minimum viable populations, Conservation of rare and key stone species
1.4 In situ and ex situ conservation, gene banking

UNIT 2: ECOTOURISM AND CAPTIVE BREEDING
2.1 Ecotourism development in India
2.2 Ecotourism potential of wildlife habitats of Jammu and Kashmir
2.3 Captive breeding: procedures and requirements
2.4 Captive breeding programs in India

UNIT III: PROJECT WORK
A project related to the following topics/parameters will be allotted to each student which is mandatory and has to be submitted by the student up to the end of August:
1. Important wildlife issues
2. Conservation status of important mammals and birds
3. Mammal and bird diversity of important habitats of J & K
4. Anthropogenic interferences in wildlife habitats

SUGGESTED BOOKS/READING MATERIAL
ZOO-308-GE: CLINICAL PARASITOLOGY AND IMMUNOLOGY

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

Maximum Marks: 75 (25/Credit)*

[Mark 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: CLINICAL PARASITOLOGY
1.1 Coprological examination techniques
1.2 Blood and urine examination techniques
1.3 Histological techniques in parasitology
1.4 Culture of parasites, eggs and larvae

UNIT II: IMMUNOLOGY
2.1 Introduction about immune system
2.2 Immunodeficiency diseases
2.3 Hypersensitivity reactions; Mechanism of cytotoxic reactions
2.4 Autoimmune diseases: Autoimmune anaemia & Systemic lupus erythematosis

UNIT III: PRACTICAL WORK
3.1 Examination of faecal samples of animals for diagnosis of helminth diseases
3.2 Examination of blood of certain vertebrate hosts for the presence of parasites
3.3 Microtomy of helminth parasites
3.4 Micrometry
3.5 Demonstration of antigen-antibody reaction through Haem-agglutination

SUGGESTED BOOKS/READING MATERIAL
1. Immunology by Kuby, J., Goldsby, R., Kindt, T.J. and Osbourne, B.A., W.H. Freeman
2. Medical Immunology for Students by Playfair, J.H.L. and Lydyard, P.M. Churchill
ZOO-309-GE: CONSERVATION BIOLOGY AND WILDLIFE RESOURCE MANAGEMENT

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: CONSERVATION BIOLOGY
1.1 IUCN protected area categories, Marine protected areas, Transfrontier Protected areas
1.2 Protected area network in India
1.3 Minimum viable populations, conservation of rare and key stone species
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
2.4 Wildlife conventions and organizations: Ramsar, Bonn, CITES, IUCN, WWF, BNHS

UNIT III: PRACTICAL WORK
3.1 Visit to important wildlife habitats of J & K to study different habitat aspects and to identify the animals in the field
3.2 Study of species diversity by various methods
3.3 Study of vegetation by quadrat method to determine frequency, density, abundance and distribution pattern
3.4 Study of pugs and hooves of wild animals in the field
3.5 Operation of GPS, field binoculars and digital camera

SUGGESTED BOOKS/READING MATERIAL

P. G. Department of Zoology
syllabus
University of Kashmir, Srinagar
M.Sc
3rd Semester

2. An Introduction to Fishes by H.S. Bhamrah, Kavita Juneja Anmol Publications Pvt Ltd
3. Fish and Fisheries by Yadav, B N Daya Publishing House
6. Fish and Fisheries of India by V. G. Jhingram Hindustan Publishing Corporation

ZOO-311-OE: BENEFICIAL AND HARMFUL INSECTS
Total Credits: 2 (2 Lecture + 0 Tutorial +0 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: BENEFICIAL INSECTS
1.1 Insects as human food
1.2 Insects as pollinators
1.3 Insects in medicine
1.4 Role of insects in forensic science

UNIT II: HARMFUL INSECTS
2.1 Household insects
2.2 Occurrence, life cycle and control of some major insect pests on apple in Kashmir
2.3 Damage, life cycle and migratory behavior of locusts

SUGGESTED BOOKS/READING MATERIAL