

# National Curriculum and Credit Framework (NCCF)

## Syllabus

*for*

### Minor Courses in Zoology

w.e.f. Academic Session 2023-24



## Kazi Nazrul University

Asansol, Paschim Bardhaman

West Bengal 713340

# Semester-I

**Course name:** Diversity of Non-chordates

**Course code:** BSCZOOMN101

Course Type: <b>Minor</b> (Theoretical & Practical)	Course Details: <b>MNC-1</b>		L-T-P: <b>3-0-4</b>		
Credit: 5	Full Marks: <b>100</b>	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		<b>30</b>	<b>15</b>	<b>20</b>	<b>35</b>

### About the course :

The course is a walk for the Bachelor's entrant through the amazing diversity of living forms from simple to complex one. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

### Learning outcomes :

After successfully completing this course, the students will be able to:

- Develop understanding on the diversity of life with regard to protists and non-chordates.
- Group animals on the basis of their morphological characteristics/structures.
- Develop a critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
- Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.
- Understand how morphological change due to change in environment helps drive evolution over a long period of time.
- The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills.
- It will further enable the students to think and interpret individually due to different animal species chosen

## THEORY (MNC-1)

### Unit I: Principles of Animal Classification

(15 Lectures)

1. Definitions: Systematics, taxonomy, Hierarchy, taxonomic levels/types (alpha, beta, gamma, omega).
2. Principles of codes of Zoological Nomenclature : Binomial nomenclature and utility of scientific names. Principle of priority; Principle of typification (Holotype, Syntype, Allotype, Paratype, Lectotype, Paralectotype, Neotype); Principle of Homonymy and synonymy.
3. Classification : Artificial, Natural and phylogenetic concept.

### Unit II: Multicellularity and Origin of Metazoa

1. Species concept : Biological, evolutionary.
2. Origin of Metazoans: diploblastic and triploblastic organization; symmetries; body cavities; protostomes and deuterostomes.
3. Metamerism and its relevance.

### UNIT III: Diversity in Protists, Acoelomate and Pseudocoelomate Metazoa

(11 Lectures)

1. Structure and diversity in Protists (classification up to Phylum).
2. Porifera : Classification up to classes ; Structural diversity of skeletal organization.
3. Cnidaria : Classification up to classes ; Polymorphism and division of labour ;
4. Coral reef: types, formation& significance.
5. Pseudocoelomates; Basic organization and Classification of Nematoda up to classes.
6. Type study: *Paramecium*, *Ascaris*

#### UNIT IV: Diversity in and Coelomate Non chordates and hemichordates (13 Lectures)

1. Basic organization and diversity (classification up to classes) in Annelids.
2. Classification of arthropods up to classes.
3. Basic organization and diversity (classification up to classes) in Molluscs.
4. Basic organization and classification (up to classes) of Echinoderms; their affinity to Chordates.
5. Type study: *Periplaneta*

**Note:** Classification to be followed from Ruppert and Barnes Invertebrate Zoology VI edition, except for Protozoa (American Association of Protozoologist ref: Levine 1980) and Porifera (Brusca and Brusca 2002; IV edition. Invertebrate Zoology).

### PRACTICAL (MNC-1)

1. Identification of animals through slides and museum specimens/photographs with their classification, and diagnostic features (**record book**). Animals to be included for the study are as follows:

Non-chordates :
i. <b>Protista:</b> <i>Euglena</i> , <i>Amoeba</i> , <i>Paramecium</i> . ii. <b>Porifera:</b> <i>Euspongia</i> , <i>Scypha</i> . iii. <b>Cnidaria:</b> <i>Obelia</i> , <i>Physalia</i> , <i>Aurelia</i> , <i>Tubipora</i> , Sea Anemone, <i>Pennatula</i> . iv. <b>Platyhelminthes:</b> <i>Fasciola</i> , <i>Taenia solium</i> . v. <b>Nematoda:</b> <i>Ascaris</i> . vi. <b>Annelida:</b> <i>Aphrodite</i> , <i>Chaetopterus</i> , <i>Pheretima</i> . vii. <b>Arthropoda:</b> <i>Carcinoscorpius</i> , <i>Macrobrachium</i> , <i>Balanus</i> , <i>Periplaneta</i> , <i>Peripatus</i> . viii. <b>Mollusca:</b> <i>Chiton</i> , <i>Pila</i> , <i>Lamellidens</i> , <i>Sepia</i> . ix. <b>Echinodermata:</b> <i>Astropecten</i> , <i>Cucumaria</i> and <i>Antedo</i> x. <b>Larval forms:</b> Ephyra, Trochophore, Nauplius, Glochidium, Bipinnaria

2. **Excursion:** Study of animals in nature during a survey of a National Park or Forest area or coastal area or any local biodiversity rich area.
3. Dissection of *Periplaneta* to expose- (a) Digestive, (b) Nervous and (c) Reproductive system.
4. Group discussion or Seminar presentation on following topics:

#### Pool of Topics for Group Discussion or Seminar presentation :

1. Tree of Life.	2. Coral reef – A marine rainforest.	3. Protostome vs deuterostome
4. Polymorphism.	5. Metamerism and its relevance.	6. Principle of Typification
7. Freshwater sponges.	8. Coelom and animal development	9. Concept of symmetry
10. Species concept	11. Basis of classification	12. Significance of living fossils
13. Molecular system of classification.	14. Molecular systematics vs Traditional taxonomy.	15. Type study: Any one animal as per your syllabus.

**Format for conducting CA and ESE practical examination :**

CA (30 marks)	ESE (20 marks)
1. Assessment based on practical topics (class test)- <b>10</b> 2. PPT/Poster preparation, presentation and write up submission-3+3+2= <b>8</b> 3. Attendance and Participation in class- <b>4</b> 4. Practical skills, laboratory reports, etc- <b>3</b> 5. Participation in excursion- <b>5</b>	1. Identification - 2 items (item 1 and 7)- [Sc. Name, systematic position (3 taxa), generic characters, habit & habitat,] 0.5+0.5+1+0.5=2.5 ( <b>2.5x2=5</b> ) 2. Dissection/mounting- Exposing and display/mounting-3, Drawing-2, Labelling-1. ( <b>6</b> ) 3. Field Report (Item no 2) - <b>3</b> 4. LNB (Laboratory Note Book) - <b>3</b> 5. Viva - <b>3</b>
<b>NOTE :</b> <ul style="list-style-type: none"> <li>• Identification could be done by using card printed with photograph/drawing/data/preserved specimen/permanent slide.</li> <li>• CA can be done multiple times even by more than one teacher. An average will be taken for marks capturing.</li> <li>• LNB should be prepared (item 1 &amp; 3) in inter-leaf practical note book with date &amp; Teacher's sign.</li> <li>• Project report (Presentation mandatory), Field report, Write-up, etc to be prepared separately.</li> <li>• A maximum of 4 students can present same topic of GD/seminar presentation, as a group or solo.</li> </ul>	

**Recommended readings**

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VII Edition. Thompson Brooks Cole (International Edition)
- Barnes, R.S.K., Callow, 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.
- Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrímsson B. (2008), Strickberger's Evolution. 4<sup>th</sup> Edition. Jones and Bartlett Publishers Inc.
- Chattopadhyay, S (2014) LIFE: Evolution, adaptation, ethology, 2<sup>nd</sup> Ed, Books & Allied.
- Lomolino, M. V. et al (2010) Biogeography, 4<sup>th</sup> Edition, Sinauer Associates.
- Simpson, G G (2012) Principles of animal taxonomy, Scientific publishers.
- Mayr, E and Ashlock P D (2014) Principles of systematic zoology, 2<sup>nd</sup>, McGraw-Hill Education.
- Verma, A (2017) Principles of animal taxonomy, 1<sup>st</sup> Ed, Narosa.
- Ghosal, S (2020) Taxonomy Principle and Problems, 1<sup>st</sup> Ed, Techno world.
- Quicke, Donald L (1993) Principles and Techniques of Contemporary Taxonomy (Tertiary Level Biology), 1<sup>st</sup> Ed, Springer
- Sinha, K. S., Adhikari, S., Ganguly, B. B. & Bharati Goswami, B. D. (2001). Biology of Animals. Vol. I. New Central Book Agency (p) Ltd.
- Kapoor, V C (2019) Theory And Practice Of Animal Taxonomy And Biodiversity 8<sup>th</sup> Ed, Oxford & IBH Publishing
- Ruppert, E.E., Fox, R.S., Barnes, R. D. (2003). Invertebrate Zoology: A Functional Evolutionary Approach. VII Edition, Cengage Learning, India
- Pechenik, J. A. (2015). Biology of the Invertebrates. VII Edition, McGraw-Hill Education
- Miller S.A. & Harley J.P. (2015) Zoology. 10<sup>th</sup> Ed., McGraw-Hill Education
- Hickman C., et. al. (2019) Integrated principles of zoology., 18<sup>th</sup> Ed., McGraw-Hill Education.

## Semester-II

**Course name:** Diversity of Chordates

**Course code:** BSCZOOMN201

Course Type: <b>Minor (Theoretical &amp; Practical)</b>	Course Details: <b>MNC-2</b>		L-T-P: <b>3-0-4</b>		
Credit: 5	Full Marks: <b>100</b>	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		<b>30</b>	<b>15</b>	<b>20</b>	<b>35</b>

### About the course :

The course is a walk for the Bachelor's entrant through the amazing diversity of living forms from simple to complex one. It enlightens how each group of organisms arose and how did they establish themselves in the environment with their special characteristics. It also deals with the differences and similarities between organisms on the basis of their morphology and anatomy which led to their grouping into taxa and clades.

### Learning outcomes :

After successfully completing this course, the students will be able to:

- Develop understanding on the diversity of life with regard to chordates.
- Group animals on the basis of their morphological characteristics / structures.
- Develop critical understanding of how aquatic to terrestrial journey happens in chordate animals.
- Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.
- Understand how morphological change due to change in environment helps drive evolution over a long period of time.
- The project assignment will also give them a flavour of research to find the process involved in studying biodiversity and taxonomy besides improving their writing skills.
- It will further enable the students to think and interpret individually due to different animal species chosen.

## THEORY (MNC-2)

### Unit 1: Protochordata and Agnatha

(15 Classes)

1. Characters and affinities of Hemichordates
2. General characteristics of Urochordata and Cephalochordata;
3. Study of larval forms in protochordate;
4. Theories of Origin of Chordata
5. General characteristics, and affinities of cyclostomes

### Unit 2: Ectotherms: Pisces, Amphibia and Reptilia

(18 Classes)

1. General characteristics and Classification of fish up to order,
2. Migration of Fishes
3. Origin of Tetrapoda (Evolution of terrestrial ectotherms),
1. General characteristics and classification of Amphibia up to living order; Parental care in Amphibia
4. General characteristics and classification of reptiles up to living order;
5. Type study (respiratory system, circulatory system, urinogenital system): *Labeo*, *Duttaphrynus*

**Unit 3: Endotherms: Aves and Mammalia (15 Classes)**

1. General characteristics and classification of Aves up to subclass
2. Principles and aerodynamics of flight and migration in birds
3. Origin of Mammals- Special features of Monotremes and Marsupials.
4. Characteristics and classification of mammalian groups (up to orders)
5. Type Study: *Columba*

**Unit 4: Specialized systems (12 Classes)**

2. Accessory respiratory organ and acoustico lateralis system in fishes
3. Poison apparatus and Biting mechanism in snakes
4. Echolocation in chiropterans
5. Ruminant stomach

**Note:** Classification from Young, J. Z. (1981) to be followed except for classification fishes. For Pisces classification scheme to be followed from Nelson, J. S. (2006).

**PRACTICAL (MNC-2)**

1. **Study** of animals through slides and museum specimens/photographs in the laboratory with their classification, biogeography and diagnostic features (**record book**). Animals to be included for the study are as follows:

Chordates :
<i>i. Protochordata: Balanoglossus, Branchiostoma</i> <i>ii. Fishes: Scoliodon, Torpedo, Catla, Labeo, Exocoetus, Hippocampus,</i> <i>iii. Amphibia: Ichthyophis, Necturus, Duttaphrynus, Rachophorous</i> <i>iv. Reptiles: Chelone, Calotes, Chamaeleon, Draco, Vipera, Naja.</i> <i>v. Birds: Psittacula, Pycnonotus.</i> <i>vi. Mammals: Sorex, Pteropus, Funambulus.</i>

**2. Dissection:**a) Expose and display afferent Branchial system, weberian ossicles and IX-X<sup>th</sup> cranial nerve of fish (carp).

b) Expose and display V<sup>th</sup> and VII<sup>th</sup> cranial nerve of Fowl.

**3. Mounting:** a) Temporary mount of external scales in fishes (cycloid, placoid, ganoid, ctenoid). b) Temporary mount of Pecten of Fowl.

**4. Comparison** of two species of birds belonging to same genus (Interspecific difference).

**5. Comparison and weighting** of characters of two birds belonging to same family but dissimilar genera.

**6. Demonstration** of Poisonous and non-poisonous snake by chart preparation.

**7. Group discussion or Seminar presentation on following topics:**

Pool of Topics for Group Discussion or Seminar presentation :		
1. Protochordates-the gateway of chordates	2. Evolution of terrestrial ectotherms	3. Affinities, and biology of cyclostomes
4. Origin of Chordata	5. Monotremes and Marsupials	6. Adaptive radiation of mammals
7. Affinities of Prototheria	8. Zoogeographical realms	9. Lung Fishes
10. Type study: anyone in your syllabus	11. Venomous vs non-venomous snake	12. Plate tectonic & Continental drift theory

**Format for conducting CA and ESE practical examination :**

CA (30 marks)	ESE (20 marks)
1. Assessment based on practical topics (class test)- <b>10</b> 2. PPT/Poster preparation, presentation and write up submission-3+4+3= <b>10</b> 3. Attendance and Participation in class- <b>5</b> 4. Practical skills, laboratory reports, etc- <b>5</b>	1. Identification (Sl no 1)- Sc. Name-0.5, Characters-1, Habit & habitat-0.5, (2x2= <b>4</b> ) 2. Dissection/mounting- Exposing and display/mounting-5, Drawing-2, Labelling-1. ( <b>8</b> ) 3. Bird album- <b>2</b> 4. LNB - <b>3</b> 5. Viva- <b>3</b>
<b>NOTE :</b> <ul style="list-style-type: none"> <li>• <i>Study of specimen should include-Scientific name, Habit and Habitat, Diagnostics feature, importance/values if any.</i></li> <li>• <i>Identification could be done by using card printed with photograph/drawing/data/preserved specimen/permanent slide.</i></li> <li>• <i>CA can be done multiple times even by more than one teacher. An average will be taken for marks capturing.</i></li> <li>• <i>LNB should be prepared in inter-leaf practical note book with date &amp; Teacher's sign.</i></li> <li>• <i>A maximum of 4 students can present same topic of GD/seminar presentation, as a group or solo.</i></li> </ul>	

**Recommended readings**

1. Young, J. Z. (1981). The Life of Vertebrates. 3<sup>rd</sup> Ed. Oxford university press.
2. Pough H. Vertebrate life, VIII Edition, Pearson International.
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
4. Hall B.K. and Hallgrimsson B. (2008), Strickberger's Evolution. 4<sup>th</sup> Edition. Jones and Bartlett Publishers Inc.
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