SYLLABI AND SCHEME OF EXAMINATIONS
FOR
DISCIPLINE SPECIFIC COURSES OF B.Sc. LIFESCIENCES
OFFERED BY DEPARTMENT OF ZOOLOGY

(Based on Curriculum and Credit Framework for UG Programs under NEP)

WITH EFFECT FROM THE SESSION 2024-25

MAHARSHI DAYANAND UNIVERSITY ROHTAK (HARYANA)

Semester I (Session 2024-25)															
Discipline Specific Courses/ Major Course			**Credits Distribution**			**Total Credits**	**Workload**			**Total Workload**	**Marks**				
	Nomenclature of Course	**Course Code**	**L**	**T**	**P**		**L**	**T**	**P**		**Theory**		**Practical**		**Total Marks**
											Internal	**External**	**Internal**	**External**	
DSC @ 4 credits	**Animal diversity-1**	**24ZOOM401DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**15**	**35**	**100**
Semester II (Session 2024-25)															
DSC @ 4 credits	**Animal diversity-11**	**24ZOOM402DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**15**	**35**	**100**
Semester III (Session 2025-26)															
DSC @ 4 credits	**Cell Biology and Genetics**	**25ZOOM403DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**15**	**35**	**100**
Semester IV (Session 2025-26)															
DSC @ 4 credits	**Bimolecules and Mammalian Physiology**	**25ZOOM404DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**15**	**35**	**100**
Semester V (Session 2026-27)															
DSC @ 4 credits	**Basics of developmental biology**	**26ZOOM405DS01**	**2**		**2**	**4**	**2**		**4**	**6**	**15**	**35**	**15**	**35**	**100**
Semester VI (Session 2026-27)															
DSC @ 4 credits	**Ecology & Evolution**	**26ZOOM406DS01**	**2**		**2**	**4**	**2**		**4**		**15**	**35**	**15**	**35**	**100**

L: Lecture; T: Tutorial; P: Practical Note:

The Syllabi and Scheme of Examinations (SOE) for Discipline Specific Courses/Major Courses for UG Semester 7 and Semester 8 will be same as applicable for Syllabi and S.O.E. for Post Graduate semester 1 and semester 2 respectively.

SYLLABI FOR FOR DISCIPLINE SPECIFIC COURSES OF B.Sc. LIFESCIENCES OFFERED BY DEPARTMENT OF ZOOLOGY

Semester ..I.....

Session: ...2024-25.....

Name of Program	**B.Sc. LIFESCIENCES**	**Program Code**	**UMLS4**
Name of the Course	**ANIMAL DIVERSITY-I**	**Course Code**	**24ZOOM401DS02**
Hours per Week	**4**	**Credits**	**4**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):

CLO 1: Student will be able to describe unique characters and recognize life forms of Lower phylum Protozoa to Helminthes

CLO 2. Student will be able to describe unique characters and recognize life forms of higher phylum Annelida to Echinodermeta

CLO 3. Student will be able to describe unique characters and recognize life forms of lower chordates phylum

Unit 1:

Phylum- Protozoa

i) General characters and classification up to order level
ii) Type study of *Plasmodium;*
iii) Parasitic protozoans: Life history, mode of infection and pathogenicity of *Entamoeba,Trypanosoma*

Phylum- Porifera:

i) General characters and classification up to order level
ii) Canal system and Spicules in sponges

Unit 2: Phylum - Coelenterata:

i) General characters and classification up to order level
ii) Corals and coral reefs

Phylum - Helminths:

i) General characters and classification up to order level
ii) Type study - *Fasciola hepatica*

Helminths parasites: Brief account of life history, mode of infection and pathogenesity of *Ancylostoma, Wuchereria*

Unit 3:

Phylum - Annelida:

i) General characters and classification up to order level
ii) Metamerism in Annelids

Phylum – Arthropoda:

General characters and classification up to order level
Type study – *Periplaneta*

Unit 4:

Phylum - Mollusca:

i) General characters and classification up to order level

ii) Torsion and detorsion in gastropoda

Phylum - Echinodermata:

i) General characters and classification up to order level

ii) Type Study -*Asteries* (Sea Star)

Phylum – Hemichordata:General characters

References:

1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
2. Ayyar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd. Madras.
3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invertebrates. Saras Publication, Nagercoil.
5. Rastogi V.B. 2021 . Invertebrate Zoology. Kedar Nath Ram Nath , Meerut
6. Lal S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut
7. Anderson D.T. (1999) Invertebrate Zoology, Oxford University Press
8. Edward E. Ruppert, Robert D. Barnes (1994)· Invertebrate Zoology ; Saunders College Pub

PRACTICAL SYLLABUS

A. Classification up to orders with ecological note and economic importance of the following animals:

1. Protozoa
2. Parazoa (Porifera):
3. Playhelminthes:
4. Annelida:
5. Arthropoda:
6. Mollusca:
7. Echinodermata:
10. Hemichordata:

(B). Study of the following permanent stained preparations:

1. L.S. and T.S. *Sycon;* gemmules, spicules and spongin fibres of *Sycon,* canal system of sponges
2. T.S. *Hydra* (testis and ovary region)
3. T.S. *Fasciola* (different regions)
4. T.S. *Ascaris* (male and female)
5. T.S. *Pheretima* (pharyngeal and typhlosolar regions), Setae, septal nephridia and spermathecae of *Pheretima.*

Semester ..II.....

Session: ...2024-25.....

Name of Program	B.Sc. LIFESCIENCES	Program Code	UMLS4
Name of the Course	ANIMAL DIVERSITY - II	Course Code	24ZOOM402DS02
Hours per Week	4	Credits	4
Maximum Marks	100	Time of Examinations	3hrs

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO 1: Student will be able to describe unique characters and recognize life forms of lower chordates phylum like Protochordates
CLO 2. Student will be able to describe unique characters and recognize life forms of vertebrate phylum **Pisces to Mammals**

Unit 1 :
Chordates : Salient features of chordates, principles of classification
Protochordates : Type study of Herdmania

Unit 2:
Pisces : General characters and classification upto classes. Types of scales and fins in fishes.
Type study : Labeo

Unit 3:
Amphibia : General characters and classification upto classes
Type study : Frog, Parental care in Amphibians
Reptilia : General characters and classification upto classes

Unit 4:
Aves : General characters and classification upto classes
Flight adaptations in birds, Archeopteryx as missing link
Mammals : General characters and classification upto classes
Type study : Rat

References:
1. Jordan, E.L and P.S. Verma. 2009. Invertebrate Zoology, S.Chand and Co. Ltd. New Delhi.
2. Ayyar, E.K and T. Ananthakrishnan. 1992. Manual of Zoology Vol.1 Invertebrates Part I and II, S.Viswanathan Printers and Publishers Pvt. Ltd. Madras.
3. Kotpal, R.L. 2021. Zoology Invertebrates. Rastogi Publications, Meerut.
4. Nair, N.C., N. Arumugam, N. Soundarapandian, T. Murugan and S. Leelavathy. 2010. A textbook of Invertebrates. Saras Publication, Nagercoil.
5. Rastogi V.B. 2021 . Invertebrate Zoology. Kedar Nath Ram Nath , Meerut
6. Lal S.S. (2019) Practical Zoology Invertebrates. Rastogi Publications, Meerut

PRACTICAL SYLLABUS

1. Classification upto orders, habit, habitats, external characters and economic importance (if any):
   - Protochordata: *Molqula, Hetryllus, Pyrosoma, Doliolum, Olikopleura,* and *Amphioxus.*
   - Cyclostomata: *Myxine, Petromyzon* and *Ammocoetus larva*.
   - Chondrichthyes: *Zygaena, Pristis, Narcine* (electric ray), *Trygon, Rhinobatus, Raja* and *Chimaera.*

- Osteichthyes: *Acipenser, Lepidosteus, Muraena, Mystus, Catla, Hippocampus, Syngnathus, Exocoetus, Anabas, Diodon, Ostracion, Tetradon, Echinus, Lophius, Solea* and *Polypterus.* Any of the Lung Fishes.
- Amphibia: *Necturus, Proteus, Amphiuma, Salamandra, Amblystoma, Axolotl larva, Alytes, Bufo, Rana.*
- Reptilia: *Hemidactylus, Calotes, Draco, Varanus, Phrynosoma, Chamaeleon, Typhlops, Python, Eryx, Ptyas, Bungarus, Naja, Hydrus, Viper, Crocodilus, Gavialis, Chelone* (Turtle) and *Testudo* (Tortoise).
- Aves: *Casuarius, Arden, Anas, Milvus, Pavo, Eudynamis, Tyto, Alcedo, Halcyon*
- Mammalia: *Ornithorhynchus, Echidna, Didelphis, Macropus, Loris, Macaque, Hystrix, Funambulus, Felix, Panthera, Canis, Herpestes, Capra, Pteropus.*

2. Internal anatomy of the following animals:

   (i) Computer simulated model/study of General anatomy; (b) *Rat*: Digestive, arterial, venous and urinogenital systems; (c) *Hemidactylus*: Digestive, arterial, venous and urinogenital systems

   (ii) Demonstration & Study of Internal Anatomy of locally available fish (*Labeo)*. Digestive and reproductive systems, cranial nerves, Ear ossicle

3. Study of the skeleton of *Scoliodon, Labeo, Rana* (Frog), *Varanus,* Pigeon or Gallus and *Orcyctolagus*/rat, Palates of birds, skulls of dog & rabbit.
4. Study of the following prepared slides: Histology of rat (compound tissues), different types of scales.
5. Make permanent stained preparations of the following: *Salpa,* Spicules, and Pharynx of *Herdmania, Amphioxus*, Cycloid scales
6. Field Visit to National Park or Zoo.

Semester ..III.....

Session: ...2025-26.....

Name of Program	**B.Sc. LIFESCIENCES**	**Program Code**	**UMLS4**
Name of the Course	Cell Biology and Genetics	**Course Code**	**25ZOOM403DS02**
Hours per Week	**4**	**Credits**	**4**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO 1: Students would gain expertise in the ultrastructural information of animal cell besides the detailed views of the cell interior revealing the various events and actions of cell at the molecular level.

CLO 2: The study will help the students to understand the new discoveries about the structure and internal functioning of the cell due to technological improvements.

CLO 3: The study will help the students to increase powerful means of visualization in the field of cell biology.

Unit 1:

Plasma Membrane: Fluid mosaic model, transport across the membrane, mechanism of active and passive transport, endocytosis and exocytosis.
Endoplasmic reticulum (ER): Types and its functions.
Golgi complex: Structure and role of golgi-complex in animal cell.
Ultrastructure and functions of Nucleus: nucleolus, nucleosome concept and role of histones, fine structure of chromosomes, Euchromatin and heterochromatin, lampbrush chromosomes and polytene chromosomes.

Unit 2:

Ribosomes: Types, and role in protein synthesis.
Lysosomes: Structure, enzyme and their role; polymorphism
Mitochondria: Structure and role of mitochondria.
Cytoskeleton: Microtubules, microfilaments, centriole and basal body, cilia and flagella
Mitosis and Meiosis, an elementary idea of cellular basis of Immunity.

Unit 3:

Elements of Heredity and variations, the varieties of gene interactions, Linkage and recombination, Sex determination and its mechanism, Sex linked inheritance: Haemophilia and colour blindness in man,
Extra chromosomal and cytoplasmic inheritance:
i) Kappa particles in Paramecium.
ii) Milk factor in mice
Multiple allelism: Eye colour in Drosophila; A, B, O blood group in man.

Unit 4:

Nature and function of genetic material : Structure and type of nucleic acids
Gene mutations: spontaneous and induced (chemical and radiations) mutations; chemical basis of mutations; transition, transversion,
Chromosomal abnormalities involving autosomes and sex chromosomes : Structural chromosomal aberrations (deletion, duplication, inversion and translocation) and Numerical aberrations (autoploidy, euploidy and polyploidy in animals)
Inborn errors of metabolism (Alcaptonuria, Phenylketonuria, Albinism, sickle-cell anaemia

References:

1. Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc., USA.
2. Molecular Biology of the Cell, B.Alberts, D.Bray,J. Lewis,M.Raff,K. Roberts, and J.D. Watson. Garland Publishing Inc., New York.
3. Cell and molecular biology Phillip Sheeler, Donald E. Bianchi Wiley,1987

PRACTICAL SYLLABUS

I. Cell division: Prepared slides of stages of mitosis and meiosis.

2. Temporary squash preparations of onion root tip / grasshopper testis for the study of mitosis using acetocarmine stain.

Project:

1. Parasitic adaptations

2. DNA: types, structure and its model preparation

3. Inborn errors of metabolism (Alcaptonuria, Phenylketonuria, Albinism, sickle-cell anaemia 4. Microscopy: principles and its significance

5. Staining techniques and their significance

6. Sex determination and its mechanism

Semester ..IV.....

Session: ...2025-26.....

Name of Program	**B.Sc. LIFESCIENCES**	**Program Code**	**UMLS4**
Name of the Course	Biomolecules and Mammalian Physiology	**Course Code**	**25ZOOM404DS02**
Hours per Week	**4**	**Credits**	**4**
Maximum Marks	**100**	**Time of Examinations**	**3hrs**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO1: The aim of this paper is to impart advanced knowledge about the principles of physiology of both cells and organisms.
CLO2: An appropriate understanding of functioning of each system of different groups of animals with their comparison will be acquainted.

Unit 1:
Introduction, classification, structure, function and general properties of Proteins, carbohydrates and fats.
Nomenclature, classification and mechanism of enzyme action. Inhibition of enzyme action, cofactors.

Unit 2:
Nutrition : Digestion and absorption of Carbohydrates, Proteins, Fats. Vitamins.
Circulation: Origin, conduction and regulation of heart beat, cardiac cycle, electrocardiogram, cardiac output, Composition and functions of blood & lymph; Mechanism

of coagulation of blood, haempoiesis
Unit 3: **Respiration:** Exchange of respiratory gases, transport of gases, lung air volumes, oxygen dissociation curve of hemoglobin, Bohr's effect, Hamburger's phenomenon (Chloride shift), control / regulation of respiration. **Excretion:** Patterns of excretory products viz. Amonotelic, ureotlic uricotelic, ornithine cycle (Kreb's– Henseleit cycle) for urea formation in liver. Urine formation, counter-current mechanism of urine concentration.
Unit 4: **Neural Integration:** Nature, origin and propagation of nerve impulse along with medullated & non-medullated nerve fibre, conduction of nerve impulse across synapse. **Chemical integration of Endocrinology:** Structure and mechanism of hormone action; physiology of hypothalamus, pituitary, thyroid, parathyroid, adrenal, pancreas and gonads.
References: 1. Chatterjee C C , Human Physiology. 1992. 2. Guyton, Text book of Medical Physiology, 10th Ed. W B Saunders 23 3. Wood, D.W. Principles and Animal physiology,1968. 4. Hoar, W.S. General and Comparative Physiology, Prentice Hall of India. 5. Strand, F.L. Physiology: A regulatory Systems Approach. Macmillan Publishing Co., New York. 6. Pummer, L. Practical Biochemistry, Tata McGraw-Hill. 7. Prosser, C.L. Environmental and Metabolic Animal Physiology. Wiley-Liss Inc., New York. 8. Satyanarayan (2021) : Biochemistry, Elsevier, 6th Edition

PRACTICAL SYLLABUS

Preparation of models of the different systems of the following animals:

1. General anatomy Labeo (locally available fish): Digestive and reproductive systems: cranial nerves
2. Study of the skeleton of Scoliodon, Labeo
3. Study of the following prepared slides: Tornaria larva, T.S. Amphioxus (through different regionds). Oikopleura, different types of scales.
4. Make permanent stained preparations of the following: Salpa, Spicules, and Cycloid scales
5. Zoological excursion and its report
6. Qualitative tests for identification of simple sugars, disaccharides and polysaccharides.
7. Study of human salivary amylase activity: Effect of temperature, pH, Concentration.
8. Project Report: 1. Migration in fishes 2. Ornamental fishes

Semester ..V.....

Session: ...2026-27.....

Name of Program	**B.Sc. LIFESCIENCES**	**Program Code**	**UMLS4**
Name of the Course	Basics of developmental biology	**Course Code**	**26ZOOM405DS02**
Hours per Week	**4**	**Credits**	**4**
Maximum Marks	**100**	**Time of**	**3hrs**

		Examinations	

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \

Course Learning Outcomes (CLO):
CLO1: The aim of this paper is to impart advanced knowledge about the Knowledge on the fundamental processes and roles of reproduction in animals,
CLO2: Students would gain knowledge how the developmental stages are maintained and regulated.

Unit 1:
Gametogenesis: spermatogenesis and oogenesis; Structure of spermatozoon and ovum. Hormonal regulation of gametogenesis, ovulation, formation of corpus luteum.

Unit 2:
Fertilization: events and types, prevention of polyspermy, monozygotic and dizygotic twins. Parthenogenesis.
Types of eggs and patterns of cleavage, Implantation and gestation, types and functions of placenta in mammals.

Unit 3:
Blastulation, gastrulation and Fate maps in frog.
Amphibian metamorphosis and hormonal regulation.
Extra-embryonic membranes and fate maps in chick.

Unit 4:
Concept of organizer and induction.
Regeneration in invertebrates and vertebrates.
Concepts and models of ageing.

References:
1. Barresi, M. J. F., and Gilbert, S. (2020). Developmental Biology (12th edition). Sinauer Associates, Inc.
2. Sadler, S. L. (2019). Langman's Medical Embryology (13th edition). Wolters Kluwer India Pvt. Ltd.
3. Sastry, K. V., and Shukla, V. (2018). Developmental Biology (2nd edition). Rastogi Publications.
4. Verma. P. S., and Agarwal, V. K. (2010). Chordate Embryology: Developmental Biology. S. Chand and Company Ltd., New Delhi.
5. Wolpert, L., Smith, J., Jessell, T., Lawrence, P., Roberson, E., and Meyerowitz, E. (2018). Principles of Development (5th edition). Oxford University Press.

PRACTICAL SYLLABUS

1. To study the various developmental stages of embryogenesis and life cycle of Drosophila.
2. To study the various developmental stages of life cycle of Frog.
3. To study various developmental stages of chick embryo with the help of the permanent slides.
4. To dissect out Drosophila larvae and to take out the imaginal discs
5. To study Influence of temperature on insect development
6. To study Influence of mutagens on insect development
7. To study Development and Preservation of chick Embryo.

Semester ..VI.....

Session: ...2026-27.....

Name of Program	B.Sc. LIFESCIENCES	Program Code	UMLS4
Name of the Course	Ecology & Evolution	Course Code	26ZOOM406DS02
Hours per Week	4	Credits	4
Maximum Marks	100	Time of Examinations	3hrs

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks. \

Course Learning Outcomes (CLO):
CLO1: The aim of this paper is to impart advanced knowledge about the evolution in animals
CLO2: Students would gain knowledge how the animals interacted with the ecosystem.

Unit 1:
Basic concepts of ecology: Definition, significance. Concepts of habitat and ecological niche.
Factors affecting environment: Abiotic factors (light-intensity, quality and duration), temperature, humidity, topography; edaphic factors; biotic factors.

Unit 2:
Ecosystem: Concept, components, properties and functions; Ecological energetics and energy flow-food chain, food web, trophic structure; ecological pyramids concept of productivity.
Biogeochemical cycles: Concept, reservoir pool, gaseous cycles and sedimentary cycles.
Population: Growth and regulation.

Unit 3:
Origin of life.
Concept and evidences of organic evolution.
Theories of organic evolution.
Concept of microevolution and concept of species

Unit 4:
Concept of macro-and mega-evolution.
Phylogeny of horse.
Evolution of man.

References:
1. Futuyma, D. J. (2017). Evolution (4th edition). Sinauer Associates Inc.
2. Hall, B. K., and Hallgrimsson, B. (2013). Strickberger's Evolution (5th edition). Jones and Bartlett Publishers.
3. Mathur, R., and Singh, S. P. (2008). Evolution and Behaviour. Rastogi Publications, Meerut, India.
4. Mandal, F. K. (2012). Textbook of Animal Behaviour. PHI Learning Private Limited, New Delhi, India.
5. Rubenstein, D. R., Alcock, J. (2018). Animal Behavior: An Evolutionary Approach (11th edition). Sinauer Associates Inc.5. Wolpert, L., Smith, J., Jessell, T., Lawrence, P., Roberson, E., and Meyerowitz, E. (2018).
Principles of Development (5th edition). Oxford University Press.

PRACTICAL SYLLABUS

1. Evolutionary evidences and/or its demonstration through models/video/CD etc and preparation of working models of the different systems of the following animals: - Adaptive modifications in feet and beaks of birds-
2. Evolutionary evidences of man and Horse
3. Chemical analysis of pond water and soil for pH,
4. Chemical analysis of pond water and soil for dissolved oxygen,
5. Chemical analysis of pond water and soil for free CO2 nitrates,
6. Chemical analysis of pond water and soil for phosphates and chlorides

PROJECT

7. Phylogenetics Tree from lower to higher vertebrates