**GARDEN CITY UNIVERSITY**
**SEMESTER- III**
**B.Sc. Biotechnology, Biochemistry, Genetics**

**Title of the course: MOLECULAR BIOLOGY**
**COURSE CODE: 02ABBGR17311** **CREDITS: 04**

**Unit 1**

1.1 Structure and Properties of DNA and RNA: Central dogma of life, Biochemical evidences for DNA as genetic material.
1.2Watson and Crick model of DNA, different forms of DNA (A, B, Z, and D). Structure and Functions of different types of RNA.
1.3 Replication: Semi conservative model of replication, bacterial DNA polymerases, Mechanism of prokaryotic DNA replication. Fidelity of replication. Eukaryotic DNA polymerases and mechanism of replication.
1.4 Replication of viral DNA – HIV. Inhibitors of replication.

**Unit – 2**

2.1 Transcription: Mechanism of transcription in Prokaryotes and Eukaryotes. Post transcriptional modifications of mRNA (5'CAP formation, poly adenylation, mechanism of splicing.
2.2 Splicing: Group I, II, III and IV, spliciosome assembly, Processing of tRNA and rRNA. Inhibitors of transcription. Ribozymes.
2.3 Translation: Genetic code, Wobble hypothesis. Ribosome assembly, mechanism of activation of amino acids. Mechanism of translation in prokaryotes and eukaryotes. Inhibitors of protein synthesis.
2.4 Post translational modification: Co and posttranslational modifications, Control of translation in eukaryotes (Antisense RNA, Heme and interferon).

**Unit – 3**

3.1 Regulation of Gene expression: Gene regulation in prokaryotes, Operon Model-Inducible and repressible systems, lac, trp.
3.2 Regulation of Gene expression in Eukaryotes – transcriptional activation, galactose metabolism in yeast.
3.3 Gene Silencing**:** Definition, types –transcriptional and post transcriptional gene silencing.
3.4 Gene organization and expression in Mitochondria and chloroplasts.

**Unit – 4**

4.1 Recombination in prokaryotes-Transformation, Conjugation and Transduction
4.2Transposable elements in Maize and Drosophila
4.3 DNA damage and Repair:
DNA damage- alkylation, deamination, oxidation, UV radiation.
4.4 Repair mechanisms- photo reactivation, excision repair, post replication repair, mismatch repair and SOS repair.

**TITLE OF THE COURSE: METABOLISM & BIO-ENERGETICS**

**COURSE CODE: 02ABBGR17312 CREDITS – 4**

UNIT I: Introduction to Biochemistry:

1.1Thermodynamics –First law of thermodynamics, second law of thermodynamics

1.2 Gibbs free energy, endergonic & exergonic reactions, Standard state free energy changes- DG, $DG^0$ and $DG'^0$, Relationship between equilibrium constant and $DG'^o$.

1.3Feasibility of reactions. Simple problems, ATP-Structure, properties and energy currency of the cell, Importance of Coupled reactions, High energy compounds, simple problems.

1.4 Introduction to Metabolism - Catabolism, anabolism, catabolic, anabolic and amphibolic pathways

UNIT II

2.1 Carbohydrate Metabolism: Glycolysis - Reactions, energetics and regulation. Fate of pyruvate under aerobic and anaerobic conditions.

2.2 TCA cycle, Electron Transport Chain, Oxidative phosphorylation

2.3 Pentose phosphate pathway and its significance. Gluconeogenesis, Glycogenolysis and glycogen synthesis (schematic)

2.4 Regulation of carbohydrate metabolism in brief

UNIT III

3.1 Beta – oxidations of saturated & unsaturated fatty acids.

3.2 Ketone bodies, production during starving and diabetes Biosynthesis of fatty acids – Acetyl-CoA carboxylase reaction, Fatty acid synthase complex.

3.3 Biosynthesis of palmitate, energetics, Regulation of fatty acid biosynthesis. Biosynthesis of triacylglycerols.

3.4 Biosynthesis of cholesterol, regulation

UNIT IV

4.1 Amino acids metabolism: amination, transamination, deamination. decarboxylation,

4.2 Urea cycle and its regulation

4.3 Nucleic acids: Structure of bases, nucleosides and nucleotides

4.4 Biosynthesis and degradation: Purine and pyrimidine, denovo and salvage pathway.

**TITLE OF THE COURSE: DEVELOPMENT & EVOLUTIONARY GENETICS**
**COURSE CODE: 02ABBGR17313 CREDITS – 4**

Unit 1: Fundamental process and concepts in development
1.1Spermatogenesis, Oogenesis, hormonal regulation.
1.2Fertilization: Activation of sperm motility, attachment to egg, sperm penetration to egg surface, fusion of sperm and egg nuclei, mammalian fertilization
1.3Pattern of cleavage, Morphogenetic movement: Epiboly and Emboly
1.3 Cell- cell communication in development, switching genes on and off during development.

Unit 2: Axis Specification
2.1 Genetics of axis specification in Drosophila: Role of Maternal Genes Primary axis formation during Oogenesis. Origin of anterior-posterior polarity, Establishment of dorso -ventral polarity.
2.2Segmentation genes (gap, pair rule and segment polarity genes) and Homeotic selector genes.
2.3Cleavage and axis formation in C. elegans
2.4Axis formation in Amphibia and mammals. Fate mapping & Nuclear Transplantation

Unit – 3 Post embryonic Development
3.1Metamorphosis – Amphibia and Insect, Hormonal control.
3.2 Regeneration, two – step model.
3.3Environmental regulation of animal development)
The genetics of development in plants- Arabidopsis Developmental,steps in the formation of a plant embryo. Organization of shoot meristem. Genes expressed in apical, central and basal region. Flower development (floral morphogenesis and Homeotic gene expression)

Unit – 4 Evolution:

4.1 Isolating Mechanism – Pre zygotic and post zygotic.
4.2 Modes of speciation: Instantaneous Vs Gradual. Allopatric, parapatric, peripatric and quantum speciation.
4.3 Evolutionary agents: Selection differential selection, gametic selection, zygotic selection, fitness; Migration; Mutation and Random drift.
4.4 Molecular Phylogenetics: Construction of Phylogenetic tree. Distance method, parsimony method and maximum likelihood method.