Unit – I
**Regulation of Gene Expression**
- Principle of gene regulation
- Definition: constitutive enzyme, induced enzyme, constitutive gene expression, inducible and induction, repressible and repression activators, repressors, operon
- Lac operon hypothesis, Tryptophan operon hypothesis
- Regulation of gene expression in eukaryotes

Unit – II
**Gene Mutation & Repair**
- Definition: mutation, hotspots, mutagens, Base analogues
- Agents modifying purines and pyrimidine, Agents producing distortion in DNA
- Thymine dimer, X-rays
- Mismatch repair, Base excision repair, Nucleotide excision repair, Direct repair: UV repair system in e-coli

Unit – III
- Protein trafficking; Signal transduction. G protein mediated signal transduction, Protein kinases mediated signal transduction, MAPK cascade.

Unit – IV
- Retroviruses and retroposons; DNA rearrangement Genomics – Comparative and functional genomics; SNPs.

**Reference Books:**
- Principle of Biochemistry-Lehninger
- Gene-Levin-8
- Molecular Biology of the Gene-Watson etal
- Gene Cloning by T.A. Brown
- Elements of Biotechnology by R. K. Gupta.

SHRI GOVIND GURU UNIVERSITY
Paper Code: C – 2  
Title of Paper: Plant Biochemistry

Unit – I
Plant cell Structure,  
Biochemistry of Specialized Plant cell Organelles, Primary and Secondary cell wall, Plasmodesmata (structure and Function),  
Water relations of plants: Role of water, Absorption, Adsorption, Conduction and Transpiration, Guttation, Water Balance and Stress.

Unit – II
Secondary Metabolites-Phenols, Tannins, Lignin, Flavonoids, Waxes, Cutin and Suberin-structures and functions.

Unit – III
Photosynthesis:  
Hill’s Reaction, Light Reaction, Dark Reaction C₃ and C₄ cycles, Photo Respiration, Factors affecting rate of Photosynthesis.

Unit – IV
Plant Hormones:  
Auxins, Cytokinins, Gibberalic acids, Absisic acid, Brassinosteroids, Salicylic acid, Jasmonic acid.

Reference Books:
- Plant Physiology by Salis burry and Ross  
- Plant Biochemistry by Hans - Walter Heldt
Syllabus with effect from: June-2018

Paper Code: C – 3
Title of Paper: Regulation of Metabolic Pathway

Unit – I
Significance and importance of studying the regulation of metabolism. Generalmechanisms of regulations (Feedback, Allosteric, Covalent modification of enzymes, hormonal and gene expression level).

Unit – II
Signal Transduction. Molecular mechanism of signal transduction, Gated ion channels, Receptor enzyme, G protein coupled receptor and secondary messenger, Regulation of transcription by steroid hormone, Regulation of the cell cycle by protein kinases.

Unit – III
Regulation of carbohydrate metabolism. Overall pathway and regulation of Glycolysis, tricarboxylic acid cycle, Pentose phosphate pathway, glyoxylate pathway). Regulation of Guconeogenesis, glycolysis, starch, cellulose synthesis.

Unit – IV
Regulation of Lipid metabolism: Overall pathways and regulation of fatty acid synthesis and breakdown. Regulation of complex lipid.
Regulation of Purine and pyrimidine synthesis and catabolism
Regulation of amino acid metabolism. Overall anabolic and catabolic pathways of pyruvate family, aspartate family, aromatic family.

Reference Books:

Unit – I
Clinical biochemistry- definition, major causes of disease
Correlation of biochemical pathways with diseases development with appropriate example.
Blood: general composition- physical characteristics, functions,
Functions of RBC, WBC, platelets, blood fluid- composition and functions of C.S.F and lymph.
Composition of urine - normal and abnormal.

Unit – II
Plasma Proteins- Biochemical Importance.
Chemistry, clinical significance and importance of -- Albumin, HaptoGlobin, α AT1, Transferrin, Cerulloplasmin.
Lipoproteins (different types, their role, factor affecting LDL and HDL concentration in blood.).
Lipid profile.

Unit – III
Organs Functions Tests:
Liver Functions Tests (Serum Bilirubin, V.D. Bergh, Urine bilirubin, Total plasma protein Total albumin A: G ratio, Serum Cholesterol), Jaundice-(types, causes and symptoms).
Kidney Functions Tests, (Tests based on Glomerular filtration – Urea clearance Test Endogenous Creatinine clearance test, Inulin clearance test. Tests based on tubular function- Concentration test, Dilution test.) , Nephritis-(types, causes and symptoms).

Unit – IV
Haemostasis - vascular system, platelets plugs, formation of blood clotting,
Role of Blood Platelets, biochemical reaction in the clotting process.
Fibrinolytic systems.
Haemoglobin- chemistry and structure of haemoglobin.
Definition and types of anemia.
Normal types and properties of haemoglobin.
Life cycle of RBCs.

ReferenceBooks:
- Biochemistry by clinical correlation by Devlin.
Unit – I
Introduction to the proteome and the genome, codon bias, gene expression, Genomesize-C-value paradox, DNA sequencing: Maxam-Gilbert, Sanger, Pyrosequencing, automated DNA sequencing, other features of nucleic acid sequencing.
Analysis and Annotation-ORF, Exon-intron boundaries, Protein motif and domains.

DNA Microarray Technology: The generation of cDNA expression libraries, their robotic arraying, complex hybridization on DNA chips.

Unit – II
Human genome project- Strategies for large-scale sequencing projects; landmarks on chromosomes generated by various mapping methods; BAC libraries and shotgun libraries preparation; Physical map-cytogenetic map, contig map, restriction map.
Model organisms and other genome projects (Arabidopsis, Caenorhabditis elegans);
Comparative genomics of relevant organisms such as pathogens and non-pathogens

UNIT – III
Relationship between protein structure and function, Identification and analysis of proteins by
2D Analysis; Spot visualization and picking; Tryptic digestion of protein and peptide
fingerprinting; Mass spectrometry; ion source (MALDI, sprays sources); analyzer (ToF, quadrupole, quadrupole trap) and detector.

Protein-protein interactions: Solid phase ELISA, pull-down assays (using GST-tagged protein), far western analysis, surface plasmon resonantanc technique, Yeast two-hybrid system,
Phagedisplay; Protein interaction maps.

Protein arrays- definition, applications, diagnostics, expression profiling, Uses of automated technologies to generate protein arrays and chips

Unit – IV
Transcriptomics: Comparative transcriptomics, Differential gene expression, Genotyping/SNP detection; Detection technology; Computational analysis of microarray data.


Reference Books:
- Essential of Genomics and Bioinformatics C.W. Sensen, Wiley (2003),
- Introduction to Proteomics by Daniel C, Liebler, Humana Press
Unit – I

Introduction to rDNA technology
Steps involved in rDNA technology, isolation of DNA from different sources, concept of restriction and modification, restriction endonucleases, manipulative enzymes used in cloning. Introduction of vector and host. Introduction to generation of genomic and cDNA libraries.

UNIT 2

Gene amplification through PCR
Polymerase Chain Reaction: Principle, methodology, primer designing, types of polymerase and factors affecting PCR, advantages, limitations and application PCR.
Variants of PCR: Reverse Transcriptase PCR, Real Time PCR, Inverse PCR, anchored PCR, nested PCR, overlap extension PCR, hot start PCR, multiplex PCR, touchdown PCR, ARMS (amplification refractive mutation system) PCR.

UNIT 3

Characterization of DNA
Methodology and application of DNA fingerprinting methods (RFLP with probe introduction, RAPD, AFLP, SSR, SCAR, DGGE)
Principle methodology and types of DNA sequencing (Sanger-Coulson method, Maxam-Gilbert method, Pyrosequencing)

UNIT 4

Application of rDNA technology
Improvement of plant, animals and microbes. Gene therapy, pharmaceutical products and molecular diagnostics, Molecular pharming, Metagenomics, Metabolic engineering.

Reference Books:
1. Recombinant DNA: Watson et. al.
2. Principle of gene manipulation: Old and Primerose
5. Molecular Biotechnology – Glick
6. Applied Molecular Genetics – Roger Miesfeld
7. Biotechnology – H. K. Das
8. Genetic Engineering- Smita Rastogi and Neelam Pathak
9. Animal Biotechnology- P. Ramadaas