M.Sc. Zoology syllabus for 1st 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	
MZOOCAD125	Animal Development	CC	3	0	2	**4 (3+1)**	28 Marks	72 Marks	**100**
MZOOCBB125	Bio-techniques & Biostatistics	CC	4	0	4	**6 (4+2)**	42 Marks	108 Marks	**150**
MZOOCFW125	Fundamentals of Wildlife	CC	4	0	4	**6 (4+2)**	42 Marks	108 Marks	**150**
MZOODMPH125	Medical Protozoology & Helminthology	DCEC	2	0	0	**2**	14 Marks	36 Marks	**50**
MZOODMVE125	Medical and Veterinary Entomology	DCEC	2	0	0	**2**	14 Marks	36 Marks	**50**
MZOODFB125	Fish Biology	DCEC	2	0	0	**2**	14 Marks	36 Marks	**50**
MZOODWEC125	Wildlife Ecotourism & Conservation	DCEC	2	0	0	**2**	14 Marks	36 Marks	**50**

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. Out of **20 credits** in a semester, a candidate has to obtain compulsorily **16 credits** from **"Core Course" (CC)** while the remaining **04 credits** can be obtained from the **"Discipline centric Elective course"(DCEC)** in the following manner:

   ►Out of **08 credits (DCEC**) offered by the Department, a candidate has to obtain maximum of **04 credits** from the DCEC.
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: **ANIMAL DEVELOPMENT**

Course code**: MZOOCAD125** **Total Credits**: 4 (3L + 0T +1P) **Max. Marks**: **100** (75L+25P)

Unit-Wise CLOs (Course Learning Outcomes)	
MZOOCAD125.I	Develop a clear understanding about early embryonic development in animals
MZOOCAD125.II	Explain clearly the late embryonic development in animals
MZOOCAD125.III	Assess a clear understanding about post embryonic development in animals
MZOOCAD125.IV	Develop a practical understanding about the development in animals

Theory: (3 Credits)

UNIT I: EARLY EMBRYONIC DEVELOPMENT

1.1 Gametogenesis: spermatogenesis, oogenesis; types of eggs & egg membranes
1.2 Fertilization: monospermy, polyspermy and parthenogenesis
1.3 Cleavage: planes and patterns of cleavage
1.4 Vitellogenesis

UNIT II: LATE EMBRYONIC DEVELOPMENT

2.1 Process of blastulation and gastrulation
2.2 Introduction to extra embryonic membrane in birds
2.3 Implantation of blastocyst and formation of foetal membranes in humans
2.4 Placenta: structure, types and functions

UNIT III: POST EMBRYONIC DEVELOPMENT

3.1 Metamorphosis: changes & hormonal regulation in amphibians
3.2 Regeneration: modes of regeneration and factors affecting regeneration
3.3 Role of hormones in pregnancy and parturition
3.4 Ageing: concepts and theories

UNIT IV: PRACTICALS: (1 Credit)

1. Study of gametogenesis through prepared slides/charts
2. Study of whole mounts of developmental stages of chick / frog through permanent slides
3. Study of different types of placenta
4. Project report on chick embryo development by raising chick embryo in the laboratory

Suggested Books / Reading Material

1. Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
2. Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers.
3. Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press
4. Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Publishers.
5. A Text Book of Animal Distribution & Developmental Biology by Veer Bala Rastogi
6. Developmental Biology By M.A. Subramanian MJP Publishers

CLO - PLO Mapping

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg
MZOOCAD125.I	3	1	2	2	1	2	1	0	0	2	1.4
MZOOCAD125.II	3	1	2	2	1	2	1	0	0	2	1.4
MZOOCAD125.III	2	2	2	2	2	2	2	1	1	2	1.8
MZOOCAD125.IV	2	1	2	3	2	2	2	1	2	3	2.0
Avg. PLO	2.5	1.25	2.0	2.25	1.5	2.0	1.5	0.5	0.75	2.25	1.65

Course Title: BIO-TECHNIQUES & BIOSTATISTICS

Course Code: **MZOOCBB125** Total Credits: **6 (4L + 0T +2P)** Maxi. Marks: **150 (100L+50P)**

Unit-Wise CLOs (Course Learning Outcomes)	
MZOOCBB125.I	Understand the working of different microscopes and allied tools & techniques used in scientific studies
MZOOCBB125.II	Understand the dynamics of cell culture media and establishment of cell lines
MZOOCBB125.III	Develop computational and analytical methods for biological data
MZOOCBB125.IV	Analyze biological data through various statistical tools and predict logical conclusions form the experimental data sets.
MZOOCBB125.V	Understand the operation of different biological tools and equipment's for biological studies

Theory (4 Credits)

UNIT I: BIOTECHNIQUES-I

1.1 Microscopy – principle & types (simple, light, phase contrast & electron)
1.2 Microbiological techniques: media preparation and sterilization; inoculation & growth monitoring
1.3 Cell culture techniques: cell viability testing; culture media preparation and cell harvesting methods
1.4 Histological techniques

UNIT II: BIOTECHNIQUES-II

2.1 Centrifuge – principle & types
2.3 Electrophoresis-principle, types (AGE & PAGE) and applications
2.3 Principle and applications of pH meter and spectrophotometer
2.4 PCR-variants & applications; RFLP, RAPD AFLP techniques

Unit III: RESEARCH PROCESSES & COMPUTATIONAL STATISTICS

3.1 Hypothesis; preparing the research design; sample design – deliberate, random, systematic
3.2 Data collection – observation, interview, questionnaires, schedules
3.3 Computer aided techniques for data presentation & data analyses
3.4. Introduction to statistical package (MS-Excel &SPSS)

UNIT IV: BIOSTATISTICS

4.1. Methods of sampling: diagrammatic & graphic representation of data
4.2. Measures of central tendency: mean, mode and median. Measures of dispersion: standard deviation & standard error
4.3. Correlation: types & methods
4.4. Tests of significance: chi-square test, students t-test & one-way ANOVA

UNIT-V: PRACTICALS (02 Credits)

1. Structure and working of different microscopes
2. Sub-cellular fractionation by centrifugation
3. Gel Electrophoresis
4. Histological techniques
5. Preparation of buffers
6. Demonstration of PH meter & spectrophotometer
7. Representation of collected/hypothetical data through : a. Histogram b. Bar chart c. Pie charts
8. Statistical analysis of hypothetical data : chi square analysis, student t test & ANOVA
9. Visit to a research institutes within Kashmir for demonstration of advanced equipment

Suggested Books / Reading Material

1. Walliman, N. (2011). Research Methods-The Basics. Taylor & Francis, London and New York.
2. Kothari, C. R. Research Methodologies-Methods and Techniques. New Age Publishers.
3. Dawson, C. (2002). Practical Research Methods. UBS Publishers, New Delhi
4. Monamy, V. (2009). Animal Experimentation-A Guide to the Issues, II edition. Camb. Univ. Press.
5. Biotechniques : Theory and Practice by S. V. S. Rana, Rastogi Publishers
6. Principles and techniques of Biochemistry and Molecular Biology by Wilson and Walker
7. An Introduction to Biostatistics by N. Gurumani
8. Biotechniques Theory and Practice by S. V. S. Rana, Rastogi publishers
9. Fundamentals of Biostatistics by Khan and Khanum, Ukaaz Publications

CLO - PLO Mapping

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO8	PLO9	PLO10	Avg.
MZOOCBB125.I	2	3	3	2	1	1	0	2	2	1.8
MZOOCBB125.II	2	3	3	2	1	1	0	2	2	1.8
MZOOCBB125.III	2	2	2	3	2	2	0	3	3	2.1
MZOOCBB125.IV	2	3	2	3	1	2	0	3	3	2.1
MZOOCBB125.V	2	3	2	3	1	2	0	3	3	2.1
Avg. PLO	2.0	2.8	2.4	2.6	1.2	1.6	0.0	2.6	2.6	1.98

Course title: **FUNDAMENTALS OF WILDLIFE**

Course code: **MZOOCFW125** Total Credits: **6 (4L+0T+2P)** Max. Marks: **150(100L+50P)**

Unit-wise CLOs (Course Learning Outcomes)	
MZOOCFW125I	Explain basic concepts and ecological role of wildlife with a focus on the importance of IUCN red list categories and other conservation frameworks
MZOOCFW125II	Analyze various strategies of wildlife conservation including on site conservation, gene banking, and conservation projects and communicate effectively on conservation issues
MZOOCFW125III	Evaluate the importance of protected area network in India and promote human-wildlife coexistence and wildlife disease management in the changing world
MZOOCFW125IV	Interpret the basic principles and pre requisites of field-based conservation methods for reliable data collection
MZOOCFW125.V	Demonstrate and apply the field methods to gather and analyze data on various aspects of wildlife eecology and conservation

(Theory: 04 Credits)

Unit I: INTRODUCTION TO WILDLIFE

1.1 Wildlife: concept, definitions and importance

1.2 Wildlife habitat types (an overview); important bird areas and Ramsar sites in J&K

1.3 IUCN red list categories and criteria; regional red list assessments

1.4 Brief introduction to conventions and conservation bodies: CITES, CBD, CMS, IUCN, WWF, BNHS, NCF

UNIT II: WILDLIFE CONSERVATION

2.1 In situ and Ex situ conservation strategies for wildlife in India

2.2 Concepts of keystone, flagship and umbrella species in conservation

2.3 Conservation projects: Tiger, Hangul, and Snow leopard

2.4 Conservation issues of wildlife in India

UNIT III: MANAGEMENT AND LEGISLATION

3.1 Protected area network in India with special focus on Jammu & Kashmir

3.2 Human- wildlife conflict: causes, consequences and management

3.3 Common diseases of wild animals and control measures

3.4 Wildlife (Protection) Act 1972: brief structure and recent amendments

UNIT IV: TECHNIQUES IN WILDLIFE CONSERVATION

4.1 Remote sensing and GIS: concept and applications in wildlife

4.2 Wildlife census methods (birds & mammals)

4.3 Capture of wildlife: live trapping, mist netting, chemical captures

4.4 Bird ringing and banding, use of radio transmitters in wildlife study

UNIT V: PRACTICALS (02 Credits)

1. Identification of mammals, birds, reptiles & amphibians available in the museum and local vicinity
2. Demonstration of basic equipment needed in wildlife studies (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of cameras)
3. Demonstration of census methods in the field
4. Study of animal evidences in the field through hairs, pug marks, hoof marks, scats, pellets etc.
5. Examination of faecal matter of wild animals for parasitic infections
6. Preservation of stuffed animals and birds
7. Visit and study of important wildlife habitats of J & K

Suggested Books / Reading Material

1. Conservation Biology. Richard B. Primack (2017). Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, U.S.A
2. Managing our Wildlife Resources by S. A. Anderson
3. Manual of Wildlife Techniques of India, Sale & Berkmuller. Wl Institute of India, Dehradun.
4. Remote Sensing & Image Interpretations, Lilles & T.M.; Kiefer, R.W.; Chipman, J.W. (2004) John wiley and Sons, Inc
5. Wildlife Biology by Raymond F. Dasmann1.
6. Basics of Wildlife Health Care and Management, Rajesh Jani (2012) Narendra Publ. House
7. Wildlife Ecology and Management by Bolen and Robinson Printice Hall International (UK)
8. Animal Ecology and Distribution of Animals by Rastogi and Jayaraj
9. Managing our Wildlife Resources by S. A. Anderson
10. Fundamentals of Wildlife Management by Rajesh Gopal Natraj Publishers, Dehradun India

CLO - PLO Mapping

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOOCFW125.I	3	1	2	2	2	2	2	3	1	2	2.0
MZOOCFW125.II	2	2	3	2	3	2	2	3	1	2	2.2
MZOOCFW125.III	2	1	2	2	3	2	2	3	1	2	2.0
MZOOCFW125.IV	2	3	3	2	2	2	2	2	3	3	2.4
MZOOCFW125.V	2	3	3	2	2	2	2	2	3	3	2.4
Avg. PLO	2.2	2	2.6	2.0	2.6	2.0	2.0	2.6	1.8	2.4	2.2

Course Title**: MEDICAL PROTOZOOLOGY & HELMINTHOLOGY**

Course code**: MZOODMPH125 Total Credits**: 2 (2L+0P) **Max. Marks**: **50** (50L+0P)

Unit-Wise CLOs (Course Learning Outcomes)	
MZOODMPH125-I	Understand the general characteristics, classification, life cycle patterns, pathogenicity & control of medically important protozoan parasites
MZOODMPH125-II	Understand the general characteristics, classification, life cycle patterns , pathogenicity & control of medically important helminth parasites

Theory: (02 Credits)

UNIT I: MEDICAL PROTOZOOLOGY

1.1 Introduction to medical protozoology with special emphasis on their epidemiology

1.2 Luminal protozoan parasites of man: *Giardia* and *Trichomonas*

1.3 Protozoan parasites of blood: *Leishmania* & *Plasmodium*

1.4 Opportunistic protozoan parasites of man: *Toxoplasma* and *Cryptosporidium*

UNIT II: MEDICAL HELMINTHOLOGY

2.1 Morphology and biology of helminths and their larval stages

2.2 Intestinal & liver flukes of man: *Fasciolopsis* & *Clonorchis*

2.3 Diseases caused by larval cestodes in man: Cysticercosis & Hydatidosis

2.4 Roundworms of man: *Enterobius* & *Dracunculus*

Suggested Books / Reading Material

1. Animal Parasitology by J. D. Smyth
2. Foundations of Parasitology by Gerald D. Schmidt and Larry S. Roberts
3. General parasitology by Thomas C. Cheng
4. Introduction to Parasitology by ASA C. Chandler & Clark P. Read
5. Parasitology (Protozoology & Helminthology) K.D. Chatterjee
6. Parasitology by Elmer R. Nobel and Glenn A. Noble

CLO - PLO Mapping

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOODMPH125-I	3	1	2	2	2	2	2	1	0	2	1.7
MZOODMPH125-II	3	1	2	2	2	2	2	1	0	2	1.7
Avg. PLO	3.0	1.0	2.0	2.0	2.0	2.0	2.0	1.0	0.0	2.0	1.7

Course Title: **MEDICAL AND VETERINARY ENTOMOLOGY**

Course code**: MZOODMVE125** **Total Credits**: 2 (2L+0P) **Max. Marks**: **50** (50L+0P)

Unit-wise CLOs	
MZOODMVE125 -I	Analyze the role of insects in transmitting pathogens & as disease causing agents in humans
MZOODMVE125-II	Understand the implications of insect vectors livestock farming and management strategies against insect vectors

Theory: 02 Credits

UNIT I: MEDICAL ENTOMOLOGY

1.1 General account of insects as vectors of human diseases

1.2 Insect-born bacterial and protozoan diseases of man

1.3 Life-cycle and control measures of major vectors of protozoan diseases in man: *Culex*, *Phlebotomus* and *Glossina*

1.4 Insects causing diseases in man– myiasis (types and causes)

UNIT II: VETERINARY ENTOMOLOGY

2.1 Life-cycle and control measures of myiasis causing insects in animals: *Hypoderma lineatum* and *Cochliomyia hominivorax*

2.2 Insects as vectors of helminthic diseases of domestic animals

2.3 Insects as vectors of bacterial and viral diseases of domestic animals

2.4 Life-cycle & control measures of insect vectors of animal diseases: *Tabanus* & *Chrysops*

SUGGESTED BOOKS/READING MATERIAL

1. Medical & Veterinary Entomology by D. S. Kettle
2. Modern Entomology by D. B. Tembhare Himalaya Publishing House
3. Medical & Veterinary Entomology by Mullen & Durden Academic Press
4. A text book of Applied Entomology –vol. II by K.P. Srivastava Kalyani Publishers
5. A text book of Applied Zoology by Pradip V. Jabde

CLO - PLO Mapping

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOODMVE125-I	3	3	3	2	0	0	3	2	3	1	2.0
MZOODMVE125-II	3	3	3	2	0	0	3	2	3	1	2.0
Avg. PLO	3	3	3	2	0	0	3	2	3	1	2.0

Course Title**: FISH BIOLOGY**

Course code**: MZOODFB125** **Total Credits**: 2 (2L+0P) **Max. Marks**: **50** (50L+0P)

Unit wise CLOs (Course Learning Outcomes)	
MZOODFB125-I	Assess fishery resource exploitation, feeding habits, population dynamics, and growth analysis using scales, otoliths, and length-weight relationships.
MZOODFB125-II	Evaluate fish adaptations in extreme environments, specialized organs, migration patterns, and reproductive strategies including spawning and parental care.

Theory: 02 Credits

UNIT I: POPULATION BIOLOGY

1.1. Rational exploitation of fishery resources; introduction to various fishing crafts and gears
1.2. Methods of determining food and feeding habits of fishes
1.3. Population estimation, structure and dynamics in fishes
1.4. Age and growth determination: scale and otoliths; length frequency analysis, model progression methods, length-weight relationship

UNIT I: ADAPTATION AND MIGRATION

2.1 Adaptations in extreme environments: hill stream, deep sea and cave
2.2 Specialized organs as adaptations: Venom glands, Bioluminescence; Electric organs
2.3 Fish migration and its types, Spawning migration in salmon and eel
2.4 Reproductive strategies, Nest building and Parental care in fishes

Suggested Reading:

1. Khanna, S. S., & Singh, H. R. (2003)**.** A Textbook of Fish Biology and Fisheries. Narendra Publishing House, New Delhi.
2. Wootton, R. J. (1998)**.** Ecology of Teleost Fishes (2nd ed.). Springer.
3. Jhingran, V. G. (1975)**.** Fish and Fisheries of India. Hindustan Publishing Corporation, Delhi.
4. Moyle, P. B., & Cech, J. J. (2004)**.** Fishes: An Introduction to Ichthyology (5th ed.). Pearson.
5. Bhamrah, H. S., & Juneja, K. An Introduction to Fishes. Anmol Publications Pvt. Ltd.
6. Yadav, B. N**.** Fish and Fisheries. Daya Publishing House.
7. Pandey, K., & Shukla, J. P**.** Fish and Fisheries.

PLO CLO Mapping

CLOs	PLO 1	PLO 2	PLO 3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOODFB125-I	3	3	3	3	2	2	2	3	2	3	2.6
MZOODFB125-II	3	2	2	3	2	2	3	3	1	3	2.4
Avg. PLO	3.0	2.5	2.5	3.0	2.0	2.0	2.5	3.0	1.5	3.0	2.5

Course Title**: WILDLIFE ECOTOURISM AND CONSERVATION**

Course code**: MZOODWEC125** **Total Credits**: 2 (2L+0P) **Max. Marks**: **50** (50L+0P)

Unit wise CLOs (Course Learning Outcomes)	
MZOODWEC125-I	Understand fundamentals, principles and scope of wildlife ecotourism in India
MZOODWEC125-II	Develop understanding in developing ecotourism activities for promoting wildlife conservation and local livelihoods

Theory: 02 Credits

UNIT I: CONCEPTS AND FUNDAMENTALS IN ECOTOURISM

1.1 Ecotourism-definition, principles and practices

1.2 Wildlife tourism in India, Stakeholders in ecotourism, organizations & NGO's promoting ecotourism

1.3 Aesthetic and touristic aspects of wildlife

1.4 Environmental and social impacts of ecotourism

UNIT II: ECOTOURISM AND CONSERVATION

2.1 Ecotourism and wildlife conservation in India

2.2 Sustainable tourism in protected areas- Case studies on ecotourism development

2.3 Marine wildlife tourism

2.4 Environmental impact assessment and mitigation strategies

SUGGESTED BOOKS/READING MATERIAL

1. Abhilash Mallya. 2006. Wildlife Tourism & Conservation. GNOSIS Publishers Delhi

2. Taj Rawat. 2012. Biodiversity Conservation & Wildlife Tourism. Discovery Pub. house, Delhi

3. A. K. Raina. 2005. Ecology Wildlife and Tourism Development. Roshan Offset Printers Delhi

4. Hosetti, B.B. 2007. Ecotourism development and management, Pointer publishers, Jaipur.

5. Chiranjeev, A. 2008. Ecotourism planning and Development. Jnanada Prakashan.

CLO-PLO Mapping

CLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	Avg.
MZOODWEC125-I	3	3	1	1	1	2	3	3	2	3	2.2
MZOODWEC125-II	3	3	2	2	1	2	3	2	2	3	2.3
Avg. PLO	3	3	1.5	1.5	1	2	3	2.5	2	2	2.25