

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: I

**GENETICS PAPER I
CELL BIOLOGY AND MENDELISM**

Course Code: 18IGT1

No. of Hours: 60

COURSE OBJECTIVES:

- To learn the basic concepts of genetics
- To learn the structure of cell organelles and their functions

LEARNING OUTCOMES:

- To understand the scope of genetics
- To obtain a strong knowledge of the basic concepts of cell biology

UNIT I CELLULAR STRUCTURE AND FUNCTION 23 HRS

Cell Wall: Ultra structure, chemical composition, and function; plasmodesmata and gap junctions **3 HRS**

Plasma membrane: Ultra structure – Fluid mosaic model; chemical composition, Functions of plasma membrane –Osmosis, phagocytosis, pinocytosis, active transport. **3 HRS**

Cytoplasm and cytoskeleton: Chemical composition, Peroxisomes and microsomes **2 HRS**

Cell organelles: Ultra structure, chemical composition and functions of Endoplasmic reticulum, Ribosomes, Centrosomes, Lysosomes, Golgi complex **7 HRS**

Mitochondria: Ultra structure, chemical composition, functions in general, Mitochondria as a semi-autonomous cell organelle **2 HRS**

Chloroplast: Ultra structure, chemical composition and functions, Chloroplast as a semi-autonomous cell organelle **2 HRS**

Nucleus: Chemical composition and functions, Morphology – nuclear envelope, nuclear pore complex, nucleolus, nucleoplasm and chromatin **2 HRS**

Cell line study: General characteristics, protocol for deriving cell lines and applications **2 HRS**

UNIT II: CELLULAR REPRODUCTION 13 HRS

Cell cycle: Phases; checkpoints and cyclin dependent regulation of cell cycle (in brief) **2 HRS**

Mitosis: Stages; structure and function of mitotic apparatus (astral and anastral spindle); spindle fibres and its composition; cytokinesis in plant and animal cell; significance of mitosis. Mitotic stimulators and inhibitors **4 HRS**

Meiosis: Stages; synaptonemal complex, crossing over, chiasma formation; significance of meiosis **4 HRS**

Cell death: Programmed cell death (apoptosis), process and mechanisms of apoptosis; its significance **3 HRS**

UNIT III: MODEL ORGANISMS **8 HRS**

Introduction to model organisms; life cycles and genetic significance of -

Virus – Lambda phage;

Bacteria - *E.coli*;

Fungi - *Saccharomyces cerevisiae*,

Invertebrates – *Caenorhabditis elegans*, *Drosophila melanogaster*,

Vertebrates – *Danio rerio*, *Mus musculus*

Plants – *Pisum sativum* and *Arabidopsis thaliana*

UNIT IV: HISTORY AND SCOPE OF GENETICS **7 HRS**

Pre-mendelian genetic concepts: Pre-formation theory, Epigenesis, Pangenesis, inheritance of acquired characters, Germplasm theory. **3 HRS**

Genetics -scope; genetics in relation to society - breeding, medicine, genetic counseling, betterment of human race, and ethical and legal issues **2 HRS**

Heredity and environment; genotype and phenotype; heredity and variation; clones, pure lines and inbred lines. Norm of reaction and phenocopies **2 HRS**

UNIT V: MENDELISM **9 HRS**

Biography: Mendel and his experiments on pea plant **1 HR**

Law of Segregation: Monohybrid cross, back cross and test cross, Dominance and recessive, **2 HRS**

Law of Independent Assortment: Dihybrid cross in pea plant and *Drosophila sp.*, back cross and test cross. **2 HRS**

Deviation from Mendalism: Co-dominance and Incomplete dominance **2 HRS**

Genetic problems **2 HRS**

I B.Sc. Genetics-I Semester - Practical I

DURATION: 3 HRS/UNIT

NO.OF UNITS: 15

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| 1. Microscopy: | 2 UNITS |
| Study of dissection, stereo, compound and binocular microscopes | |
| 2. Model Organisms- External and their significance in genetic studies: | 5 UNITS |
| Virus – λ phage | |
| Bacteria – <i>E. coli</i> (slide) | |
| <i>Neurospora</i> and <i>Saccharomyces cerevisiae</i> (slides) | |
| <i>Caenorhabditis elegans</i> | |
| <i>Drosophila melanogaster</i> | |
| <i>Danio rerio</i> | |
| Maize (<i>Zea mays</i>) | |
| Arabidopsis | |
| 3. Staining Techniques: | 3 UNITS |
| Vital staining - Mitochondria in yeast | |
| Gram staining - Lactobacillus / E.coli | |
| 4. Observation of mitotic stages in permanent slides | 1 UNIT |
| 5. Temporary squash preparation of onion root tip for mitosis | 1 UNIT |
| 6. Floral structure of <i>Crotolaria</i> and Brassica species (mustard) | 1 UNIT |
| Practical tests/repetition | 2 UNITS |
| Note: 13 Practical + 2 units for practical tests/repetition | |

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2. Gardener et al(2005), PRINCIPLES OF GENETICS, 8th edition, John Wiley & Sons Inc., New York.
3. Gerald Karp (2005), CELL AND MOLECULAR BIOLOGY, 4th edition, John Wiley & Sons Inc., New York.
4. Gupta P. K. (2003), CELL AND MOLECULAR BIOLOGY, 2nd edition, Rastogi Publications, Meerut.\
5. Cheryl P. Helgason and CindyL.Miller (2012), BASIC CELL CULTURE PROTOCOL, Humana Press-Science

6. Simon P. Langdon (2004) *CANCER CELL CULTURE: METHODS AND PROTOCOLS*, Springer
7. Roberts E.D.P. and Roberts E.M.F., *CELL BIOLOGY & MOLECULAR BIOLOGY*, Saunders College Publication, Philadelphia.
8. Sinnott E.W., Dunn L.C. and Dobzhansky T.(1958), *PRINCIPLES OF GENETICS*, 5th edition, McGraw-Hill Publications, New York.
9. Tamarin R.H. (2002), *PRINCIPLES OF GENETICS*, 7th edition, Tata McGraw-Hill, New Delhi.
10. Verma P.S. and Agarwal V.K. (2010), *GENETICS*, S. Chand and Co. Ltd., New Delhi
11. e-books:<http://www.ncbi.nlm.nih.gov/books/NBK21766/>, Anthony JF Griffiths et al (2000),*INTRODUCTION TO GENETIC ANALYSIS*, 7th edition,W. H. Freeman, New York
12. <http://www.ncbi.nlm.nih.gov/omim>Online Mendelian Inheritance in Man (OMIM), An Online Catalog of Human Genes and Genetic Disorders