

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

M.Sc. Zoology (Semester: I-II)

(Under Continuous Evaluation System)

Session: 2018-19



The Heritage Institution

**KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)**

M.Sc. Zoology (Session 2018-19)

Program Outcomes (PO)

- **PO1** The core biology subjects like Cytology, Biochemistry, Microbiology etc which are offered in first year makes the students appreciate the implications of these subjects in further research in animal sciences.
- **PO2** All the courses in the programme are carefully designed to equip the students for competitive exams like CSIR NET/JRF, ICMR-JRF, SET etc and also to write research proposals for grants. Modules on Forensic Biology, Aquaculture, Entomology, Bioanalytical Tools, Biostatistics etc would make the students ready to take up either jobs or research in those aspects.
- **PO3** Equip the theoretical knowledge gained during the program to the actual practice of laboratory animal science.
- **PO4** Develop problem solving skills in students & encourage them to carry out innovative research projects thereby enkindling in them the spirit of knowledge creation.
- **PO5** Equip the students to perform functions that demand higher competence in national/international organizations.
- **PO6** The programme is design to sustain students motivation & enthusiasm not only to appreciate different life forms but also to inspire them in the dissemination of the concept of biodiversity conservation.

M.Sc. Zoology (Session 2018-19)

Program Specific Outcomes (PSO)

- **PSO1** Used the evidences of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They are able to use specific examples to explicate how descent with modification has shaped animal morphology, physiology, life history, and behavior.
- **PSO2** Explicate the ecological interconnectedness of life on earth by tracing energy and nutrient flows through the environment. They are able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.
- **PSO3** Subjects such as invasive or endangered species, embryonic development in mammals and ageing in social insects. Lead to advances in medicine to prevent disease amongst both animals and human beings.
- **PSO4** Develop knowledge and understood of living organisms at several levels of Zoological and Biological organization from the molecular, through to cells and whole organisms and ecosystems all organs of evolutionary perspectives.
- **PSO5** Understand how the chemistry and structure of the major biological macromolecules, including proteins and nucleic acids, determines their biological properties.
- **PSO6** Demonstrate knowledge to acquire, articulate, retain, and employ practical skills relevant to Fundamentals of computer, Molecular biology & rDNA technology,
- **PSO7** 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.
- **PSO8** 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.
- **PSO9** 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.

Scheme of Studies and Examination

M.Sc. (Zoology) Session: 2018-19

M.Sc. (Zoology) Semester I							
Course Code	Course Name	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MZOL-1481	Functional Organization of Animals – I	C	100	80	-	20	3
MZOL-1482	Animal Ecology	C	100	80	-	20	3
MZOL-1483	Cell Biology	C	100	80	-	20	3
MZOM-1134	Computer Programming & Data Processing	C	50	25	15	10	3
MZOP-1485	Practical- I (F.O.A. -I)	C	50	-	40	10	3
MZOP-1486	Practical- II (Ecology & Cell Biology)	C	50	-	40	10	3
Total			450				

MSc. (Zoology) Semester II

Course Code	Course Name	Course Type	Marks				Examination time (in Hours)
			Total	Ext.		CA	
				L	P		
MZOL-2481	Functional Organization of Animals – II	C	100	80	-	20	3
MZOL-2482	Applied Zoology I (Invertebrates)	C	75	60	-	15	3
MZOL-2483	Evolution	C	50	40	-	10	3
MZOL-2334	Biostatistics	C	50	40	-	10	3
MZOS-2485	Seminar	C	50	-	40	10	3
MZOP-2486	Practical- III (F.O.A. –II)	C	50	-	40	10	3
MZOP-2487	Practical- IV (Evolution & Applied Zoology-I)	C	50	-	40	10	3
Total			425				

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOL-1481
FUNCTIONAL ORGANIZATION OF ANIMALS– I
(THEORY)

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.
- CO5 Come to know the physiology of reproductive system.

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOL-1481
FUNCTIONAL ORGANIZATION OF ANIMALS– I
(THEORY)

Time: 3 hrs.

Max. Marks: 100
(Theory: 80, CA: 20)

Instructions for the Paper Setter:

Eight questions of equal marks 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 & 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 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.

Reproduction

Pattern of reproduction in non-chordates and larval forms.

Evolution of the urino-genital system in chordates with special reference to the separation of the two systems

Unit - IV

Osmoregulation and Excretion

Osmoconformers and osmoregulators, 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.
17. Withers, P.C. (1992), *Comparative Animal Physiology Saunder College Publishing*, New York.

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOL-1482
ANIMAL ECOLOGY
(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 Present an overview of diversity of life forms in an ecosystem.
- CO3 Explain and identify the role of the organism in energy transfers.
- CO4 Describe the Habitat ecology and Resource ecology.
- CO5 Understand the Environmental Pollution and their management.

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOL-1482
ANIMAL ECOLOGY
(THEORY)

Time: 3 hrs.

Max. Marks: 100
(Theory: 80, CA: 20)

Instructions for the Paper Setter:

Eight questions of equal marks 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 and aquatic ecosystems).

Weather

Temperature, Moisture, Light, fire, Malentite, pollution

Unit - II

Analysis of Environment

Resource

Food, its distribution, relative and absolute shortages

Place in which to live

Community Structure

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

Interactions and Coactions

Between animals of same kind

Between animals of different kind

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)
Ecological basis of pest regulation (in brief)

Bio Geography

Zoo Geographical regions
Island ecology. (endemicity)

Suggested Reading Material:

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

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOL-1483
CELL BIOLOGY
(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.

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOL-1483
CELL BIOLOGY
(THEORY)

Time: 3 hrs.

Max. Marks: 100
(Theory: 80, CA: 20)

Instructions for the Paper Setter:

Eight questions of equal marks 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.

General Properties of the Cell

Size, shape, number, life span and death.

Cell types: Prokaryotes and eukaryotes

Stem cells.

Organization of Prokaryote Cell

Mycoplasma, Bacteria, Cyanobacteria (Blue Green Algae). Structure and importance of their study.

From Prokaryotes to Eukaryotes

Events leading to origin of eukaryotic cells. Endo symbiotic theory and recent views.

Structure of Cell Membrane

General properties of cell membrane, chemical composition.

The concept of unit membrane.

Various Lipoprotein models including fluid mosaic model.

Unit - II

Golgi Complex

Structure and Function of : Cisternae, vacuoles and vesicles.

Functions

Role in secretion, cell wall formation, packaging of intracellular products and other functions

GERL concept.

Mitochondria

Elaboration of the plasma membrane and multi enzyme complex, outer and inner membranes, cristae, matrix, inner and outer compartments,

Location of enzyme complexes of TCA cycle (and ATP generation)
Electron transport chain, semi autonomous nature (mitochondrial DNA, RNA, ribosomes and protein synthesis)

Endoplasmic Reticulum

Extension of cell membrane, cisternae, Site of location
Compartmentalization of enzymes and metabolites and their associated functions.

Unit - III

Ribosomes

A complex of ribonucleoproteins,
Dynamics of association - disassociation of ribosomes into polysomes, microsomes,
Site of protein synthesis (initiation, elongation, translocation and termination phases of protein synthesis)
Central dogma.

Lysosomes

Polymorphic single membrane structure, site of proteolytic activity for intracellular digestion
Phagocytosis, increase in lysosomal activity with age
Lipofuscin pigments, diseases associated with lysosomes.

Peroxisomes and Glyoxisomes

Single membrane structure; site of enzyme complexes involved in hydrogen peroxide, metabolism, gluconeogenesis (conversion of non carbohydrate into carbohydrates)
Glyoxylate pathway, microperoxisomes.

Cytoskeleton

Actin filament, Myosin, Intermediate filament, microtubules.

Unit - IV

Cell Surface Modifications

Glycocalyx, villi, microvilli, caveolae.

Cytoplasmic Inclusions

Inert storage materials, glycogen, starch, lipids, metabolic crystals

Nucleus

Nuclear membrane, pores, chromatin, (euchromatin & heterochromatin), nucleolus,
Eukaryote chromosomes structure (DNA, Histone and other proteins, Nucleosome and solenoid concept).
Kinetochore, centromere and gene structure.

Cell Continuity

Phases of cell cycles
Mitosis and Meiosis

Suggested Reading Material:

1. Alberts, B. Bracy, P. Lewis, J. Raff, M. Roberts K and Watson, J. (eds) (1994). Molecular Biology of the Cell, Garland Publishing, New York.
2. Avers, C. J. (1976). Cell Biology, Van Nostrand Reinhold, New York.
3. Cooper, G. M. (2004). The cell, A Molecular Approach ASM press, Washington, D. C.
4. Chandra Roy, S and DE Kumar, K. (2001) Cell Biology. New Central Book Agency (P) Ltd. Kolkata.
5. Darnell, J. Lodish, H. and Baltimore, D. (2004). Molecular Cell Biology, 2nd edition, Freeman, New York.
6. Derobertis, E. D. P. and Derobertis, E.M.F. (1987). Essentials of Cell and Molecular Biology. Hold Saunders – Philadelphia.
7. Dewitt., W. (1977). Biology of the Cell – An evolutionary approach, Saunders – Philadelphia.
8. Holtzman, E. and Novikoff, A. B. (1984). Cells and Organelles. Saunder – Philadelphia.
9. Hopkins, C. L. (1978). Structure and Functions of Cells. Saunders – Philadelphia.
10. Karp, G. (1984). Cell Biology 4th Edition, McGraw Hill, New York.
11. Karp G. (1999). Cell and Molecular Biology. Concepts and Experiments, 2nd Editon John Wiley and Sons, Inc. New York, Brisbane, Toronto.
12. Loewy, A. G., Siekevitz, P, Menningee, J. R., and Allant, J. A. N. (1991). Cell Structure and Functions. An integrated Approach 3rd edition. Saunders College Publishing, Philadelphia, London.
13. Pollard. T.D. and Earnshaw, W.C. (2002) Cell Biology. Saunders, Philadelphia London. New York, St. Luis Sydney, Toronto.
14. Powar, C. B. (1990). Cell Biology. Himalaya Publishing House, Bombay.
15. Sadava, D. E. (1993). Cell Biology – Organelle, Structure and Fuctions. H. Jones and Bartlett- Boston.
16. Sheeler, P. and Binachi, D. E. (1983). Cell Biology, John Wiley, New York.
17. Smith & Wood (1992). Cell Biology, Chapman & Hall, London, New York.
18. Wolfe, S. L. (1983). Introduction of Cell Biology, Woodworth Belmont.

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOM-1134
COMPUTER PROGRAMMING & DATA PROCESSING (THEORY) Semester – I
(THEORY & PRACTICAL)

COURSE OUTCOMES:

After passing this course the student will be able to:

- CO1: Understand computer architecture and its organization
- CO2: Understand the fundamentals of computer system and its components
- CO3: Use various features of Word Processing, Spreadsheet and Presentation software
- CO4: Solve problems using C programming.

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOM-1134
COMPUTER PROGRAMMING & DATA PROCESSING (THEORY) Semester – I
(THEORY & PRACTICAL)

Time: (3+3) Hours

Max. Marks: 50
(Theory: 25, Practical: 15, CA: 10)

Instructions for Paper Setter -

Eight questions of equal marks 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 hardware and software concepts, operating systems, peripherals, I/O devices, Limitations of computer.

Unit - II

Basic Features and usage of:

3. Introduction to MS Word: Creating, Editing, Formatting and Printing document
4. Introduction to Excel: Creating, Editing, Formatting and Printing a sheet
5. Introduction to PowerPoint: 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.
Control statements: if, if else, else if ladder, nesting, switch,

Unit - IV

Looping statements: do while, while, for
Arrays: Basic usage, Declaration, Initialization and Types

Suggested Readings :

- 1) Learn Programming in C, Anshuman Sharma
- 2) Programming in ANSI C, Balaguruswamy
- 3) Let Us C, Yashwant Kvitkar
- 4) Fundamentals of Computer in MS Office, Gurwinder Singh, Rachpal Singh
- 5) Fundamentals of IT, Anshuman Sharma
- 6) C Programming, Schaum series

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOP-1485
FUNCTIONAL ORGANIZATIONS OF ANIMALS-I (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

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOP-1485
FUNCTIONAL ORGANIZATIONS OF ANIMALS-I (PRACTICAL)

Time: 4 Hours

Max. Marks: 50
(Practical: 40, CA: 10)

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:-
 - Mouth parts : honey bee, housefly, cockroach, butterfly, mosquito, and bug.
 - Salivary glands.
 - Blood of animals.
 - Radula of Pila and jaws of Leech
2. 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 & vertebrates.
 - Reproductive organs in Hydra, Flatworm, Earthworm, Cockroach, Pila, Fish, Frog, Lizard, Bird and Rat.

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOP-1486
ECOLOGY & CELL BIOLOGY(PRACTICAL)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Perform the experiments to analyze the macromolecules in animals
- CO2 Describe the fine structure and functions of cell organelles.
- CO3 Perform a variety of cellular biology techniques.
- CO4 Analyse various physicochemical parameters in environmental matrices.

M.Sc. Zoology Session 2018-19
(Semester – I)
Course Code : MZOP-1486
ECOLOGY & CELL BIOLOGY(PRACTICAL)

Time: 4 Hours

Max. Marks: 50
(Practical: 40, CA: 10)

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 Moong and Mash beans).

Estimation of population:

Protozoans

Nematodes

Soil arthropods

Combined population studies using quadrates.

Intrapopulation distribution and poisson distribution, construction of life table and survivorship curves from given data.

-Microscopy:

Principles of compound, phase contrast, electron microscopy.

Use and care of Light compound microscope.

Lens aberrations

-Study of Cells: 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.

-Preparation of permanent slides: Principles and procedures – Section cutting of tissues and staining of tissues with Haematoxylin/Eosin method.

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

-Cytochemical techniques: Study carbohydrates, nucleic acids, proteins, lipids and enzymes.

-Study of electron micrographs of various cell organelles :- plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen, lipids etc.

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOL-2481
FUNCTIONAL ORGANIZATION OF ANIMALS – II
(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

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

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOL-2481
FUNCTIONAL ORGANIZATION OF ANIMALS – II
(THEORY)

Time: 3 hrs.

Max. Marks: 100
(Theory: 80, CA: 20)

Instructions for the Paper Setter:

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

Unit - I

Integumentary System

Embryonic origin

General features of the Integument

Specializations of integument

Evolution of Skin

Muscular System

Classification of Muscles, Structure of Skeletal Muscles and cardiac muscle, Tendons

Muscle mechanics

Muscle Function Basis of Muscles contraction,

Muscle Fiber, Muscle organs and fibers

Bone-muscle lever systems

Unit - II

Skeletal System

Exo and Endo 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 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 HillBook 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.

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOL-2482
APPLIED ZOOLOGY – I (INVERTEBRATES)
(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- Describe the Taxonomy, Morphological sex differences in larva and adult of beneficial and harmful insects.
- Understand the culture of mulberry plants, mulberry silk and silk gland.
- Know the culture methods of *B.mori* and *Apis*.
- Understand the diseases and pests of *B.mori* and plants.
- Study the quality of silk and marketing strategies of silk.
- Know the culture and harvesting methods of Lac.
- Describe the insect species and host plants of Lac.
- Know the culture methods of honeybee and prawn.

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOL-2482
APPLIED ZOOLOGY – I (INVERTEBRATES)
(THEORY)

Time: 3 hrs.

Max. Marks: 75
(Theory: 60, CA: 15)

Instructions for the Paper Setter:

Eight questions of equal marks 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

Arthropods (Important Species and their Economic Importance)

- Diplopods and chilopods
- Arachnids (other than plant pests)
- Insects (other than insect pests of crops, parasites of man and domestic animals)
 - As pollinators
 - In Biological pest management
 - As source of food
 - Venomous insects

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

Crustaceans (Important species and their Economic Importance)

Crab, lobsters, copepods.

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

Molluscs (Economically important species)

- Eulamellibranchs
- Gastropods
- Cephalopods

Pearl Culture

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

Unit - IV

Economic Importance of :-

Protozoans

Important Parasitic species, diseases caused, prevention and cure.

Annelids

- Leeches
- Vermiculture; species of worms, conditions for efficient vermiculture (domestic and commercial level), Economics of Vermiculture

Helminthes

- Liver flukes
- Cestodes/ tapeworms
- Roundworms (Animal and plant parasitic Nematodes)

Echnioderms

Sea cucumbers

Star Fish

Suggested Reading Material

1. Bhamrah, H. S. & Juneja, K. (2001), An Introduction to Mollusca. Anmol Publications Pvt., Ltd. New Delhi.
2. Bhatnagar, R. K. and Palta, R. K. (2003), Earthworm ; Vermiculture and Vermicomposting , Kalyani Publishers India.
3. Carter, G. A. (2004) Beekeeping , Biotech Books, New Delhi.
4. Fenemore, P. G. and Prakash, A. (1992), Applied Entomology, Wiley Eastern Ltd. New Delhi.
5. Ghorai, N. (1995), Lac Culture in India. International Books and Periodicals, New Delhi.
6. Jhingran , V. G. (1991) Fish and Fisheries of India, Hindustan Publishing Company India.
7. Kumar, A. and Nigam, P. M. (1989), Economic and Applied Entomology EMKAY Publishing Co. New Delhi.
8. Mishra, R. C. (1995), Honey Bees & their Management in India. ICAR, New Delhi.
9. Mustafa, S. (1990) Applied and Industrial Zoology. Associated Publishing Company, New Delhi.
10. Shukla, G. S. & Upadhaya, V. B. (1991-92), Economic Zoology, Rastogi Publications, Meerut.
11. Sathe, T. V. and Jadhav, A. D. (2001) Sericulture and Pest Management, Daya Publishing House, New Delhi.
12. Shimizu, M. (1972) Handbook of Silkworm Rearing (Agricultural Techniques Manual-1) Fuji Publishing Co. Ltd , Tokyo, Japan.
13. Singh, S. (1962), Bee Keeping in India, I. C. A. R. Publications, New Delhi.
14. Sobti, R. C. (1992), Medical Zoology, Nagin Chand & Co. Jalandhar.
15. Srivastava, P. A. (1977), Economic Zoology, Commercial Publication Bureau, Kanpur.
16. Ullal, S.R. and Narsimhanna, M. N. (1981), A Handbook of Practical Sericulture, Central Silk Board, Bombay.
17. Venkatanarasaiah, P. (1992), Sericulture in India, Ashish Publishing House, New Delhi.

(Semester – II)
Course Code : MZOL-2483
EVOLUTION
(THEORY)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Understand that many of the organisms that inhabit the Earth today are different from those that inhabited it in the past.
- CO2 Understand that the four propositions underlying Darwin's theory of evolution through natural selection are:
 - (1) More individuals are produced than can survive;
 - (2) There is therefore, a struggle for existence
 - (3) Individuals within a species show variation
 - (4) Offspring tend to inherit their parental characters
- CO3 Explain adaptation, providing examples from several different fields of biology.
- CO4 Explain how the molecular record provides evidence for evolution.
- CO5 Understand the Human origin and evolution.

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOL-2483
EVOLUTION
(THEORY)

Time: 3 hrs.

Max. Marks: 50
(Theory: 40, CA: 10)

Instructions for the Paper Setter:

Eight questions of equal marks 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
- 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
Causes of extinction
Great extinctions

Unit - IV

Quantative and Molecular Aspects of Evolution

Hardy- Weinberg law
Selection pressure
Mutation pressure
Genetic drift
Migration
Meiotic drive
Brief account of:
Evolution of genome in viruses, prokaryotes and eukaryotes
Evolution of sexual reproduction,
Molecular clocks
Future Course of Evolution

Suggested Reading Material

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

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOL-2334
BIostatistics
(THEORY)

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.
- **CO 2:** 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 3:** 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.
- **CO 4:** 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 5:** 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 6:** 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.
- **CO 7:** Manage to solve problems using t, F, Z and Chi-Square test.
- **CO 8:** To describe the use of ANOVA for one way and two way classified data with one observation per cell.

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOL-2334
BIostatistics
(THEORY)

Time: 3 hrs.

Max. Marks: 50
(Theory: 40, CA: 10)

Instructions for the Paper Setter:

Eight questions of equal marks 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

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

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, random variables and its pmf, pdf, cdf, mathematical expectation and variances, Distribution of binomial, poisson and normal variables and their fittings only.

UNIT-II

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-III

Hypothesis Testing: Sample statistics and parameters, population null hypothesis, level of significance. Definitions of Chi-square test, 't' and 'f' variates and their Pdf^s only, Application of χ^2 -t and F in testing of hypothesis.

UNIT-IV

Analysis of Variance: Meaning of analysis of variance with linear models, Analysis of variance for one-way classified data, analysis of variance for two-way classified data with one observation per cell, analysis of variance for two-way classified data with multiple but equal number of observations per cell (data analysis only).

Suggested Reading Material:

1. Hussain I. et. al. Mathematics, A textbook for class XI, NCERT.
2. Joshi, D.D. et. al. Mathematics, A textbook for class XII, NCERT.
3. Batschelet, Mathematics for Life Sciences.
4. S. Sokal, R. and James F. Introduction to Biostatistics

**M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOS-2485
SEMINAR (PRACTICAL)**

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.

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOS-2485
SEMINAR (PRACTICAL)

Time: 3 hrs.

Max. Marks: 50
(Practical: 40, CA: 10)

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 (10 for material, 10 for presentation, 5 for discussion and 15 for the seminar based paper at the end of the semester).

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOP-2486
FUNCTIONAL ORGANIZATIONS OF ANIMALS-II (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

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOP-2486
FUNCTIONAL ORGANIZATIONS OF ANIMALS-II (PRACTICAL)

Time: 4 Hours

Max. Marks: 50
(Practical: 40, CA: 10)

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 antenna in arthropods

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOP-2487
EVOLUTION AND APPLIED ZOOLOGY-I (PRACTICAL)

COURSE OUTCOMES

After passing this course the student will be able to:

- CO1 Know the Animals of evolutionary importance, fossils, analogous and homologous organs, Mimicry and Colouration.
- CO2 Acquaint with the applied aspects of Zoology i.e. sericulture, laculture, apiculture, dairy farming, poultry etc..
- Understand the propositions underlying theories of evolution through demonstrations.
 - (1) More individuals are produced than can survive;
 - (2) There is therefore, a struggle for existence
 - (3) Individuals within a species show variation
 - (4) Offspring tend to inherit their parental characters

M.Sc. Zoology Session 2018-19
(Semester – II)
Course Code : MZOP-2487
EVOLUTION AND APPLIED ZOOLOGY-I (PRACTICAL)

Time: 4 Hours

Max. Marks: 50
(Practical: 40, CA: 10)

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

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