

**Model Syllabus for 4-Year UG Honours in B.Sc. (Biotechnology) as Major
in consonance with Curriculum framework w.e.f. AY 2026-27**

COURSE STRUCTURE (for Semester III)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	III	5	Biophysical Techniques	3	3
			Biophysical Techniques-Practical	2	1
		6	Basic Molecular Biology	3	3
			Basic Molecular Biology-Practical	2	1
		7	Genetic Engineering	3	3
			Genetic Engineering-Practical	2	1

SEMESTER - III

COURSE 6: BASIC MOLECULAR BIOLOGY

Theory

Credits: 3

3 hrs/week

Course Objectives:

1. To understand the experimental proof that DNA is the genetic material.
2. To study genome organization in prokaryotes and eukaryotes.
3. To explain the processes of DNA replication, transcription, and translation.
4. To understand the regulation of gene expression in prokaryotic and eukaryotic systems.
5. To develop a basic understanding of molecular mechanisms underlying heredity and protein synthesis.

Learning Outcomes:

After completing this course, students will be able to:

1. Describe experiments that established DNA as the genetic material.
2. Compare the genome structure of prokaryotes and eukaryotes.
3. Explain the mechanism of DNA replication, transcription, and translation.
4. Discuss the regulation of gene expression using operon models.
5. Apply knowledge of molecular biology to understand genetic processes in living organisms.

Syllabus

Unit I

Genome Structure: Experiments to prove DNA as genetic material (Griffith experiment, Hershey-Chase experiment). **Genome Organization:** Prokaryotic and Eukaryotic genomes. Concept of Gene, Genome and Genome size with respect to Prokaryotic and Eukaryotic genomes.

Unit II

DNA Replication: Proof of semiconservative replication. Enzymes Involved in DNA Replication: DNA polymerase I, II and III, Helicases, Topoisomerases, single strand binding proteins, primase. Mechanism of DNA Replication (Prokaryotic and Eukaryotic). M13 Viral DNA Replication (Rolling circle method).

Unit III

Transcription: Basic features of transcription, the structure of prokaryotic RNA polymerases – Prokaryotic and Eukaryotic. Concept of core enzyme, holo enzyme, and sigma factor. Concept of promoter – TATA Box, -10 and -35 sequences). Transcription Mechanisms: Prokaryotic and Eukaryotic. Post Transcriptional Modifications in Eukaryotes. Concept of Reverse Transcription.

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Unit IV

Translation: Genetic code: Features of genetic code, Structure of mRNA, brief structure of tRNA. Codon-anticodon interaction - the Wobble Hypothesis. Mechanism of Translation - Prokaryotic and Eukaryotic. Initiation, elongation, termination protein.

Unit V

Gene Regulation: Clustered genes the operon concepts - Negative and positive control of the Lac Operon, trp operon, Control of gene expression. Poly and Mono cistronic mRNA.

Reference books:

- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. & Losick, R. (2017). *Molecular Biology of the Gene*. 7th Edition, Pearson Education.
- Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. & Martin, K. (2021). *Molecular Cell Biology*. 9th Edition, W.H. Freeman and Company.
- Krebs, J.E., Goldstein, E.S. & Kilpatrick, S.T. (2017). *Lewin's Genes XII*. Jones & Bartlett Learning.
- Alberts, B., Johnson, A., Lewis, J., Morgan, D., Raff, M., Roberts, K. & Walter, P. (2014). *Molecular Biology of the Cell*. 6th Edition, Garland Science.
- Primrose, S.B. & Twyman, R.M. (2006). *Principles of Gene Manipulation and Genomics*. 7th Edition, Blackwell Publishing.
- Berg, J.M., Tymoczko, J.L., Gatto, G.J. & Stryer, L. (2019). *Biochemistry*. 9th Edition, W.H. Freeman and Company.
- Weaver, R.F. (2018). *Molecular Biology*. 6th Edition, McGraw Hill Education.

Ch. Jan. 2022

SEMESTER - III

COURSE 6: BASIC MOLECULAR BIOLOGY

Practical

Credits: 1

2 hrs/week

Practical Component:

1. Effect of UV radiations on the growth of microorganisms.
2. Determination of absorption maxima of DNA and RNA and their quantification
3. Quantitative estimation of RNA
4. Quantitative estimation of DNA
5. Isolation of plasmid DNA from bacteria
6. Isolation of genomic DNA from *E. coli*
7. Isolation of DNA from sheep liver
8. Isolation of DNA from plant leaves (Rice or Tobacco or any other plant)
9. Separation of DNA by Agarose gel Electrophoresis
10. Purity analysis of the Nucleic acids

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4- Year UG Honours, Major
Syllabus
(2026-27)
Semester-III

Model Question Paper

Time : 3hrs

Marks:75

Part-A

Answer any Five Questions. Each Question carries 3 Marks.

5x3=15

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Answer the following questions. Each question carries 12 Marks

5x12=60

11. a) Unit-I
(Or)
b) Unit-I

12. a) Unit-II
(Or)
b) Unit-II

13. a) Unit-III
(Or)
b) Unit-III

14. a) Unit-IV
(Or)
b) Unit-IV

15. a) Unit-V
(Or)
b) Unit-V