

## SYLLABUS TEMPLATE

<b>Semester: VII</b>	
<b>Course: MAJOR 1</b>	
<b>Paper Title: Chromatin Biology &amp; Epigenetics</b>	
<b>Paper code:</b>	<b>Credits: (Th:4)</b>
<b>Hours/week : 4 Hours</b>	
<b>Category: Core/MDC/SEC/VAC : CORE</b>	
<b>Theory / Practical / Composite : Theory</b>	
<b>No of Modules : 1</b>	
<b>Course Overview:</b>	
The course aims to:	
<ol style="list-style-type: none"> <li>1. Provide a comprehensive understanding of the fidelity of genome structure-function is maintained in eukaryotes through chromatin dynamics.</li> <li>2. Familiarize students with chromatin structure, chromatin modifications and remodelling to understand how precisely genome function is regulated.</li> <li>3. Impart understanding of the interplay between DNA methylation and histone modifications and their combined effect on epigenetic regulations.</li> <li>4. Provide an understanding of how precisely chromatin regulation occurs during various DNA metabolic processes like transcription, replication, DNA damage repair, etc.</li> <li>5. Provide students with the various facets of post-transcriptional regulation of gene expression which delivers fidelity to the RNA and nucleo-cytoplasmic trafficking, for further downstream processes like translation.</li> </ol>	
<b>Course Outcome:</b>	
<ol style="list-style-type: none"> <li>1. Explain the dynamism of chromatin structure-function in regulating DNA metabolic processes and various modes of post-transcriptional regulation of gene expression.</li> </ol>	
<ol style="list-style-type: none"> <li>2. Apply molecular biology and biochemical tools such as ChIP-based assays, nuclease assays, restriction enzyme accessibility assays, western blot, EMSA, Co-IP to understand chromatin dynamism, and processing of mRNA, rRNA and tRNA.</li> </ol>	
<ol style="list-style-type: none"> <li>3. Analyze chromatin structure function dynamism in understanding precise regulation of DNA metabolic processes like transcription, replication, DNA damage repair, etc., along with 5' -capping, 3'-polyadenylation, splicing, etc.</li> </ol>	
<ol style="list-style-type: none"> <li>4. Interpret chromatin dynamism and epigenetic regulation to understand the basis of spatio-temporal regulation of genome function and the need for precise steps of post-transcriptional regulation of gene expression and nucleo-cytoplasmic trafficking to maintain fidelity of genome structure-function.</li> </ol>	
<ol style="list-style-type: none"> <li>5. Evaluate results of nucleosome mapping, nuclease assay, RE accessibility assays, ChIP assays, western blot, EMSA, Co-IP, etc to understand chromatin modulation and epigenetic regulation, post-transcriptional regulation of gene expression and nucleo-cytoplasmic trafficking.</li> </ol>	
<ol style="list-style-type: none"> <li>6. Design experimental strategies to understand chromatin dynamics, epigenetic regulation, post-transcriptional regulation of gene expression and nucleo-cytoplasmic trafficking.</li> </ol>	

**Prerequisites: Basic knowledge about biological macromolecules and DNA metabolic processes**

**SYLLABUS**

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
UNIT I-II	<p><b>UNIT I:</b>  <b>Concept of chromatin structure</b> (nucleosome structure-function, higher order compaction, chromatin domains).  <b>Chromatin modifications:</b> Histone modifications (acetylation, methylation, phosphorylation, ubiquitination)  <b>Chromatin remodelers;</b>  <b>Histone Exchange:</b> histone variants and histone chaperones;  <b>DNA methylation;</b>  <b>miRNA mediated regulation (outline).</b>  <b>Techniques used to study Chromatin Regulation</b>            Study of chromatin and epigenetic regulation during nuclear processes like transcription, DNA damage repair, etc using- nucleosome mapping and repositioning, DNase I and MNase assays; restriction enzymes accessibility assay; ChIP-based assays; Chromatin conformation capture based techniques.</p>	36	CO1	K1 to K6
	<p><b>UNIT II:</b>  <b>Post-transcriptional gene regulation and Nuclear transport:</b>            RNA processing enzymes, post-transcriptional modification of RNA: 5'-cap, 3'end processing and polyadenylation; mRNA Splicing, Alternative splicing,</p>	12	CO2, CO3	K1 to K6

	Editing, regulation of pre-mRNA processing, Nuclear export of mRNA Different modes of splicing of rRNA and tRNA. Concept of epi-transcriptomics.			
<b>Text Books</b>				
<ol style="list-style-type: none"> <li>1. <b>Chromatin Biology- Byran M. Turner</b></li> <li>2. <b>Epigenetics – C.D. Allis et al.</b></li> <li>3. <b>Molecular Cell Biology- Darnell et al.</b></li> </ol>				
<b>Suggested readings:</b>				
<b>Relevant research papers and review articles</b>				
<b>Evaluation:</b> Theory: 100 marks CIA- 20 Assignment – 05 Attendance - 05 End-Semester Exam- 70				
<b>Paper Structure for Theory Semester Exam Module:</b> 4 questions, 5 marks each; i.e., 5 x 4 = 20 marks 5 questions, 10 marks each; i.e., 10 x 5 = 50 marks				

### **COURSE OUTCOMES (COS) AND COGNITIVE LEVEL MAPPING**

<b>COs</b>	<b>CO Description</b>	<b>Cognitive levels</b>
<b>CO1</b>	Explain the dynamism of chromatin structure-function in regulating DNA metabolic processes and various modes of post-transcriptional regulation of gene expression.	K1 to K6
<b>CO2</b>	Apply molecular biology and biochemical tools such as ChIP-based assays, nuclease assays, restriction enzyme accessibility assays, western blot, EMSA, Co-IP to understand chromatin dynamism, and processing of mRNA, rRNA and tRNA.	K1 to K6
<b>CO3</b>	Analyze chromatin structure-function dynamism in understanding precise regulation of DNA metabolic processes like transcription, replication, DNA damage repair, etc., along with 5' -capping, 3'-polyadenylation, splicing, etc.	K 1 to K6

<b>CO4</b>	Interpret chromatin dynamism and epigenetic regulation to understand the basis of spatio-temporal regulation of genome function and the need for precise steps of post-transcriptional regulation of gene expression and nucleo-cytoplasmic trafficking to maintain fidelity of genome structure-function.	K1 to K6
<b>CO5</b>	Evaluate results of nucleosome mapping, nuclease assay, RE accessibility assays, ChIP assays, western blot, EMSA, Co-IP, etc to understand chromatin modulation and epigenetic regulation, post-transcriptional regulation of gene expression and nucleo-cytoplasmic trafficking.	K1 to K6
<b>CO6</b>	Design experimental strategies to understand chromatin dynamics, epigenetic regulation, post-transcriptional regulation of gene expression and nucleo-cytoplasmic trafficking.	K1 to K6