AMITY UNIVERSITY
UTTAR PRADESH

Annexure **'CD-01'**

**Course Title: Advanced Molecular Biology**
**Course Code: GCMB604**
**Credit Units: 04**
**Level: PG**

| L | T | P/ S | SW/F W | TOTAL CREDIT UNITS |
|---|---|---|---|---|
| 3 | 0 | 2 | 0 | 4 |

**Course Objectives:**
The objective of this course is to provide an understanding of the molecular aspects of the structure and function of the genetic material and their implication in regulating the functioning of the cell. In addition, we will take a look at various key processes including RNA Processing, DNA repair mechanisms and regulation of gene expression by different types of proteins and noncoding RNAs.

**Prerequisites:**
Graduate in Life Sciences with Cell Biology, biochemistry and molecular biology as subjects.

**Student Learning Outcomes:**
- Define how molecular machines within the cell are constructed and regulated so that they can accurately copy, repair, and interpret genomic information.
- Discuss the mechanisms of bacterial and eukaryotic DNA replication, DNA repair, transcription, and translation.
- Outline how pre-mRNA splicing occurs and compare how alternative splicing generates protein diversity.
- Defend molecular mechanisms behind different modes of gene regulation in bacteria and eukaryotes at both pre- and post-transcriptional levels.
- Compare and contrast various ways in which gene expression is regulated by small RNAs.

**Course Contents / Syllabus**

| | **Weightage** |
|---|---|
| **Module I : Basics of molecular biology** | **15%** |
| - Central dogma,<br>- structure of DNA and RNA –physical and chemical properties, reassociation kinetics, | |

| | |
|---|---|
| ▪ Genes and chromosomes,<br>▪ genome organization in prokaryotes and eukaryotes | |
| **Module II DNA replication and DNA Repair** | **20%** |
| ▪ Concept of origin of replication;<br>▪ problems of linear replicons<br>▪ Modes of DNA replication<br>▪ Replication fork<br>▪ Okazaki fragments<br>▪ Leading and lagging strands<br>▪ DNA Polymerases<br>▪ Involvement of proteins and enzymes (including DNA polymerase) in replication<br>▪ Fidelity of replication<br>▪ Photoreactivation,<br>▪ Excision repair<br>▪ Error prone repair<br>▪ Mismatch repair<br>▪ SOS mechanism | |
| **Module III: Transcription** | **13%** |
| ▪ Gene and its control regions<br>▪ Structure of protein coding genes; promoter and enhancers.<br>▪ Coding sequences,<br>▪ Introns and Exons.<br>▪ Transcription in prokaryotes and eukaryotes<br>▪ RNA Polymerases: structure and function,<br>▪ Transcription factors and their functions, | |
| **Module IV: RNA Processing** | **16%** |
| ▪ Different types of RNA<br>▪ Post-transcriptional modifications – 5' cap formation, 3' polyadenylation,<br>▪ RNA editing,<br>▪ Splicing,self splicing and spliceosomes,<br>▪ Non – coding RNAs, miRNA, siRNA, RNAi.<br>▪ Gene silencing. | |
| **Module V : Translation** | **11%** |
| ▪ Concept of genetic code,<br>▪ tRNA structure,<br>▪ Prokaryotic and eukaryotic ribosomes, | |

- Proteins involved in translation,
- Mechanism of translation in prokaryotes and eukaryotes – initiation , elongation and termination,
- Fidelity of translation
- Proof reading.

**Module VI: Regulation of Gene Expression** **23%**

- Prokaryotes : transcriptional regulatory proteins, \
- Activators, and repressors
- Concept of operon, lac operon-negative and positive control,
- trp operon,, attenuation
- Chromatin structure and organization. Regulation of eukaryotic gene expression.

List of Experiments:

Plasmid DNA isolation
Genomic DNA isolation
Site directed mutagenesis
Screening of mutants
DNA Repair

**Pedagogy for Course Delivery:**

Pedagogy for Course Delivery:

Lectures: 44,Class Test: 01,Total: 45

Lab/ Practicals details:

Practical: 28,Class Test: 01, Viva: 01,Total: 30

Assessment/ Examination Scheme:

| Theory L/T (%) | Lab/Practical/Studio (%) | Total |
|---|---|---|
| 75 | 25 | 100 |

**Theory Assessment (L&T):**

| Continuous Assessment/Internal Assessment | | |
|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **Components (Drop down)** | Mid-Term Exam | Project | Viva | Attendance | End Term Examination | **Total** |
| **Weightage (%)** | 10 | 10 | 5 | 5 | 70 | 100 |

**Lab/ Practical/ Studio Assessment:**

| | **Continuous Assessment/Internal Assessment** | | | | **End Term Examination** | | | |
|---|---|---|---|---|---|---|---|---|
| **Components (Drop down)** | **Class test** | **Lab record** | **Viva** | **Attendance** | **Performance** | **Lab Record** | **Viva** | Total |
| **Weightage (%)** | 15 | 5 | 5 | 5 | 40 | 10 | 20 | 100 |

**Text:**

Genes IX. Lewin,, Benjamin Lewin 2008, Oxford University Press

Molecular Biology of the Gene ,7th Edition. James D. Watson**,** Tania A. Baker,Stephen P. Bell and Alexander Gann 2013; Pearson Education.

Molecular Cell Biology 7th Edition. Harvey Lodish, Arnold Berk, Chris A. Kaiser and Monty Krieger**,** 2012**;** W.H. Freeman and Company.