

# **MBTCR7161T: Advanced Molecular Biology**

**Theory:** [CIA: 20 Marks; End-Sem: 80 Marks]

No.ofCredits	6
Theory/Composite	Theory
No.ofperiodsassigned	6Theory

## **Coursedescription/objective:**

Gene expression regulation is the basis of all critical events in a living cell. Through this module the students are given the basics of epigenetic regulation along with post-transcriptional gene regulation. In the epigenetics module students are walked through the basic structures of chromatin, chromatin modifications and chromatin remodeling that modulates all DNA metabolic processes like transcription, DNA repair, etc. In post-transcriptional gene regulation students get acquainted with the various facets of RNA processing following transcription and on nucleo-cytoplasmic trafficking, which delivers fidelity to the RNA for further processes like translation.

## **Syllabus:**

### **Module A: (65 Marks)**

**(5 Classes / Week)**

#### **UNIT I: Post-transcriptional gene regulation and nuclear transport:**

RNA processing enzymes, post transcriptional modification of RNA: 5'-cap, 3'end processing and polyadenylation; mRNA Splicing, Alternative splicing, Editing, regulation of pre-mRNA processing, Different modes of splicing of rRNA and tRNA, Nuclear export of mRNA (outline)

#### **UNIT II: Chromatin structure-function and Epigenetic regulation during nuclear processes**

Concept of chromatin structure (nucleosome structure and function, higher order compaction, histone proteins). Chromatin modifications: histone modifications (acetylation, methylation, phosphorylation, ubiquitination); chromatin remodelers; histone variants and histone chaperones; DNA methylation; miRNA mediated regulation (outline).Epigenetic regulation during nuclear processes like transcription, DNA damage repair (nucleosome mapping, DNase I and MNase assay; restriction enzymes accessibility assay; ChIP; ChIP on chip).

### **Module B: (15 Marks)**

**(1 Class / Week)**

**UNIT III: Eukaryotic Replication:** Differences from prokaryotic replication; DNA polymerases: types; PCNA; ARS; control and regulation; end replication problem; telomeres and telomerase; replication mechanism in Caulimoviruses, Gemini viruses and plant RNA viruses (outline)

**Teacher involved:** Dr. Ronita Nag Chaudhuri (Module A), Dr. Aryadeep Roy Choudhury (Module B)

## **Texts & Reading/Reference Lists:**

**Module A:** (1) Chromatin & Gene Regulation- Bryan Turner, Chapters- 3,4,5,6,8;

(2) Epigenetics- C. David Allis et al., Chapters 3, 4;

(3) Molecular Biology (Weaver) Chapters-14-16;

(4) Molecular and Cell Biol. (Lodish 6th Ed.); Relevant review papers

**Module B:**

(5) Genes X / XI - Benjamin Lewin

(6) Molecular Biology of the Gene - James D. Watson

(7) Review papers

### **O.Paper Structure for End Sem Theory**

#### **Module A (65):**

[5 questions of 10 marks (Any 5 from 7);

3 questions of 5 marks (any 3 from 5)]

#### **Module B (15):**

[1 question of 10 marks (Any 1 from 2);

1 question of 5 marks (Any 1 from 2)]