



जम्मू केन्द्रीय विश्वविद्यालय  
Central University of Jammu

राया-सुचानी (बगला), जिला: सांबा-181143, जम्मू (जम्मू और कश्मीर), भारत  
Rahya-Suchani (Bagla), District- Samba, 181143, Jammu (Jammu and Kashmir), India

Annexure I

SEMESTER – VII

**Course Title:** Cytogenetics and Molecular Cell Biology

**Credit:** 4 (L-4, T-0, P-0)

**Course code:**

**Contact Hrs/Week:** 4 Hrs

**Course Outcomes**

Student should be equipped to understand fundamental and advanced aspects in biological phenomenon at cellular and molecular level.

**Course Learning Outcomes (CLO):** The students will be able to:

1. Comprehend the principles governing cellular structure and function, including organelle dynamics and molecular interactions.
2. Analyze cellular processes such as signal transduction, gene expression, and metabolism at a molecular level.
3. Apply knowledge of molecular biology to understand genetic mechanisms, including replication, transcription, and translation.
4. Evaluate the role of molecular biology in disease pathology and therapeutic interventions.
5. Synthesize complex biological concepts to propose innovative research questions and methodologies.

**Unit I**

Outline of the structure of the eukaryotic cell with emphasis on its functions as a unit of life; Structure of cell membrane, Mechanism of diffusion, facilitated diffusion, active transport with suitable examples.

Structural organization and function of intracellular organelles. Cytoskeleton: Composition, organization and functions of Microfilaments, microtubules, intermediate filaments and associated proteins. Cell division and cell cycle regulation.

**Unit II**

Chromosome and chromatin organization, Heterochromatin and euchromatin, Structural and numerical variations of chromosomes, Structural organization and significance of polytene, lampbrush and supernumerary chromosomes. Chromosomal rearrangements and their cytogenetic consequences.

DNA replication in prokaryotes and eukaryotes, DNA damage and repair mechanisms, homologous and site-specific recombination.

**Unit III**

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Transcription in prokaryotes and eukaryotes; RNA polymerases, transcription activator and repressor, RNA processing, RNA editing, splicing, and polyadenylation, Regulation of prokaryotic and eukaryotic gene expression at transcription level.

Protein synthesis and processing; Ribosome, genetic code, translational inhibitors, post-translational modification of proteins. Control of gene expression at translation level in prokaryotic and eukaryotic genes.

**Unit IV**

Extracellular matrix; Cell- cell and cell-matrix adhesion; Cell junctions; Intercellular communication: Key concepts in cellular signaling mechanisms; Second messenger systems; G-protein coupled receptors; Receptor tyrosine kinases; MAP kinase cascade; Desensitization of receptors; Survival and death pathways.

**Unit V**

Development and cause of cancer: Proto-oncogenes, oncogenes and tumour suppressor genes. Mutations, types of mutations, mutagens, Viral and cellular oncogenes, activation and suppression of tumor suppressor genes; oncogenes as transcriptional activators.

**Suggested Readings:**

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2018). Molecular biology of the cell. New York: Garland Science.
2. Lodish, H. F. (2019). Molecular cell biology. New York: W.H. Freeman.
3. Krebs, J. E., Lewin, B., Kilpatrick, S. T., & Goldstein, E. S. (2015). Lewin's genes XI. Burlington, MA: Jones & Bartlett Learning.
4. Cooper, G. M., & Hausman, R. E. (2019). The cell: A molecular approach. Washington: ASM ; Sunderland.
5. Hardin, J., Bertoni, G., Kleinsmith, L. J., & Becker, W. M. (2019). Becker's world of the cell. Boston: Benjamin Cummings.
6. Watson, J. D. (2016). Molecular biology of the gene (7th ed.). Menlo Park, CA: Benjamin/Cummings.

**Course Title:** Cytogenetics and Molecular Cell Biology Lab

**Credit:** 2 (L-0, T-0, P-4)

**Course code:**

**Contact Hrs/Week:** 4 Hrs

**Lab component**

1. Isolation and Quantification (UV spectrophotometer) of nucleic acid (DNA and RNA).
2. Isolation of plasmid DNA from bacteria.
3. Analysis of Plasmid and Genomic DNA using agarose gel electrophoresis.
4. Polymerase Chain Reaction and analysis by agarose gel electrophoresis
5. Analysis of mitosis and meiosis