Veer Narmad South Gujarat University, Surat
M. Sc. Semester I
MB 1002: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

1. Course Code & Title

Course code: Core course II
Course title: Molecular biology and genetic engineering
Course type: Core
Course credits: 04

2. Course overview and Course Objectives

The course includes the study of structure of genetic material and molecular mechanisms in bacteria. It shall include the various tools and technology applied for the construction of rDNA and the applications of tools and techniques to carry out transfection in plants and animals.

Course Objectives

- To understand the structure and topology of genetic material and its replication.
- To gain an insight on the genetic code and the process of transcription and translation.
- To learn about the tools and techniques used in genetic engineering.
- To increase knowledge of varied application of rDNA technology.

3. Course Content

UNIT 1	GENOME ORGANIZATION AND REPLICATION
1.1	Nucleosomes
1.2	DNA Structure
1.3	DNA topology
1.4	RNA Structure
1.5	The replication fork
1.6	The specialization of DNA polymerases
1.7	DNA replication in prokaryotes
	1.7.1 Synthesis at the replication fork
	1.7.2 Initiation
	1.7.3 Binding and unwinding
	1.7.4 Finishing replication

UNIT 2	EXPRESSION OF THE GENOME
2.1	Transcription
	2.1.1 RNA polymerase
	2.1.2 Features of prokaryotic promoters
	2.1.3 The transcription cycle in Bacteria

2.2	Translation 2.2.1 Messenger RNA 2.2.2 Structure and role of tRNA 2.2.3 Ribosome structure 2.2.4 Genetic code 2.2.5 Initiation, elongation and termination of protein synthesis in prokaryotes

UNIT 3	TOOLS AND TECHNIQUES OF RECOMBINANT DNA TECHNOLOGY
3.1	Enzymes 3.1.1 Enzymes used in Genetic Engineering 3.1.2 Restriction Endonucleases 3.1.3 Ligation of DNA fragments using DNA Ligases
3.2	Vectors: plasmids as vectors in Genetic engineering, λ and M13 bacteriophages as cloning vehicle, phagemids, cosmids, YAC, BAC, HAC, MAC
3.3	Polymerase Chain Reaction
3.4	Construction of Genomic and cDNA libraries

UNIT 4	APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY
4.1	Nucleic acid as therapeutic agents 4.1.1 Anti-sense RNA 4.1.2 Interference RNA 4.1.3 Nucleic acid delivery
4.2.	Transfection of Plants 4.2.1 Plant Transformation with Ti plasmid 4.2.2 Ti plasmid derived vector systems 4.2.3 Plants as Bioreactors
4.3	Methods of Transgenesis in Animals 4.3.1 Retroviral Vector Method for mice 4.3.2 DNA microinjection method 4.3.3 Cre-loxP Recombination System

4. Course Learning Outcomes/Student's Learning Outcomes (SLO)

Unit 1: Students shall understand the structure, topology and structure of DNA and RNA. It shall also include the study of DNA replication and role of DNA polymerase in replication.

Unit 2: Students shall gain knowledge of transcription process, importance of genetic code and the process of translation.

Unit 3: Students shall learn about the various tools and techniques for rDNA technology.

Unit 4: Students shall develop an insight regarding the application of nucleic acids as therapeutic agents and the methods of plant transfection and animal transgenesis.

Recommended Learning Resources:

- Watson, J. D. et al (2017). Molecular Biology of the Gene. 7th edition., Pearson India Education Services Pvt. Ltd. (ISBN; 9780321762436)
- Glick B.R. and Patten C.L. (2017, 2018 Indian reprint). Molecular Biotechnology Principles and Applications of Recombinant DNA. 5th edition, ASM Press Washington DC, USA. (ISBN; 978-1-555-81936-1)
- Rastogi S. and Pathak N. (2016). Genetic engineering. 7th impression, Oxford University Press. (ISBN; 978-0195696578)
- Primrose S.B. and Twyman R.M. (2007), Principles of gene manipulation and Genomics. 7th edition. Blackwell Publishing, USA. (ISBN; 978-1-405-13544-3)