

UNIVERSITY OF MADRAS
B.Sc. DEGREE PROGRAMME IN MICROBIOLOGY
SYLLABUS WITH EFFECT FROM 2023-2024

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
236C3A	Molecular Biology and Microbial Genetics	Core Course V -Theory	4	1	-	-	5	5	25	75	100

Learning Objectives

- CO1 Provide knowledge on structure and replication of DNA.
- CO2 Illustrate the significance and functions of RNA in protein synthesis.
- CO3 Explain the cause and types of DNA mutation and DNA repair mechanisms.
- CO4 Outline the role of plasmids and phages in genetics.
- CO5 Examine mechanisms of gene transfer and recombination.

Unit	Details	No. of Hours	Course Objectives
I	DNA Structure - Salient features of double helix, forms of DNA. Denaturation and renaturation. DNA topology – Supercoiling, linking number, topoisomerases. DNA organization in prokaryotes, eukaryotes. Replication of DNA in prokaryotes and eukaryotes - Bidirectional and unidirectional replication, semi-conservative and semi-discontinuous replication. Mechanism of DNA replication – enzymes involved – DNA polymerases, DNA ligase, primase.	15	CO1
II	Transcription in Prokaryotes. Concept of transcription. RNA Polymerases - prokaryotic and eukaryotic. General transcription factors in eukaryotes. Translation in prokaryotes and eukaryotes - Translational machinery - ribosome structure in prokaryotes and eukaryotes, tRNA structure and processing. Inhibitors of protein synthesis in prokaryotes and eukaryotes. Overview of regulation of gene expression - <i>lac</i> operons as example.	15	CO2
III	Mutation - Definition and types of mutations. Physical and chemical mutagens. Reversion and suppression. Uses of mutations. Repair Mechanisms - Photoreactivation, Nucleotide Repair, Base Excision Repair, Methyl Directed Mismatch Repair and SOS Repair.	15	CO3
IV	Plasmid – Structure, types, replication, plasmid incompatibility, plasmid amplification and curing of plasmids. Bacteriophage-T4 Phage – Structure and lifecycle, Lambda phage-Structure, Lytic and Lysogenic cycle. Applications of Phages in Microbial Genetics.	15	CO4
V	Gene Transfer Mechanisms - Conjugation and its uses. Transduction - Generalized and Specialized, Transformation - Natural and Artificial Transformation. Transposable elements - Prokaryotic transposable elements – insertion sequences, composite, and non-composite transposons. Transposition and Types of Transposition reactions. Mechanism of transposition: Replicative and non- replicative transposition. Uses of transposons.	15	CO5
	Total	75	

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Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Analyze the significance of DNA and elucidate the replication mechanism.	PO4, PO5, PO7,PO9
CO2	Illustrate the types of RNA and protein synthesis machinery.	PO4, PO7,PO9
CO3	Infer the causes and types of DNA mutation and summarize the DNA repair mechanisms.	PO5, PO7,PO9
CO4	Evaluate the importance of plasmids and phages in genetics.	PO7,PO9
CO5	Analyze gene transfer and recombination methods.	PO5, PO6, PO7,PO9
Text Books		
1.	Malacinski G.M. (2008). Freifelder's Essentials of Molecular Biology. 4 th Edition. Narosa Publishing House, New Delhi.	
2.	Gardner E. J. Simmons M. J. and SnustedD.P.(2006). Principles of Genetics. 8 th Edition. Wiley India Pvt. Ltd.	
3.	Trun N. and Trempy J. (2009). Fundamental Bacterial Genetics. 1 st Edition. Blackwell Science Ltd.	
4.	Brown T. A. (2016). Gene Cloning and DNA Analysis- An Introduction. (7 th Edition). John Wiley and Sons, Ltd.	
5.	Dale J. W., Schantz M.V. and Plant N. (2012). From Gene to Genomes – Concepts and Applications of DNA Technology. (3 rd Edition). John Wileys and Sons Ltd.	
References Books		
1.	Glick B. R. and Patten C.L. (2018). Molecular Biotechnology – Principles and Applications of Recombinant DNA. 5 th Edition. ASM Press.	
2.	Russell P.J. (2010). iGenetics - A Molecular Approach, 3rd Edition., Pearson New International edn.	
3.	Nelson, D.L. and Cox, M.M. Lehninger(2017). Principles of Biochemistry. 7 th Edition, W.H. Freeman.	
4.	Synder L., Peters J. E., Henkin T.M. and Champness W. (2013). Molecular Genetics of Bacteria, 4 th Edition, ASM Press Washington-D.C. ASM Press.	
5.	Primrose S.B. and Twyman R. M. (2006). Principles of Gene Manipulation and Genomics. (7 th Edition). Blackwell Publishing	
Web Resources		
1.	[PDF] Lehninger Principles of Biochemistry (8th Edition) By David L. Nelson and Michael M. Cox Book Free Download - StudyMaterialz.in	
2.	https://microbenotes.com/gene-cloning-requirements-principle-steps-applications/	
3.	https://courses.lumenlearning.com/boundless-biology/chapter/dna-replication/	
4.	Molecular Biology Notes - Microbe Notes	
5.	Molecular Biology Lecture Notes & Study Materials Easy Biology Class	

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Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1				S	S	M	S	M	S	M	
CO2				S	M	M	S	M	S	L	
CO3				M	S	M	S	M	S	L	
CO4				M	M	M	S	M	S	L	
CO5				M	S	S	S	M	S	L	