Subject Code : P8GT3

CORE COURSE III – CELL AND MOLECULAR BIOLOGY

Unit I

Introduction to cell concept – Components of a cell – Molecular organization and functions of cell membranes and organelles. Cytoskeleton and its role in cell organization and motility – Cellular energy transactions in mitochondria – Protein sorting – Vesicular traffic in secretion (endoplasmic reticulum through Golgi to lysosome; from plasma membranes via endosomes). Organization of nucleus – cell division – cell cycle – mitosis and meiosis

Unit II

DNA structure – types, Sequence organization of prokaryotic and eukaryotic DNA, DNA modification in specialized chromosomes, Mitochondrial and Chloroplast DNA, DNA replication: Types of DNA replication. Enzymes of DNA replication, Denaturation – Renaturation kinetics, Types of DNA mutations – Detection of mutations. DNA repair mechanisms, RNA binding proteins, Ribonucleoprotein – complexes and functions, RNA – protein recognition and interactions.

Unit III

Transcription: Structure of a transcriptional unit – Regulatory signal elements: promoter, hI.h motifs, Post transcriptional modification of RNAs, mRNA and coding sequence, Transcription factors, Genetic code, Properties and Wobble hypothesis. Translation, ribosomes and tRNAs. Mechanism and regulation of protein synthesis. Post Translational modification of proteins, inhibitors of protein syntheis, Non-coding RNAs: structure and function, RNA interference: siRNA and miRNAs.

Unit IV

Concept of gene: Genetic fine structure –cistron, muton and recon – exons and introns. Gene Regulation in Prokaryotes: Types of gene regulation, Operon concept – Lac Trp and Ara operons – Gene regulation in eukaryotes – Down stream regulation. DNA re-arrangement: Expression of immunoglobulin gene, antibody diversity. Insertional elements and Transposons – Structural organization and transposition, Plant, Bacterial and Animal Transposons – Classification, Structure, Overlapping genes.. Homologous recombination of genes – Holiday junction – Rec. A and other recombinases

Unit V

Cell signaling: hormones and growth factors, hormone receptors and signal transduction. Cell differentiation: cortical differentiation, Nuclear differentiation, tumorigenesis – theories regarding tumor formation aging theories – cellular, systems, pace maker, Biological clock and Mutation theory, The transformed cancer cell – oncogenes. Cell Senescence and Programmed

Cell Death – Apoptosis and necrosis. Genetic pathways for PCD Anti- and – pro – apoptotic proteins

Text Book:

1. Freifelder. D. (2003) – Essentials of molecular Biology – fourth edition, Jones and
Bartlett Publications Inc.

Reference Books:

1. Lewin.B. (2007) – Genes IX, Jones and Bartlett Publishers
2. Turner, P.C., Mclennan, A.D. Bates, A.D. (2005) – Instant notes Molecular Biology – III Edition, Routledge, UK
3. Watson, J.D. (1987) – Molecular Biology of Gene – The Benjamin / Cummings Publishing Company Inc., California
4. Darnell, J.E., Lodish, H, and Baltimore, D. (2000) – Molecular Cell Biology, Fourth Edition, W.H. Freeman and Company, New York.
5. Stanley. R. Maloy. John.E. Cronan., David Freifelder (1998), Microbial Genetics, II edition, Narosa Publishing House, Madras
6. Strickberger (1996), Genetics, Prentice Hall of Inida Pvt. Ltd., New Delhi
7. Brown. T.A. (2006), Genomes 3, Garland Science Publications
8. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff. Keith Roberts, Peter Walter, (2002), Molecular Biology of the Cell, IV edition, Garland Publishing, New York
9. Ldish, Harvey, Arnold, Matsudaira, Paul, Kaiser, Chris. A,. Krieger, Monty Scott, Matther P. Zipuruky, Lawrence, Darnell, James (2004), Molecular Cell Biology, W.H. Freeman & Company
10. Anthony J.F. Griffiths, (2000), An introduction to Genetic Analysis, W.H. Freeman
11. Paul. G. Young. (2003), Exploring Genomics, W.H. Freeman
12. Geoffrey M. Cooper, Robert E. Hausman, (2007). The Cell – A Molecular Approach, Sinauer Associates, Inc.,