

FACULTY OF LIFE SCIENCES

Syllabus

of

Master of Science (Zoology)

(Under Credit Based Continuous Evaluation Grading System)

(SEMESTER: I-II)

Session: 2025-27



Kanya Maha Vidyalaya, Jalandhar (Autonomous)
The Heritage Institution

Master of Science (Zoology)

Session 2025-27

Program Specific Outcomes

1. Understand and analyse the ecological and evolutionary principles such as evidences of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life and their economic importance. they will be able to use specific examples to explicit how descent with modification has shaped animal morphology, physiology, life history and behaviour.
2. Understanding of fundamental concepts of various branches of zoology and efficiency in computational tools, numerical methods relevant to zoology.
3. Acquire proficiency in experimental techniques, data analysis and drawing conclusions in zoology.
4. Ability to critically evaluate scientific literature, synthesize information from multiple sources and apply scientific reasoning to solve problems in zoology and related fields.
5. Demonstrate knowledge to acquire, articulate, retain and employ practical skills relevant to fundamentals of computer, molecular techniques and statistical tools.
6. Students will be able to apply their knowledge of zoology to address real world challenges in areas such as animal ecology, wildlife management, biotechnology, applied zoology and taxonomy.
7. Demonstrate adaptability to emerging technologies and tools relevant to the field of zoology and enhance communication skills for effectively presenting scientific findings and collaborating within interdisciplinary teams.
8. Understand how the chemistry and structure of the major biological macromolecules, including nucleic acids to know their biological properties and determine relationship of variations in phenotypic expression of genome and their genome wide interactions with other organisms.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)

Session-2025-27

Master of Science (Zoology) Semester-I										
Course Code	Course Name	Course Type	Hours Per Week	Credit	Total Credit	Marks				Examination time (in hours)
				Ext.		CA	Total			
				L				P		
MZOL-1481	Functional Organization of Animals–I	C	4	4-0-0	4	70	-	30	100	3
MZOL-1482	Animal Ecology	C	4	4-0-0	4	70	-	30	100	3
MZOL-1483	Cell Biology	C	4	4-0-0	4	70	-	30	100	3
MZOL-1484	Concepts of Biotechnology	C	4	4-0-0	4	70	-	30	100	3
MZOM-1135	Computer Programming and Data Processing	C	4	2-0-1	3	40	30	30	100	3+3
MZOP-1486	Practical-I (Functional Organization of Animals-I)	C	4	0-0-2	2	-	35	15	50	3
MZOP-1487	Practical-II (Ecology and Cell Biology)	C	4	0-0-2	2	-	35	15	50	3
Students can opt any one of the following interdisciplinary optional courses		IDE			4	70		30	100	3
Total					23				575	
IDEC-1101 IDEM-1362 IDEH-1313 IDEI-1124 IDEW-1275		● Communication Skills ● Basics of Music (Vocal) ● Human Rights and Constitutional Duties ● Basics of Computer Applications ● Indian heritage: Contribution to the World								

IDE–Inter Disciplinary Elective/Optional Course

***Credits/Grade points of the courses will not be included in the SGPA/CGPA of semester.**

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE
PROGRAMME
(Under Credit Based Continuous Evaluation Grading System) (CBCEGS)
Session 2025-27

Master of Science (Zoology) Semester-II										
Course Code	Course Name	Course Type	Hours Per Week	Credits	Total Credits	Marks				Examination time (in hours)
						Ext.		CA	Total	
				L-T-P		L	P			
MZOL-2481	Functional Organization of Animals–II	C	4	4-0-0	4	70	-	30	100	3
MZOL-2482	Applied Zoology-I (Invertebrates)	C	4	4-0-0	4	70	-	30	100	3
MZOL-2483	Evolution	C	2	2-0-0	2	35	-	15	50	3
MZOL-2334	Biostatistics	C	4	4-0-0	4	70	-	30	100	3
MZOS-2485	Seminar	C	4	0-0-2	2	-	35	15	50	3
MZOP-2486	Practical-III (Functional Organization of Animals–II)	C	4	0-0-2	2	-	35	15	50	3
MZOP-2487	Practical-IV (Evolution and Applied Zoology-I)	C	4	0-0-2	2	-	35	15	50	3
Total					20				500	

Master of Science (Zoology) Semester–I
Session 2025-27
Course Title: Functional Organization of Animals-I
Course Code: MZOL-1481
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1. Understand the mechanism of digestion in chordates and non-chordates.
- CO2. Understand the blood composition, types, groups and circulatory system.
- CO3. Familiarize with the physiology of respiratory system of chordates & non-chordates.
- CO4. Understand the physiology of the excretory system and come to know the physiology of the reproductive system.

Master of Science (Zoology) Semester–I
Session 2025-27
Course Title: Functional Organization of Animals–I
Course Code: MZOL-1481
(Theory)

Examination Time: 3 hrs

L-T-P: 4-0-0

Maximum Marks: 100

Theory: 70

CA: 30

Instructions for the Paper Setter:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Nutrition and Digestion

Ingestion of soluble food and particulate food in relation to habitat and habits Symbiotic nutrition
Mechanism of digestion and regulation of secretion in non-chordates and chordates

Unit–II

Transport and circulatory mechanisms

Intracellular transport in Protozoa

Circulation of external medium of transport within the body of sponges and cnidarians Open and closed types of circulatory system

Chambered, tubular and ampullary hearts

Neurogenic and myogenic hearts

Evolution of Heart and Cardio vascular system

Unit–III

Respiratory System

Respiratory organs in aquatic animals and aquatic respiration Respiratory organs and aerial mode of respiration

Distribution and brief chemistry of respiratory pigments and their function in nonchordates and chordates

Unit–IV

Excretion and Reproduction

Excretory structures and waste disposal in non-chordates, coelom, coelomic ducts, nephridia, antennal / green glands, malpighian tubules

Regulation of water salt balance

Pattern of reproduction in non-chordates and their larval forms

Evolution of the urinogenital system in chordates with special reference to the separation of the two systems

Suggested Reading Material:

- Barrington, E.U.W. (1967), Invertebrates Structure and Functions. Houghton Mifflin Co. Boston.
- Barth, R. H. and Broshears, R. E. (1982), The Invertebrate world. Holt Saunder, Japan.
- Brusca, R. C. and Brusca, G. J. (2003), Invertebrates second edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
- Cooper, G.M.(2004), The Cell: A Molecular Approach IIIrd edition, ASM Press, Washington, D.C.
- Engemann, J.G. and Hegner, R.W. (1981), Invertebrate (Zoology) (3rd ed.) Macmillan, New York.
- Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
- Hill, R.W., Wyse, G. K. and Anderson, N. (2004), Animal physiology. Sinauer Associate, INC. Pub. Saunder land, Massachusettes, USA.
- Hoar, W. S. (1984), General and Comparative Physiology. Prentice Hall of India Pvt. Limited, New Delhi, India.
- Karp, G. (2005), Cell and Molecular Biology; concepts and experiments (4th ed.), Hoboken, John Willy and Sons, New York.
- Meglitsch, P.A. and Schran, F.R. (1991), Invertebrate (Zoology) 3rdEd. Oxford University Press, NewYork.
- Pechenik, A. Jan. (2000), Biology of the invertebrates, Fourth Edition, McGraw Hill Book Co. Singapore.

Master of Science (Zoology) Semester–I
Session 2025-27
Course Title: Animal Ecology
Course Code: MZOL-1482
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1. Demonstrate and understand the ecological relationships between organisms and their environment.
- CO2. Explain and identify the role of the organism in energy transfers.
- CO3. Understand various types of adaptations and ecology of population
- CO4. Understand the applied aspect of ecology.

Master of Science (Zoology) Semester–I
Session 2025-27
Course Title: Animal Ecology
Course Code: MZOL-1482
(Theory)

Examination Time: 3 hrs
L-T-P: 4-0-0

Maximum marks: 100
Theory: 70
CA: 30

Instructions for the Paper Setter:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Introduction and History of Ecology

Structure and Functions of some special types of ecosystems (Grasslands, forests, deserts, aquatic ecosystems and agroecosystem)

Abiotic factors

Temperature, Moisture, Light, fire, Malentite, Pollution

Unit–II

Biotic Factors

Analysis of Environment

Place in which to live

Community Structure

Ecological Niche, Food chains, Food webs, biomagnifications, succession/temporal changes

Interactions and Coactions

Intraspecific Interactions

Interspecific Interactions

Predation, Parasitism, Commensalism, Mutualism etc

Unit-III

Adaptations

Cave, deep sea, arboreal, aerial, and subterrestrial

Co-adaptations and adaptive resemblances (mimicry, warning colouration, seasonal polymorphism)

Population Ecology

Concept of Population

Biotic potential and carrying capacity, dispersal and distribution
population growth and its regulations

Methods of sampling

Life tables, longevity, Migration

Unit–IV

Applied Ecology

Anthropogenic interferences

Biomonitoring of environment using animal species

Modeling and Use of remote sensing (GIS) in ecology (introduction)

Overview of sustainable development of ecosystems

Bio Geography

Zoo Geographical regions

Island ecology (endemicity)

Suggested Reading Material:

- Anderwartha, H.G. and Birch, L. C. (1970), The distribution and abundance of animals, University of Chicago Press, Chicago London.
- Beeby, A. (1992), Applying Ecology Chapman and Hall Madras.
- Begon, M., Harper J.L. and Townsend, C.R. (1995), Ecology–Individuals, populations and communities, Blackwell Science, Cambridge UK.
- Brewer, R. (1994), The science of Ecology, Saunders College of Publishing, New York.
- Chapman, J.L. and Resis, M.J. (1995), Ecology-Principles and applications, Cambridge University Press, Cambridge UK.
- Kaeighs, S.C. (1974), Ecology with special references to animal and Man, Prentice Hall Inc.
- Odum, E.P.(1983),Basic Ecology.
- Putmann, R. J. and Wratten, S.D. (1984), Principles of Ecology, Crown Helm, London.
- Salanki, J., Jeffery E. and Hughes G.M. (1994), Biological Monitoring of the Environment (Amanualof Methods) CAB International, Wallingford UK.
- Rastogi, V.B. (2018). Animal Ecology. Kalyani Publishers.

Master of Science (Zoology) Semester–I
Session 2025-27
Course Title: Cell Biology
Course Code: MZOL-1483
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1. Describe the ultra-structure and functions of cell organelles.
- CO2. Understand DNA replication, RNA and protein synthesis and come to know protein synthesis can be controlled at the level of transcription and translation.
- CO3. Understand cell signaling and cellular communication.
- CO4. Understand the types and applications of stem cells.

Master of Science (Zoology) Semester–I
Session 2025-27
Course Title: Cell Biology
Course Code: MZOL-1483
(Theory)

Examination Time: 3 hrs
L-T-P: 4-0-0

Maximum marks: 100
Theory: 70
CA: 30

Instructions for the Paper Setter:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Introduction

Cell—a unit of structure and function, cell theory Prokaryotes and eukaryotes cells

Cytoskeleton

Actin filament, Myosin, Intermediate filament, microtubules

Structure of Cell Membrane

Chemical composition

Various Lipoprotein models including fluid mosaic model

Nucleus

The Nuclear Envelope and Traffic between
the Nucleus and the Cytoplasm

Internal Organization of the Nucleus

The Nucleolus and rRNA Processing

Unit–II

Ribosomes

Prokaryotic and Eukaryotic ribosomes

Role of ribosomes in protein synthesis in prokaryotes and eukaryotes

Golgi complex

Structure and Function of: Cisternae, vacuoles and vesicles Types of
Vesicle Transport and their functions

Protein sorting and targeting GERL concept

Endoplasmic Reticulum

Structure and Function of endoplasmic reticulum

Membrane synthesis in the ER

Mechanism ensuring destruction of misfolded protein ER to Golgi vesicular transport

Unit-III

Mitochondria

Structure and Functions

Oxidative metabolism in the Mitochondrion Role of Mitochondria in the formation of ATP

Electron-Transport complexes

Lysosomes

Lysosomal acid hydrolases Endocytosis and Lysosome formation Lipofuscin pigments

Peroxisomes

Functions of peroxisomes Glyoxylate pathway Peroxisome assembly

Unit-IV

Cell signaling

Signaling molecules and their receptors

Functions of cell surface receptors Pathways of intracellular signal transduction Signal transduction and the cytoskeleton

Cell Cycle

Various cell cycle check points Cyclin and cyclin dependent kinases Regulation of CDK- cyclin activity

Suggested Reading Material:

- Alberts, B. Bracy, P. Lewis, J. Raff, M. Roberts K and Watson, J. (eds) (1994). Molecular Biology of the Cell, Garland Publishing, New York.
- Avers, C.J. (1976). Cell Biology, VanNostr and Reinhold, New York.
- Cooper, G.M. (2004). The cell, A Molecular Approach ASM press, Washington, D.C.
- Darnell, J. Lodish, H. and Baltimore, D. (2004). Molecular Cell Biology, 2nd edition, Freeman, New York.
- Derobertis, E. D. P. and Derobertis, E.M.F. (1987). Essentials of Cell and Molecular Biology. Hold Saunders – Philadelphia.
- Karp,G. (1984). Cell Biology 4th Edition, McGraw Hill, New York.
- Karp G. (1999). Cell and Molecular Biology. Concepts and Experiments, 2nd Editon John Wiley and Sons, Inc. New York, Brisbane, Toronto.
- Powar, C.B. (1990). Cell Biology. Himalaya Publishing House, Bombay.

Master of Science (Zoology) Semester–I
Session 2025-27
Course Title: Concepts of Biotechnology
Course Code: MZOL-1484
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1. Describe cell culture and cell lines.
- CO2. Understand molecular markers and vectors used in biotechnology fields.
- CO3. Understand various techniques in biotechnology.
- CO4. Understand the types and applications hybridoma technology and vaccines.

Master of Science (Zoology) Semester-I
Session 2025-27
Course Title: Concepts of Biotechnology
Course Code: MZOL-1484
(Theory)

Examination Time: 3 hrs
L-T-P: 4-0-0

Maximum marks: 100
Theory: 70
CA: 30

Instructions for the Paper Setter:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Brief introduction to Biotechnology

Cell culture and medium

Cell culture, Cell lines, protocol cryo-preserving cultured cells, cell viability and cell proliferation

Restriction Enzymes

DNA ligase, Klenow enzyme, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase

Stem Cells and Tissue engineering

Embryonic stem cell, adult stem cells, stem cell differentiation

Unit-II

Markers and Vectors Molecular markers

RFLP, RAPD, SSLP markers

Vectors

Plasmid vectors, Bacteriophage vectors, Cosmids, M13, Phagemids, Fosmids, BACs and YACs

Cloning

Gene cloning and sequencing, cDNA cloning, Identification of Specific clone with a specific probe, Practical applications of gene cloning

Unit-III

Techniques

Principal, theory and application of Southern, Northern, Western Blotting

Polyacrylamide gel electrophoresis (PAGE)

Polymerase chain reaction (PCR)

DNA finger printing

DNA foot printing

In situ hybridization

Restriction fragment length polymorphism (RFLP)

Unit–IV

Hybridoma Technology

Immunization of animals:

isolation of stimulated spleen cells

Myeloma cell lines used as fusion partners

Fusion methods

Monoclonal antibodies

Detection and applications

Vaccines

Conventional vaccines

Viral vaccines

Peptide vaccines

Genetically engineered vaccines

Production and applications of Cytokines

Suggested Reading Material:

- Spier, R.R. and Griffiths, J.B. (1994). Animal Cell Biotechnology, 6thEd., Academic Press, London.
- Krogsgaard-larsen, P., Liljefors T., Madsen U. and Larsen K, Liljefors T. Madsen U. (2016). Textbook of Drug Design and Discovery, 5 th Ed. Taylor and Francis Publications, Washington D.C.
- Gupta, P. K. (1996). Elements of Biotechnology, Rastogi and Co., Meerut.
- Henry, R.J. (1997). Practical Applications of Plant Molecular Biology, Chapman and Hall.

Master of Science (Zoology) Semester-I
Session 2025-27
Course Title: Practical-I (Functional Organization of Animals-I)
Course Code: MZOP-1486
(Practical)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1. Understand the comparative anatomy of gut through demonstration.
- CO2. Understand the comparative physiology of circulatory, excretory & reproductive system through ICT based videos, presentations and charts.
- CO3. Understand Nephridia in annelids (earthworm), green glands in crustaceans, Malpighian tubules in Cockroach.
- CO4. Understand Excretory system of frog, lizard, bird and rat.

Master of Science (Zoology) Semester-I
Session 2025-27
Course Title: Practical-I (Functional Organization of Animals-I)
Course Code: MZOP-1486
(Practical)

Examination Time: 3 hrs
L-T-P: 0-0-2

Maximum marks: 50
Practical: 35
CA: 15

Instructions for the Practical Examiners:

Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Study of permanent slides

Mouth parts: honeybee, housefly, cockroach, butterfly, mosquito, and bug Salivary glands

Blood smear of animals

Radula of Pila

Jaws of Leech

Using slides/charts/models/videos study of following

Anatomy of gut in relation to food and feeding habits of detritivores, carnivores, herbivores, omnivores and sanguivores

Different kinds of Heart and blood vascular system in animals

Respiratory structures: Gills (Crustaceans, Bivalves, Cephalopods, and Fish); Book Lungs (Scorpion); Trachea and spiracles (Cockroach)

Nephridia in annelids (earthworm), green glands in crustaceans, Malpighian tubules in Cockroach

Excretory system of frog, lizard, bird and rat

Histology of ovary, oviduct, uterus, testis and placenta in different groups of invertebrates and vertebrates

Reproductive organs in Hydra, Flatworm, Earthworm, Cockroach, Pila, Fish, Frog, Lizard, Bird and Rat

Note: The above-mentioned practicals are in accordance with the guidelines of UGC. Practical involving animal material will be conducted using models/charts/e-resources. Minor modifications in the curriculum are allowed subject to availability of resources.

Master of Science (Zoology) Semester-I
Session 2025-27
Course Title: Practical-II (Ecology and Cell Biology)
Course Code: MZOP-1487
(Practical)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1. Understand the population estimation of Invertebrates and vertebrates using different methods.
- CO2. Describe the fine structure and functions of cell organelles.
- CO3. Perform a variety of cellular biology techniques.
- CO4. Analyze various physicochemical properties of blood.

Master of Science (Zoology) Semester-I
Session 2025-27
Course Title: Practical-II (Ecology and Cell Biology)
Course Code: MZOP-1487
(Practical)

Examination Time: 3 hrs
L-T-P: 0-0-2

Maximum marks: 50
Practical: 35
CA: 15

Instructions for the Practical Examiners:

Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Population estimations:

Using Mark and Release method and to study the effect of migration on them (Using colored beads).

Estimation of population: Protozoans, Nematodes and Soil arthropods

Combined population studies using quadrates:

Intra-population distribution and Poisson distribution, construction of life table and survivorship curves from given data.

Analysis of following:

Normal and abnormal constituents in urine sample RBC, WBC (TLC, DLC), platelet counts
Determination of ESR and PCV of human blood

Study of cell using permanent slides:

Prokaryote cells: *Lactobacillus*, *E.coli*. Blue green algae

Eukaryote cells, Testicular material (for studies of spermatogenesis).

Microtomy: Introduction of the instrument—its use, care

Study of permanent slides of various tissues (gut region, liver, lung, spleen kidney, pancreas, testis, ovary, tongue, skin etc.).

Study of electron micrographs of various cell organelles:

Plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen and lipids etc

Note: The above-mentioned practicals are in accordance with the guidelines of UGC. Practical involving animal material will be conducted using models/charts/e-resources. Minor modifications in the curriculum are allowed subject to availability of resources.

Master of Science (Zoology) Semester–II
Session 2025-27
Course Title: Functional Organization of Animals–II
Course Code: MZOL-2481
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Describe the specializations and evolution of skin and muscles.
- CO2 Describe the physiology of nervous system of human beings.
- CO3 Understand the physiology of endocrine system.
- CO4 Understand the physiology of sense organs

Master of Science (Zoology) Semester–II
Session 2025-27
Course Title: Functional Organization of Animals–II
Course Code: MZOL-2481
(Theory)

Examination Time: 3 hrs
L-T-P: 4-0-0

Maximum marks: 100
Theory: 70
CA: 30

Instructions for the Paper Setter:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit-I

Integumentary System

Embryonic origin

General features of the Integument Specializations of integument Evolution of Skin

Muscular System

Classification of Muscles

Structure of Skeletal Muscles and cardiac muscle

Tendons Muscle mechanics

Muscle Function

Basis of Muscles contraction

Muscle Fiber

Muscle organs and fibers Bone-muscle lever systems

Unit–II

Skeletal System

Exo and Endo Skelet on in Invertebrates

Appendicular skeleton in vertebrates

Basic Components

Phylogeny of fishes and tetrapods

Evolution of the appendicular system

Form and Function

Swimming

Terrestrial locomotion

Unit–III

Integratory Systems

Chemical coordination of body functions through neuro-secretion in non-chordates Physiology of nerve net and giant fibre system

Evolution of functional anatomy of brain

Endocrine System

Endocrine organs

Chemical coordination of body functions through hormones and neuro-secretions

Unit-IV

Sensory System

General sensory organs

Free sensory receptors

Encapsulated sensory receptors

Associated sensory receptors

Mechanisms of perceiving stimuli

Special sensory organs (Mechano, Radiation, Chemo and Electoreceptors)

Additional special sensory organ

Suggested Reading Material:

- Barrington, E. U. W. (1967), Invertebrates Structure and Functions. Houghton Mifflin Co. Boston.
- Barth, R.H. and Broshears, R.E (1982), The Invertebrate World. Holt Saunder, Japan.
- Brusca, R. C. and Brusca, G. J. (2003), Invertebrates Second Edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
- Prosser, C.L. (1984), Comparative Animal Physiology. Satish Book Enterprise Books Seller & Publishers, Agra.
- Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2001), Life– The Science of Biology 6th ed., Sinauer Assoc. Inc., USA.
- Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations. W.H. Freeman and Company, New York.
- Ruppert, E. E. and Barnes, R. D. (2004), Invertebrate ((Zoology)) 7th ed. Saunders Publ., Philadelphia.
- Willmer, P., Stone,G. and Johnston, I (2000). Environmental Physiology of Animals, Blackwell Science.
- Withers, P.C. (1992), Comparative Animal Physiology. Saunder College Publishing New York.

Master of Science (Zoology) Semester–II

Session 2025-27

Course Title: Applied Zoology–I

Course Code: MZOL-2482

(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: Understand the methods of beekeeping, diseases of honey bee and various bee products.
- CO2: Know the culture and harvesting methods of Lac and mulberry silkworm.
- CO3: Understand the various methods of prawn farming. The students will also know about the spoilage, processing and preservation of prawns.
- CO4: Understand the artificial pearl formation and economics of Vermiculture.

Master of Science (Zoology) Semester–II

Session 2025-27

Course Title: Applied Zoology–I

Course Code: MZOL-2482

(Theory)

Examination Time: 3 hrs

L-T-P: 4-0-0

Maximum marks: 100

Theory: 70

CA: 30

Instructions for the Paper Setter:

Eight questions of equal marks (14 marks each) are to be set, two in each of the four Sections (A- D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Apiculture

History and Introduction

Honey bee Species

Social organization of colony and nests

Life Cycle of Honey Bee

Relation between honey bees and plants Flora for Apiculture

Honey composition, quality and importance

Beekeeping, selection, methods, precautions

Products of beekeeping

Bee enemies and diseases

Unit–II

Lac culture

Introduction

Lac insect species, Life cycle and Host plants

Lac composition, properties & importance

Cultivation and harvesting of Lac

Enemies of Lac insect and host plants

Lac industry in India

Sericulture

Indian sericulture industry (Distribution and Prospects)

Silk moth species and their Life Cycle

Silk composition, kinds and uses

Mulberry cultivation

Rearing of silkworm

Treatment and disposal of cocoons

Silk reeling, twisting and weaving

Diseases & pests of silkworm

Unit–III

Prawn Culture

Introduction to prawns

Prawn species

Freshwater prawn farming and Marine Prawn farming

Methods of Prawn farming

Spoilage and its prevention

Processing and preservation of prawns

Future of prawn culture

Unit–IV

Pearl Culture

Historical background

Pearl oyster –species

Pearl formation, composition, quality and commercial value

Artificial Culturing of Pearls

Synthetic pearls types and their manufacturing

Methods of harvesting

Problems of pearl industry

Vermiculture

Species of worms

Conditions for efficient

Vermiculture (domestic and commercial level)

Economics of Vermiculture

Suggested Reading Material:

- Bhamrah, H. S. & Juneja, K. (2001), An Introduction to Mollusca. Anmol Publications Pvt. Ltd. New Delhi.
- Bhatnagar, R. K. and Palta, R. K. (2003), Earthworm; Vermiculture and Vermicomposting, Kalyani Publishers India.
- Carter, G.A. (2004) Beekeeping, Biotech Books, New Delhi.
- Fenermore, P.G. and Prakash, A. (1992), Applied Entomology, Wiley Eastern Ltd. New Delhi
- Ghorai, N. (1995), Lac Culture in India. International Books and Periodicals, New Delhi.
- Jhingran, V.G. (1991) Fish and Fisheries of India, Hindustan Publishing Company India.
- Kumar, A. and Nigam, P.M. (1989), Economic and Applied Entomology EMKAY Publishing Co. New Delhi.
- Mishra, R. C. (1995), Honey Bees & their Management in India. ICAR, New Delhi.

- Mustafa, S. (1990) Applied and Industrial (Zoology). Associated Publishing Company, New Delhi.
- Shukla, G.S. & Upadhaya, V.B. (1991-92), Economic (Zoology), Rastogi Publications, Meerut.
- Sathe, T.V. and Jadhav, A.D. (2001) Sericulture and Pest Management, Daya Publishing House, New Delhi.

Master of Science (Zoology) Semester–II

Session 2025-27

Course Title: Evolution

Course Code: MZOL-2483

(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: Understand the process of origin of life and evidences of organic evolution.
- CO2: Understand the variations in animals and how natural selection operates.
- CO3: Explain how speciation and extinction takes place and distribution of species.
- CO4: Explain how the molecular aspects provides evidence for evolution.

Master of Science (Zoology) Semester–II

Session 2025-27

Course Title: Evolution

Course Code: MZOL-2483

(Theory)

Examination Time: 3 hrs

L-T-P: 2-0-0

Maximum marks: 50

Theory: 35

CA: 15

Instructions for the Paper Setter:

Eight questions of equal marks (7 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

Unit–I

Origin of Life

Origin of Micro molecules

Origin of Macromolecules

Origin of Viruses

Origin of Prokaryotes

Origin of Unicellular eukaryotes and multicellularity

Organic Evolution

Theories (Lamarckism and Darwinism)

Evidences

Separation of kingdoms

Unit–II

Variations

Types of variations

Causes of variations

Mutation rates and directions

Natural Selection

Types of selection

Selection forces

Experimental demonstration of Natural selection

Industrial melanism and polymorphism

Sexual selection

Selection and non-adaptive characters

Unit–III

Speciation

Isolation and its types

Gradual and abrupt

Origin of higher categories

Distribution of Species

Island, Ocean and Continental distribution

Theories of continental drift

Extinction

Kinds of extinction and causes of extinction

Major extinctions

Unit – IV

Quantitative and Molecular Aspects of

Evolution

Hardy-Weinberg law

Genetic drift

Selection pressure

Mutation pressure

Migration

Meiotic drive

Brief account of

Evolution of genome in viruses, prokaryotes and eukaryotes

Evolution of sexual reproduction

Molecular clocks

Evolution of Horse, Elephant, Man (in brief)

Future Course of Evolution

Suggested Reading Material:

- Avers, C. J. (1989). Evolution - Process and Pattern in Evolution Oxford University, Press, New York, Oxford.
- Ayala, F.J. and Valentine J.W. (1979). Evolving the theory and Process of Organic Evolution, Benjamin Cumming.
- Brook field, A. P. (1986). Modern aspects of Evolution. Hutchinson London, Melbourne.
- Gallow, P. (1983). Evolutionary principles. Chapman and Hall.
- Freeman, S. and Herron, Jon C. (2007). Evolutionary analysis Pearson Prentice Hall, New Jersey.
- Futuyma, D.J. (1998), Evolutionary Biology, Sinauer Assoc. Inc. Pub. USA.
- Meglitsch, P.A. (1991), Invertebrate (Zoology) (3rd edition), Oxford University Press.
- Minkoff, E. C. (1983), Evolutionary Biology, Addison Wesley Pub. Co., London.
- Wen-Hsiung Li (1997), Molecular Evolution, Sinauer associates Inc.Pub.USA.

Master of Science (Zoology) Semester–II
Session 2025-27
Course Title: Seminar
Course Code: MZOS-2485

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: Express their innovative ideas & creativity on any scientific phenomenon and develop interest in research aptitude.
- CO2: Buildup confidence for public speaking.
- CO3: Improve their presentation skills.
- CO4: Learn to study literature

Master of Science (Zoology) Semester–II

Session 2025-27

Course Title: Seminar

Course Code: MZOS-2485

Examination Time: 3 hrs

L-T-P: 0-0-2

Maximum marks: 50

Theory: 35

CA: 15

Instructions for the Paper Setters:

The students are required to present a seminar on a topic of relevance related to recent research in life sciences. It emphasizes hands-on learning through group discussions, presentations, and research activities.

Master of Science (Zoology) Semester–II
Session 2025-27
Course Title: Practical–III (Functional Organizations of Animals-II)
Course Code: MZOP-2486
(Practical)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: Understand the comparative anatomy through demonstration.
- CO2: Understand the comparative physiology of sense organs, muscles, endocrine system through ICT based videos, presentations and charts.
- CO3: Compare reproductive systems of various invertebrates.
- CO4: Understand the comparative physiology reproductive system through ICT based videos, presentations and charts.

Master of Science (Zoology) Semester–II
Session 2025-27
Course Title: Practical–III (Functional Organizations of Animals-II)
Course Code: MZOP-2486
(Practical)

Examination Time: 3 hrs
L-T-P: 0-0-2

Maximum marks: 50
Practical: 35
CA: 15

Instructions for the Practical Examiners:

Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Study of permanent slides

Skin of fish, frog, lizard, bird and mammal
Setae of earthworm
Spicules of Sponges and Herdmania
Internal ear of fish
Tentorium of grasshopper
Muscle fibers, cartilage and bone
Endocrine glands of vertebrates

2. Appendicular skeleton

3. Study the following with the help of charts/models/videos/permanent slides

Appendages of Prawn
Wing venation, coupling and types of wings of insects
Comparative anatomy of nervous system in Earthworm, Cockroach, Pila, Sepia, Fishes, Bird and Mammal
Eye muscles of fish/mammal
Modification of antennae of arthropods

Note: The above mentioned practicals are in accordance with the guidelines of UGC. Practical involving animal material will be conducted using models/charts/e-resources. Minor modifications in the curriculum are allowed subject to availability of resources.

Master of Science (Zoology) Semester–II
Session 2025-27
Course Title: Practical–IV (Evolution and Applied Zoology-I)
Course Code: MZOP-2487
(Practical)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1: Calculate regression, correlation and variance of gene frequency and genetic equilibrium and understand the principle of natural selection as a process related to evolution.
- CO2: Comparison of skeletons for listing evolutionary trends and comparison of molluscan shells to depict polyphyletic origin.
- CO3: Compare homologous and analogous structures.
- CO4: Prepare of Phylogenetic tree using some Priory weight characters with the help of 8 – 10 animals from various categories.

Master of Science (Zoology) Semester–II
Session 2025-27
Course Title: Practical–IV (Evolution and Applied Zoology-I)
Course Code: MZOP-2487
(Practical)

Examination Time: 3 hrs
L-T-P: 0-0-2

Maximum marks: 50
Practical: 35
CA: 15

Instructions for the Practical Examiners:

Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Calculations for regression, correlation and variance of gene frequency and genetic equilibrium (taking pea pods).
2. Examination of the principle of natural selection as a process related to evolution in a population (using coloured marbles /beads).
3. Comparison of skeletons for listing evolutionary trends.
4. Comparison of molluscan shells to depict polyphyletic origin.
5. Comparison of homologous and analogous structures (e.g. insect antenna, legs, limbs of vertebrate etc.).
6. Demonstration of kinds of mimicry in various groups of animals.
7. Mapping of geographic distribution of some birds, insects, fish etc.
8. Study of various evolutionary phenomenon using slides/photographs.
9. Study of fossils.
10. Preparation of Phylogenetic tree using some Priory weight characters with the help of 8 – 10 animals from various categories.
11. Visit to apiary/vermicomposting unit/ sericulture unit/ Prawn Farm and preparation of report.

Note: The above-mentioned practical are in accordance with the guidelines of UGC. Practical involving animal material will be conducted using models/charts/e-resources. Minor modifications in the curriculum are allowed subject to availability of resources.