Choice Based Credit System (CBCS) Scheme for 4th Semester (Batch-2021 onwards)

Course Code	Course Title	Course Type	Hours / Week			Credits	Examinations / Marks	
			L	T	P		Internal Assessment	Term End Examination
ZOO21401CR	Ecology, Limnology & Biodiversity	Core	4	0	0	4	20 Marks	80 Marks
ZOO21402CR	Immunology & Applied Zoology	Core	4	0	0	4	20 Marks	80 Marks
ZOO21403CR	Fish Biology and Processing Technology	Core	2	0	0	2	10 Marks	40 Marks
ZOO21404CR	Laboratory Course 07 (Dissertation)	Core	0	0	8	4	20 Marks	80 Marks
ZOO21405DCE	Insect Morphology, Classification and Ecology	Discipline Centric	3	0	0	3	15 Marks	60 Marks
ZOO21406DCE	Economic Entomology and Pest Management	Discipline Centric	3	0	0	3	15 Marks	60 Marks
ZOO21407DCE	Lab Course 08	Discipline Centric	0	0	4	2	10 Marks	40 Marks
ZOO21004GE	Fundamentals of Immunology	Generic Elective	2	0	0	2	10 Marks	40 Marks
ZOO21004OE	Introduction to Wildlife Studies	Open Elective	2	0	0	2	10 Marks	40 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.

(Value Added Course)

Course No.: **ZOO21401CR** Course Title: **Ecology, Limnology & Biodiversity**
Total Credits: **4** (4 L + 0 T + 0 P) Maximum Marks: **100** (20+80)

Course objective: To understand structure and function of different ecosystems
Course outcome: The knowledge will be utilized in conservation and sustainable exploitation of ecosystems

Unit I: Ecosystem Ecology (16 Hours)

Ecosystem: structure and function, energy flow and mineral cycling (CNP); structure and function of forest and fresh water ecosystems; habitat and niche: concept of habitat and niche, niche width and overlap, fundamental and realized niche; ecological succession: types, mechanisms, changes involved in succession, concept of climax community; bioremediation; biomagnification; biomonitoring.

Unit II: Population Ecology (16 Hours)

Attributes of population: natality, mortality, immigration, emigration, life tables, survivorship curves and net reproductive rate; population growth– exponential and logistic growth patterns, growth models- (time lag models); lotka–volterra model and leslie matrix model; life history strategies: r and k selection, clutch size and sex ratio; population regulation– extrinsic and intrinsic factors.

Unit III: Limnology (16 Hours)

Physicochemical parameters of water bodies (temperature, pH, dissolved oxygen, total alkalinity, turbidity and total dissolved solids); thermal stratification and its modifications; role of macro and micro-nutrients in water bodies; eutrophication in lakes, its causes and consequences.

Unit IV: Biodiversity (16 Hours)

Biodiversity: concept, levels and values; biodiversity hotspots; loss of biodiversity; convention on biological diversity (CBD): objectives, priorities and action plan; biological diversity Act, 2002: main provisions and rules.

Suggested Books / Reading Material

1. Animal Ecology and Environmental Biology by PD Sharma
2. Ecology and Field Biology by Smith RL
3. Ecology by Chapman and Reiss
4. Ecology by Molles
5. Limnology by Welch PS
6. An Advanced textbook on Biodiversity by Krishnamurthy.
7. Limnology: Lake and River Ecosystems by Wetzel RG

8. Textbook of Limnology by Cole GA

(Value Added Course)

Course No.: **ZOO21402CR** Course Title: **Immunology & Applied Zoology**
Total Credits: **4** (4 L + 0 T+ 0 P) Maximum Marks: **100** (20 + 80)

Course objective: To understand the principles of immunology and applied zoology
Course outcome: The students shall utilise the knowledge in understanding the immune responses and disorders of immune systems, gene cloning, sequencing and gene mapping in addition techniques that revolutionized the pharmaceutical, health and agricultural industries.

Unit I: Defense Mechanism in Higher Vertebrates (16 Hours)

Innate immunity and acquired immunity; complement system: classical & properdin pathways; immuno-deficiency diseases: stem cell, B & T-cell deficiency diseases; tumour immunology with special emphasis on tumour immunotherapy (MAb's)

Unit II: Damaging and Defective Immune Response (16 Hours)

Concept of hypersensitivity, classification of hypersensitivity reactions; mechanism of type I and type II hypersensitivity reactions; general account on autoimmune diseases with special emphasis on auto-immune anemia's & rheumatoid arthritis; transplantation immunology-homograft rejection.

Unit III: Animal Biotechnology (16 Hours)

Production & contribution of transgenic animals to human welfare (Poultry & Dairy); modern assisted reproductive techniques for the improvement of cattle; application of biotechnology in – (a) sericulture, (b) apiculture; rDNA technology for production of useful molecules.

Unit IV: Animal Cell Culture and Gene Therapy (16 Hours)

Cell culture media; cell culture types & techniques; sterilization techniques; gene therapy: ex-vivo & in-vivo; target human diseases & tissues of choice for gene therapy.

Suggested Books / Reading Material

1. Basic Immunology by Sharon, J. William and Wilkins
2. Biotechnology and Genomic by P. K. Gupta
3. Immunology by F. M. Burnet
4. Immunology by Kuby Goldsby, R., Kindt, T.J. and Osbourne, B.A., W.H. Freeman
5. Immunology by P. M. Lydyard, A. Whelan And M. W. Fanger
6. Immunology by Roitt, I.M., Brostoff, J. and Male, D. Mosby
7. Immunology: An Introduction by Ian R Tizard
8. Medical Immunology for Students by Playfair, J.H.L. and Lydyard, P.M. Churchill

(Skill Development Course)

Course No.: **ZOO21403CR** Course Title: **Fish Biology and Processing Technology**
Total Credits: **2** (2 L + 0 T+ 0 P) Maximum Marks: **50** (10 + 40)

Course objective: Population and growth studies, Study of adaptive strategies, Basic knowledge about the migration of important fishes, Knowledge of the biochemical composition and preservation of fishes

Course outcome: The main outcome of the fish biology study is that it will help the students to have the knowledge of population estimation, age and growth for conservation and sustainable growth of fishes. On the other hand, knowledge about the biochemical composition and processing of fish will be helpful in reducing the loss by spoilage. Processing is considered as a branch of food science, where a set of methods and techniques are used to transform raw ingredients into food for safe consumption by humans or animals.

Unit I: Fish Biology (16 Hours)

Population estimation, structure and dynamics; Fecundity: absolute and relative; Age determination: Length frequency analysis, model progression methods, growth check, scale and otoliths; Adaptations in hill stream, deep sea and cave fishes; Fish migration and its types.

Unit II: Fish Biochemical Composition and Processing (16 Hours)

Biochemical composition of fish: Protein, carbohydrates, fats, vitamins and minerals; Factors affecting the seasonal variation in biochemical composition of fish; Methods used for preservation and processing of fish; Fish by-products.

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. Fish and Fisheries by B.N. Yadav Daya Publishing House
4. Fish and Fisheries by Pandey and Shukla
5. Fish and Fisheries of India by Jhingran
6. Fundamentals of Ichthyology by S.P. Biswas

(Skill Development Course)

Course Code: **ZOO21404CR** Course Title: **Laboratory Course 07 (Dissertation)**
Total Credits: **4** (0 L + 0 T+ 4 P) Maximum Marks: **100** (20 + 40 + 40)

I. The students shall be allotted a mini project in M. Sc. 3rd Semester by a mentor to whom he/she shall be assigned. The students shall start the project work right from 3rd semester and by the time they reach 4th semester, they shall have to complete the same and submit the processed collection for the Museum and a report for the perusal of the examiners (Internal & External). A brief outline of the projects in different specializations is as under:

a. **Parasitology**
b. **Ichthyology**
c. **Entomology**
d. **Wildlife**

II. The students are provided an opportunity to visit various places within and outside the valley for fauna collection. All students are required to submit the collected specimens, duly identified, labeled and accompanied with a detailed account.

Course Code: **ZOO21405DCE** Course Title: **Insect Morphology, Classification and Ecology**
Total Credits: **3** (3 L+ 0 T+0 P) Maximum Marks: **75** (15 + 60)

Course objective: To impart knowledge about the morphology, classification and ecology of insects.
Course outcome: The learner can utilize the knowledge to identify insects in general and beneficial and harmful insects in particular. Besides, the learner can forecast the incidence of agriculturally important insects.

Unit I: Insect Morphology (16 Hours)

Integument– structure and composition; head– structure and appendages (mouth parts and antennae); thorax– structure and appendages; abdomen and its modifications

Unit II: Insect Classification (16 Hours)

Basis of insect classification; outline classification of apterygota with important orders and families- Protura, Collembola, Diplura and Thysanura; Classification of Pterygota with economically important orders and families- Orthoptera, Hemiptera, Isoptera, Diptera, Coleoptera, Lepidoptera, and Hymenoptera,

Unit III: Insect Ecology (16 Hours)

Effects of high-altitude environment on morphology, physiology and development of insects; effects of temperature, humidity and light on the activities of insects; population dynamics; insect-plant interactions.

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 & II by O. W. Richards and R.G. Davis Springer
4. Introduction to Entomology by Comstock
5. Modern Entomology by D. B. Tembhare, Himalaya Publishing House
6. Physiological Systems in Insects by Marc J. Klowden Academic Press
7. The Insects: Structure and Function by R.F. Chapman Cambridge University Press

(Value Added Course)

Course Code: **ZOO21406DC** Course Title: **Economic Entomology & Insect Pest Management**
Total Credits: **3** (3 L+ 0 T +0 P) Maximum Marks: **75** (15 + 60)

Course objective: To study insect pests of agriculture and horticultural crops along with their management strategies

Course outcome: The learner can utilize the knowledge in establishing insect pest consultancies

Unit I: Agricultural and horticultural Entomology (16 Hours)

General account of polyphagous insect pests with emphasis on the occurrence, economic importance, life cycle and control of cutworm and white grubs; insect pests of temperate fruits with emphasis on the occurrence, economic importance, life cycle and control of major pests; insect pests of paddy, wheat and maize with emphasis on the occurrence, economic importance, life cycle and control of major pests; insect pests of brassicaceous vegetables with emphasis on the occurrence, economic importance, life cycle and control of major pests.

Unit II: Medical and veterinary entomology (16 Hours)

General account of insects as vectors of human diseases; insect borne bacterial and protozoan diseases of man; myiasis causing insects in humans and domestic animals; life cycle and control measures of *Cochliomyia hominivorax* and *Hypoderma lineatum*.

Unit III: Insect Pest Management (16 Hours)

Cultural control of insects– principles, methods and techniques with examples; chemical insecticides–organochlorines and organophosphates; biological control with successful examples of parasitoids and predators; IPM: concept, strategies and tools in pest management.

Suggested Books / Reading Material

1. A text book of Applied Zoology by Pradip V. Jabde
2. A text book of Applied Entomology –vol. II by K.P. Srivastava Kalyani Publishers
3. Entomology by Cedric Gillott Plenum Press, New York
4. Fundamentals of Entomology by Richard J. Elizinga
5. Introduction to Entomology by Comstock
6. Modern Entomology by D. B. Tembhare Himalaya Publishing House


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Course Code: **ZOO21407DCE** Course Title: **Laboratory Course 08**
Total Credits: **2** (0 L + 0 T +2 P) Maximum Marks: **50 (10+40)**

A. Field Survey: (10 Marks)

1. Visit to various local agricultural and horticultural fields etc., for demonstration & collection of insects of economic importance and their preservation. Students are required to present a detailed report of the survey.

B. Practical's: (40 Marks) Duration: **64 Hours**

1. Specimen study of Apterygota, Orthoptera, Isoptera, Hemiptera, Lepidoptera, Diptera, Coleopyera and Hymenoptera.
2. Permanent mount preparation of aphids, sucking lice, mosquitoes.
3. Minor dissection/temporary mount preparation of head, mouthparts, antennae, wings, legs, and genitalia of grasshopper/cricket/ cockroach/housefly/mosquito.

Suggested Books / Reading Material

1. A Manual of Practical Zoology by P. S. Verma
2. A Manual of Practical Entomology by M.M. Trigunayat

Course Code**: ZOO21004GE** Course Title**: Fundamentals of Immunology**
Total Credits: **2** (2 L+ 0 T + 0 P) Maximum Marks: **50**

Course objective: To aware students about defense mechanism in higher vertebrates, defective immune responses like hypersensitivity, autoimmune diseases and graft-rejection

Course outcome: To utilize the knowledge for making immune system strong & taking prophylactic measures when suffering from different allergic and auto-immune diseases.

Unit I: Immunology I (16 Hours)

Introduction to immunity: innate immunity: phagocytosis & inflammation; acquired immunity: cell mediated & humoral; types of acquired immunity; introduction to compliment system.

Unit II: Immunology II (16 Hours)

Hypersensitivity reactions, types & mechanism of allergic reactions; autoimmune diseases: autoimmune anaemia & rheumatoid arthritis; transplantation immunology: mechanism of homograft rejection; tumour immunology & tumour immunotherapy.

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
3. Immunology by Roitt, I.M., Brostoff, J. and Male, D. Mosby
4. Basic Immunology by Sharon, J. William and Wilkins
5. Immunology by P. M. Lydyard, A. Whelan and M. W. Fanger
6. Immunology by F. M. Burnet
7. Immunology: An Introduction by Ian R Tizard.

(Value Added Course)

Course Code**: ZOO21004OE** Course Title**: Introduction to Wildlife Studies**

Total Credits: **2** (2 L+ 0 T + 0 P) Maximum Marks: **50**

Course objective: To acquaint the students with basic information on various aspects and issues of wildlife

Course outcome: The students can utilize the knowledge for launching awareness programs among local masses.

Unit I: Wildlife of India **(16 Hours)**

Wildlife: Introduction and importance; types of protected areas in India; threats to wildlife habitats of India; wildlife protection act (1972), its brief structure and recent amendments

Unit II: Wildlife of J & K **(16 Hours)**

Wildlife of Jammu & Kashmir- an overview; protected area network in J & K; threatened fauna of J & K; wetlands: introduction and importance

Suggested Books / Reading Material

1. Fundamentals of wildlife Management -2nd edition) Rajesh Gopal (2012) Natraj Publishers, Dehradun India
2. Wilderness Wildlife G.A. Bhat (2008) Book Vision Hazratbal Srinagar
3. Wildlife in India, V.B. Saharia (1982) Natraj Publishers Dehradun