FACULTY OF LIFE SCIENCES

Syllabus for

Master of Science (Zoology)
(Under Credit Based Continuous Evaluation Grading System)
(SEMESTER: I-II)
Session: 2024-26

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
The Heritage Institution

(Session 2024-26)

Master of Science (Zoology)

Program Specific Outcomes

1. Understand and analyse 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

Session-2024-26

Master of Science (Zoology) Semester-I

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-T-P		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**				**600**	

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 Course

*** Credit points of these 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

Session-2024-26

Master of Science (Zoology) Semester-II

Course Code	Course Name	Course Type	Hours Per Week	Credits	Total Credits	Marks				Examination time (in hours)
						Ext.				
				L-T-P		L	P	CA	Total	
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	70	-	30	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**	

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Functional Organization of Animals– I (Theory)
Course Code: MZOL-1481

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand the physiological mechanisms.
- CO2 Familiarize with the physiology of digestive and respiratory system of chordates & non-chordates.
- CO3 Understand the blood composition, types, groups and circulatory system.
- CO4 Understand the physiology of excretory system.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Functional Organization of Animals– I (Theory)
Course Code: MZOL-1481

Examination Time: 3 hrs **Maximum marks: 100**
L-T-P: 4-0-0 **Theory marks: 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 bodyof sponges and cnidarians
Open and closed types of circulatory system
Chambered, tubular and ampullary hearts
Neurogenic and myogenic hearts
Evolution of Heart and Cardiovascular 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. Saunderland, 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) 3rd Ed. Oxford University Press, NewYork.
- Pechenik, A. Jan. (2000), Biology of the invertebrates, Fourth Edition, McGraw Hill Book Co. Singapore.
- 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.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Animal Ecology (Theory)
Course Code: MZOL-1482

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

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Animal Ecology (Theory)
Course Code: MZOL-1482

Examination Time: 3 hrs **Maximum marks: 100**
L-T-P: 4-0-0 **Theory marks: 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 and longevity, Migration and Ecesis

Unit – IV

Applied Ecology
Anthropogenic interferences
Bio monitoring 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 ofthe Environment (A manual of Methods) CAB International, Wallingford UK.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Cell Biology (Theory)
Course Code: MZOL-1483

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.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Cell Biology (Theory)
Course Code: MZOL-1483

Examination Time: 3 hrs **Maximum marks: 100**
L-T-P: 4-0-0 **Theory marks: 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
Glyoxylatepathway
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 , Van Nostrand 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.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Concepts of Biotechnology (Theory)
Course Code: MZOL-1484

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 cloning and its applications.
- CO4 Understand the types and applications of stem cells and various techniques used in biotechnology.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Concepts of Biotechnology (Theory)
Course Code: MZOL-1484

Examination Time: 3 hrs **Maximum marks: 100**
L-T-P: 4-0-0 **Theory marks: 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 Griffttths, J.B. (1994). Animal Cell Biotechnology, 6th Ed., 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.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Computer Programming and Data Processing
Course Code: MZOM-1135

COURSE OUTCOMES

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.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Computer Programming and Data Processing
Course Code: MZOM-1135

Examination Time: 3+3 Hours **Max. Marks: 100**
L-T-P: 2-0-1 **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

1. Introduction to Computer capabilities, Classifications and generations.
2. Computer architecture, organization, its components, Introduction to hardware and software concepts, operating systems, peripherals, I/O devices, Limitations of computer.

Unit - II

Basic Features and usage of:
3. Word Processing Software: Creating, Editing, Formatting and Printing document
4. Spreadsheet Software: Creating, Editing, Formatting and Printing a sheet
5. Presentation Software: Creating, Editing, Formatting and Printing a presentation

Unit - III

6. 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.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Practical-I (Functional Organization of Animals-I)
Course Code: MZOP-1486

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 anatomy of gut in relation to food and feeding habits of detritivores, carnivores, herbivores, omnivores and sanguivores and Different kinds of Heart and blood vascular system in animals
- CO4 Respiratory structures: Gills (Crustaceans, Bivalves, Cephalopods, and Fish); Book Lungs(Scorpion); Trachea and spiracles (Cockroach).

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Practical-I (Functional Organization of Animals-I)
Course Code: MZOP-1486

Examination Time: 3 hrs **Maximum marks: 50**
L-T-P: 0-0-2 **Practical marks: 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: honey bee, 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
Excretorysystem 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. Practicals involving animal material will be conducted using models/charts/e- resources. Minor modifications in the curriculum are allowed subject to availability of resources.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Practical-II (Ecology and Cell Biology)
Course Code: MZOP-1487

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.

Session 2024-26
Master of Science (Zoology)
Semester–I
Course Title: Practical-II (Ecology and Cell Biology)
Course Code: MZOP-1487

Examination Time: 3 hrs **Maximum marks: 50**
L-T-P: 0-0-2 **Practical marks: 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 studythe effect of migration onthem (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. Practicals involving animal material will be conducted using models/charts/e- resources. Minor modifications in the curriculum are allowed subject to availability of resources.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Functional Organization of Animals –II (Theory)
Course Code: MZOL-2481

COURSEOUTCOMES

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 muscles and endocrine system.
- CO 4 Understand the physiology of sense organs.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Functional Organization of Animals –II (Theory)
Course Code: MZOL-2481

Examination Time: 3 hrs **Maximum marks: 100**
L-T-P: 4-0-0 **Theory marks: 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 ofthe 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 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
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 Electroreceptors)
Additional special sensoryorgan

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. SaundersPubl., 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.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Applied (Zoology)–I (Theory)
Course Code: MZOL-2482

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 understand the methods of bee keeping, diseases of honeybee 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.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Applied (Zoology)–I (Theory)
Course Code: MZOL-2482

Examination Time: 3 hrs **Maximum marks: 100**
L-T-P: 4-0-0 **Theory marks: 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 and kinds
Social organization of colony and nests Life Cycle
Relation between honeybees and plants Flora for Apiculture
Honey composition, quality and importance
Bee keeping, selection, methods, precautions Products of bee keeping
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
Fresh water 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.
- Shimizu, M. (1972) Handbook of Silkworm Rearing (Agricultural Techniques Manual- Fuji Publishing Co. Ltd , Tokyo, Japan.
- Singh, S. (1962), Bee Keeping in India, I. C. A. R. Publications, New Delhi.
- Sobti, R. C. (1992), Medical (Zoology), Nagin Chand & Co. Jalandhar.

- Srivastava, P. A. (1977), Economic (Zoology), Commercial Publication Bureau, Kanpur.
- Venkatanarasaiah, P. (1992), Sericulture in India, Ashish Publishing House, New Delhi.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Evolution
Course Code: MZOL-2483

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 take place and distribution of species.
- CO4 Explain how the molecular aspects provides evidence for evolution.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Evolution
Course Code: MZOL-2483

Examination Time: 3 hrs **Maximum marks: 100**
L-T-P: 4-0-0 **Theory marks: 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

Origin of Life
Origin of Micro molecules
Origin of Macro molecules
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.
- Brookfield, 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.

Session 2024-26
Master of Science (Zoology)
Semester–II
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.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Biostatistics
Course Code: MZOL-2334

Examination Time: 3 hrs **Maximum marks: 100**
L-T-P: 4-0-0 **Theory marks: 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.

Probability: Random experiments, sample space, events. Mathematical definition of probability of an event. Use of permutations and combinations in calculations of probability, Conditional probability, Additive and multiplication law of probability.

UNIT-II

Random variables and its pmf, pdf, cdf, mathematical expectation and variances, 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 X2-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.

Suggested reading material:

1. P.N. Arora, P.K. Malhan, Biostatistics, Himalaya Publishing House, Mumbai, Reprint 2013.

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

3. E. Batschelet, Introduction to Mathematics for Life Scientists, Springer Publisher, Third Edition, 1979

Session 2024-26
Master of Science (Zoology)
Semester–II
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 & develop interest in research aptitude.
- CO2 Build up confidence for public speaking.
- CO3 Improve their presentation skills.
- CO4 Improve computer knowledge.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Seminar
Course Code: MZOS-2485

Examination Time: 3 hrs **Maximum marks: 50**
L-T-P: 0-0-2 **Theory marks: 35**
CA: 15

Instructions for the Paper Setters:

The students are required to present a seminar on a topic of relevance and importance from the subject (Zoology). The seminar carries 40 marks for the seminar based paper at the end of the semester.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Practical –III (Functional Organizations of Animals-II)
Course Code: MZOP-2486

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 systemthrough ICT based videos, presentations and charts.
- CO3 Understand Appendicular skeleton.
- CO4 Understand comparative anatomy of nervous system in Earthworm, Cockroach, Pila, Sepia, Fishes, Bird and Mammal.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Practical –III (Functional Organizations of Animals-II)
Course Code: MZOP-2486

Examination Time: 3 hrs **Maximum marks: 50**
L-T-P: 0-0-2 **Practical marks: 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. Practicals involving animal material will be conducted using models/charts/e-resources. Minor modifications in the curriculum are allowed subject to availability of resources.

Session 2024-26
Master of Science (Zoology)
Semester–II
Course Title: Practical – IV (Evolution and Applied Zoology- I)
Course Code: MZOP-2487

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 of8 – 10 animals from various categories.

Session 2024-26

Master of Science (Zoology)Semester–II

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

Course Code: MZOP-2487

Examination Time: 3 hrs **Maximum marks: 50**

L-T-P: 0-0-2 **Practical marks: 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 geneticequilibrium (taking pea pods).
2. Examination of the principle of natural selection as a process related to evolution in apopulation (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, limbsof 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. Studyof various evolutionary phenomenon using slides / photographs.
9. Studyof fossils.
10. Preparation of Phylogenetic tree using some Priory weight characters with the help of8 – 10 animals from various categories.
11. Visit to apiary/vermicomposting unit/ sericulture unit/ Prawn Farm and preparation ofreport.

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