



**M.Sc. Zoology syllabus for 3<sup>rd</sup> Semester as per NEP-2020  
(Batch-2025 onwards)**

Course Code	Course Title	Course Type	Hours / Week			Credits	Examinations / Marks		Total Marks
			L	T	P		Internal Assessment	Term End Examination	
<b>MZOOCAP325</b>	Advanced Parasitology	CC	3	0	4	5	35 Marks	90 Marks	<b>125</b>
<b>MZOOCIEPM325</b>	Insect Ecology and Pest Management	CC	3	0	4	5	35 Marks	90 Marks	<b>125</b>
<b>MZOOCAF325</b>	Aquaculture and Fish Nutrition	CC	3	0	4	5	35 Marks	90 Marks	<b>125</b>
<b>MZOOCBC325</b>	Biogeography and Conservation Ecology	CC	3	0	4	5	35 Marks	90 Marks	<b>125</b>

**GENERAL INSTRUCTIONS**

1. A student must earn a minimum of **20 credits** in each semester. To be eligible for the award of a **1-year diploma** (02 semesters) or **2-year Master's degree** (04 semesters), a minimum of 40 or 80 credits respectively is required.
2. The **20 credits** in the **3<sup>rd</sup> semester** can be earned by completing **04 Core Courses (CC)**, each carrying **05 credits**.
3. A candidate shall be free to obtain optional **04 credits** from the **Open Elective Course (OEC)/Employability & Entrepreneurship Course (EEC)** offered by other departments. A candidate has the option to opt for **MOOC's** in place of **OEC/EEC**.
4. Maximum marks per credit are **25** (One unit is equivalent to 01 credit).
5. One credit in theory is 16 Hours direct teaching learning, where as in practical and tutorial, it is 32 hours.



Course Title: **ADVANCED PARASITOLOGY**

Course code: **MZOOCAP325** Total Credits: 5 (3L + 0T +2P)

Max. Marks: **125** (75L+50P)

Unit-Wise CLOs (Course Learning Outcomes)	
MZOOCAP325.I	Interpret & use the basic concepts of antigen-antibody interactions and their relevance in immunology
MZOOCAP325.II	Gain expertise in dealing with parasitic diseases & diagnose the causative agents
MZOOCAP325.III	Use the skills of immunoassays effectively in various scientific research and biomedical science
MZOOCAP325.IV	Acquire practical understanding about advanced techniques in immunology

**Theory: (3 Credits)**

**UNIT I - IMMUNO-PARASITOLOGY**

- 1.1. General principles of parasitic immunity and adaptive immune responses
- 1.2. Host immune responses to protozoans & helminths
- 1.3 Evasion of immunity; concomitant immunity; spring-rise & self-cure
- 1.4 Immuno-prophylactic approaches to parasitic diseases with emphasis on Malaria

**UNIT II - PARASITOLOGICAL TECHNIQUES**

- 2.1. Coprological techniques for identification and diagnosis of parasites/eggs/cysts
- 2.2. Blood and urine examinations techniques for diagnosis of parasites/eggs/ larvae
- 2.3. Staining techniques used in parasitology
- 2.4. Cultural techniques in parasitology

**UNIT III - SERODIAGNOSTIC PROCEDURES**

- 3.1. Enzyme-Linked Immuno-Sorbent Assay (ELISA)
- 3.2. Immuno-Fluorescent Antibody Test (IFAT)
- 3.3. Radio-Immuno Assay (RIA)
- 3.4. Compliment Fixation Test (CFT)

**UNIT IV: PRACTICALS: (02 credits)**

1. Demonstration of antigen antibody reactions (Haemagglutination test)
2. Demonstration of antigen-antibody precipitation (Ouchterlony Gel Diffusion test)
3. Preparation of permanent mounts of parasitic protozoans
4. Laboratory diagnostic procedures for parasite/egg/larvae detection & identification through faecal, blood and urine examinations
5. Visit to any research institute/department for on sight demonstration of latest equipment's used in parasitology
6. A field visit aimed at collecting biological samples viz., faecal, blood ,urine etc., for the diagnosis of parasitic diseases from sheep/poultry/fish farms.



**Suggested Books / Reading Material**

1. Immunology by Kuby, Goldsby, R., Kindt, T.J. and Osbourne, B.A., W.H. Freeman
2. Immunology by P. M. Lydyard, A. Whelan And M. W. Fanger
3. Immunology by Roitt, I.M., Brostoff, J. and Male, D. Mosby
4. Immunology: An Introduction by Ian R Tizard
5. Animal Parasitology by J. D. Smyth
6. Foundations of Parasitology by Gerald D. Schmidt and Larry S. Roberts
7. Practical Guide to Diagnostic Parasitology by Lynne S. Garcia.
8. Experimental Immunology" by Ivan M. Roitt, Peter J. Delves, and Abdul K. Abbas
9. Immunological Methods" by Ivan Lefkovits and Benjamin Pernis
10. Manual of Clinical Immunology" by N. R. Rose, H. G. Herskowitz, and C. S. R. R. Detrick

**CLO - PLO Mapping**

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOOCAP325.I	3	1	2	2	2	2	2	1	0	2	1.7
MZOOCAP325.II	2	3	3	2	2	2	2	1	1	2	2.0
MZOOCAP325.III	2	3	3	2	2	2	2	1	1	2	2.0
MZOOCAP325.IV	2	2	3	2	2	2	2	1	1	3	2.0
<b>Avg. PLO</b>	2.25	2.25	2.75	2.0	2.0	2.0	2.0	1.0	0.75	2.25	1.9



Course Title: **INSECT ECOLOGY AND PEST MANAGEMENT**

Course Code: **MZOOCIPM325** Total Credits: **5 (3L + 0T +2P)** Max. Marks: **125 (75L+50P)**

Unit-Wise CLOs (Course Learning Outcomes)	
MZOOCIEPM325.I	Understand the interaction of insects and surrounding ecosystems
MZOOCIEPM325.II	Understand the mechanism of pesticide action as well as biocontrol agents in the management of pest populations
MZOOCIEPM325.III	Develop effective management strategies against insect pests
MZOOCIEPM325.IV	Get the firsthand knowledge in collecting and dealing with insects & management strategies thereof.

**Theory: (3 Credits)**

**UNIT I- INSECT ECOLOGY**

- 1.1 Fundamentals of insect ecology: natural balance, biotic potential & environmental resistance
- 1.2 Effects of temperature, humidity and light on the activities of insects
- 1.3 Effects of high-altitude environment on morphology, physiology and development of insects
- 1.4 Population dynamics and insect-plant interaction

**UNIT II - PEST MANAGEMENT – I**

- 2.1 Chemical control: organophosphorus compounds, organochlorine insecticides and insecticides of plant origin
- 2.2 Insect chemo-sterilization: types of chemo-sterilants, mode of action and their use in insect control
- 2.3 Biological control: concept and principles with successful examples of parasites/parasitoids and predators
- 2.4. Legislative control (laws & quarantine regulation)

**UNIT III- PEST MANAGEMENT – II**

- 3.1 Insect resistance to chemical pesticides: concept, types and solution
- 3.2 Cultural control of insects: principles, methods and techniques with examples
- 3.3 Pheromones: types and applications in insect control
- 3.4 Insect Pest Management: concept, strategies and tools in pest management

**UNIT IV: PRACTICALS (02 credits)**

- 1. Collection, preservation and identification of important insects from different ecosystems of Kashmir
- 2. Permanent mount preparation and identification of small insects such as:
  - a) Aphids    b) Thrips    c) Sucking louse    d) Hymenopterous parasitoids    e) Mosquitos
- 3. Survey and study of entomofauna at high altitudes of Kashmir
- 4. Field study and documentation of some insect pests of different pome fruits and vegetables in Kashmir
- 5. Preparation of insecticidal formulations and their application in controlled conditions
- 6. Collection and preservation of bio-control agents



### SUGGESTED BOOKS/READING MATERIAL

1. A text book of Applied Entomology –vol. I by K.P. Srivastava Kalyani Publishers
2. A Text book of Entomology by R. Mathur
3. Entomology by Cedric Gillott Plenum Press, New York
4. Fundamentals of Entomology by Richard J. Elizinga
5. Handbook of Entomology by M.R. Dhingra
6. Modern Entomology by D. B. Tembhare Himalaya Publishing House

### CLO - PLO Mapping

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOOCAF325.1	2	3	3	2	2	2	2	2	1	2	2.1
MZOOCAF325.2	2	2	3	2	2	2	2	1	1	2	1.9
MZOOCAF325.3	2	2	3	2	2	2	2	1	1	2	1.9
MZOOCAF325.4	2	3	3	2	2	2	2	2	2	3	2.3
<b>Avg. PLO</b>	2.0	2.5	3.0	2.0	2.0	2.0	2.0	1.5	1.25	2.25	2.0



Course Title: **AQUACULTURE AND FISH NUTRITION**

Course Code: **MZOOCAF 325** Total Credits: **5 (3L + 0T +2P)** Max. Marks: **125 (75L+50P)**

<b>Unit-Wise CLOs (Course Learning Outcomes)</b>	
MZOOCAF325.I	Design aquaculture systems with sustainable practices.
MZOOCAF325.II	Formulate balanced fish feeds
MZOOCAF325.III	Manage fish health in aquaculture
MZOOCAF325.IV	Apply advanced techniques (e.g., biofloc, RAS) in J&K

**Theory: (3 Credits)**

**UNIT 1: PRINCIPLES OF AQUACULTURE**

- 1.1. Definition, history, scope, types and importance of aquaculture; role of aquaculture in food security and economy
- 1.2. Site selection, construction and management of fish ponds, brood stock management, spawning techniques; larval rearing
- 1.3. Recent advances in aquaculture (IMTA, Biofloc, RAS)
- 1.4. Soil and water quality management

**UNIT II: NUTRIENT REQUIREMENTS IN FISHES**

- 2.1. Macronutrients: protein, fats and carbohydrate requirement of fishes
- 2.2. Micronutrients: vitamins and mineral requirement and their deficiency signs
- 2.3. Fish feed ingredients, anti-nutritional factors, proximate composition and formulation of fish feed
- 2.4. Types of fish diet: moist, semi-moist and dry diets; use of probiotics in aquaculture

**UNIT III: FISH HEALTH MANAGEMENT**

- 3.1. Fish health management in aquaculture
- 3.2. Bacterial, viral, fungal and non-pathogenic diseases
- 3.3. Haematological and serum biochemical parameters with reference to different pathological conditions.
- 3.4. Antibiotics and use of herbal medicine in aquaculture

**UNIT IV: PRACTICALS (02 credits)**

- 1. Identification of various culturable fish species
- 2. Physico-chemical parameters of water viz., Temperature, pH, conductivity, transparency, total alkalinity, dissolved oxygen (DO), free carbon dioxide (CO<sub>2</sub>), etc.
- 3. Demonstration of the FRP carp hatchery and its working
- 4. Demonstration of the hypophysation and injection of hormones
- 5. Microscopical examination of infected fish samples and preparation of slides
- 6. Estimation of moisture, protein, fat & ash contents from fish and available feed ingredients
- 7. Visit to local fish hatcheries and feed manufacturing units for onsite demonstration



### Suggested Reading Material

1. Pillay, T.V.R. & Kutty, M.N. (2005). Aquaculture: Principles and Practices (2<sup>nd</sup> ed.). Oxford: Wiley-Blackwell.
2. Boyd, C.E. (2015). Water Quality: An Introduction. Dordrecht: Springer.
3. Hasan, M.R. & New, M.B. (2013). On-farm Feeding and Feed Management in Aquaculture. Rome: FAO Fisheries and Aquaculture Technical Paper No. 583.
4. Tacon, A.G.J. (1993). Feed Ingredients for Warm Water Fish: Fish Meal and Other Processed Feedstuffs. Rome: FAO Fisheries Circular No. 856.
5. Khanna, S.S. & Singh, H.R. A Textbook of Fish Biology and Fisheries. Narendra Publishing House
6. Bhamrah, H.S. & Juneja, K. (2002). An Introduction to Fishes. Anmol Publications Pvt. Ltd.
7. Yadav, B.N. (2007). Fish and Fisheries. New Delhi: Daya Publishing House.
8. Chakroff, M. (2007). Freshwater Fish Pond Culture & Management. Jodhpur: Scientific Publishers
9. Biswas, S.P. (1993). Fundamentals of Ichthyology. New Delhi: Narendra Publishing House.
10. Jhingran, V. G. (1975). Fish and Fisheries of India. Hindustan Publishing Corporation, Delhi

### CLO - PLO Mapping

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOOCAF325.I	2	3	3	2	2	2	2	2	1	2	2.1
MZOOCAF325.II	2	2	3	2	2	2	2	1	1	2	1.9
MZOOCAF325.III	2	2	3	2	2	2	2	1	1	2	1.9
MZOOCAF325.IV	2	3	3	2	2	2	2	2	2	3	2.3
<b>Avg. PLO</b>	2.0	2.5	3.0	2.0	2.0	2.0	2.0	1.5	1.25	2.25	2.0



**Course Title: BIOGEOGRAPHY AND CONSERVATION ECOLOGY**

Course Code: **MZOOCBC 325** Total Credits: **4 (3L + 0T +2P)** Max. Marks: **125 (75L+50P)**

<b>Unit-Wise CLOs (Course Learning Outcomes)</b>	
MZOOCBC325.I	Explain key principles affecting distribution and ecology of the fauna which is key to conservation and mapping, and communicate effectively on the emerging threats to wildlife species
MZOOCBC325.II	Analyze the values of biodiversity and ecosystem services, as well as current conservation challenges for sustainable future
MZOOCBC325.III	Evaluate the participatory conservation models and predict how human conduct impacts biodiversity conservation to address real world problems
MZOOCBC325.IV	Apply field-based techniques for data collection, analysis, and scientific communication

**Theory: (3 Credits)**

**UNIT-1: BIOGEOGRAPHY**

- 1.1 Biogeographic realms, Ecoregions and Biomes; Island biogeography; Historical biogeography, Biogeographical processes, Endemism, Refugia.
- 1.2 Continental drift, biological dispersal: mechanisms and barriers
- 1.3. Biogeographical zones of India with reference to distribution of wild fauna, biogeographical affinities of Indian fauna and flora
- 1.4. Conservation biogeography: habitat loss, over-harvest, pollution, and climate change impacts on species distribution and abundance

**UNIT II: BIODIVERSITY AND WILDLIFE ECOLOGY**

- 2.1 Biodiversity: concepts, levels and patterns; measurement of biodiversity: alpha, beta, and gamma diversity and diversity indices – Shannon, Simpson
- 2.2 Values of biodiversity: consumptive and non-consumptive; ecosystem Services and valuation; Payment for Ecosystem Services (PES)
- 2.3 Hotspots of biodiversity; conservation issues and loss of biodiversity; extinction through geological time scale: mass extinction, current extinction trends
- 2.4 Ecology of major wildlife habitat types: forests, deserts & grasslands; predator-prey interactions

**UNIT-III: CONSERVATION AND PARTICIPATORY MODELS**

- 3.1 Biological Diversity Act, 2002: Structure, rules; National Biodiversity Authority, State Biodiversity Boards
- 3.2 Participatory conservation models: Community-Based Natural Resource Management (CBNRM); Joint Forest Management (JFM); Eco-development and co-management strategies
- 3.3 Role of local institutions (panchayats, van panchayats, tribal councils) in conservation; Case studies of successful community-led conservation (e.g., Annapurna conservation area, India's Eco-development committees)
- 3.4 Social psychology theories applied to conservation behavior; foundational theories of human dimensions in wildlife conservation ; Methods to assess perceptions: structured interviews, Likert scales, Q-methodology, tools and techniques in Human dimensions research



### UNIT IV: PRACTICALS (02 credits)

1. GIS: basic mapping and LULC; Mapping distribution of threatened fauna
2. Describing plant communities: vegetation sampling, measurement of ground, shrub & tree cover
3. Camera trapping: various modes and settings of camera trap
4. Diet analysis of wild carnivores through scat analysis
5. Diet analysis of wild herbivores through pellet analysis
6. Evaluating habitat availability and utilization; measuring and mapping habitat variables in the field
7. Designing of data sheets, field surveys, and data collection: structured interviews
8. Likert scales, Q-methodology, focus groups, data analysis
9. Zoological tour to visit different National Parks, Sanctuaries, Aquaria, Zoos, Sea-shores etc., for imparting practical and field knowledge. Each student/group of students shall have to submit the collection of specimens for the departmental museum along with the survey report.

### 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. Conservation Biology. Richard B. Primack (2017). Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, U.S.A
4. An Introduction to Applied Biogeography by Spellerberg & Sawyer, Cambridge University Press
4. Wildlife Ecology & Management by Bolen and Robinson. Printice Hall International (UK)
5. Managing our Wildlife Resources by S. A. Anderson (1999). Printice Hall Upper Saddle River New Jersey
6. Community-Based Natural Resource Management by Sam Landon (1998). Claire Thompson, Programs Branch, IDRC, P.O. Box 8500, Ottawa, Ontario, Canada
7. Human Dimensions of Wildlife Management by Daniel J. Decker, Shawn J. Riley and William F. Siemer. The John Hopkins University Press, Baltimore, Maryland, USA
8. Human Dimensions of Wildlife Management in Japan by Ryo Sakurai, Ritsumeikan University, Osaka Japan

### CLO - PLO Mapping

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOOCBC325.I	3	1	2	2	2	2	2	3	1	2	2.0
MZOOCBC325.II	3	1	2	2	2	2	2	3	1	2	2.0
MZOOCBC325.III	2	2	3	2	3	2	2	3	1	2	2.2
MZOOCBC325.IV	2	3	3	2	2	2	2	3	3	3	2.5
<b>Avg. PLO</b>	2.5	1.75	2.5	2.0	2.25	2.0	2.0	3.0	1.5	2.25	2.2