

JYOTI NIVAS COLLEGE AUTONOMOUS
PROGRAMME: B.SC.
SEMESTER: I - GENETICS - I
CELL BIOLOGY AND GENETICS

COURSE CODE: 21IGT1
CREDITS: 04

NO. OF HOURS: 60

COURSE OBJECTIVES (COS):

- Describe the structure and function of the cell organelles.
- Illustrate the different stages of cell division and cellular aging.
- Understand Mendel's laws and deviations from Mendelism.
- Learn to classify human chromosomes and determine the types of chromosomal disorders.

LEARNING OUTCOMES:

At the end of the course the student will be able to

- Acquire in depth knowledge on the structure and functions of cell organelles
- Differentiate the stages in cell division and cellular aging
- Relate Mendel's laws and its deviations to solve problems
- Compare the karyotypes and predict chromosomal disorders

UNIT – 1

15 HOURS

CHAPTER 1:

10 HRS

Ultrastructure – fluid mosaic model, chemical composition and functions of Plasma membrane.
Ultrastructure and functions of Cytoplasmic organelles: Mitochondria, Chloroplast, Endoplasmic reticulum, Ribosomes, Lysosomes, Golgi bodies and Cytoskeleton.

CHAPTER 2:

02 HRS

Nucleus: Morphology, nuclear envelope, nucleoplasm, nucleolus and chromatin.

CHAPTER 3:

03 HRS

Ultra structure of Eukaryotic Chromosome: Macro-molecular organization-Nucleosome model.
Primary and Secondary constriction, SAT-bodies, telomere.

UNIT – 2

15 HOURS

CHAPTER 4:

10 HRS

Molecular Basis of Cell Cycle and Cell Division: G₁, S, G₂ and M phases, Checkpoints.
Mitosis: Stages, Mitotic apparatus, cytokinesis, Mitogens and Inhibitors, Significance.
Meiosis: Stages, Synaptonemal complex, crossing over and chiasma formation, Significance.

CHAPTER 5:

05 HRS

Cell senescence and Cell death: cellular features of Senescence-spontaneous and induced, Programmed cell death - Process and Mechanism and significance.

UNIT – 3

15 HOURS

CHAPTER 6:

05 HRS

Biography of Mendel and his experiments:
Law of Segregation: Monohybrid cross, Back cross and Test cross, related Genetic Problems.
Law of Independent Assortment: Dihybrid cross, Back cross and Test cross, related Genetic Problems.

CHAPTER 7:	02 HRS
Multiple Alleles: Definition, ABO blood groups and Rh factor in Human, related Genetic Problems.	
CHAPTER 8:	08 HRS
Gene Interactions:	
Incomplete dominance (<i>Mirabilis jalapa</i>)	
Non-epistasis: Inheritance of comb pattern in fowl	
Epistasis:	
Dominant epistasis – coat color in dog (12:3:1), Recessive epistasis – coat color in mice (9:3:4),	
Dominant – recessive interaction – plumage in fowls (13:3) Related problems	
UNIT – 4	15 HOURS
CHAPTER 9:	04 HRS
Karyotype, Ideogram and Chromosome nomenclature according to Denver and Paris Conference.	
Banding Techniques: G, C, Q, R and Ag-NOR (Nucleolar organizing region).	
CHAPTER 10:	02 HRS
Human Cytogenetics: Patau's classification, Normal Human karyotype (Male & Female).	
CHAPTER 11:	07 HRS
Numerical chromosomal abnormalities:	
Clinical features and Karyotype of Syndromes: Down's, Edward's, Patau's, Turner's, and Klinefelter's.	
Structural chromosomal aberrations:	
Clinical features and Karyotype of Syndromes:	
Deletion - Smith-Magenis syndrome, Cri-Du-Chat Syndrome	
Translocation - Burkitt's lymphoma, Philadelphia translocation (Chronic myelogenous leukemia)	
CHAPTER 12:	02 HRS
Introduction to Eugenics: Positive and Negative Eugenics, Euthenics, Euphenics	
TEXT BOOKS:	
1. Karp, G. (2009). <i>Cell and molecular biology: concepts and experiments</i> . John Wiley & Sons.	
2. Russell, P. J., Hertz, P. E., McMillan, B., & Benington, J. (2020). <i>Biology: the dynamic science</i> . Cengage Learning.	
3. Singh, S. P., & Tomar, B. S. (2008). <i>Cell biology</i> . Rastogi Publications, Meerut, India.	
4. Cooper, G. M., Hausman, R. E., & Hausman, R. E. (2007). <i>The cell: a molecular approach</i> (Vol. 4). Washington, DC: ASM press.	
5. Gupta, P.K. (2010). <i>Cytogenetics</i> . Rastogi Publications, Meerut, India.	
6. Lewin, B., Krebs, J., Kilpatrick, S. T., & Goldstein, E. S. (2011). <i>Lewin's genes X</i> . Jones & Bartlett Learning.	
REFERENCES:	
1. Pierce, B. A. (2012). <i>Genetics: a conceptual approach</i> . Macmillan publication.	
2. Roberts, K., Alberts, B., Johnson, A., Walter, P., & Hunt, T. (2002). <i>Molecular biology of the cell</i> . New York: Garland Science.	
3. Lodish, Harvey, et al. <i>Molecular cell biology</i> . Macmillan, 2008.	
4. Snustad, D. P., & Simmons, M. J. (2015). <i>Principles of genetics</i> . John Wiley & Sons.	

PRACTICAL

CREDITS: 2

NO OF HOURS: 56

1. Preparation of pre-treating / fixing agents/ stains for cytological studies.
2. Study of Mitosis using root tips
3. Study of Meiosis using flower buds/ grasshopper testes
4. Preparation of salivary gland chromosomes in *Chironomous* larvae
5. Preparation of salivary gland chromosomes in *Drosophila* larvae
6. Blood typing in humans to study multiple allelism and Rh factor
7. Genetic problems on ABO blood grouping
8. Genetic Problems on Monohybrid cross
9. Genetic Problems on Dihybrid cross
10. Genetic Problems on non-Mendelian Interactions.
11. Study of Karyotypes –Normal Karyotypes in Humans
12. Study of Abnormal Karyotypes – Down's syndrome (autosomal).
13. Study of Abnormal Karyotypes – Turner's syndrome (sex chromosomal)
Study of Abnormal Karyotypes - Klinefelter's syndrome (sex chromosomal)

