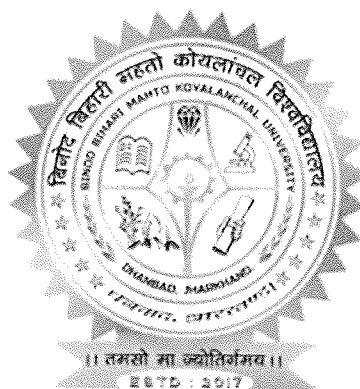


**Syllabus for**  
**Bachelor of Science in Zoology (Honours)**  
**Four Year Under Graduate Programme**

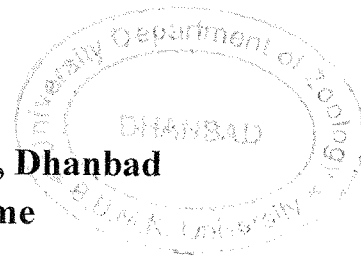
**Academic Session**

**w.e.f. 2022-2026**



**For**  
**All Constituent / Affiliated Colleges under**  
**Binod Bihari Mahto Koyalanchal University,**  
**Dhanbad**

**Binod Bihari Mahto Koyalanchal University, Dhanbad**  
**Four Year Undergraduate Programme**  
**NEP, 2022**



**List of Members of Board of Studies of NEP under Four Year Undergraduate Programme Syllabus**

Sl. No.	Name		Signature
1.	Dr. Lal Bihari Singh Head, University Dept. of Zoology, BBMKU, Dhanbad.	Chairman	
2.	Dr. A. C. Gorai Retrd. Professor, Vinoba Bhave University, Hazaribag	Expert Member	
3.	Dr. Shailendra Kumar Sinha – Associate Professor Head University Dept. of Zoology BBMKU, Dhanbad	Member	
4.	Dr. Navita Gupta Associate Professor, University Dept. of Life Science, BBMKU, Dhanbad.	- Member	
5.	Dr. Rupam Mallik, Assistant Professor, University Dept. of Zoology, BBMKU, Dhanbad.	- Member	
6.	Dr. Sarita Murmu, Assistant Professor, University Dept. of Zoology, BBMKU, Dhanbad.	- Member	

**Binod Bihari Mahto Koyalanchal University, Dhanbad**  
**Four Year Undergraduate Programme**  
**Department of Zoology**  
**NEP UG Syllabus**  
**Semester I**

**Major – 1 (MJ - 1) Systematics and Diversity of Life- Protists to Chordates**

**Credit – 4**

**Lectures – 60 Hours**

**FM= 100 [75 +25]**

**T= 75 {60Ext. +15 Int.} (10+05)}**

**Instructions:**

- There will be two groups of questions. **Group A** is compulsory which will contain **three questions**.
- **Question no. 1** will be very short answer type consisting of **five questions of 1 mark each**.
- **Question no. 2 & 3** will be of short answer type of **5 marks each**.
- **Group B** will contain **descriptive type five questions of 15 marks each**, out of which **any three are to answer**.

**Learning Outcomes:**

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

1. Develop understanding on the diversity of life with regard to Protists, non chordates and chordates.
2. Group animals on the basis of their morphological characteristics/ structures.
3. Develop critical understanding how animals changed from a primitive cell to a collection of simple cells to form a complex body plan.
4. Examine the diversity and evolutionary history of a taxon through the construction of a basic phylogenetic/ cladistics tree.
5. Understand how morphological change due to change in environment helps drive evolution over a long period of time.
6. 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.

Unit	Topic	Total no. of Lectures
<b>Unit 1: Origin of Life on Earth, Products of evolutionary process</b>		
<b>1.1</b>	<b>Origin:</b>  <b>1.1.1:</b> Origin of life on Earth: Arrival of simple form from primordial chemicals. <b>1.1.2:</b> Multicellularity <b>1.1.3:</b> Biological Diversity	<b>03</b>

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<b>1.2</b>	<b>1.2.1: Systematics and taxonomy</b>	<b>04</b>
	<b>1.2.2: Species concept</b>	
	<b>1.2.3: Clades</b>	
<b>Unit 2: Diversity in Protists and Acoelomate Metazoa</b>		<b>Total no. of Lectures</b>
<b>2.1</b>	<b>Protozoa:</b>	<b>02</b>
	<b>2.1.1</b> Structure and diversity in Protists.	
	<b>2.1.2</b> General Account of Locomotion	<b>04</b>
<b>2.2</b>	<b>Porifera:</b>	<b>02</b>
	<b>2.2.1</b> Canal System in Sponges	
<b>2.3</b>	<b>Coelenterata:</b>	<b>04</b>
	<b>2.3.1:</b> Structure, Life Cycle & Meatgenesis in Obelia	
	<b>Corals and Coral Reefs:</b>	<b>02</b>
	<b>2.3.2:</b> Types, Distribution and Formation	
<b>Unit 3: Diversity In Pseudocoelomate and Coelomate Non-Chordates</b>		<b>Total no. of Lectures</b>
<b>3.1</b>	<b>Aschelminthes:</b>	<b>06</b>
	<b>3.1.1:</b> Morphology and Life Cycle of Ascaris	
<b>3.2</b>	<b>Annelida:</b>	<b>02</b>
	<b>3.2.1:</b> Segmental Organs & Metamerism in Pheretima	
<b>3.3</b>	<b>Arthropoda:</b>	<b>04</b>
	<b>3.3.1:</b> Nervous System in Palaemon	
	<b>3.3.2:</b> Larval Forms in Crustacea	<b>02</b>
<b>3.4</b>	<b>Mollusca:</b>	<b>04</b>
	<b>3.4.1:</b> Respiration in Pila	
	<b>3.4.2:</b> Torsion & Detorsion in Gastropods	<b>02</b>
<b>3.5</b>	<b>Echinodermata:</b>	<b>03</b>
	Water Vascular System in different classes of Echinodermata	
<b>Unit IV: Diversity in Protochordates and Chordates</b>		<b>Total no. of Lectures</b>
<b>4.1</b>	<b>Hemichordates:</b>	<b>02</b>
	<b>4.1.1:</b> General Organization	
	<b>4.1.2:</b> Affinities	
<b>4.2</b>	<b>Urochordates:</b>	<b>01</b>
	<b>4.2.1:</b> General Organization	
	<b>4.2.2:</b> Retrogressive Metamorphosis in Herdmania	<b>02</b>

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4.3	<b>Fishes:</b>	<b>01</b>
	4.3.1: Basic organization and Diversity of Fishes.	
	4.3.2: Accessory Respiratory Organs in Teleosts	<b>02</b>
4.4	<b>Amphibia:</b>	
	4.4.1: Amphibian's Diversity and Adaptability to Dual Mode of Life.	<b>02</b>
	4.4.2: Origin & Evolution of Amphibia	<b>02</b>
4.5	<b>Reptiles :</b>	<b>01</b>
	4.5.1: Poisonous & non Poisonous snakes of India	
	4.5.2: Poisonous Apparatus in Snakes	<b>01</b>
	4.5.3: Biting Mechanism	<b>01</b>
	4.5.4: Types of Venom & their Toxic Effects	<b>01</b>
4.6	<b>Aves:</b>	
	4.6.1: Flight Adaptations in Birds	<b>03</b>
	4.6.2: Mechanism of Flight	
4.7	<b>Mammalia:</b>	<b>04</b>
	4.7.1: Distribution General Characters, Classification & Affinities	
	4.7.2: Special features: <ul style="list-style-type: none"> <li>• Prototheria</li> <li>• Metatheria</li> <li>• Eutheria</li> </ul>	
4.8	<b>Comparative Anatomy of Vertebrates</b> 4.8.1: Heart 4.8.2: Aortic Arches 4.8.3: Kidney	<b>06</b>

## Books Recommended

### Systematics (Animal Taxonomy)

1. Dalela & Sharma: Animal Taxonomy and Museology (1976, Jai Prakash Nath).
2. Kapoor: Theory and Practicals of Animal Taxonomy (1988, Oxford & IBH).
3. Simpson: Principles of Animal Taxonomy (1962, Oxford).
4. Mayer & Ashlock: Principles of Systematic Zoology (1991, McGraw Hill).

### Non Chordates

1. Ruppert and Barnes, RD (2006) Invertebrate Zoology, VIII edition .Holt Saunders International edition
2. Barnes ,R.S.K., Calow, P.Olive., Golding, D.W. and Spicer, J.LI. (2002) The Invertebrates; E.J.W, III Edition ,Blackwell Science
3. Nigam: Biology of Non-chordates (1997, S Chand)
4. Miller and Harley : zoology (6th Ed. 2005, W.C. Brown)
5. Parker & Haswell: Text Book of Zoology, Vol. I (2005, Macmillan)

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### Chordates:

1. Miller & Harley: Zoology (6th ed. 2005, W.C. Brown)
2. Nigam: Biology of Chordates (1997, S Chand)
3. Parker & Haswell, A Text Book of Zoology Vol.II (2005, Macmillan)
4. Sinha, A.K., & Adhikari, S and Ganguli, B.B Biology of Animals Vol.II New Central Agency, Calcutta
5. Vishwanath – vertebrate Zoology

### ONLINE TOOLS AND WEB RESOURCES

- Swayam (MHRD) Portal
- Animal Diversity (<https://swayam.gov.in/courses/5686-animal-diversity>)
- Advances in Animal Diversity, Systematics and Evolution (<https://swayam.gov.in/courses/5300-zoology>)
- ePGPathshala (MHRD) Module 10, 18, 19 of the paper P-08 (Biology of Parasitism) <https://epgp.inflibnet.ac.in/ahl.php?csno=35>

### Practical

#### Semester I

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**Major – 1 (MJ - 1) P (Practical) Systematics and Diversity of Life- Protists to Chordates**  
**Credit – 2**

**Lectures – 30 Hours**

**FM= 100 [75 +25]**

**F.M. = 25**

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Practical Marks	Distribution
1. Dissection/ Project:	05
2. Slide Preparation (Mounting):	03
3. Spotting:	5×2=10
a. Museum Specimen: (03)	
b. Slides (02)	
5. Class record & Viva Voce	07
	<hr/>
	<b>Total=25</b>

### Suggested Practical:

#### MJ 1

#### Study of Available Museum Specimen of animals:

##### Non Chordates:

*Sycon, Physalia, Metridium, Fasciola, Taenia solium, Nereis, Aphrodite, Pheretima, Lingula, Chiton, Pila, Unio, Sepia, Loligo, Octopus, Eupagurus, Limulus, millipedes, centipedes, Palaemon, Antedon, Asterias, Echinus, Holothuria*

##### Chordates:

*[Handwritten signatures and initials]*

1. **Protochordate:** Balanoglossus, Herdmania
2. **Agnatha:** Petromyzon and Myxine
3. **Pisces:** *Scoliodon*, *Torpedo*, *Chimaera*, *Labeo rohita*, *Cirrhinus mrigala*, *Labeo bata*, *Hippocampus*, *Exocoetus*, *Syngnathus*, *Heteropneustes*, *Clarias batrachus*, *Anabas*, *Echeneis*, *Channa*, *Notopterus*
4. **Amphibia:** *Necturu*, *Proteus*, *Ambystoma*, *Axolotl* larva, *Salamandra*, *Alytes*, *Hyla*, *Bufo* (Toad), *Rana* (Frog)
5. **Reptiles:** *Kachuga*, *Calotes*, *Draco*, *Phrynosoma*, *Chameleon*, *Typhlops*, *Naja naja*, *Bungarus* (Krait), *Vipera* (Chandrabora), *Hydrophis*, *Crocodylus*, *Python*.
6. **Aves:** *Columba livia*, *Psittacula* (Parrot), *Bubo* (Great Horned owl), *Alcedo* (Kingfisher), *Dinopium* (Woodpecker), *Passer* (House Sparrow), *Pycnonotus* (Bul-Bul), Ostrich model. Types of beaks and claws
7. **7. Mammals:** Prototheria Models of Duck-Bill Platypus, Spiny Anteater, *Pteropus* (Megachiroptera), *Manis* (Pangolin), *Funambulus* (squirrel), *Hystrix* (Porcupine), *Cavia* (Guinea Pig), *Rattus rattus* (rat).

**Study of the following through permanent slide**

*Paramecium* (wm), Conjugation of *Paramecium*, *Obelia* colony, Medusa, Gemmules of Sponges, Miracidium larva, Sporocyst larva, Redia larva, Cercaria larva, Trochophore larva, Glochidium larva, Nauplius, Zoea larva, Mysis larva, Megalopa larva, Bipinnaria larva, Echinopluteus larva, Ophiopluteus larva,

**Mounting:**

Mounting of Nephridia & Ovary of Earthworm, Trachea And Salivary Gland of *Periplaneta americana*,  
Cycloid and Placoid

**Collection of five species** (preferably invertebrates, insects) belonging to a clade. A project work on their generic identification, description and illustration with a note on their locality. Also the assessment of their relationship by constructing a cladogram using characters and character states.

**Study of animals in nature during a survey of a National Park or Forest area.**

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**Binod Bihari Mahto Koyalanchal University, Dhanbad**  
**Four Year Undergraduate Programme**  
**Department of Zoology**  
**NEP UG Syllabus**  
**Semester II**

**Major – 2 (MJ - 2) Cell Biology and Histology**  
**Credit – 4**

**Lectures – 60 Hours**

**FM= 100 [75 +25]**

**T= 75 {60Ext. +15 Int.} (10+05)}**

**Instructions:**

- There will be two groups of questions. **Group A** is compulsory which will contain **three questions**.
- **Question no. 1** will be **very short answer type** consisting of **five questions of 1 mark each**.
- **Question no. 2 & 3** will be of **short answer type** of **5 marks each**.
- **Group B** will contain **descriptive type five questions** of **15 marks each**, out of which **any three are to answer**.

**Learning outcomes**

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



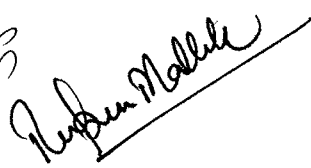



1. Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.
2. Acquire the detailed knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.
3. Develop an understanding how cells work in healthy and diseased states and to give a 'health forecast' by analyzing the genetic database and cell information.
4. Get new avenues of joining research in areas such as genetic engineering of cells, cloning, vaccines development, human fertility programme, organ transplant, etc.
5. Understand how tissues are produced from cells in a normal course and about any malfunctioning which may lead to benign or malignant tumor.

Unit	Topic	No. of periods
<b>Unit 1: Prokaryotic and Eukaryotic Cells.</b>		
<b>1.1</b>	General structure of prokaryotes, bacteria, Archaea and eukaryotes.	<b>02</b>
<b>1.2</b>	<b>Ultrastructure and Functions:</b>	<b>10</b>
	<b>1.2.1: Endoplasmic Reticulum</b>	
	<b>1.2.2: Ribosome</b>	
	<b>1.2.3: Golgi Apparatus</b>	



	1.2.4: Lysosome,	
1.3	<b>Mitochondria:</b> Origin, Structure, Composition and Function.	02
1.4	<b>Nucleus:</b> Size, Shape, Structure and Functions	02
<b>Unit 2: Cell Membrane and Transport Mechanism</b>		
2.1	<b>Plasma Membrane:</b> 2.1.1: Origin 2.1.2: Structure 2.1.3: Composition 2.1.4: Function 2.1.5: Fluid Mosaic Model.	04
2.2	2.2.1: Transport Across Membrane: Diffusion And Osmosis. 2.2.2: Active And Passive Transport, Endocytosis And Exocytosis	02
<b>Unit 3: Cell Cycle, Cell Signaling</b>		
3.1	3.1.1: Cell Cycle, Cell Division- Mitosis And Meiosis. 3.1.2: Cell Divisions Check Points And Their Regulation. Role Of Growth Factors	10
3.2	Programmed Cell Death (Apoptosis).	
3.3	Cell Regulation and Cell Signaling: Signaling Molecules and their Receptors.	
<b>Unit 4: Structural and Functional Significance of Animal Tissues</b>		
4.1	<b>Introduction to tissues.</b> Epithelial Tissue: Types, Structure And Characteristics. Surface Modifications.	
4.2	<b>Basement membrane:</b> Structure and Characteristics	06
4.3	<b>Cell junctions.</b>	
4.4	<b>Connective tissue cells.</b> Structure and function of loose, dense and adipose tissue.	
4.5	<b>Muscular tissue: Ultrastructure of</b> 4.5.1: Smooth Muscles 4.5.2: Skeletal Muscles 4.5.3: Cardiac Muscles	04

#### Books Recommended

1. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments (6th edition) John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. (2006) Cell and Molecular Biology (8th edition) Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. (5th edition) ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M.; Kleinsmith, L.J.; Hardin. J. and Berton, G. P. (2009) The World of the Cell. (7th edition) Pearson Benjamin Cummings Publishing, San Francisco.

### Practical Semester II

**Major – 2 (MJ - 2) Cell Biology and Histology**  
**Credit – 2**

**Lectures – 30 Hours**

**FM= 100 [75 +25]**

**F.M.= 25**

Practical Marks	Distribution
1. Study of Meiosis stages through slides	05
2. Slide Preparation (Mounting):	03
3. Spotting:	05x02= 10
a. Slides (Tissues) (03)	
b. Slides (Eukaryotic & Prokaryotic Cells) (02)	
5. Class record & Viva Voce	07
<b>Total=20</b>	

#### Suggested Practical

##### Cell Biology

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis.
2. Study of slides of prokaryotic-Bacteria
3. Study of slides of Unicellular Eukaryotic cell- *Amoeba*, *Paramecium*, *Euglena*
4. Study of various stages of cell division through permanent slides Mitosis and Meiosis.
5. Study of types of tissue through permanent slides: epithelial, connective, muscular, nervous etc.

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*Rupam Mallik*

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**Binod Bihari Mahto Koyalanchal University, Dhanbad**  
**Four Year Undergraduate Programme**  
**Department of Zoology**  
**NEP UG Syllabus**  
**Introductory Regular Course**

**Introductory Regular Course: Zoology**

**Credit – 3**

Unit	Topic	Total No. of Lectures
Unit 1: Diversity in the Living World		
1.1	Living World: Taxonomic Categories	04
	1.1.1: What is living?	
	1.1.2: Diversity in the living world	
	1.1.3: Taxonomic Categories	
	1.1.4: Taxonomic Aids	
1.2	Biological Classification	04
	1.2.1: Kingdom Monera	
	1.2.2: Kingdom Protista	
	1.2.3: Kingdom Fungi	
	1.2.4: Kingdom Plantae	
	1.2.5: Kingdom Animalia	
	1.2.6: Viruses, Viroids & Lichens	
1.3	Animal Kingdom	02
	1.3.1: Basis of Classification	
	1.3.2: Classification of Animals	
Unit 2: Cell Biology		
2.1	Cell: Structure & Function	04
	2.1.1: Cell Theory	
	2.1.2: Prokaryotic Cell	
	2.1.3: Eukaryotic Cell	
2.2	Biomolecules: 2.2.1: Biomacromolecules: Proteins, Carbohydrates, Lipids, Nucleic Acids, Enzymes	08

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2.3	Cell Cycle & Cell Division	02
<b>Unit 3: Human Physiology</b>		
3.1	<b>Digestion &amp; Absorption</b> 3.1.1: Alimentary Canal & Digestive Glands 3.1.2: Digestion of Food 3.1.3: Absorption 3.1.4: Associated Disorders	06
3.2	<b>Respiration &amp; Transport of Gases</b> 3.2.1: Respiratory Organs 3.2.2: Mechanism of Breathing 3.2.3: Exchange of Gases 3.2.4: Transport of Gases 3.2.5: Regulation of Respiration 3.2.6: Associated Disorders	08
3.3	<b>Body Fluids &amp; Circulation</b> 3.3.1: Blood 3.3.2: Lymph 3.3.3: Circulatory Pathways 3.3.4: Double Circulation 3.3.5: Regulation of Cardiac Activity 3.3.6: Associated Disorders	08
3.4	<b>Excretory System:</b> 3.4.1: Human Excretory System 3.4.2: Urine Formation 3.4.3: Function of the Tubules 3.4.4: Counter Current Mechanism 3.4.5: Regulation of Kidney Function & Micturition 3.4.6: Associated Disorders	08
3.5	<b>Nervous System</b> 3.5.1: Human Neural System 3.5.2: Neuron 3.5.3: Central Nervous System 3.5.4: Sensory Reception & Processing	06
3.6	<b>Reproductive System</b> 3.6.1: Types of Reproduction 3.6.2: Male Reproductive System 3.6.3: Female Reproductive System 3.6.4: Gametogenesis 3.6.5: Menstrual Cycle 3.6.6: Fertilization, Implantation & Parturition	06
<b>Unit 4: Genetics &amp; Evolution</b>		
4.1	<b>Principles of Inheritance and Variation</b> 4.1.1: Mendel's Law of Inheritance	

	4.1.2: Sex Determination	06
	4.1.3: Mutation	
	4.1.4: Genetic Disorders	
4.2	<b>Molecular Basis of Inheritance</b> 4.2.1: The DNA	06
	4.2.2: RNA World	
	4.2.3: Replication	
	4.2.4: Transcription	
	4.2.5: Genetic Code	
	4.2.6: Translation	
4.3	Evolution: Theories & Sources of Evolution <ul style="list-style-type: none"> <li>• Lamarckism</li> <li>• Neo- Lamarckism</li> <li>• Darwinism</li> <li>• Neo-Darwinism</li> </ul>	
4.4	<b>Sources of Variations:</b> 2.2.1: Mutation 2.2.2: Recombination	
4.5	Reproductive Isolation & Its Role in Evolution	
4.6	<b>Evolutionary Forces:</b> <ul style="list-style-type: none"> <li>• Hardy – Weinberg Law of Equilibrium</li> </ul>	
4.7	<b>Genetic Drift</b> 3.2.1: Bottle- Neck Phenomenon 3.2.2: Founder's Principle	

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