

M.Sc., II SEMESTER

SOFT CORE PAPER -3

GENE REGULATION

THEORY

48 Hrs.

UNIT I

8 Hrs.

A. Introduction, Inducible and repressible systems, House-keeping genes, Levels of control of gene activity.

B. Transcriptional control in Prokaryotes: The Operons - Lactose operon (Allosteric control), Arabinose operon - Positive and negative control, Galactose operon - Alternate start points.

UNIT II

8 Hrs.

A. Regulation beyond transcription initiation, premature termination of transcription - Tryptophan operon (*trp* attenuator) and Histidine operon (*His* attenuator).

B. Cis acting elements and Transacting factors: Structural and functional motifs, Helix-turn-Helix, Helix-loop-Helix. C. Regulation in Lambda Phage - Lytic and lysogenic cycle induction (Logic of lambda), Autoregulation. D. i) Ribosomal proteins as translational repressors (ii) rRNA-nucleotide sensing system (iii) Riboswitches.

UNIT III

8 Hrs.

A. Gene regulation in eukaryotes: Basic considerations, Britten and Davidsons model, Transcription factors, Response elements, Structural domains and motifs - Leucine Zipper and Zinc finger motifs, HLH and HTH motifs.

B. Transcriptional activators: Recruitment of different transcription machinery proteins by activators, Activators re

ruit nucleosome modifiers and insulators, Activators work in combinatorial way (eg. Human B interferon).

UNIT IV

8 Hrs.

Chromatin remodeling by Polycomb and Trithorax proteins, (i) Transcriptional repression : Mechanism - Competition, inhibition, direct repression, indirect repression, (ii) Gene silencing by modification of histones and DNA (deacetylation and methylation).

a) Regulation of chromatin structure – chromatin remodeling, chromosome condensation by condensins, Histone modification – acetylation, methylation, Histone code, Histone phosphorylation.

UNIT V**8 Hrs.**

Regulation after transcription initiation: Alternative mRNA splicing ex. *svl* gene, Translational control as in rRNA/GcN4, Ferritin and transferrin mRNA, RNA interference (miRNA, siRNA), mRNA localization & translational regulation during development.

UNIT VI**8 Hrs.**

Epigenetics: a) Introduction to concept and definition of Epigenetics - Epigenetics landscape, (b) Pronuclear transplantation experiments in mouse (c) Sex determination in Coccids (d) X-chromosome inactivation in Marsupial females. e) Molecular basis of epigenetics – Epigenome, Epigenotypes, Chromosome modifications and Non-coding RNA.

Tutorials -----**16X2 = 32 hours**