

MBTCR0271T:

Virus: Structure and Life Cycles & Epigenetics: Health and Disease

Total Marks = 100 (Modules A & B – 60 + Module C - 40); CIA (12+8); End Sem (48+32).

No. of Credits	6
Theory/Composite	Theory
No. of periods assigned	6 Theory

Course description/objective:

In context of today's medical crisis, this module will help our students to learn about the pathogenic viruses from structural and host-pathogen interaction point of view for future development of appropriate therapeutics and vaccines. From the epigenetic module the students will get an idea of the epigenetic basis of diseases pertaining to defects in DNA methylation and domain structure organization during embryogenesis and adulthood. The students will be provided with an insight into how to analyze data related to epigenetic modifications generated using high throughput techniques.

Syllabus:

Module A: *Structure of Viruses:* 24 marks

(2 classes/week)

Unit I: Enveloped and naked viruses: Structural insights; Virus Capsid: Icosahedral and helical capsid structures, Examples: Human papillomavirus, rhinovirus, hepatitis B virus; Complex Viral Structures, Examples: Poxviruses,

Unit II: Host pathogen interactions, Mechanism of infection from structural point of view: Human papillomavirus, Dengue virus, Zika virus.

Unit III: Virus-like particles: immunogenicity and their roles as nanovaccines and drug nanocarriers.

Module B: *Life Cycle of Viruses:* 24 marks

(2 classes/week)

Unit IV: Bacteriophage Lambda - lytic or lysogenic, a paradigm of transcriptional regulation.

Unit V: Influenza Virus – life cycle, cap snatching and transcription in Influenza, aberrant RNA synthesis, host immune response and evasion strategies, antigenic drift and antigenic shift.

Unit VI: Coronavirus (SARS, MERS, nCoV/SARS-2) - life cycle, direct pathogenesis and immuno-pathogenesis (cytokine storm), host's immune response and virus's evasion strategies, variants, treatment – therapeutics (anti-viral drugs) and prophylactic (vaccines) treatment, nCoV-19 pandemic – lessons learned.

Unit VII: Flavivirus (Dengue) - life cycle, dynamicity of viral structure, four different strains, antibody dependent enhancement (ADE) of infection, hemorrhagic fever, host's immuneresponse and virus's evasion strategies, vaccine.

Unit VIII: Applications of Viruses in Biotechnology: viral vectors – vectors based on bacteriophage λ genome structure - insertional and replacement vectors; lentiviral vector systems.

Module C:

Unit VIII: *Epigenetics: Health & Disease:* 20 Marks

(1.5 classes/week)

Dynamics of the epigenome- chromatin domains organization; DNA methylation and Genomic imprinting- Imprinting disorders, interaction between genome, epigenome and environment; DNA

methylation and tumorigenesis; Diet and epigenetic regulations - the concept of nutriepigenomics.

Unit IX: Computational Epigenetics: 12 Marks (0.5 classes/week)

1. Data Repositories: Human Epigenome Project and Consortium, ENCODE Database and Data formats
2. Structural Insights: Using Genome Browsers for identification of CpG islands and MicroRNA targets using integrated bayesian modeling.
3. Functional Insights: Identification of methylation sites and phosphorylation sites in functional proteins
4. Artificial Intelligence towards identification of Gene and Taxon set Enrichment: Multi-Layer Perceptrons and Pathway Analysis; Predicting Pathogenic Load from Gut Microbial Dataset

Texts & Reading/Reference Lists:

Modules A, B & C: Relevant Research Papers

Module B: Biochemistry - Voet and Voet

Principles of Gene Manipulation & Genomics – Primrose & Twyman.

Q.Paper Structure for End Sem Theory

Module A (24):

Compulsory objective questions of 8 marks with choice;

2 questions of 8 marks (Any 2 from 3)

Module B (24):

Compulsory questions of 8 marks;

2 questions of 8 marks (Any 2 from 3)

Module C (32):

5 questions of 2 marks (Any 5 from 7), 2 questions of 5 marks (Any 2 from 3)

3 questions of 2 marks (Any 3 from 5), 1 question of 6 marks (Any 1 from 2)]
