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**FIRST SEMESTER 2016-17**

**COURSE HANDOUT (PART II)**

In addition to part-I (General Handout for all courses) printed on page 1 of the Time Table booklet, this portion gives further specific details regarding the course.

**Course No. : BIO G512**

**Course Title : Molecular Mechanism of Gene Expression**

**Instructor- in Charge : S. K. VERMA**

**Instructor : Lalita Gupta**

**1. Course Description:**

Prokaryotic and Eukaryotic genomes and their topology; DNA protein interaction, RNA transcription and transcriptional control, Translation, RNA processing, Post transcriptional control and other mechanisms of gene expression

**2. Scope & Objective:**

This course is designed to impart knowledge of molecular genetics, which is one of the fundamental requirements for the biotechnology. This course is designed to make the student understand the various mechanisms, which regulate the biological processes at genetic level including transcriptional and post transcriptional regulation of gene.

**3. Text Books:**

Lewin's Genes XI: Jocelyn Krebs, Elliott Goldstein and Stephen Kilpatrick; (11<sup>th</sup> Ed), Jones & Bartlett Learning Publication, 2014

**Reference Book:**

Molecular Biology of Gene: Watson, Baker, Bell, Gann, Lavine & Losick (5<sup>th</sup> Ed)  
Pearson Education





#### 4. Course Plan:

Lecture No.	Learning Objective	Topics to be covered	Reference Chap/Sec(Books)
1-5	<b>Overview of Molecular Genetics</b>	<b>Basics of genomics</b>  Genes are DNA, The Interrupted Gene, The Content of Genome, Clusters and repeats	Lecture Notes
6-8	<b>Chromatin</b>	<b>Controlling chromatin structure:</b> Alternative states of chromatin, chromatin remodeling, Alteration of nucleosome organization at promoter. Histone acetylation & modification, Histone methylation & phosphorylation.	Chap 10
9-10	<b>Transcription</b>	<b>Prokaryotic Transcription:</b> Three stage of Transcription, RNA Polymerase structure, Promoter recognition, and efficiencies, Sigma factor, alternate sigma factors and its binding with DNA, termination of transcription; Intrinsic and rho-dependent	Chap 19.
11-13	<b>Eukaryotic Transcription</b>	<b>Polymerases:</b> RNA polymerase I,II, III & Types of Promoters, Enhancers, Demethylation. CpG islands. nscription factors, Assembly of basal apparatus, , Insulation block	Chap 20
14-16	<b>Post-Transcription mechanism</b>	<b>RNA Splicing and Processing:</b> 5' Cap, Nuclear Splicing, Splice junctions, lariat formation and spliceosome, Splicing of group I & II introns, Splicing & gene Expression, Alternative splicing, Trans-splicing, 3' End Processing, tRNA & rRNA splicing	Chap.21
17-20	<b>mRNA stability and Localization</b>	<b>Messenger RNA:</b> Formation, structure and function of Messenger RNA & transfer RNA, Modifications at 3' and 5' end of mRNA in eukaryotes, Degradation pathways in bacteria and eukaryotes,	Chap.22



		Nuclear & Cytoplasmic Surveillance system	
21-23	<b>Catalytic RNA</b>	<b>Role of catalytic RNA:</b> Group I intron removal, Group II Introns and reverse transcriptase, ribozyme, Ribonuclease activities and RNA editing, Guide RNA	Chap.23
24-26	<b>Translation and Genetic Code</b>	<b>Protein Synthesis:</b> Stages in protein synthesis, Initiation of translation in bacteria, Elongation, Termination <b>Genetic code:</b> Structure and wobbling in codons, anticodones, Mitochondrial and archetypal code, mutated anticodones, Accuracy of translation	Chap.24-25
27-30	<b>Gene Regulation</b>	<b>Operon Circuits:</b> Structural gene clusters, Operator and regulator gene, Repressor protein structure, Specificity of protein-DNA interaction, binding of repressor with operator and inducer. Allosteric changes in repressor. <i>lac</i> and <i>trp</i> operon	Chap.26
31-32	<b>Phage Strategies</b>	<b>Lysogeny and lytic cycle:</b> Control of lytic cascades in T4, T7 and lambda phage, Maintenance of lysogeny, Repressor synthesis and binding, Balance between lysogeny and lytic cycle	Chap.27
33-36	<b>Eukaryotic Transcription Regulation and Epigenetic Effects</b>	<b>Mechanism of action of activators and repressor:</b> Interaction of activators with basal apparatus, Methylation of histones and DNA, DNA binding domains, Zinc fingers, steroid receptors, leucine zipper, Histone acetylation and modification, Yeast <i>GAL</i> genes, Histone methylation and phosphorylation, Epigenetic effects	Chap 28- 29
37-40	<b>Regulatory RNA</b>	<b>Regulation of noncoding RNA:</b> Riboswitch, Regulate gene expression by noncoding RNA, Attenuation and regulation by small RNA molecules, Gene silencing and RNA interference, antisense RNA	Chap 30



#### 5. Examination Scheme:

EC No	Evaluation Component	Duration	Date	Weightage (%)	Remarks
1	Mid- Sem Test	90 min	<TEST_1>	30	CB
3.	Quiz (multiple)	-		15	CB
4.	Seminar + Report	-		15	OB
5.	Comprehensive Examination	3 Hrs.	<TEST_C>	40	OB+CB

**6. Chamber Consultation Hour:** Will be announced later

**7. Notices:** Notices will be displayed on **Biological Science Dept.** Notice Board

**8. Make-up Policy:** Prior Permission has to be obtained from the Instructor-In-Charge, No make-up will be granted for surprise evaluation component.

**Instructor-in-Charge**  
**BIO G512**