

JAI NARAIN VYAS UNIVERSITY, JODHPUR



SYLLABUS

Three/Four-Year Undergraduate Programme in Zoology (As per NEP 2020)

Semester I & II Examination Session 2026-2027

Semester III & IV Examination Session 2027-2028

Semester V & VI Examination Session 2028-2029

Semester VII & VIII Examination Session 2029-2030 (Honours)

Semester VII & VIII Examination Session 2029-2030 (Honours with Research)

Semester - I		Type of Course - Minor	
Course Code	08/Zoo/MNR/101T	Name of Course	Invertebrate Zoology

08/Zoo/MNR/101T: Invertebrate Zoology

Unit 1: Principles of classification and taxonomy, Levels of organization: cellular, tissue, organ, organ-system, Symmetry: asymmetry, radial, bilateral, Coelom: acoelomate, pseudocoelomate, coelomate, Segmentation and metamerism.

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Unit 2: Porifera: General characters and classification up to classes, Canal systems: ascon, sycon, leucon, Skeleton: spicules and spongin fibres, Reproduction: asexual and sexual;

Cnidaria (Coelenterata): General characters and classification, Polymorphism in cnidarians.

Ctenophora: General characteristics, Comb plates, bioluminescence.

Unit 3: Platyhelminthes: General characters and classification, Parasitic adaptations, Life cycles: *Fasciola hepatica* and *Taenia solium*

Nematoda (Aschelminths): General characters and classification, Life cycles and diseases caused by *Ascaris lumbricoides*.

Unit 4: Annelida: General characters and classification up to order, Metamerism, Nephridia and locomotion. Arthropoda: General characters and classification, Appendages and mouthparts, Larval forms of crustacea.

Unit 5: Mollusca: General characters and classification, Larval forms: trochophore, veliger.

Echinodermata: General characters and classification, Water vascular system, Larval forms.

Suggested Books

R.L. Kotpal – Modern Textbook of Zoology: Invertebrates

P.S. Verma & V.K. Agarwal – Invertebrate Zoology

E.L. Jordan & P.S. Verma – Invertebrate Zoology

Semester - I		Type of Course – Minor Practical	
Course Code	08/Zoo/MNR/101P	Name of Course	Invertebrate Zoology

Practical

1. Diagrammatic presentation of Dissection of following animals:

Palaemon: General anatomy and nervous system

Mollusca- *Pila*: General anatomy and nervous system

2. Identification, systematic position up to order and general study of the following animal forms, microscopic slides / museum specimens:

Protozoa: *Entamoeba*, *Euglena*, *Noctiluca*, *Trypanosoma*, *Trichomonas*, *Foraminifera* (Oozes),

Opalina, *Balantidium*, *Nyctotherus*, *Paramecium*, and *Vorticella*.

Porifera: *Leucosolenia*, *Grantia*, *Scypha*, *Hyalonema*, *Euplectella*, *Spongilla* and *Euspongia*

Coelenterata: *Obelia* (colony and medusa), *Physalia*, *Porpita*, *Aurelia*, *Rhizostoma*, *Alcyonium*,

Gorgonia, *Pennatulilla* and *Madrepora*

Ctenophora: *Beroe*

Platyhelminthes: *Dugesia*, *Fasciola* and *Taenia*

Nematoda: *Ascaris*, *Ancylostoma*, *Dracunculus*, *Trichinella*, *Schistosoma* and *Enterobius*

Annelida: *Nereis*, Phase Heteronereis, *Aphrodite*, *Pheretima*, and *Hirudinaria*

Arthropoda: *Limulus*, *Apus*, *Lepas*, *Balanus*, *Palaemon*, *Lobster*, *Lepisma*, *Odontotermes*, *Pediculus*, *Bombyx*, *Apis*, *Julus* and *Scolopendra*

Mollusca: *Chiton*, *Dentalium*, *Patella*, *Pila*, *Aplysia*, *Slug*, *Snail*, *Mytilus*, *Lamellidens*, *Teredo*, *Nautilus*, *Sepia*, *Octopus*

Echinodermata: *Pentaceros*, *Asterias*, *Ophiothrix*, *Echinus*, *Holothuria* and *Antedon*

3. Study of sections, developmental stages and isolated structures (microscopic slides)

Porifera: L. S. and T. S. of *Scypha* / *Grantia*

Coelenterata: *Hydra*, Sections of *Hydra*, *Obelia*

Platyhelminthes: Transverse sections of *Dugesia*, *Fasciola* and *Taenia*, mature and gravid proglottids of *Taenia*, developmental stages of *Fasciola* and *Taenia*

Annelida: Transverse sections of *Nereis* and *Hirudinaria*, Trochophore larva of *Nereis*, Parapodium of *Nereis*.

Arthropoda: Crustacean larvae (*Nauplius*, *Zoea*, *Megalopa* and *Mysis*), mosquito larva & pupa.

Echinodermata: Pedicellariae of Star fish.

5. Permanent preparations:

- Protozoa: *Paramecium* / *Euglena*
- Porifera: Sponge spicules spongin fibres, gemmules
- Coelenterata : *Obelia* colony

Marking Scheme

S. No	Experiments	Marks
1.	Exercise 1 Diagrammatic presentation of Dissection	10
2.	Exercise 2 Permanent Preparation	05
3.	Exercise 3 Spot (5)	15
4.	Viva Voce	10
	Total	40
	CCA - internal assessment	10
	G Total	50

Semester - II		Type of Course - Minor	
Course Code	08/Zoo/MNR/151T	Name of Course	Vertebrate Zoology

08/Zoo/MNR/151T: Vertebrate Zoology

Unit – 1. General Character and Classification and Affinities of Hemichordata, Urochordata & Cephalochordata.

Unit – 2. General Character and Classification of Pisces; origin and evolution of fishes; deep sea adaptations in fishes. Parental care in fishes; General Character Classification, origin and adaptive radiation in Amphibia; parental care in Amphibia.

Unit – 3. General Character and Classification, origin and adaptive radiations in reptiles; evolutionary significance of *Sphenodon*; Dinosaurs,

Unit – 4. General Character and Classification of Aves up to orders; migration of birds; types of palate, aquatic and flight adaptation in birds; *Archaeopteryx*.

Unit – 5. General Character and Classification of mammals up to orders; Aquatic and flying adaptations in mammals; Prototheria and Metatheria; salient adaptive radiation in Eutheria.

  

Suggested Books-

P.S. Verma & V.K. Agarwal – Chordate Zoology (S. Chand)

R.L. Kotpal – Chordate Zoology (Rastogi)

Semester - II		Type of Course – Minor Practical	
Course Code	08/Zoo/MNR/151P	Name of Course	Vertebrate Zoology

Practical

- Study of afferent and efferent blood vessels of Scoliodon
- Identification, systematic position and comments of the following animals:
 Cephalochordata: *Amphioxus*, Hemichordata: *Balanoglossus*, Urochordata: *Salpa*, *Doliolum* and *Herdmania*
 Cyclostomata: *Petromyzon* and *Myxine*
 Pisces: *Zygaena*, *Scoliodon*, *Pristis*, *Torpedo*, *Trygon*, *Labeo*, *Belone*, *Exocoetus*, *Anabas*
 Amphibia: *Necturus*, *Amblystoma*, *Axolotal* larva, *Hyla*, *Uraeotyphlus*
 Reptilia: *Trionyx*, *Chelone*, *Varanus*, *Uromastix*, *Naja*, *Bungarus*, *Hydrophis*, *Eryx*, *Ptyas*, *Crocodylus* and *Gavialis*
 Aves: *Columba*, *Pavo*, *Choriotis*, Sparrow
 Mammalia: *Funambulus*, *Rattus*, *Pteropus*, *Presbytis* and *Macaca*
- Microscopic Study
 Hemichordata: Section through proboscis and branchiogenital region
Branchiostoma: T.S. oral hood, pharynx, gonads, intestine and caudal region
Scoliodon: T.S. gill and scroll valve
Rana: T.S. through various organs, T.S. and L.S. of developmental stages
 Reptilia: V.S. skin of lizard

Marking Scheme

S. No	Experiments	Marks
1.	Exercise 1: Study of afferent and efferent blood vessels of Scoliodon	10
2.	Exercise 2: Microscopic Study	05
3.	Exercise 3: Spotting (5)	15
4.	Viva Voce	10
Total		40
CCA-internal assessment		10
G.Total		50

Semester - III		Type of Course - Minor	
Course Code	08/Zoo/MNR/201T	Name of Course	Cell Biology and Genetics

08/Zoo/MNR/201T: Cell Biology and Genetics

Unit 1: Overview of Cells: Prokaryotic and Eukaryotic cells, Virus, Viroid, Mycoplasma, Prions.

Unit 2: Plasma Membrane: Various models of plasma membrane structure, Transport across membranes: Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Desmosomes, Gap junctions.

Unit 3: Cell Organelles: Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Nucleus: Structure of Nucleus: Nuclear envelope, nuclear pore complex, Nucleolus Chromatin: Euchromatin and Heterochromatin.

Unit 4: Cytoskeleton: Structure and Functions: Microtubules, Microfilaments and Intermediate filaments, Cell Division: Mitosis, Meiosis, Cell cycle and its regulation

Unit 5: Cell Signalling: GPCR and Role of second messenger (cAMP), Cell junctions, Cytoskeleton,

Suggested Books-

De Robertis & De Robertis – Cell and Molecular Biology

Karp – Cell Biology

Verma & Agarwal – Cell Biology, Genetics & Evolution

Semester - III		Type of Course – Minor Practical	
Course Code	08/Zoo/MNR/201P	Name of Course	Cell Biology and Genetics -P

Practical:

1. Observation of a Eukaryotic cell under higher microscope.
2. Preparation of mitotic chromosomes from roots tips.
3. Preparation of mitotic Chromosomes from testis of grasshopper.
4. Membrane fragility as a measure of osmotic tolerance
5. Lysosome isolation in isotonic sucrose.
6. Isolation & determination of number of mitochondria
7. Extraction of nuclear Chromate
8. Extraction of membrane lipids and observation of lipid bilayer formation
9. Problems based on multiple alleles – Blood groups
10. Problems based on Mendel's Laws – monohybrid and dihybrid ratios

11. Problems based on gene frequency – Hardy Weinberg Law

12. Karyotype studies

13. Haemoglobin and Insulin variations

14. Collection of termites to observe variants

Marking Scheme

S. No	Experiments	Marks
1.	Exercise 1: Major	10
2.	Exercise 2: Slide Preparation for stages	05
3.	Exercise 3: Spotting (5)	15
4.	Viva Voce	10
	Total	40
	CCA- internal assessment	10
	G. Total	50

Semester - IV		Type of Course - Minor	
Course Code	08/Zoo/MNR/251T	Name of Course	Animal Ecology and Behavior

08/Zoo/MNR/251T: Animal Ecology and Behavior

Unit 1: Introduction of ecology, definition, history, scope of ecology. Environmental factors; Biotic and Abiotic factors, interspecific and intraspecific relations, neutralism, mutualism, commensalism, antibiosis, parasitism, predation, competition. Concept of limiting factors.

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Unit 2: Population and community ecology, measurement of population density. characteristic of community, concept of ecosystem and niches. Food chain, food web, Ecological pyramid.

Unit 3: Brief introduction to the major ecosystem of the world and ecological succession, conservation of natural resources; Ecology in relation to Thar desert.

Unit 4: Assessment of animal behavior, Innate and Learned behavior, Memory, cognition, sleep, and biological clock. Type of Learning, Hormone and behavior, Genetics of behavior.

Unit 5: Social behavior, Group selection, kin selection, communication, Territorial behavior, social communication, Foraging and Migratory behavior, mating behavior, and parental care.

Suggested Books-

Odum – Fundamentals of Ecology

P.S. Verma & Agarwal – Ecology

V.K. Agarwal – Animal Behaviour

Reena Mathur- Animal Behaviour

Semester - IV		Type of Course – Minor Practical	
Course Code	08/Zoo/MNR/251P	Name of Course	Animal Ecology and Behavior

Practical

1. Demonstration of working of pH meter and colorimeter.
2. Estimation of pH of Soil and water samples.
3. Measurement of temperature and relative humidity.
4. Estimation of soil moisture and water holding capacity.
5. Ecosystem study: Aquarium.
6. Pond water study to identify zoo-planktons and their permanent preparations
7. Study of phototactic response in insects such as housefly or *Tribolium*.
8. Study of food preference and feeding behaviour in stored grain pests (*Tribolium*).
9. Study of imprinting behaviour during critical period (demonstration/record-based).
10. Study of chemical communication in earthworms or ants (pheromone response).
11. Study of nesting behaviour of birds such as tailor bird or weaver bird (field observation).
12. Field study: Behaviour of animals in natural habitat or zoo with report writing.

Marking Scheme

S. No	Experiments	Marks
1.	Exercise 1: Ecological Experiments	10
2.	Exercise 2: Behavior Experiments	05
3.	Spotting (5)	15
4.	Viva Voce	10
	Total	40
	CCA- internal assessment	10
	G.Total	50

Semester - VI		Type of Course – Minor	
Course Code	08/Zoo/MNR/351T	Name of Course	Developmental Biology and Evolution

08/Zoo/MNR/351T: Developmental Biology and Evolution

Unit 1: Introduction to Developmental Biology, Gametogenesis & Fertilization; Phases of development, Types of eggs;

Unit 2: Cleavage: Planes and patterns of cleavage; Types of Blastula; Fate maps; Embryonic induction and organizers.

Unit 3: Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta). Metamorphosis, Regeneration:

Unit 4: Introduction to Evolutionary Theories: Lamarckism, Darwinism, Neo-Darwinism, Natural Selection. speciation, Isolating. Species Concept:

Unit 5: Direct Evidences of Evolution: Types of fossils, Incompleteness of fossil record, Dating of fossils, Index Fossils, Phylogeny of horse and Man.

Semester - VI		Type of Course – Minor Practical	
Course Code	08/Zoo/MNR/351P	Name of Course	Developmental Biology and Evolution -P

Practical:

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages).
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation.
3. Study of different sections of placenta (photomicrograph/ slides).
4. Study of developmental stages by raising chick embryo in the laboratory.
5. Study of fossil evidences from plaster cast models and pictures.
6. Study of homology and analogy from suitable specimens/ pictures.
7. Charts: a. Phylogeny of horse and Man with diagrams/ cut outs.





Marking Scheme

S. No	Experiments	Marks
1.	Exercise 1: Experiment 1	15
2.	Exercise 2: Spotting (5)	15
3.	Viva Voce	10
	Total	40
	CCA- internal assessment	10
	G. Total	50

SUGGESTED READINGS

1. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
2. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers
3. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin, Cummings.
4. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
5. Minkoff, E. (1983). Evolutionary Biology. Addison-Wesley.
6. Lewis Wolpert (2010). Principles of Development. II Edition, Oxford University Press.
7. Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers.
8. Verma PS and Agrawal VK, Chordata Embryology (2010) (S Chand Publication).

