

SYLLABUS OF ZOOLOGY (MINOR)

For 4-Year Undergraduate Programme Under
NCCF, 2023



Cooch Behar Panchanan Barma University

Panchanan Nagar, Vivekananda Street, Cooch Behar,
West Bengal – 736 101

3rd Semester

SUBJECT ZOOLOGY
4 YEAR UG SYLLABUS_CBPBU
MINOR 3: ANIMAL DIVERSITY

Course Objectives:

Theory:

1. To form a general understanding of the diversity of the Animal Kingdom through the study of general characters of each Phylum/Class.
2. To form an outline idea of the taxonomic classification of different non-chordate phyla and chordate classes through the study of classification scheme for each Phylum/Class.
3. To form an understanding of the body plan, structural adaptations, life history, physiological processes, behaviour and evolutionary relationships in different animals through the study of special topics included in each Phylum/Class.

Practical:

1. To be able to identify common and representative specimens from different Phyla/Classes through the study of identifying characters.
2. To be able to identify the body plan and developmental stages of common non-chordates through the study of histological sections and larval forms.
3. To acquire basic skills of dissection and mounting of invertebrate specimens.

MINOR 3: ANIMAL DIVERSITY

SUBJECT-ZOOLOGY

DIFFICULTY LEVEL: 200 MODE OF INSTRUCTION: LPT

THEORY (CREDITS 4)

Group A: Non -Chordates

Unit 1: Kingdom Protista

General characters and classification up to classes; Life cycle of *Plasmodium vivax*.

Unit 2: Phylum Porifera

General characters and classification up to classes; Canal System in Sycon.

Unit 3: Phylum Cnidaria

General characters and classification up to classes; Polymorphism in Hydrozoa.

Unit 4: Phylum Platyhelminthes

General characters and classification up to classes; Life history of *Taenia solium*.

Unit 5: Phylum Nematoda

General characters and classification up to classes; Life history of *Ascaris lumbricoides*.

Unit 6: Phylum Annelida

General characters and classification up to classes; Metamerism in Annelida.

Unit 7: Phylum Arthropoda

General characters and classification up to classes; Vision in Arthropoda.

Unit 8: Phylum Mollusca

General characters and classification up to classes; Respiration in *Pila globosa*.

Unit 9: Phylum Echinodermata

General characters and classification up to classes; Water-vascular system in *Asterias*.

Group B: Chordates

Unit 1: Protochordates

General features of Protochordata with examples.

Unit 2: Agnatha

General features of Agnatha and classification of cyclostomes up to classes

Unit 3: Pisces

General features and classification up to orders; Migration in fishes.

Unit 4: Amphibia

General features and classification up to orders; Parental care.

Unit 5: Reptiles

General features and classification up to orders; Poisonous and non-poisonous snakes; Dos and don'ts after snake bite.

Unit 6: Aves

General features and classification up to orders; Flight adaptations in birds.

Unit 7: Mammals

General features and classification up to infra class; Dentition in mammals.

[Note: Classification of invertebrates to be followed from Invertebrate Zoology by Ruppert and Barnes VI edition (1987, 1994) Saunders College Pub, except for Protozoa (American Association of Protozoologist ref: Levine 1980) and Porifera (Brusca and Brusca 2002; IV edition. Invertebrate Zoology). For chordates classification from Young, J. Z. (2004), The Life of Vertebrates to be followed except fish (Talwar and Jhingran, 1991)]

PRACTICAL (CREDITS 2)

1. Identification with reasons following specimens (Preserved specimens/models/photographs as available to be used):

Non-Chordates: *Amoeba, Paramoecium, Scypha, Aurelia, Metridium, Taenia solium, Ascaris lumbricoides, Nereis, Pheretima, Hirudinaria, Macrobrachium, Cyclops, Daphnia, Leptocoriza, Limulus, Julus, Scolopendra, Peripatus, Chiton, Achatina, Loligo, Octopus, Asterias, Echinus.*

Chordates: *Balanoglossus, Branchiostoma, Ascidia, Petromyzon, Scoliodon, Labeo, Catla, Channa, Anabas, Heteropneustes, Clarias, Bufo, Hyla, Chamaeleo, Naja, Columba, Cavia.*

2. Study of following Permanent Slides (Permanent slides/photographs as available to be used):

CS of sponges (syconoid and leuconoid), LS of *Metridium*, CS of *Ascaris* (male & female) through gonadal region.

Larvae: trochophore, glochidium, nauplius, echinopluteus, axolotl.

3. Staining/slide preparation/mounting:

Hydra, Obelia colony, *Cyclops, Daphnia, Tubifex*, digestive system of cockroach, mouth parts of cockroach, Cycloid and Ctenoid scales, hyoid apparatus and pecten of fowl.

4. Key for Identification of poisonous and non-poisonous snakes.

SUGGESTED READINGS

- Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
- Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
- Pough H. Vertebrate life, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
- Brusca, J.G. and Brusca, C.R. (2003) Invertebrates: Second Edition. Sinauer Associates, Inc., Sunderland.
- Jhingran, V.G. (1983). Fish and fisheries of India. (Revised second edition). Hindustan Publishing Corporation. New Delhi.

4th Semester

SUBJECT: ZOOLOGY
COURSE: MINOR 4
ECOLOGY AND ANIMAL BEHAVIOUR

Difficulty level: 200

Mode of instruction: Lecture and Practical

COURSE OBJECTIVES

Theory:

1. To form an understanding about the different ecological levels, components, and their functioning through the study of basic concepts, experiments, and laws.
2. To sensitize students about conservation of wildlife resources.
3. To form a preliminary idea about animal behaviour through the study of different modes of behaviour including behavioural patterns, social behaviour, communication, and biological rhythms.

Practical:

1. To train students to perform calculations of selected biodiversity indices, identification of zooplanktons and determination of selected parameters from water samples.
2. To give a cursory idea of the selected methods of the study of animal behaviour.

THEORY (Credits 4)

Group A: Ecology

Unit 1: Introduction to Ecology

Levels of organization; Laws of limiting factors: Liebig's Law of Minimum, Shelford's Law of Tolerance, Blackman's Law of Limiting factors.

Unit 2: Population

Population attributes: Density, natality, mortality, life tables, survivorship curves, age pyramids, exponential and logistic growth, r and k strategies; Population interactions; Gause's Principle of competitive exclusion.

Unit 3: Community

Community characteristics: species richness, dominance, diversity, abundance; ecotone and edge effect, ecotype; concept of ecological succession with hydrosere as example; theories pertaining to climax community-monoclimax, polyclimax and climax pattern theory.

Unit 4: Ecosystem

Definition of ecosystem; food chain: Detritus and grazing food chains; food web; energy flow models: single channel and Y shaped; ecological pyramids-pyramid of number, biomass and energy.

Unit 5: Wildlife & Conservation

Wildlife conservation (ideas of in-situ and ex-situ conservation); National Park, Wildlife sanctuary, Biosphere reserve; Project Tiger.

Group B: Animal Behaviour

Unit 1: Introduction to Animal Behaviour

Origin, history, and scope of ethology; proximate and ultimate causes of behaviour.

Unit 2: Patterns of Behaviour

Innate behaviour: concept of sign stimulus, fixed action pattern, innate releasing mechanism; study of egg rolling behaviour of greylag geese; learnt behaviour: classical conditioning (Pavlov's experiment), habituation, imprinting (Lorenz's experiment).

Unit 3: Social Behaviour

Altruism and kin selection, Hamilton's rule; Eusociality in honey bees.

Unit 4: Animal Communication

Round dance and waggle dance in honey bees; communication by pheromones in insects; echolocation in marine mammals.

Unit 5: Biological Rhythms

Types: circadian rhythms, tidal rhythms, lunar rhythms, circannual rhythms; hibernation and aestivation (brief discussion); biological clocks: concept of entrainment, *zeitgeber*, free running period, significance of biological clocks.

PRACTICAL (Credits 2)

Group A: Ecology

1. Calculation of Sorenson's Similarity & Shannon-Weiner diversity indices for a natural/hypothetical community.
2. Identification of zooplankton (from permanent slides/microphotographs): *Daphnia*, *Cyclops*, *Cypris*, *Anopheles* larva, *Culex* larva.
3. Estimation of dissolved oxygen content (Winkler's method) and free CO₂ of water sample.

Group B: Animal Behaviour

1. Identification of different types of bird nests (from filed study/photographs): cup nest, cavity nest, pendant nest, platform nest, floating nest.
2. Study of aggressive behaviour in *Betta* sp. (live demonstration/videographs).
3. Study of learning behaviour in mice through T maze (live demonstration/videographs).

SUGGESTED READINGS

- Smith and Smith (2012) Elements of Ecology. Pearson
- Colinviaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- Robert Leo Smith Ecology and field biology Harper and Row publisher
- Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres
- David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
- John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
- Biological Rhythms: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

8th Semester

SUBJECT ZOOLOGY

4 YEAR UG SYLLABUS_CBPBU

MINOR 6- (PARASITOLOGY AND IMMUNOLOGY)

Course Description: The course is divided into two groups Group A associated with Parasitology and Group B associated with Immunology. Parasitology course provides basic Knowledge of general parasitology, host-parasite interactions, important disease-causing parasites and their control measures. Immunology is the branch of biology which deals with the body's defence mechanisms. This course aims to provide an overview of the immune systems also emphasizes on the applications of various immunological tools.

Course Objectives:

- Learn the structures, life cycles, and disease mechanisms of key parasites and vectors.
- Explore how the immune system defends the body through cells, antibodies, and pathways.
- Recognize key medical parasites and insect vectors using slides and photographs.
- Develop hands-on skills in blood typing, smear staining, and identifying immune tissues.

Course Outcome: After completion of this Course students will be able to

- Obtain Knowledge about the General Parasitism, Host Parasite Interaction.
- Know about the different disease-causing parasites, their impact on human health, their control measure.
- Obtain basic knowledge about the immune system, organs and cells associated with the immune system.
- Know how immune system works to keep our body healthy and disease free.
- Learn about the basis of antigen recognition, hypersensitivity reaction, antigen-antibody reactions
- Learn about Application of Immunology in treating and diagnosis of disease.

Mode of Instruction: Lecture, Practical and Tutorial

THEORY (CREDIT 4) Group A PARASITOLOGY

Unit I: Introduction to Parasitology

Brief introduction to Parasitism, Host, Parasite, Parasitoid, Hyperparasite and Vectors, Host-parasite interaction

Unit II: Parasitic Protists

Study of Morphology, Life Cycle, Pathogenicity, Prophylaxis and Treatment of *Entamoeba histolytica*, *Plasmodium vivax* and *Leishmania donovani*.

Unit III: Parasitic Helminthes

Study of Morphology, Life Cycle, Pathogenicity, Prophylaxis and Treatment of *Fasciola hepatica*, *Schistosoma haematobium* and *Wuchereria bancrofti*

Unit IV: Parasitic Arthropods

Biology, Medical importance and control of *Pediculus humanus* (head and body louse) and *Xenopsylla cheopis*

Unit V: Vector Biology

Life Cycle, Control of *Anopheles sp.*, *Culex sp.*, *Aedes sp.* and *Phlebotomus sp.* and diseases caused by these Vector Species

Group B IMMUNOLOGY

Unit I: Introduction to Immunology

Cells and organs of the Immune system

Unit II: Innate and Adaptive Immunity

Anatomical barriers, Inflammation, Adaptive immunity (Cell mediated and humoral), Passive: Artificial and natural Immunity, Active: Artificial and natural Immunity

Unit III: Antigens

Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Superantigen, Factors influencing immunogenicity.

Unit IV: Immunoglobulins

Structure and functions of different isotypic classes of immunoglobulins, Antigen-antibody interactions (basic idea of precipitation and agglutination)

Unit V: Major Histocompatibility Complex

Structure and functions of MHC molecules. Endogenous and exogenous pathways of antigen processing and presentation.

Unit VI: Cytokines and Complement System

Properties and functions of cytokines, Components and pathways of complement activation. (Classical, Alternative and Lectin Pathway)

Unit VII: Hypersensitivity

Gell and Coombs' classification and brief description of various types of hypersensitivities

Unit VIII: Applied Immunology

Vaccine – Different types of vaccine; Immunoassays- RIA, ELISA

PRACTICAL (CREDIT 2)

1. Identification of life stages of *Entamoeba histolytica*, *Leishmania donovani* and *Plasmodium vivax* through permanent slides/micro photographs
2. Identification of adult and life stages of *Fasciola hepatica*, *Schistosoma haematobium* and *Wuchereria bancrofti* through permanent slides/micro photographs
3. Identification of Vectors: Mosquito (*Anopheles*, *Culex* and *Aedes*) and sandfly
4. Identification of Parasitic Arthropods: *Pediculus humanus* (head and body louse) and *Xenopsylla cheopis*
5. Demonstration of lymphoid organs of Rat (Through Photograph/ Dissection)
6. Identification of Histological Sections of spleen, thymus and lymph node through slides/ photographs
7. Preparation of a blood smear, staining of the slide, and identification of various types of blood cells
8. ABO blood group determination

Suggested Readings:

1. Arora, D. R and Arora, B. (2001) *Medical Parasitology*. II Edition. CBS Publications and Distributors.
2. Bogitsh, B. J., Carter, C. E. and Oletmann, T.N. (2013). *Human Parasitology*. 4th Ed. Academic Press, New York.
3. Chandra, G. (2000). *Mosquito*. Sree Bhumi Publication Co. Kolkata.
4. Chatterjee, K. D. (1981). *Parasitology (Protozoology and Helminthology)*. 13th ed. CBS.
5. Cheng, T. C. (1986). *General Parasitology*. 2nd ed. Academic Press, Inc. Orlando, U.S.A.
6. Hati, A. K. (2001). *Medical Entomology*. Allied Book Agency, Kolkata.
7. Hati, A. K. (2001). *Medical Parasitology*. Allied Book Agency, Kolkata.
8. Kettle, D. S. (1995). *Medical and veterinary Entomology*. 2nd Ed. CAB International.
9. Roberts, L. S., Janovy, J. & Nadler S. (2013) Gerald D. Schmidt & Lary S. Roberts' *Foundation of Parasitology*. 9th ed. McGraw-Hill International.
10. Sastry, A. S., and Bhat, S. (2018). *Essentials of medical parasitology*. Jp Medical Ltd.
11. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2015). *Basic immunology: functions and disorders of the immune system*. Elsevier Health Sciences.
12. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2021). *Cellular and Molecular Immunology, 10e, South Asia Edition*. Elsevier Health Sciences.

13. Delves, P. J., Martin, S. J., Burton, D. R., & Roitt, I. M. (2017). *Roitt's essential immunology*. John Wiley & Sons.
14. Owen, J. A., Jones, P. P., Kuby, J., Punt, J., & Stranford, S. A. (2013). *Kuby immunology* (7th ed.). New York: W.H. Freeman.