

B.Sc Genetics & Genomics Syllabus in Semester System (2019 onwards)

Semesters	Type of Paper	Papers	Title of paper
I	Subjective	1	Non Chordata (<i>Protozoa- Echinodermata</i>)
	Subjective	2	Basic Genetics
II	MCQ	3	Cell Biology
		Practical	
III	Subjective	4	Chordata
		Practical	
IV	MCQ	5	Animal Physiology and Biochemistry
	MCQ	6	Developmental Genetics, Population Genetics & Behavioural Genetics
V	Subjective	7	Applied Molecular Genetics & Bioinstrumentation
	Subjective	8	Biostatistics & Bioinformatics
		Practical	
VI	MCQ	9	Immunogenetics & Microbial Genetics
	MCQ	10	Cancer Genetics & Clinical Genetics
	MCQ	11	Genomics

**Department of Zoology
University of Lucknow
Lucknow**

**Syllabus of Genetics and Genomics
Self Finance Course
B.Sc Semesters I-II (2018 onwards)**

Semester I

PAPER 1 Non-chordata (Protozoa to Echinodermata) (Subjective)

The habits, morphology, physiology, reproduction, development (in outline) and classification of the following groups of animals including a detailed study of the types given in each:

Unit I

Protozoa to Coelenterata

- Protozoa - *Euglena*, *Plasmodium*, *Monocystis* and *Paramecium*.
- Porifera - *Sycon*
- Cnidaria: - *Obelia* and *Aurelia*

Unit II

Ctenophora to Nemathelminthes

- Ctenophora - Salient features
- Platyhelminthes - *Fasciola* (Liver fluke) and *Taenia* (Tape worm)
- Nemathelminthes - *Ascaris* and *Ancylostoma* (Hook worm)

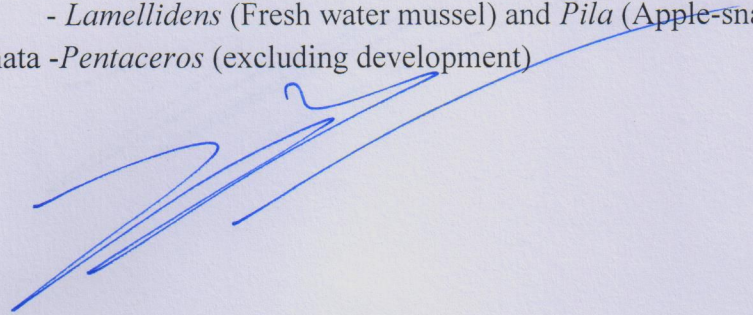
Unit III

Annelida to Arthropoda

- Annelida - *Nereis* and *Hirudinaria* (Leech)
- Arthropoda - *Palaemon* (Prawn) and *Schistocerca* (Locust)

Unit IV

Mollusca to Echinodermata

- Mollusca - *Lamellidens* (Fresh water mussel) and *Pila* (Apple-snail)
 - Echinodermata - *Pentaceros* (excluding development)
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PAPER 2 Basic Genetics (Subjective)

Unit I

Mendelian genetics and gene transmission

- Mendelism: Mendel's laws, extensions of Mendelism, complementation test
- Linkage and crossing over
- Sex-linked characteristics: sex-influenced, sex-limited
- Cytoplasmic inheritance, maternal effects

Unit II

Gene structure and function

- DNA replication, DNA repair and DNA recombination
- Genomic organization—C-value paradox, repetitive sequences
- Giant chromosomes: polytene and lampbrush chromosomes
- Dosage compensation

Unit III

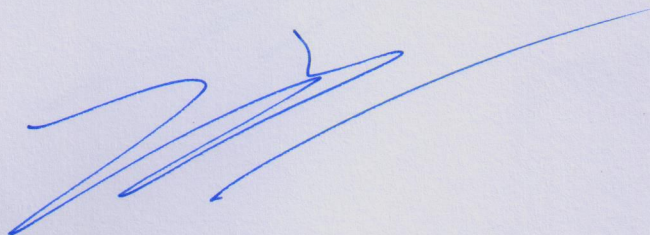
Transcription and translation

- Transcription process in prokaryotes
- Transcription process in eukaryotes
- Translation process in prokaryotes
- Translation process in eukaryotes

Unit IV

Regulation of Gene Expression

- Prokaryotes: *lac* and *trp* operons in *E. coli*
- Eukaryotes Post-transcriptional processing, RNA splicing, RNA editing, RNAi, RNA degradation
- Post-translational processing, protein folding, protein degradation



Semester II

PAPER 3 Cell Biology (MCQ)

Unit I

Structure and function of cell organelles I

- Plasma membrane: chemical structure—lipids and proteins, Membrane transport
- Cell-cell interaction: cell adhesion molecules, cellular junctions
- Endomembrane system: protein targeting and sorting, endocytosis, exocytosis

Unit II

Structure and function of cell organelles II

- Cytoskeleton: microtubules, microfilaments, intermediate filaments
- Mitochondria: Structure, oxidative phosphorylation
- Peroxisome and ribosome: structure and function

Unit III

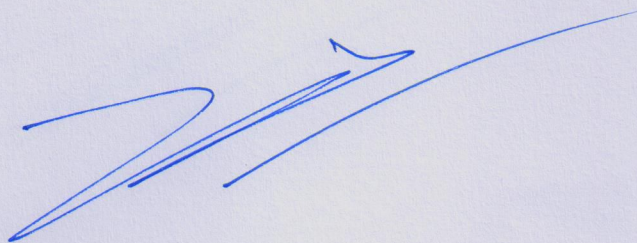
Nucleus and chromatin structure

- Structure and function of nucleus in eukaryotes
- Chemical structure and base composition of DNA and RNA
- DNA supercoiling, chromatin organization, structure of chromosomes

Unit IV

Cell cycle and cell signaling

- Cell division: mitosis and meiosis
- Cell cycle and its regulation
- Signal transduction: intracellular and cell surface receptors, signaling via G-protein linked receptors, JAK-STAT pathway



Practical Syllabus

1. Study of museum specimens and slides of invertebrates

2. Dissection- Nervous system of *Palaemon* (Prawn)

3. Familiarization with microscopes & binoculars.

4. Temporary/ Glycerin preparation of :

- Spicules of sponges
- Nerve ring of earthworm
- Setae *in situ* of earthworm
- Hastate plate of *Palaemon*

5. Permanent stained preparations of-

- Gemmule of sponges
- Parapodia of *Nereis*
- Septal nephridia of earthworm

6. Preparation of molecular models using bead and stick method

- Nitrogenous bases, nucleosides, nucleotides.

7. Study of cell types

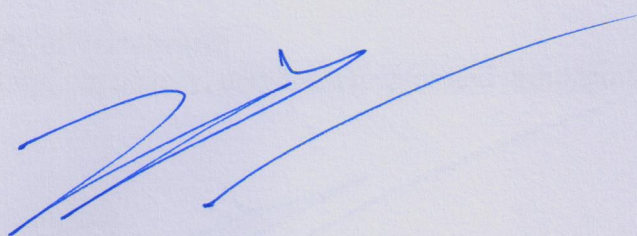
- Methylene blue staining of buccal epithelial cells, neurons, striated muscle cells.
- Leishman staining of mammalian blood cells.
- To study the effect of isotonic, hypotonic and hypertonic solutions on mammalian RBCs.

8. Chromosomal studies

- Temporary squash preparation of giant chromosomes from salivary glands of *Chironomus* Larva.
- To study the different stages of mitosis in onion root tip.

9. Class Record

10. *Viva-voce*



Semester III

PAPER 4 Chordata (Subjective)

Unit- I

Hemichordata: General characters of Hemichordata and affinities of *Balanoglossus*

Cephalochordata: Classification and detailed study (habit, morphology, anatomy and physiology) of *Branchiostoma (Amphioxus)*.

Urochordata: Classification and detailed study (habit, morphology, anatomy, physiology and post embryonic development) of *Herdmania*.

Pisces: Classification and detailed study (habit, morphology, anatomy and physiology) of *Scoliodon*.

Unit -II

Amphibia: General Characters, Classification up to order and examples.

Reptilia: General Characters, Classification up to order and examples.

Aves: General Characters, Classification up to order and examples. Flying adaptations.

Mammalia: General Characters, Classification up to order and examples.

Unit-III

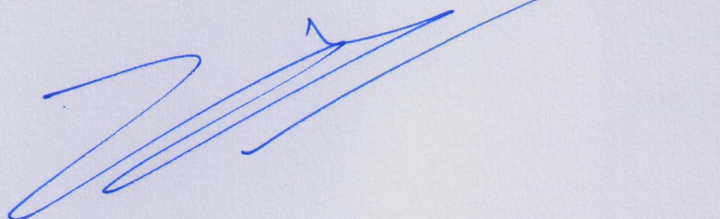
Comparative anatomy of vertebrates

Histology (types of tissues). Comparative study of integument and skeleton.

Unit-IV

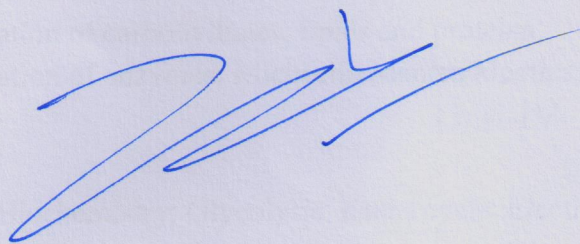
Comparative study of vertebrates

Digestive, respiratory, circulatory, nervous, receptor and urinogenital systems.



Practical Syllabus

1. Study of museum specimens and slides of vertebrates
2. Important Bones of mammals
3. Dissection- *Scoliodon*
 - Afferent System
 - Efferent System
 - Cranial Nerves
4. Temporary and permanent preparation of: Placoid scales
5. Biochemistry
 - Ninhydrin test for α -amino acids.
 - Benedict's test for reducing sugar and iodine test for starch.
 - Determination of acid value of oil.
 - Preparation of molecular models of amino acids, dipeptides using bead and stick method.
6. Physiology
 - Determination of blood groups
 - Preparation of haemin crystals.
 - Determination of Hb% in blood sample by haemometer.
7. Class Record
8. *Viva-voce*



Semester IV

PAPER 5 Animal Physiology and Biochemistry (MCQ)

General physiology (in outline) with special reference to mammals

Unit-I

- Physiology of digestion
- Respiration
- Blood and circulation (blood coagulation, transport of O₂ and CO₂)

Unit-II

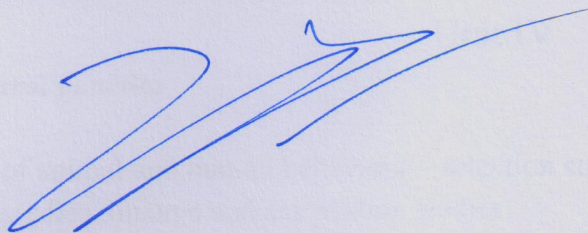
- Physiology of excretion and osmoregulation
- *Nervous and Muscular system* Thermoregulation

Unit-III

- Classification of carbohydrates, lipids and proteins
- Classification of enzymes: Michaelis-Menten kinetics,

Unit-IV

- Cellular Biochemistry: Glycolysis, Krebs cycle, Electron Transport Chain (ETC)
- Metabolism: Gluconeogenesis, Glycogenolysis, Glucogenesis



PAPER 6 Developmental Genetics, Population Genetics & Behavioural Genetics (MCQ)

Unit-I

Developmental Genetics

- Molecular basis of development
- Developmental genes
- Genetic determination of sex in *Caenorhabditis elegans*, *Drosophila melanogaster* and mammals

Unit II

Population and evolutionary genetics

- Microevolution in Mendelian population: Hardy-Weinberg equilibrium
- Allele and genotype frequencies
- Evolutionary forces: mutation, migration, natural selection, genetic drift

Unit III

Quantitative genetics

- Genotype and phenotype relation: effect of environment, penetrance, expressivity, phenocopy, gene interactions and modifying genes
- Inheritance of quantitative traits—continuous and discontinuous variation
- Polygenic inheritance, genetic variance, heritability

Unit IV

Behavioural genetics

- Genetics of animal and human behaviour—selection studies, inbred strain studies, twin and adoption studies, linkage and association studies
- Learning and memory
- Psychological disorders---mental retardation, learning disorders, mood disorders, anxiety disorders, personality disorders

