

GENERIC ELECTIVE (BOT-GE-19)

Credit distribution, Eligibility and Pre-requisites of the Course

| Course title & Code | Credits | Credit distribution of the course | | | Eligibility criteria | Pre-requisite of the course |
|---|---------|-----------------------------------|----------|---------------------|-----------------------------|-----------------------------|
| | | Lecture | Tutorial | Practical/ Practice | | |
| Fundamentals of Molecular Biology BOT-GE-19 | 4 | 2 | 0 | 2 | Class XII pass with Science | Nil |

Learning Objectives:

5. To gain the knowledge of structure and functions of DNA and RNA

Learning Outcomes:

Students would have understanding of

9. understanding of nucleic acid, organization of DNA in prokaryotes and Eukaryotes, DNA replication mechanism, genetic code and transcription process.
10. Processing and modification of RNA and translation process, function and regulation of expression.

Unit 1: Nucleic Acids as genetic material

02 Hours

Discovery of Nuclein by Fredrich Miescher; Experiments by Griffith, Hershey and Chase, Avery, McLeod and McCarty and Fraenkel Conrat.

Unit 2: Structure of Nucleic acids- the blueprint of Life

04 Hours

Building blocks of nucleic acid: Ribose sugar, Purine, Pyrimidine, phosphate; Watson and Crick's model of DNA, DNA types (A,B,Z type), Comparison of RNA structure and types (tRNA, mRNA and rRNA); nucleosome- chromatin structure; Euchromatin and heterochromatin.

Unit 4: Central Dogma of Life

04 Hours

Concept of Central dogma; Salient features of genetic code, deciphering the genetic code (Contribution of Nirenberg, Matthei and Ochoa, H.G. Khorana).

Unit 3: Replication

05 Hours

Semi-conservative mode of DNA replication; replication of linear and circular DNA (Theta and Rolling circle model); mechanism and role of key enzymes in replication; role of telomerase enzyme in eukaryotic DNA replication; reverse transcription.

Unit 5: Transcription

05 Hours

Comparative account of transcription in Prokaryotes and eukaryotes; post-transcriptional processing of pre-mRNA in eukaryotes (3', 5' end modifications and general mechanism of splicing involving spliceosomes).

Unit 6: Translation**05 Hours**

Comparative account of prokaryotic and eukaryotic ribosome structure and translation; inhibitors of protein synthesis (antibiotics).

Unit 7: Gene regulation**05 Hours**

Gene regulation in Prokaryotes- Operon concept: inducible and repressible operon; regulation of lactose (lac) and tryptophan (trp) in *Escherichia coli*; attenuation regulation.

Practicals**60 hours**

6. DNA isolation from cauliflower head by spooling method.
7. Study experiments establishing nucleic acid as genetic material: Griffith's, Avery et al, Hershey & Chase's and Fraenkel Conrat's experiments (through photographs)
8. Study DNA packaging (photographs/paper models).
9. Study modes of DNA replication: Meselson and Stahl's experiment, Rolling circle and Theta model of replication and semi-discontinuous, semi conservative replication (photographs).
10. Study structure of tRNA, prokaryotic RNA polymerase and eukaryotic RNA polymerase II (photographs/paper models).
11. Study RNA modification: Assembly of Spliceosome machinery, Splicing mechanism in group I & group II introns (photographs/paper models).
12. Study gene regulation mechanism in prokaryotes: lactose (lac) operon and tryptophan (trp) operon (photographs).
13. Finding the T_m of different DNA samples from the photographs of DNA melting profile provided. Problem solving for calculating the GC content.

Suggested Readings:

- Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington, D.C.: ASM Press & Sunderland, Sinauer Associates, MA.
- Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons
- Snustad, D.P., Simmons, M.J. (2012). Principles of Genetics, 6th Edition. New Delhi, Delhi: John Wiley & Sons
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings

Additional Resources:

6. Hardin, J. and Lodolce, J.P. (2021). Becker's World of the cell, 10th edition, Pearson

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.