

M.G. Science Institute, Autonomous

Affiliated to Gujarat University, Ahmedabad

(Managed by The Ahmedabad Education Society)

Department of Biotechnology

Programme: Bachelor of Science (Hons.) in Biotechnology

SYLLABUS

(Effective from Academic Year 26-27)



Syllabus B.S. Biotechnology Semester V

Semester: V	Title: rDNA technology	Credit: 4
Course Code: BTM351 (T)		4hr/week

COURSE OUTCOMES (COS)

By the end of the course student should be able to:

- CO1: Explain the fundamental processes of gene expression and the regulatory mechanisms in prokaryotic and eukaryotic systems.
- CO2: Analyze epigenetic and post-transcriptional mechanisms involved in gene regulation, including methylation, histone modifications, and RNA interference pathways.
- CO3: Describe and compare natural and artificial gene transfer methods, including physical, chemical, and biological approaches, and their application in different organisms.
- CO4: Differentiate between types of mutations and mutagens, and evaluate various mutagenesis techniques, including site-directed and random mutagenesis, along with DNA repair mechanisms.
- CO5: Demonstrate knowledge of vector systems such as plasmids, phages, cosmids, BACs, and YACs, and apply basic genetic engineering tools like restriction enzymes, ligases, and cloning strategies.
- CO6: Construct recombinant DNA molecules using molecular cloning tools and techniques, and interpret screening and selection strategies in genetic engineering experiments.

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8
CO-1	3	2		1		2	1	
CO-2	3	3	1	1			1	
CO-3		3			1			1
CO-4		2	2					1
CO-5	1		2			1		
Co-6		2		2				1

Unit I: Gene Expression and regulation

(Teaching hours 15 hrs)

- Prokaryotic and eukaryotic gene expression: transcription and translation
- Prokaryotic gene regulation (lac operon: positive and negative regulation)
- Eukaryotic gene regulation (transcription factors, enhancers, silencers)
- Epigenetic regulation (methylation, histone modification)

- Post-transcriptional regulation (RNA splicing)

Unit II: Mutation and Mutagenesis

(Teaching hours 15 hrs)

- Definition and Types of mutations (point, insertion, deletion, frameshift)
- Spontaneous vs. induced mutations
- Mutagenic agents (physical: X rays, UV rays and gamma rays and, chemical: nitrous acid, base analogues, alkylating agents, biological: virus)
- Concept of site-directed mutagenesis
- DNA repair mechanisms: Photoreactivation and dark repair, SOS repair, base excision, mismatch repair

Unit III: Gene Transfer Techniques

(Teaching hours 15 hrs)

- Natural gene transfer (transformation, transduction, conjugation)
- Artificial gene transfer techniques:
 - I. Physical methods: Electroporation, microinjection, biolistics
 - II. Chemical methods: Calcium phosphate, lipofection
 - III. Biological methods: Agrobacterium-mediated transfer, viral vectors
- Examples of artificial gene transfer: A. Prokaryote B. Eukaryote

Unit IV: Vectors and Basic Genetic Engineering Methods

(Teaching hours 15 hrs)

- Restriction enzymes (types and nomenclature), DNA ligase
- Plasmid vectors (pBR322, pUC18), phage vectors (λ , M13)
- Cosmids, BACs, YACs
- General steps of cloning
- Blue-white screening, selectable markers (auxotroph)

Reference Books

1. Molecular Biology of the Gene – James D. Watson et al. (Pearson)
2. Principles of Gene Manipulation and Genomics – Sandy B. Primrose & Richard Twyman (Wiley)
3. Molecular Cloning: A Laboratory Manual – Sambrook & Russell (Cold Spring Harbor Press)
4. Genetic Engineering & Biotechnology
5. Genetic Engineering – Desmond S.T. Nicholl (Cambridge University Press)
6. Biotechnology: Expanding Horizons – B.D. Singh (Kalyani Publishers)
7. Genomes – T.A. Brown (Garland Science)
8. Gene Expression & Regulation
9. Gene Control – David S. Latchman (Garland Science)

10. Lewin's Genes XII – Krebs, Goldstein, Kilpatrick (Jones & Bartlett Learning)
11. Techniques and Lab Manuals
12. Molecular Biology Techniques: A Classroom Laboratory Manual – Heather Miller et al. (Academic Press)
13. Biochemistry and Molecular Biology – William H. Elliott & Daphne C. Elliott (Oxford University Press)