

Syllabus template

Semester:	4			
Course :	Major			
Paper Title:	Basic molecular biology and virology			
Paper code:	C2MB230411T		Credits: 4	
Hours/week :	4			
Category: Core/MDC/SEC/VAC :	Core			
Theory / Practical / Composite :	Theory			
No of Modules :	No			
Course Overview: This course syllabus aims to provide basic knowledge on transcription, translation, replication in prokaryotes and comparison with eukaryotes. It also delivers basics of virology and advanced studies in bacteriophages. This course enables the students to design experiments, analyze results, evaluate biological significance etc.				
Course Outcome:				
1. Remember- learning and remembering the basic concepts of molecular biology and virology				
2. Understand- understanding the mechanisms of bacterial replication, transcription and translation and life cycles of bacteria sp. bacteriophages, mechanism of oncogenesis				
3. Analyze- To study about the nature, properties, replication and transmission of viruses				
4. Apply- applying the knowledge of viral replication mechanism in the development of drugs;				
5. Evaluate: Evaluate the biological significance of coupled transcription and translation in Prokaryotes				
6. Create: Design experiments to study the steps of Gene transcription and translation, plaque assay				
Prerequisites: <i>Basic knowledge about any prior course</i>				
SYLLABUS				
UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
I.	Basic concepts of prokaryotic DNA replication: Origin, Bi-directionality, Replication Fork, Semiconservative, Semi-discontinuous, Primer-template junction, DNA polymerase active site, Proofreading, Accessory factors (Helicase, SSB, Gyrase, Primase, Sliding Clamp, DNA Pol I, RNase H), Initiation and Termination.	12	CO1, CO2, CO3, CO4	K1,K2,K3,K4

	Regulation of DNA replication. Comparison between prokaryotic and eukaryotic replication.			
II.	Transcription and translation Transcription in bacteria: Role of bacterial promoters, transcription initiation, promoter escape, role of elongating polymerases, transcription termination. Transcription in eukaryotes: Transcription of rRNA and tRNA, transcription of protein coding genes in eukaryotes. Translation: Structure of Bacterial ribosomes, Overview of translational machinery, Reading frames, Charging of tRNA, Aminoacyl tRNA synthetases, Steps of translation initiation, elongation and termination. Differences between eukaryotic and prokaryotic protein synthesis, antibiotics inhibiting translation. Genetic code.	12	CO1, CO2, CO3, CO4, CO5, CO6	K1,K2,K3,K4, K5, K6
III.	Nature and Properties of Viruses Discovery of viruses, nature and definition of viruses, general properties; theories of viral origin; structure of viruses: capsid symmetry, enveloped and non-enveloped viruses; viral taxonomy: Classification and nomenclature of viruses (ICTV and Baltimore classification); Isolation, purification and cultivation of viruses; concept of infectious agents like viroids, virusoids, satellite viruses and prions.	4	CO1, CO2, CO3, CO4	K1,K2,K3,K4
IV.	Viral Transmission, Salient features of viral nucleic acids and Replication Modes of viral transmission: persistent, non-persistent, vertical and horizontal; features like presence of unusual bases	6	CO1, CO2, CO3, CO4	K1,K2,K3,K4

	(TMV, T4 phage), overlapping genes (Hepatitis B virus, ϕ X174), partial double stranded genomes (Hepatitis B), long terminal repeats (retrovirus), segmented (Influenza virus), and non-segmented genomes (picornavirus), capping and tailing (TMV) in viral genome; viral tropism. Replication strategies of viruses as per Baltimore classification (Retroviridae, Vaccinia, Picorna), entry (receptors), assembly, maturation, and release of virions.			
V.	Bacteriophages Classification, one step growth curve, intracellular growth curve, life cycle of lytic (T4) and lysogenic phages (lambda phage); terminal redundancy and circular permutation in T4; concept of early and late proteins; regulation of transcription in λ phage, concatemeric DNA, packaging through cos sites.	6	CO1, CO2, CO3, CO4, CO6	
VI.	Viruses and Cancer Introduction to oncogenic viruses; types of oncogenic DNA and RNA viruses; Concepts of oncogenes and protooncogenes.	6	CO1, CO2	

Text Books

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
2. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
3. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
4. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India
5. Becker WM, Kleinsmith LJ, Hardin J and Bertoni GP (2009) The World of the Cell, 7th edition, Pearson Benjamin Cummings Publishing, San Francisco
6. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia

7. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons. Inc.
8. Dimmock, NJ, Easton, AL, Leppard, KN (2007). Introduction to Modern Virology. 6th edition, Blackwell Publishing Ltd.
9. Flint SJ, Enquist, LW, Krug, RM, Racaniello, VR, Skalka, AM (2004). Principles of Virology, Molecular biology, Pathogenesis and Control. 2nd edition. ASM press Washington DC.
10. Molecular biology by David Freifilder
11. Padmanavan and Shastri. Virology
12. David Friefilder. Molecular Biology
Suggested readings
1. Powerpoint slides provided in class
Web Resources
1. SWAYAM course on molecular biology by Dr. Mahasweta Mitra Ghosh
Evaluation Theory CIA: 30 Semester Exam:70
Paper Structure for Theory Semester Exam Module : Short questions: 10 (each 2 marks) from 12 (10x2=20) Long questions: 5 (each 10 marks) from 7 (5x10=50)

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	Remember- learning and remembering the basic concepts of molecular biology and virology	K1
CO2	Understand- understanding the mechanisms of bacterial replication, transcription and translation and life cycles of bacteria sp. bacteriophages, mechanism of oncogenesis	K2
CO3	Analyze- To study about the nature, properties, replication and transmission of viruses	K3
CO4	Apply- applying the knowledge of viral replication mechanism in the development of drugs;	K4
CO5	Evaluate: Evaluate the biological significance of coupled transcription and translation in Prokaryotes	K5
CO6	Create: Design experiments to study the steps of Gene transcription and translation, plaque assay	K6