

BINOD BIHARI MAHTO KOYALANCHAL UNIVERISTY, DHANBAD

**FYUGP NEP 2020
UNDER GRAUDATION COURSE
ZOOLOGY SYLLABUS
(Up to Semester-IV Only)**

Effective from Session 2023 Onwards and Session 2022 Semester III.

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Members of BOARD OF STUDIES:

- **Dr. Kalpana Prasad (Head, Life Sciences Department)**
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Former Head, University Department of Zoology, Delhi University Delhi.**

S.N.	Sem	Paper	Credits	Name of the Paper
1.	I	MJ-1: Theory	4	Systemic & Diversity of Non – Chordates
2.	II	MJ-2: Theory	4	Systemic & Diversity of Chordates
		MJ-3: Practical-I	4	Practical based on MJ 1 & 2
3.	III	MJ-4: Theory	4	Cell Biology & Microbiology
		MJ-5: Practical-II	4	Practical based on MJ 4
4.	IV	MJ-6: Theory	4	Biochemistry & Genetics
		MJ-7: Theory	4	Mammalian Physiology & Endocrinology
		MJ-8: Practical-III	4	Practical based on MJ 6 & 7
5.	V	MJ-9: Theory	4	Evolution & Population Genetics
		MJ-10: Theory	4	Immunology
		MJ-11: Practical-IV	4	Practical based on MJ 9 & 10
6.	VI	MJ-12: Theory	4	Human Reproductive system & Developmental Biology
		MJ-13: Theory	4	Ecology & Toxicology
		MJ-14: Theory	4	Wildlife Conservation and Management
		MJ-15: Practical-V	4	Practical based on MJ 12, 13 & 14
7.	VII	MJ-16: Theory	4	Animal Behaviour & Economic Zoology
		MJ-17: Theory	4	Applied Medical Zoology (with reference to Human Diseases)
		MJ-18: Theory	4	Biostatistics & introductory Bioinformatics
		MJ-19: Practical-VI	4	Practical based on MJ 16, 17 & 18
8.	VIII	MJ-20: Theory	4	Molecular Biology & biotechnology
		AMJ – 1 Theory	4	Tools & Techniques
		AMJ – 2 Theory	4	Applied Zoology
		AMJ – 3 Practical	4	Practical based on AMJ 1 & 2
Total Credit -			92	

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 Non-Chordate

Credit – 4

Lectures – 60 Hours

FM= 100 [75 +25]

Instructions:

- In all 9 questions to be set there shall be two groups- **Group A and Group B.**
- **Group A** is compulsory which shall contain three questions.
- Question no. 1 will be very short answer type consisting of five questions of **1 mark** each in the form of MCQ/Fill in the blanks/True or False etc.
- **Question no. 2 & 3** will be of short answer type carrying **5 marks** each.
- **Group B** will contain 6 subjective/descriptive questions out of which the examinees are required to answer any 4 carrying **15 marks** each.

Learning Outcomes:

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

- Develop understanding on the diversity of life with regard to non - chordates.
- Group animals on the basis of their morphological characteristics/ structures.
- Develop 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.
- 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.

UNITS	TOPICS	TOTAL NO. OF LECTURES
1.	1.1: Acoelomate and Coelomate 1.2: Protostomes and Deuterostomes 1.3: Bilateria and Radiata 1.4: Onychophora and Hemichordates	04
2.	Protozoa: 2.1. General Features and Life history of Paramecium, Plasmodium and Leishmania 2.2: Nutrition 2.3: Reproduction	08
3.	Porifera: 3.1 Canal System in Sponges 3.2 Skeleton	05
4.	Coelenterata: 4.1 Structure, Life Cycle & Metagenesis in Obelia	05
	4.2 Polymorphism in Syphonophora	02
	4.3 Coral reefs and their formation	01
5.	Platyhelminthes: 5.1 General features and life history of <i>Fasciola</i> and <i>Taenia</i> and their pathogenicity 5.2 Parasitic adaptation	06
6.	Nemathelminths: 6.1 General features 6.2 Life history and parasitic adaptations in <i>Ascaris</i> and <i>Wuchereria</i>	04
7.	Annelida: 7.1 General features and life history of Earthworm 7.2 Coelom and metamerism	07
8.	Arthropoda: 8.1 Larval forms in Crustacea 8.2 Respiration in Prawn 8.3 Book lungs in scorpion 8.4 Compound eye in cockroach 8.5 Comparative Study of Mouth parts (a) Cockroach (b) Mosquito – <i>Culex</i> , <i>Anopheles</i>	08
9.	Mollusca: 9.1 General features and life history of Pila 9.2 Respiration 9.3 Locomotion	05

	9.4 Torsion and Detorsion in Gastropods	
10.	Echinodermata: 10.1 General features and life history of Asterias 10.2 Larval forms of Echinodermata 10.3 Water Vascular System	05
		Total = 60 Hours

Books Recommended:**Systematics (Animal Taxonomy)**

1. Dalela & Sharma: Animal Taxonomy and Museology (1976, Jai Prakash Nath).
2. Kapoor: Theory and Practical 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.L.I. (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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ESTD: 2017

Semester II

Major – 2 (MJ - 2) Systematics and Diversity of Chordates
Credit – 4

Lectures – 60 Hours

FM= 100 [75 +25]

Instructions:

- In all 9 questions to be set there shall be two groups- **Group A and Group B.**
- **Group A** is compulsory which shall contain three questions.
- Question no. 1 will be very short answer type consisting of five questions of **1 mark** each in the form of MCQ/Fill in the blanks/True or False etc.
- **Question no. 2 & 3** will be of short answer type carrying **5 marks** each.
- **Group B** will contain 6 subjective/descriptive questions out of which the examinees are required to answer any 4 carrying **15 marks** each.

Learning Outcomes:

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

- Develop understanding on the diversity of life with regard to chordates.
- Group animals on the basis of their morphological characteristics/ structures.
- Develop 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.
- 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.

1.	Protochordates: 1.1: Origin of Chordates; General features of chordates	08
	1.2: Life history of Herdmania; Filter feeding in Branchiostoma	
2.	Pisces: 2.1: Basic organization and Diversity of Fishes; Dipnoi	10
	2.2: Structure of Gills and Respiration; Accessory Respiratory Organs in Teleosts	

3.	Amphibia:	06
	3.1: Amphibian's Diversity and classification up to living order and Adaptability to Dual Mode of Life. 3.2: Origin & Evolution of Amphibia; Neoteny in Axolotl Larva.	
4.	Reptilia:	08
	4.1: Origin of Reptiles, Skull types, Dinosaurs and causes of their extinction.	
	4.2: Poisonous Apparatus in Snakes 4.3: Types of Venom & their Toxic Effects	
5.	Aves:	06
	5.1: Flight Adaptations in Birds 5.2: Mechanism of Flight	
6.	Mammalia:	11
	6.1: Origin, General Characters, Classification & Affinities 6.2: Special features of- • Prototheria • Metatheria • Eutheria	
7.	Comparative Anatomy of Vertebrates 7.1: Heart and Aortic Arches 7.2: Kidney 7.3: Integument and its derivatives	11
		Total = 60 Hours

Books Recommended:**Chordates:**

1. Miller & Harley: Zoology (6thed. 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?csrno=35>

Semester II, Practical

Major – 3 (MJ - 3) P (Practical) Systematics and Diversity of Life- Protists to Chordates
Credit – 4 Lectures – 120 Hours

FM= 100

Practical Marks	Distribution	
1. Dissection:	10 X 2	
(one from Non -Chordate and one from Chordates)		20
2. Slide Preparation (Mounting with Procedures & Comments):		
(one from Non-Chordate and one from Chordates)	10 X 2 =	20
3. Spotting:	3 x 10 =	30
a) Museum Specimen (4)		
(Two from Non-Chordate and two from Chordates)		
b) Slides (4)		
(Two from Non-Chordate and two from Chordates)		
c) Bones (02) (One from Amphibia & one from Mammals)		
4. Class record		10
5. Viva Voce		10
6. Project/Model		10
	Total=	100

Suggested Practical:

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:

1. **Protochordate:** *Balanoglossus, Herdmania*
2. **Agnatha:** *Petromyzon* and *Myxine*
3. **Pisces:** *Scoliodon, Torpedo, Chimaera, Labeo rohita, Cirrhinus mrigala, Labeo bata, Hippocampus, Exocoetus, Syngnathus, Heteropneutes, Clarias batrachus, Anabas, Echeineis, 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. Mammals: Prototheria Models of Duck-Billed Platypus, Spiny Anteater, *Pteropus* (Megachiroptera), *Manis* (Pangolin), *Funambulus* (squirrel), *Hystrix* (Porcupine), *Cavia* (Guinea Pig), *Rattus rattus* (rat).

Study of the following through permanent slide

Non-Chordates:

Paramecium (W.M), Conjugation of *Paramecium*, *Obelia* colony, Medusa, Gemmules of Sponges, T.S of Earthworm through various region, Ovary of earthworm 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,

Chordates: Amphioxus (WM), T.S of Oral Hood Amphioxus, Placoid & Cycloid scales

Dissection:

Non- Chordate: Earthworm, Cockroach, Prawn
Chordates: Local Bony Fishes.

Mounting:

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

Bones: Amphibia & Mammals (Girdles & Limbs)

Collection of five species (preferably invertebrates, insects) belonging to a class. 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.

Semester III**Major – 4 (MJ - 4) Cell Biology & Basics of Microbiology****Credit – 4****FM= 100 [75 +25]****Lectures – 60 Hours****Instructions:**

- In all 9 questions to be set there shall be two groups- **Group A and Group B.**
- **Group A** is compulsory which shall contain three questions.
- Question no. 1 will be very short answer type consisting of five questions of **1 mark** each in the form of MCQ/Fill in the blanks/True or False etc.
- **Question no. 2 & 3** will be of short answer type carrying **5 marks** each.
- **Group B** will contain 6 subjective/descriptive questions out of which the examinees are required to answer any 4 carrying **15 marks** each.

Learning outcomes

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

- Understand the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.
- Acquire the detailed knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.
- Carry out common procedures for culturing, purifying and diagnostics of micro-organisms understand the disease-causing potential of bacteria and viruses, and the responses of the immune system.

Unit	Topic	No. of periods
Unit 1: Prokaryotic and Eukaryotic Cells.		
1.1	General structure of prokaryotes, bacteria, Archaea and eukaryotes.	02
1.2	Ultrastructure and Functions:	08
	1.2.1: Endoplasmic Reticulum	
	1.2.2: Ribosome	
	1.2.3: Golgi Apparatus	
	1.2.4: Lysosome,	

1.3	Mitochondria: Origin, Structure, Composition and Function.	04
1.4	Nucleus: Size, Shape, Structure and Functions	04
Unit 2: Cell Membrane and Transport Mechanism		
2.1	Plasma Membrane: 2.1.1: Origin 2.1.2: Structure 2.1.3: Composition 2.1.4: Function 2.1.5: Fluid Mosaic Model.	06
2.2	2.2.1: Transport Across Membrane: Diffusion and Osmosis.	03
	2.2.2: Active and Passive Transport, Endocytosis and Exocytosis	03
Unit 3: Cell Cycle, Cell Signaling		
3.1	3.1.1: Cell Cycle, Cell Division- Mitosis and Meiosis.	04
	3.1.2: Cell Divisions Check Points and Their Regulation. Role Of Growth Factors	04
3.2	Programmed Cell Death (Apoptosis).	04
3.3	Cell Regulation and Cell Signaling: Signaling Molecules and their Receptors.	04
Unit 4: Basics of Microbiology		
4.1	Prokaryotic cell: Structure and characteristics: 4.1.1: Eubacteria 4.1.2: Cyanobacteria 4.1.3: Archaeobacteria	04
4.2	Virus: Structure Characteristics and Life Cycle: 4.2.1: DNA Viruses 4.2.2: RNA Viruses	06

4.3	Bacteriophage: 4.3.1: Structure & Characteristics 4.3.2: Lytic & Lysogenic Cycle	04
		Total = 60 Hours

Books Recommended

Cell Biology

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 Bertoni, G. P. (2009) The World of the Cell. (7th edition) Pearson Benjamin Cummings Publishing, San Francisco.

Microbiology:

1. M. J. Pelczar, E.C.S. Chan and N.R. Kreig, Tata McGraw Hill
2. Prescott, Harley, Klein, McGraw Hill International Edition

Major – 5 (MJ - 5) PRACTICAL BASED ON CELL BIOLOGY AND MICROBIOLOGY

Credit – 4

Lectures – 120 Hours

FM= 100

Time: 5 Hours

Suggested Practical:

Practical Marks	Distribution
1. Preparation of Temporary slides through onion root tip to study various stages of mitosis.	15
2. Gram Staining of Bacterial cells	15
3. Study of following from models/ photographs	5x2 = 10
a) Prokaryotes cells (Eubacteria, Cyanobacteria & Archaeobacteria)	
b) Eukaryotic Cells (Unicellular Organisms)	
4. Spotting:	3x10 = 30
a) various stages of Meiosis/ Mitosis through permanent slides	
b) Structure of virus through photographs / Models	
5. Class record	10
6. Viva Voce	10
7. Project & Model	10
	100 Marks

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-Eubacteria, Cyanobacteria & Archaeobacteria
3. Study of slides of Unicellular Eukaryotic cells
4. Study of various stages of cell division through permanent slides Mitosis and Meiosis.
5. Study of virus: HIV, Retrovirus, Corona Virus, Bacteriophage.

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Semester IV**Major – 6 (MJ - 6) BIOCHEMISTRY & GENETICS****Credit – 4****Lectures – 60 Hours****FM= 100 [75 +25]****Instructions:**

- In all 9 questions to be set there shall be two groups- **Group A and Group B.**
- **Group A** is compulsory which shall contain three questions.
- Question no. 1 will be very short answer type consisting of five questions of **1 mark** each in the form of MCQ/Fill in the blanks/True or False etc.
- **Question no. 2 & 3** will be of short answer type carrying **5 marks** each.
- **Group B** will contain 6 subjective/descriptive questions out of which the examinees are required to answer any 4 carrying **15 marks** each.

Learning outcomes

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

- Understand about the importance and scope of biochemistry.
- Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.
- Understand the concept of enzyme, its mechanism of action and regulation
- Learn the preparation of models of peptides and nucleotides.
- Learn biochemical tests for amino acids, carbohydrates, proteins and nucleic acids.
- Learn measurement of enzyme activity and its kinetics.
- Understand how DNA encodes genetic information and the function of mRNA and tRNA
- Apply the principles of Mendelian inheritance.
- Understand the cause and effect of alterations in chromosome number and structure.
- Discuss and analyse the epigenetic modifications and imprinting and its role in diseases.
- Get new avenues of joining research in related areas such as genetic engineering of cells, cloning, genetic disorders, human fertility programme, genotoxicity, etc

Unit 1: Biochemistry: Carbohydrates, Lipids and Proteins

1.1	1.1.1: Carbohydrates: Structure, Classification and Biological Importance.	08
1.2	1.2.1: Glycolysis, 1.2.2: Krebs cycle,	
1.3	Lipids: 1.3.1: Structure and Biological significance.	

	Fatty acids- 1.3.2: Types, Nomenclature (Saturated and Unsaturated) and Classification	08
1.4	Amino acids – 1.4.1: Structure, Classification and Properties, Proteins: 1.4.2: Confirmation structure, Composition and Biological significance	02
1.5	Enzymes: 1.5.1: Nomenclature and Classification 1.5.2: General Properties 1.5.3: Specificity 1.5.4: Cofactors & Isozymes. 1.5.5: Mechanism of enzyme action	08
Unit 2: Nucleic acids		
2.1	Structure: Bases, nucleosides and nucleotides.	08
2.2	Types of Nucleic Acids 2.2.1: DNA Structure: Watson & Crick Model 2.2.2: Types of RNA: m-RNA, t- RNA & r- RNA	
Unit	Topic	No. of periods
GENETICS		
Unit 3: Concept of Genes, Genomics and recombination and interaction of Genes		
3.1	Classical and Modern concept of: 3.1.1: Gene (Cistron, Muton, Recon) 3.1.2: Alleles	01
3.2	Classical Genetics: 3.2.1: Mendel's laws of inheritance 3.2.2: Chromosomal basis of inheritance and its applications	08
3.3	Exceptions to Mendelian Inheritance: 3.3.1: Incomplete dominance 3.3.2: Codominance 3.3.3: Multiple allelism & Lethal alleles 3.3.4: Epistasis - Recessive, Double recessive and Double Dominant. 3.3.5: Pleiotropy	
3.3	Linkage and crossing over	02

3.4	Sex Chromosomes and sex-linkage:	04
	3.4.1: XX/XO, XX/XY, ZZ/ZW	
	3.4.2: Haploidy/Diploidy Types	
	3.4.3: Gene Dosage Compensation	
3.5	3.4.4: Epigenetics	06
	Chromosomal Aberrations:	
	3.5.1: Structural Alterations of Chromosomes	
	3.5.2: numerical Alterations of Chromosomes,	
	Genetic Disorders:	
3.5.3: Chromosomal Aneuploidy (Down, Turner And Klinefelter Syndromes), And	04	
3.5.4: Chromosome Translocation (Chronic Myeloid Leukemia)		
3.5.5: Deletion, Gene Mutation (Sickle Cell Anemia).		
3.6	Autosomal & Sex-Linked Inheritance:	04
	3.6.1: Autosomal Dominant and Autosomal recessive,	
	3.6.2: X-linked Dominant, and X-linked recessive.	
3.6.3: Haplodiploidy, Genic Balance Theory, Intersex & Gynandromorphs.	01	
3.7		Role of environmental factors- Crocodile
3.8	Analysis of Pedigree Chart	01
		Total = 60 hours

Books Recommended:**Biochemistry:**

1. Boyer: Concepts in Biochemistry (3rd ed. 2006, Brooks/Cole)
2. Lehninger, Nelson & Cox: Principles of Biochemistry (4th ed, 2007, Worth),
3. Murray *et al*: Harper's Biochemistry (25th ed. 2000, Appleton & Lange)
4. Stryer: Biochemistry (5th ed. 2001, Freeman)
5. Harper's illustrated biochemistry
6. Jawetz, M. and Adelberg (2015) Medical Microbiology (27th edition)

Genetics:

1. Study of Pattern of Inheritance in Human Population of the Traits Rolling of Tongue And Mid Digital Hair, Hypertrichosis, Widow's Peak
2. Genotype Analysis in the Pedigree Chart of the Victorian Family Affected with Haemophilia Study of Colour Blind by Ishihara Chart.
3. Study of structural chromosome aberrations (dicentric, ring chromosomes and inversions in polytene chromosomes) from prepared slides/photographs
4. Study of human karyotypes and numerical alterations (Down syndrome, Klinefelter syndrome and Turner syndrome)

Major – 7 (MJ - 7) Mammalian Physiology & Endocrinology

Credit – 4

Lectures – 60 Hours

FM= 100 [75 +25]

Instructions:

- In all 9 questions to be set there shall be two groups- **Group A and Group B.**
- **Group A** is compulsory which shall contain three questions.
- Question no. 1 will be very short answer type consisting of five questions of **1 mark** each in the form of MCQ/Fill in the blanks/True or False etc.
- **Question no. 2 & 3** will be of short answer type carrying **5 marks** each.
- **Group B** will contain 6 subjective/descriptive questions out of which the examinees are required to answer any 4 carrying **15 marks** each.

Learning outcomes

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

- Understand the physiology at cellular and system levels.
- Understand the mechanism and regulation of breathing, oxygen consumption and determination of respiratory quotient.
- Understand how mammalian body gets nutrition from different biomolecules.
- Understand the process of digestion and excretion.
- Understand the organization of nervous system and process of nerve conduction.
- Learn the determination of hemoglobin content, blood groups and blood pressure.
- Understand neurohormones and neurosecretions.
- Learn about hypo-thalamus and hypophysial axis.
- Understand about different endocrine glands and their disorders.
- Understand the mechanism of hormone action.

Unit	Topic	No. of periods
Unit 1: Mammalian Physiology: Digestion & Excretion Reproduction		
1.1	Nutrition: 1.1.1: Concept of BMR	02
	1.1.2: Concept of Balanced Diet	
1.2	Physiology of Digestion & Absorption: 1.2.1: Carbohydrates	05
	1.2.2: Proteins	
	1.2.3: Fats	

1.3	Physiology of Excretion: 1.3.1: Anatomy of Kidney	03
	1.3.2: Physiology of Urine Formation	
1.4	Reproductive Physiology: 1.4.1: Histo-Physiology of Testis	03
	1.4.2: Histo-Physiology of Ovary	
Unit 2: Respiration, Circulation & Nervous System		
2.1	Body Fluids: 2.1.1: Composition & Function of Lymph	08
	2.1.2: Composition & Function of Blood	
	2.1.3: Blood Clotting Factors	
	2.1.4: Blood Clotting Mechanism	
2.2	Respiration: 2.2.1: Mechanism & Regulation of Breathing	04
2.3	Transport of Gases: 2.3.1: Transport of Oxygen	04
	2.3.2: Oxygen Dissociation Curve	
	2.3.3: Transport of Carbon Dioxide	
	2.3.4: Carbon Dioxide Dissociation Curve	
2.4	Nerve Physiology: 2.4.1: Structure & Types of Neuron	04
2.5	Origin of Action Potential and its Propagation 2.5.1: Myelinated & Non – Myelinated Nerve Fibers	04
	2.5.2: Saltatory Conduction	
2.6	Synapse: 2.6.1: Types of Synapse and Synaptic Transmission	02
Unit 3: Endocrinology: Hormones & Endocrine Glands		
3.1	Hormones: 3.1.1: Hormones, Properties & Classification of Hormones	04
	3.1.2: Nature and Mechanism of Hormones	
3.2	Endocrine Glands: 3.2.1: Structure & Histo-Physiology of Thyroid	08
	3.2.2: Structure & Histo-Physiology of Pituitary	
	3.2.3: Structure & Histo-Physiology of Adrenal	
	3.2.4: Structure & Histo-Physiology of Endocrine Pancreas	
3.3:	Gastrointestinal Hormones: 3.3.1: Gastrin	04
	3.3.2: Cholecystokinin	

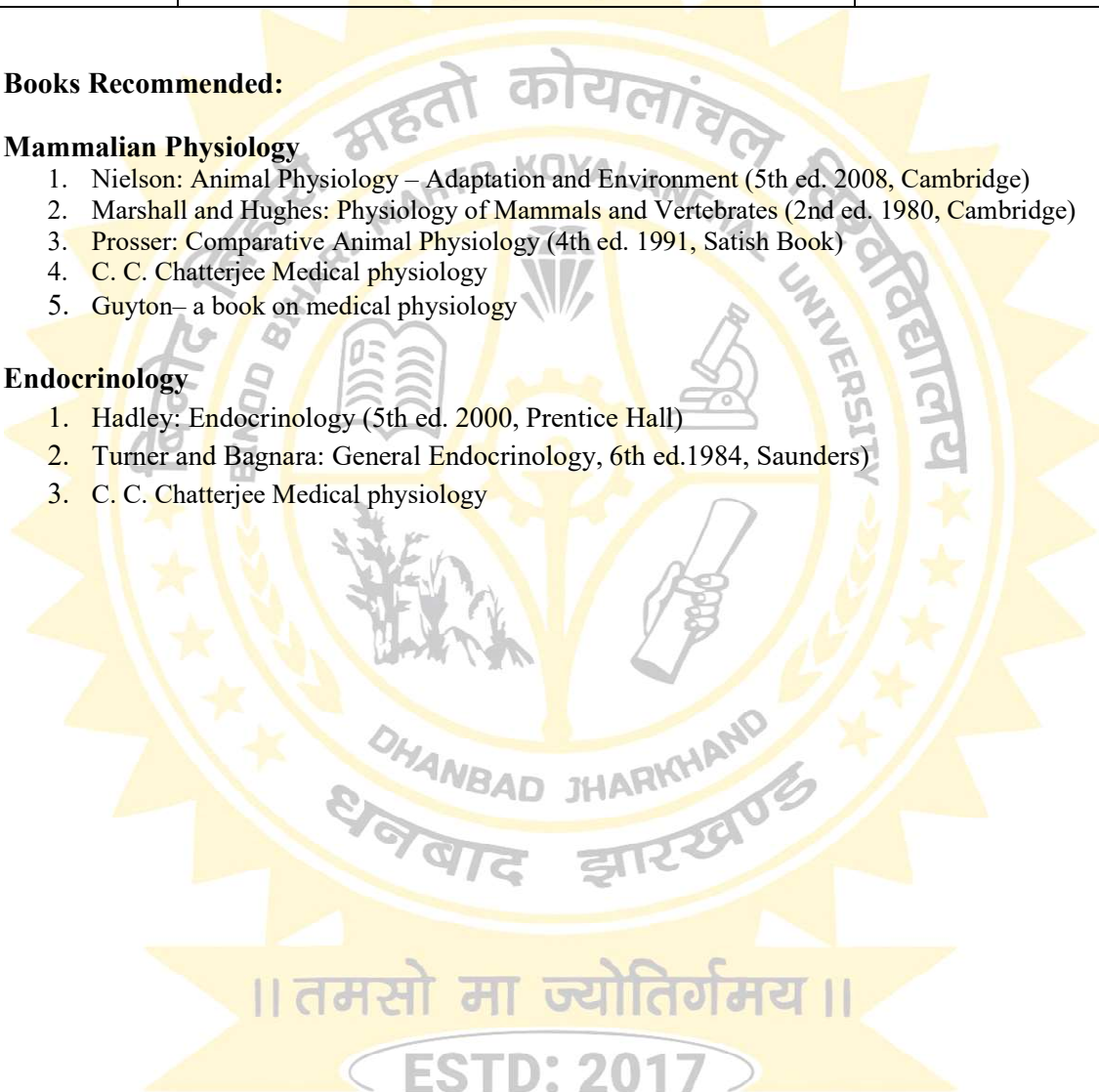
	3.3.3: Secretin	
	3.3.4: Motilin	
Unit 4: Disease Associated with Hormonal Abnormality		
4.1	4.1.1: Cretinism, Goiter & Myxedema	05
	4.1.2: Gigantism, Dwarfism & Acromegaly	
	4.1.3: Diabetes Insipidus Vs Diabetes Mellitus	
	4.1.4: Addison's Disease & Grave Disease	

Books Recommended:**Mammalian Physiology**

1. Nielson: Animal Physiology – Adaptation and Environment (5th ed. 2008, Cambridge)
2. Marshall and Hughes: Physiology of Mammals and Vertebrates (2nd ed. 1980, Cambridge)
3. Prosser: Comparative Animal Physiology (4th ed. 1991, Satish Book)
4. C. C. Chatterjee Medical physiology
5. Guyton– a book on medical physiology

Endocrinology

1. Hadley: Endocrinology (5th ed. 2000, Prentice Hall)
2. Turner and Bagnara: General Endocrinology, 6th ed.1984, Saunders)
3. C. C. Chatterjee Medical physiology



Practical Semester IV

**Major – 8 (Based on MJ – 6 & 7) (Practical)
Credit – 4**

Lectures – 120 Hours

F.M. = 100

Practical	Marks Distribution
1. Physiological Experiment:	10+5 = 15
2. Biochemistry	15
3. Genotype analysis through Pedigree chart/ Ishihara test/ Structural of chromosomal aberrations	10
4. Demonstration of Barr Body in buccal epithelium	10
5. Spotting:	10x03 = 30
a) Permanent slides (Mammalian Physiology) (05)	
b) Permanent slides (Endocrinology) (05)	
6. Class record	10
7. Viva Voce & Project / Model	10
	Total = 100 Marks

Suggested Practical

Mammalian Physiology

1. Preparation of Haemin Crystal
2. RBC count by using haemocytometer
3. Estimation of Haemoglobin using Sahil's method
4. Record of blood pressure by Sphygmomanometer
5. Determination of Bleeding time in human
6. Determination of Coagulation time in human
7. Study of permanent slide of section of organs: Stomach, lung, liver, kidney, intestine

Endocrinology

Study of permanent slide of Endocrine gland: Thyroid, Pancreas, Adrenal, Pituitary, testis, ovary and uterus.

Biochemistry:

Detection of biomolecules in the unknown sample-

- a. Benedict's test for reducing sugars.
- b. Ninhydrin test for α amino acids.
- c. Iodine test for starch

Preparation of model of nitrogenous bases, nucleosides and nucleotides.

Microbiology:

1. Vectors (Bacteria): *Salmonella typhi*, *Mycobacterium tuberculosis* & *Vibrio cholerae*.
2. Vectors (Virus): HIV & Varicella-zoster Virus

Binod Bihari Mahto Koyalanchal University, Dhanbad

Subject: Zoology

FYUGP _NEP2020(from session 2023 onwards)

UG Syllabus

Minor from Discipline Paper

Semester I

Minor – 1A (MN – 1A) Animal Classification & Diversity and Cell Biology

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**.

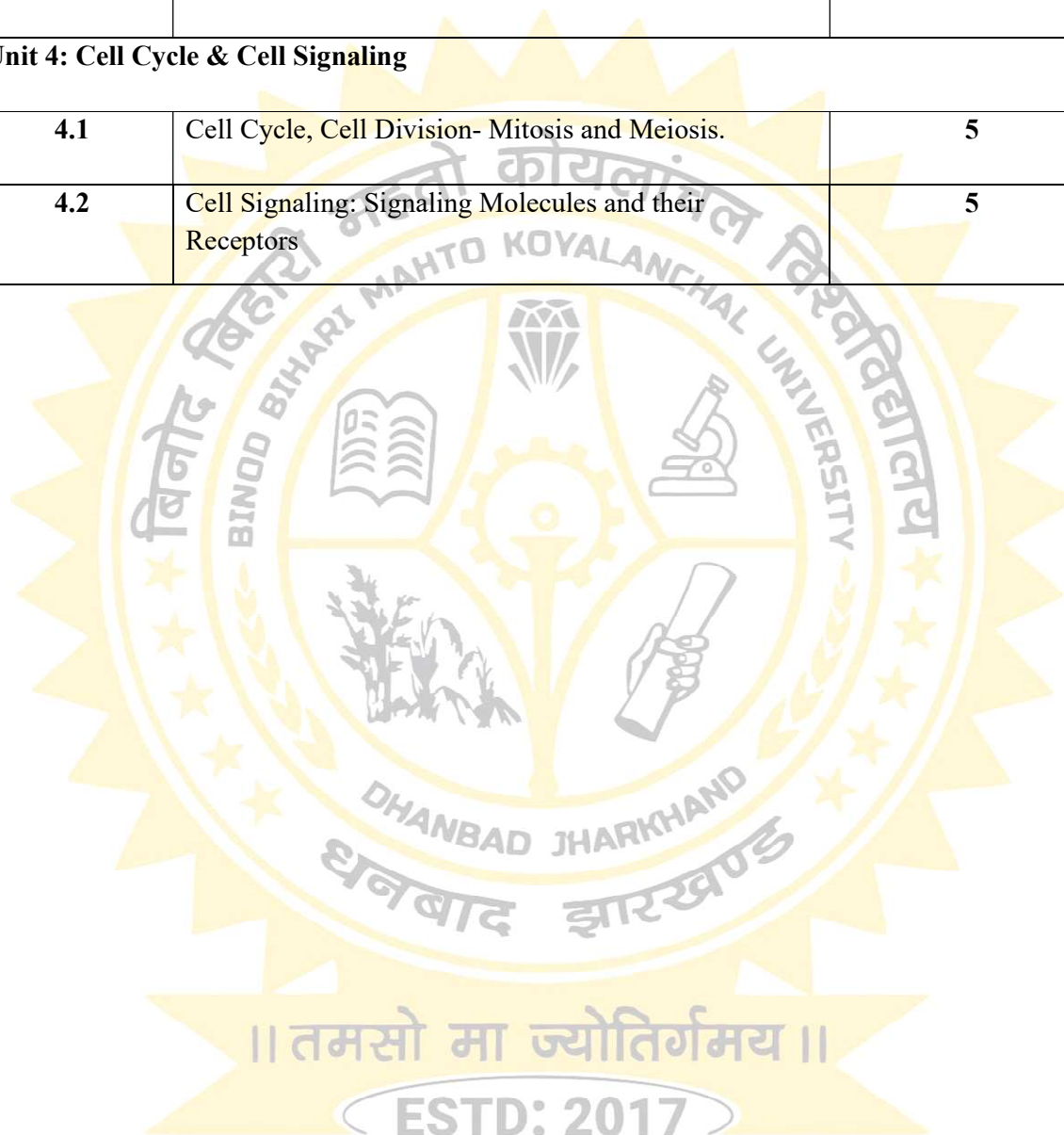
Learning Outcomes:

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

1. Develop understanding on the diversity of life with regard to Protists, non-chordates and chordates.
2. Understand 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 the functioning of nucleus and extra nuclear organelles and understand the intricate cellular mechanisms involved.
6. Acquire the detailed knowledge of different pathways related to cell signaling and apoptosis thus enabling them to understand the anomalies in cancer.
7. 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	Total no. of Lectures
Unit 1: Classification & Diversity of Non-Chordates		
1.1	General characters and classification (up to classes) of the following phyla Protozoa, Porifera, Coelenterate, Platyhelminthes, Annelida, Mollusca, Arthropoda, Echinodermata & Hemichordate with examples	10
1.2	Non-Chordates Form & function 1.2.1: Protozoa: Pathogenecity, treatment & prevention of diseases caused by <i>Entamoeba histolytica</i> & <i>Leishmania donovani</i> 1.2.2: Porifera: Canal System of <i>sycon</i> 1.2.3: Coelenterata: Life Cycle of <i>obelia</i> & Metagenesis 1.2.4: Aschelminthes: <i>Ascaries</i> - life cycle & their pathogenecity 1.2.5: Annelida: <i>Pheretima</i> - Excretory system 1.2.6: Arthropoda: <i>Palaemon</i> - Respiratory System 1.2.7: Mollusca: <i>Pila</i> - Respiratory system 1.2.8: Echinodermata: <i>Asterias</i> - Water vascular System	10
Unit 2: Classification & Diversity of Chordates		
2.1	General characters and classification of living chordates of the following Classes up to Mammalia	10
2.2	Chordate forms & Function 2.2.1: Pisces: Respiratory & Accessory Respiratory organs 2.2.2: Reptilia: Biting mechanism of snake, Poison gland , Types of Venom 2.2.3: Aves: Flight Adaptation in Birds 2.2.4: Mammals: Characters, distribution and affinities of Prototheria	10

Unit 3: Cell Biology		
3.1	Study of structure & function of Plasma membrane	5
3.2	Study of cell Organelle-Mitochondria, ribosomes, lysosomes	3
3.3	Ultra-structure of Chromosomes	2
Unit 4: Cell Cycle & Cell Signaling		
4.1	Cell Cycle, Cell Division- Mitosis and Meiosis.	5
4.2	Cell Signaling: Signaling Molecules and their Receptors	5



Department of Zoology
NEP UG Syllabus
Minor Paper
Semester III

Minor – 1B (MN – 1B) Genetics, Ecology and Evolution
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:

1. Understand how DNA encodes genetic information and the function of mRNA and tRNA
2. Apply the principles of Mendelian inheritance.
3. Understand the cause and effect of alterations in chromosome number and structure. .
4. Discuss and analyse the epigenetic modifications and imprinting and its role in diseases.
5. Get new avenues of joining research in related areas such as genetic engineering of cells, cloning, genetic disorders, human fertility programme, genotoxicity, etc
6. Know the evolutionary and functional basis of animal ecology.
7. Analyse a biological problem, derive testable hypotheses and then design experiments and put the tests into practice
8. Understand what makes the scientific study of animal ecology a crucial and exciting endeavour.
9. Acquire an in-depth knowledge on the diversity and relationships in animal world.

Unit	Topic	Total no. of Lectures
Unit 1: Genetics: Principle of Genetics		
1.1	Mendel's Law of Inheritance	
1.2	Linkage and Crossing Over	

1.3	DNA: Structure & function	10
Unit 2: Concept of gene expression		
2.1	Semi conservative DNA Replication in prokaryotes	15
2.2	Transcription in Prokaryotes	
2.3	Translation in Prokaryotes	
Unit 3: Ecology		
3.1	General Concept:	10
	3.1.1: Ecosystem	
	3.1.2: Food Chain, food Web & Ecological Pyramids	
	3.1.3: Energy Flow	
3.2	Population & Communities	05
	3.2.1: Ecological Succession	
3.3	Environmental Pollution:	10
	3.3.1: Pollution Sources	
	3.3.2: Impact of Environmental Pollution-Air & Water	
	3.3.3: Green House Gases: Causes and Effects	
Unit 4: Evolution		
4.1	Theory of Organic Evolution	10
4.2	Lamarckism's theory of Inheritance of Acquired characters	
4.3	Darwin's theory of Natural Selection	

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ESTD: 2017

Department of Zoology
NEP UG Syllabus
Minor Paper
Semester V

Minor – 1C (MN – 1C) Biochemistry, Physiology & Developmental Biology
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:

1. Understand about the importance and scope of biochemistry.
2. Understand the structure and biological significance of carbohydrates, amino acids, proteins, lipids and nucleic acids.
3. Understand the structure and function of immunoglobulins.
4. Understand the concept of enzyme, its mechanism of action and regulation.
5. Understand the physiology at cellular and system levels.
6. Understand the mechanism and regulation of breathing, oxygen consumption and determination of respiratory quotient.
7. Understand how mammalian body gets nutrition from different biomolecules.
8. Understand the process of digestion and excretion.
9. Develop critical understanding how a single-celled fertilized egg becomes an embryo and then a fully formed adult by going through three important processes of cell division, cell differentiation and morphogenesis.

Unit	Topic	Total no. of Lectures
Unit 1: Biochemistry		20
1.1	Structure and Classification of Biomolecules	
	1.1.1: Protein	
	1.1.2: Carbohydrates	
	1.1.3: Lipids	
1.2	Metabolism	
	1.2.1: Glycolysis	
	1.2.2: Kreb's Cycle	
Unit 2: Physiology		20
2.1	Blood composition, Blood Coagulation	
2.2	Respiration: Transport of gases (O_2 & CO_2)	
2.3	Digestion of food: Protein, carbohydrate and lipid	
2.4	Excretion: Nephron & Urine formation	
Unit 3: Developmental biology		20
3.1	Fertilization	
3.2	Cleavage	
3.3	Placenta & their Function	

Binod Bihari Mahto Koyalanchal University, Dhanbad
Department of Zoology
NEP UG Syllabus
Multidisciplinary Course (MDC)

Multidisciplinary Course (MDC)

Credit – 3

Unit	Topic	Total No. of Lectures
		60
Unit 1: Diversity in the Living World		
1.1	Living World: Taxonomic Categories	02
	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	02
	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	
	1.3.1: Basis of Classification	

	1.3.2: Classification of Animals	02
Unit 2: Cell Biology		
2.1	Cell: Structure & Function	02
	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	04
2.3	Cell Cycle & Cell Division	02
Unit 3: Human Physiology		
3.1	Digestion & Absorption	04
	3.1.1: Alimentary Canal & Digestive Glands	
	3.1.2: Digestion of Food	
	3.1.3: Absorption	
	3.1.4: Associated Disorders	
3.2	Respiration & Transport of Gases	04
	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	
3.3	Body Fluids & Circulation	02
	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	
3.4	Excretory System: 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	04
3.5	Nervous System 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	Reproductive System 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
Unit 4: Genetics & Evolution		
4.1	Principles of Inheritance and Variation 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	Molecular Basis of Inheritance	
	4.2.1: The DNA	
	4.2.2: RNA World	
	4.2.3: Replication	04
	4.2.4: Transcription	
	4.2.5: Genetic Code	
	4.2.6: Translation	
4.3	Evolution: Theories & Sources of Evolution	04
	<ul style="list-style-type: none"> • Lamarckism • Neo- Lamarckism • Darwinism • Neo-Darwinism 	
4.4	Sources of Variations:	
	2.2.1: Mutation	
	2.2.2: Recombination	
4.5	Reproductive Isolation & Its Role in Evolution	02
4.6	Evolutionary Forces:	02
	<ul style="list-style-type: none"> • Hardy – Weinberg Law of Equilibrium 	
4.7	Genetic Drift	02
	3.2.1: Bottle- Neck Phenomenon	
	3.2.2: Founder's Principle	