

SEMESTER-V

BTC DSM 301T GENETICS AND MOLECULAR BIOLOGY

Contact Hours: 60

Full Marks = 100 [ESE (70) CCA (30)]

Course Objective: *The Genetics and Molecular Biology course aims to provide students with a comprehensive understanding of genetic principles and molecular processes. It covers topics such as Mendelian genetics, allelic interactions, gene mutations, chromosomal abnormalities, DNA replication, RNA structure, transcription, RNA processing, and translation. The course intends to equip students with a solid foundation in genetics and molecular biology, preparing them for further studies or careers in genetics, biotechnology, or related fields.*

UNIT 1

(9 Lectures)

Mendelian genetics: Mendel's experimental design; monohybrid, di-hybrid and tri hybrid crosses; law of segregation & principle of independent assortment; Test and back cross.

Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance. **Non-allelic interactions:** complementary genes, duplicate genes and inhibitory genes.

UNIT 2

(8 Lectures)

Gene mutations: Definition and types of mutations; causes of mutations; **Variations in chromosomes structure:** deletion, duplication, inversion and translocation (reciprocal and Robertsonian).

UNIT 3

(10 Lectures)

Chromosomal abnormalities in human beings: Aneuploidies of the autosomes - Monosomy 5, Trisomy 13, Trisomy 18 and Trisomy 21; Aneuploidies of the sex chromosome - Turner syndrome and Klinefelter syndrome. **Linkage:** Complete linkage and incomplete linkage. **Crossing over:** Molecular mechanism of crossing over - copy choice theory and breakage and reunion theory.

UNIT 4

(9 Lectures)

DNA replication: replication of DNA in prokaryotes; rolling circle replication; unique aspects of eukaryotic chromosome replication. **RNA:** structure and function of mRNA, rRNA and tRNA.

UNIT 5

(9 Lectures)

Transcription: prokaryotic RNA polymerase; role of sigma factor; promoter; transcription factors; enhancers; initiation, elongation and termination of RNA chains. **RNA processing:** 5' cap formation; polyadenylation and splicing of pre-mRNA. **Translation:** mechanism of initiation; elongation and termination of polypeptides; posttranslational modifications of proteins.

Course Outcome: *By the end of this course, students will have a strong grasp of genetic concepts and molecular mechanisms. They will be able to analyze and interpret genetic data, understand the structure and function of DNA and RNA, and comprehend the processes of transcription and translation. Additionally, they will gain insights into genetic variations, mutations, and chromosomal abnormalities, providing them with valuable knowledge for various applications in genetics and molecular biology.*

SUGGESTED READING

1. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. 3rd Edition. John Wiley and Sons Inc.
2. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. 9th Edition. Benjamin Cummings.
3. Russell, P. J. (2009). Genetics- A Molecular Approach. 3rd Edition. Benjamin Cummings.
4. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
5. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. 8th Edition. Lippincott Williams and Wilkins, Philadelphia.
6. 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.
7. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., (2008) Molecular Biology of the Gene, 6th Edition. Cold Spring Harbour Lab. Press, Pearson Pub.