

FACULTY OF LIFE SCIENCES

Syllabus

of

Master of Science (Zoology)

(Under Credit Based Continuous Evaluation Grading System)

(SEMESTER: I-I)

Session: 2026-27



Kanya Maha Vidyalaya, Jalandhar (Autonomous)
The Heritage Institution

Master of Science (Zoology)
Session 2026-27
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-2026-27

Master of Science (Zoology) Semester-I										
Course Code	Course Name	Course Type	Hours Per Week	Credit	Total Credit	Marks				Examination time (in hours)
				L-T-P		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					
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

C- Compulsory

Kanya Maha Vidyalaya, Jalandhar

SCHEME AND CURRICULUM OF EXAMINATIONS OF TWO-YEAR DEGREE PROGRAMME

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

Session 2026-27

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
MZOP-2485	Practical-III (Functional Organization of Animals–II)	C	4	0-0-2	2	-	35	15	50	3
MZOP-2486	Practical-IV (Evolution and Applied Zoology-I)	C	4	0-0-2	2	-	35	15	50	3
MZOS-2487	Seminar	C	4	0-0-2	2	-	35	15	50	3
Total					20					

C-Compulsory

Master of Science (Zoology) Semester–I
Session 2026-27
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
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

Reproduction

Pattern of reproduction in non-chordates and their larval forms

**Master of Science
(Zoology) Semester-I**

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

Unit-IV

Osmoregulation and Excretion

Hyperosmotic, hyposmotic and isosmotic mediums, Excretion and metabolic waste products – an introduction.

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

Osmoregulation in non-chordates, adaptation to different environments / habitats.

Development and adult structural organization of chordate kidney: nephron, the functional unit.

Suggested Reading Material:

1. Barrington, E. U. W. (1967), Invertebrates Structure and Functions. Houghton Mifflin Co. Boston.
2. Barth, R. H. and Broshears, R. E (1982), The Invertebrate world. Holt Saunder, Japan.
3. Brusca, R. C. and Brusca, G. J. (2003), Invertebrates second edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
4. Cooper, G. M. (2004), The Cell: A Molecular Approach IIIrd edition, ASM Press, Washington, D.C.
5. Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed.) Macmillan, New York.
6. Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
7. Hill, R. W., Wyse, G. K. and Anderson, N. (2004), Animal physiology. Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
8. Hoar, W. S. (1984), General and Comparative Physiology. Prentice Hall of India Pvt. Limited, New Delhi, India.
9. Karp, G.(2005), Cell and Molecular Biology; concepts and experiments (4th ed.),Hoboken, John Willy and Sons, New York.
10. Meglitsch, P. A. and Schran, F. R. (1991), Invertebrate Zoology 3rd Ed. Oxford University Press, New York.
11. Pechenik, A. Jan. (2000), Biology of the invertebrates, Fourth Edition, McGraw Hill Book Co. Singapore.
12. Prosser, C.L. (1984), Comparative Animal Physiology. Satish Book Enterprise Books seller & Publishers, Agra.
13. Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2001), Life – The Science of Biology 6th ed., Sinauer Assoc. Inc., USA.
14. Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations. W.H. Freeman and Company, New York.
15. Ruppert, E. E. and Barnes, R. D. (2004), Invertebrate Zoology 7th ed. Saunders Publ. Philadelphia.
16. Willmer, P. Stone, G. and Johnston, I (2000). Environmental Physiology of Animals, Blackwell Science.

**Master of Science
(Zoology) Semester–I**

17. Withers, P.C. (1992), Comparative Animal Physiology Saunder College Publishing, New York.
18. Barrington, E. U. W. (2017), Invertebrates Structure and Functions (2nd edition). Houghton Mifflin Co. Boston.
19. Cooper, G. M. (2018), The Cell: A Molecular Approach 8th edition, ASM Press, Washington, D.C.
20. Hill, R. W., Wyse, G. K. and Anderson, N. (2017), Animal physiology (4th edition). Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
21. Hoar, W. S. (2003), General and Comparative Physiology 3rd edition. Prentice Hall of India Pvt. Limited, New Delhi, India.
22. Karp, G. (2020), Cell and Molecular Biology; concepts and experiment (9th ed.), Hoboken, John Willy and Sons, New York.
23. Pechenik, A. Jan. (2005), Biology of the invertebrates, Fifth Edition, McGraw Hill Book Co. Singapore.
24. Prosser, C.L. (2003), Comparative Animal Physiology fourth edition. Satish Book Enterprise Books seller & Publishers, Agra.
25. Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2022), Life – The Science of Biology 7th ed., Sinauer Assoc. Inc., USA.
26. Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations fifth ed. W.H. Freeman and Company, New York.
27. Willmer, P. Stone, G. and Johnston, I (2004). Environmental Physiology of Animals second ed., Blackwell Science.
28. Withers, P.C. (1992), Comparative Animal Physiology Saunder College Publishing, New York.

**Master of Science
(Zoology) Semester-I
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
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

Master of Science**(Zoology) Semester-I****Unit-IV****Applied Ecology**

Anthropogenic interferences

Biomonitoring of environment using animal species

Role of Artificial Intelligence in 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
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
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

**Master of Science
(Zoology) Semester-I
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.

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 2020-21

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 2026-27
COMPUTER PROGRAMMING AND DATA PROCESSING
COURSE CODE: MZOM-1135

COURSE OUTCOME

After passing this course the student will be able to:

CO1: Comprehend computer fundamentals, operating system concepts and office automation software.

CO2: Work with complete office suite for making spreadsheets, documents and presentations.

CO3: Comprehend basics of C Programming Language.

CO4: Apply various control statements and arrays of C Programming Language for designing solutions to different real-world problems.

Master of Science (Zoology) Semester-I
Session 2026-27
COMPUTER PROGRAMMING AND DATA PROCESSING
COURSE CODE: MZOM-1135

Examination Time: (3+3) Hours

L-T-P: 2-0-1

Credits: 3

Max. Marks: 100

Theory: 40

Practical: 30

CA: 30

Instructions for Paper Setter -

Eight questions of equal marks (8 marks each) are to 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 divided 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 to Computer capabilities, Classifications.

Computer components, Introduction to hardware and software concepts, operating systems, peripherals, I/O devices, Limitations of computer.

UNIT - II

Basic Features and usage of:

Word Processing Software: Creating, Editing, Formatting and Printing document

Spreadsheet Software: Creating, Editing, Formatting and Printing a sheet

Presentation Software: Creating, Editing, Formatting and Printing a presentation

UNIT- III

Introduction to C Programming language.

Program structure, elements, character set, constants, variables, data types, identifiers, operators and expressions.

I/O Statements: printf and scanf statement.

UNIT - IV

Control statements: if, if else, else if ladder, nesting, switch, Looping statements: do while, while, for

Arrays: Basic usage, Declaration, Initialization and Types.

References / Textbooks:

1. Anshuman Sharma, Learn Programming in C, Lakhanpal Publishers, 7th Edition.
2. E Balagurusamy, Programming in ANSI C, Tata McGraw-Hill, 2002.
3. Yashvant Kanetkar, Let Us C, BPB Publications, 2016.

4. Gurwinder Singh, Rachhpal Singh, Fundamentals of Computer and PC Software, Kalyani Publishers, 2015.
5. Anshuman Sharma, Fundamentals of Information Technology, Lakhanpal Publishers, 5th Edition.
6. Byron Gottfried, Schaum's Outline Programming with C, McGraw Hill, 1996.

Note: The latest editions of the books should be followed.

Master of Science (Zoology) Semester-I

Session 2026-27

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 2026-27

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.

Session 2026-27
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.

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:

AI-based recognition and classification of prokaryotic and eukaryotic cells using digital slide images.

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 2026-27

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
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 of Basis of Muscles contraction

Muscle Fiber, Muscle organs and fibers

Bone-muscle lever systems

Unit-II

Skeletal System

Exo and Endo Skeleton 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 in vertebrates

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:

1. Barrington, E. U. W. (1967), Invertebrates Structure and Functions. Houghton Mifflin Co. Boston.
2. Barth, R. H. and Broshears, R. E (1982), The Invertebrate World. Holt Saunder, Japan.
3. Brusca, R. C. and Brusca, G. J. (2003), Invertebrates Second Edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.
4. Cooper, G. M. (2004), The Cell: A Molecular Approach, IIIrd edition, ASM Press, Washington, D.C.
5. Engemann, J. G. and Hegner, R. W. (1981), Invertebrate Zoology (3rd ed.) Macmillan, New York.
6. Gardiner, M. S. (1972), The Biology of Invertebrates, McGraw Hill, New York.
7. Hill, R. W., Wyse, G. K. and Anderson, N. (2004), Animal Physiology. Sinauer Associate, INC. Pub. Saunderland, Massachusettes, USA.
8. Hoar, W. S. (1984), General and Comparative Physiology. Prentice Hall of India Pvt. Limited, New Delhi, India.
9. Karp, G. (2005), Cell and Molecular Biology; Concepts and Experiments (4th ed.), Hoboken, John Willy and Sons, New York.

10. Meglitsch, P. A. and Schran, F. R. (1991) Invertebrate Zoology, 3rd Ed. Oxford University Press, New York.
11. Pechenik, A. Jan. (2000), Biology of the Invertebrates, Fourth Edition, McGraw Hill Book Co. Singapore.
12. Prosser, C.L. (1984), Comparative Animal Physiology. Satish Book Enterprise Books Seller & Publishers, Agra.
13. Purves, W. K., Oriane, G. H., Space, H. C. and Salava, D. (2001), Life – The Science of Biology 6th ed., Sinauer Assoc. Inc., USA.
14. Randall, D., Burggren, K.L. and French, K. (2002), Eckert Animal Physiology: Mechanisms and Adaptations. W.H. Freeman and Company, New York.
15. Ruppert, E. E. and Barnes, R. D. (2004), Invertebrate Zoology 7th ed. Saunders Publ., Philadelphia.
16. Willmer, P. . Stone, G. and Johnston, I (2000). Environmental Physiology of Animals, Blackwell Science.
17. Withers, P.C. (1992), Comparative Animal Physiology Saunder College Publishing, New York.
18. Barrington, E. U. W. (2017), Invertebrates Structure and Functions 2nd ed.. Houghton Mifflin Co. Boston.
Brusca, R. C. and Brusca, G. J. (2003), Invertebrates Second Edition. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts.

Master of Science (Zoology) Semester–II
Session 2026-27
Course Title: Applied Zoology–I (Invertebrates)
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 2026-27

**Course Title: Applied Zoology–I
(Invertebrates)**

**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
AI-based image analysis for detection of 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 fishing

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

Use of Artificial Intelligence in 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 2026-27

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 2026-27
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

Role of AI in prediction of Future extinction risks

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: 2026-27
Course Title: Biostatistics
Course Code: MZOL-2334

Course Outcomes

After the Successful Completion of the subject students will be able to

CO 1: Know how to collect, analyze and interpret data and use this data to find out different measures of central tendency, dispersion, skewness, kurtosis and moments. They able to define event, outcome, trial, simple event, sample space and calculate the probability of events for more complex outcomes related to conditional, additive and multiplicative law of probability.

CO 2: Able to use and stimulate random variable, distribution function, probability mass function and probability density function using calculus to answer the quantitative questions about the outcome of probabilistic systems. And also understand the concept of mathematical expectation and use it to find out the mean, variance, standard deviation, kurtosis etc. of different probability distributions like Binomial, Poisson and Normal etc.

CO 3: Use Correlation to identify the strength and direction of a linear relationship between two variables and using Regression to predict how much a dependent variable changes based on adjustments to an independent variable and also apply Karl Pearson Correlation coefficient and Spearman's Rank Correlation and Least Square technique for Regression lines.

CO 4: Understand how to develop Null and Alternative Hypothesis and examine the process of Hypothesis testing with reference to one or two tailed test at a given level of significance. Also manage to solve problems using t, Z and Chi-Square test and will be able to describe the use of ANOVA for one way and two way classified data with one observation per cell.

Master of Science (Zoology) Semester-II

Session: 2026-27

Course Title: Biostatistics

Course Code: MZOL-2334

Examination Time: 3 Hrs

L T P 4-0-0

Max. 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.

The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

Unit I

Statistical Method: Collection of data. Frequency distribution and its graphical representation. Measures of central tendency, dispersion, moments, skewness and kurtosis .

Unit II

Probability: Random experiment, sample space events, mathematical definition of probability, addition and multiplication law of probability. Distribution of binomial, Poisson and normal variables and (without derivation)

Unit III

Correlation and Regression: Relationship between variables, covariance, Karl-Pearson's correlation coefficient, Spearman's rank correlation coefficient, interpretation of correlation coefficients, Least square technique for regression lines (without proof), regression coefficients, relationship between correlation analysis and regression analysis.

Unit IV

Hypothesis Testing: Sample statistics and parameters, population null hypothesis, level of significance. Definitions of Chi-square test, , Application of Chi Square test as a goodness of fit and association of attributes, t-test as a test of single and difference of means and F-test as a test of equality of population variances in testing of hypothesis.

Analysis of Variance: Analysis of variance for one-way classified data.

Text Book:

S.C. Gupta, V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan Chand & Sons, Twelfth Edition, 2020

Reference Books

1. E. Batschelet, Introduction to Mathematics for Life Scientists, Springer Publisher, Third Edition, 1979
2. P.N. Arora, P.K. Malhan, Biostatistics, Himalaya Publishing House, Mumbai, Reprint 2013.

Master of Science (Zoology) Semester–II
Session 2026-27

Master of Science (Zoology) Semester–II
Session 2026-27
Course Title: Practical–III (Functional Organizations of Animals-II)
Course Code: MZOP-2485
(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

Course Title: Practical–III (Functional Organizations of Animals-II)

Course Code: MZOP-2485

(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 2026-27

Session 2026-27
Course Title: Practical–IV (Evolution and Applied Zoology-I)
Course Code: MZOP-2486
(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 2026-27

Course Title: Practical–IV (Evolution and Applied Zoology-I)

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. 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 Priority 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.

Master of Science (Zoology) Semester–II

Session 2026-27

Course Title: Seminar

Course Code: MZOS-2487

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 2026-27

Course Title: Seminar
Course Code: MZOS-2487

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