



**Department of Biochemistry**

**Government college for Women  
(Autonomous), Guntur**

---

### Program Specific Outcomes for Biochemistry

At the completion of a Bachelor of Science degree in Biochemistry, a graduate will be able to

**PSO-1:** Demonstrate knowledge and understanding of structure and metabolism of macromolecules, the basic molecular machinery & relate between the regulation and disorders of different metabolic & signaling pathways.

**PSO-2:** Gain proficiency in laboratory techniques in both biochemistry and molecular biology and implement to apply the scientific method to plan and carry out simple investigations.

**PSO-3:** Able to understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by humankind. And realize the impact of science in society and plan to pursue higher studies

### Program Specific Outcomes for Molecular Genetics & Bioinformatics

At the completion of a Bachelor of Science degree in Biochemistry, a graduate will be able to

**PSO1 -** Graduates will demonstrate a comprehensive understanding of molecular genetics principles & be able to proficiently apply molecular biology methods to analyze and effectively interpret experimental data in the context of genetics research.

**PSO2 -** Graduates will exhibit skills in bioinformatics, including the ability to use computational tools for sequence analysis, structural biology, and genomics.

**PSO3 -** Graduates will possess the capability to address complex biological questions by integrating molecular genetics and bioinformatics approaches.

**Course structure for I - VIII Semesters of B. Sc. Biochemistry Honours –  
Major Programme (w.e.f.2023-24)**

Year	Semester	Course	Theory / Practical	Title of Course	Course code	
I	I	1	T	Introduction to Classical Biology	1BC-01	
		2	T	Introduction to Applied Biology	1BC-02	
	II	3	T	Biomolecules	2BC-03	
			P	Biomolecules	2BC-03P	
		4	T	Cell Biology	2BC-04	
			P	Cell Biology	2BC-04P	
II	III	5	T	Analytical Techniques	3BC-05	
			P	Analytical Techniques	3BC-05P	
		6	T	Basic Microbiology	3BC-06	
			P	Basic Microbiology	3BC-06P	
		7	T	General Physiology	3BC-07	
			P	General Physiology	3BC-07P	
		8	T	Genetics	3BC-08	
			P	Genetics	3BC-08P	
	IV	9	T	Bioenergetics and Metabolism of Carbohydrates and Lipids	4BC-09	
			P	Bioenergetics and Metabolism of Carbohydrates and Lipids	4BC-09P	
		10	T	Clinical Biochemistry	4BC-10	
			P	Clinical Biochemistry	4BC-10P	
		11	T	Immunology	4BC-11	
			P	Immunology	4BC-11P	
III	V	12	T	Nutritional Biochemistry	5BC-12	
			P	Nutritional Biochemistry	5BC-12P	
		13	T	Enzymology	5BC-13	
			P	Enzymology	5BC-13P	
		14	T	Molecular Biology	5BC-14	
			P	Molecular Biology	5BC-14P	
		15	T	Metabolism of Nitrogen Compounds	5BC-15	
			P	Metabolism of Nitrogen Compounds	5BC-15P	
	VI	<b>Long term Internship/ Apprenticeship</b>				
	IV	VII	16	T	Recombinant DNA Technology	7BC-16
P				Recombinant DNA Technology	7BC-16P	
17			T	Endocrinology	7BC-17	
			P	Endocrinology	7BC-17P	
18			T	Biomedical Correlation of Diseases	7BC-18	
			P	Biomedical Correlation of Diseases	7BC-18P	
VIII		19	T	Applied Biochemistry	8BC-19	
			P	Applied Biochemistry	8BC-19P	
20	T	Fundamentals of Biostatistics and Bioinformatics	8BC-20			

		P	Fundamentals of Biostatistics and Bioinformatics	8BC-20P
	21	T	Plant and Environmental Biochemistry	8BC-21
		P	Plant and Environmental Biochemistry	8BC-21P

***Course structure for I - V Semesters of B. Sc. Biochemistry Honours – Minor Programme***

Year	Semester	Course	Theory / Practical	Title of Course	No. of Credits
I	II	1	T	Biomolecules	3
			P	Biomolecules	1
II	III	2	T	Analytical Techniques	3
			P	Analytical Techniques	1
	IV	3	T	Bioenergetics and Metabolism of Carbohydrates and Lipids	3
			P	Bioenergetics and Metabolism of Carbohydrates and Lipids	1
		4	T	Clinical Biochemistry	3
			P	Clinical Biochemistry	1
III	V	5	T	Nutritional Biochemistry	3
			P	Nutritional Biochemistry	1
	6	T	Enzymology	3	
		P	Enzymology	1	

**Course structure for I - V Semesters of B. Sc. Molecular Genetics and Bioinformatics – Minor Programme**

Year	Semester	Course	Theory / Practical	Title of Course	No. of Credits
I	II	1	T	Cell Biology & Principles of Genetics	3
			P	Cell Biology & Principles of Genetics	1
II	III	2	T	Human molecular genetics	3
			P	Human molecular genetics	1
	IV	3	T	Clinical genetics and genetic counselling	3
			P	Clinical genetics and genetic counselling	1
		4	T	Molecular techniques in genetic engineering	3
			P	Molecular techniques in genetic engineering	1
III	V	5	T	Cellular and molecular immunology	3
			P	Cellular and molecular immunology	1
	6	T	Bioinformatics	3	
		P	Bioinformatics	1	

**Course structure for I - VI Semesters of Three major B. Sc. Biochemistry**

Year	Semester	Paper	Title of the course	Course code	
I	I	1	Biomolecules - Theory	BC 403-1	
			Biomolecules - Practical		
	II	2	Bioenergetics and Bioanalytical Techniques- Theory	BC 403-2	
			Bioenergetics and Bioanalytical Techniques- Practical		
Community Service Project					
II	III	3	Enzymes & Intermediary Metabolism - Theory	BC 403-3	
			Enzymes & Intermediary Metabolism- Practical		
	IV	4	Molecular Biology & Microbiology- Theory	BC 403-4	
			Molecular Biology & Microbiology- Practical		
		5	Physiology, Nutrition & Clinical Biochemistry- Theory	BC 403-5	
			Physiology, Nutrition & Clinical Biochemistry- Practical		
	Short term internship				
	III	V	6A	Genetic Engineering & Bioinformatics- Theory	BC 403-6A
			Genetic Engineering & Bioinformatics- Practical		
7A			Immunology & Endocrinology- Theory	BC 403-7A	
			Immunology & Endocrinology- Practical		
6B			Genetic Engineering- Theory	BC 403-6B	
			Genetic Engineering- Practical		
7B			Advances in Biochemistry- Theory	BC 403-7B	
			Advances in Biochemistry- Practical		
VI			Semester End Internship		

**COURSE WISE SYLLABUS WITH OUTCOMES**  
**SINGLE MAJOR**

**COURSE – I**

**Title: INTRODUCTION TO CLASSICAL BIOLOGY**

**SEMESTER – I**

**Course Code: IBC-01**

**Course Outcomes**

1. Learn the principles of classification and preservation of biodiversity
2. Understand the plant anatomical, physiological and reproductive processes.
3. Knowledge on animal classification, physiology, embryonic development and their economic importance.
4. Outline the cell components, cell processes like cell division, heredity and molecular processes.
5. Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

**Unit 1: Introduction to systematics, taxonomy and ecology.**

- 1.1. Systematics –Definition and concept, Taxonomy –Definition and hierarchy.
- 1.2. Nomenclature –ICBN and ICZN, Binomial and trinomial nomenclature.
- 1.3. Ecology –Concept of ecosystem, Biodiversity and conservation.
- 1.4. Pollution and climate change.

**Unit 2: Essentials of Botany.**

- 2.1. The classification of plant kingdom.
- 2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
- 2.3. Structure of flower –Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
- 2.4. Mushroom cultivation, floriculture and landscaping.

**Unit 3: Essentials of Zoology**

- 3.1. The classification of Kingdom Animalia and Chordata.
- 3.2. Animal Physiology –Basics of Organ Systems & their functions, Hormones and Disorders
- 3.3. Developmental Biology –Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
- 3.4. Economic Zoology –Sericulture, Apiculture, Aquaculture

**Unit 4: Cell biology, Genetics and Evolution**

- 4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
- 4.2. Chromosomes and heredity –Structure of chromosomes, concept of gene.
- 4.3. Central Dogma of Molecular Biology.
- 4.4. Origin of life

**Unit 5: Essentials of chemistry**

- 5.1. Definition and scope of chemistry, applications of chemistry in daily life.
- 5.2. Branches of chemistry
- 5.3. Chemical bonds –ionic, covalent, noncovalent –Vander Waals, hydrophobic, hydrogen bonds.
- 5.4. Green chemistry

## References

1. Sharma O.P., 1993. Plant taxonomy. 2<sup>nd</sup> Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4<sup>th</sup> edition. S. Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4<sup>th</sup> Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4<sup>th</sup> Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5<sup>th</sup> Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1<sup>st</sup> Edition. Oxford publishers.

## COURSE – II

**Title: INTRODUCTION TO APPLIED BIOLOGY**

## SEMESTER – I

**Course Code: 1BC-02**

### Course Outcomes

1. Learn the history, ultrastructure, diversity and importance of microorganisms.
2. Understand the structure and functions of macromolecules.
3. Knowledge on biotechnology principles and its applications in food and medicine.
4. Outline the techniques, tools and their uses in diagnosis and therapy.
5. Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

### Unit 1: Essentials of Microbiology and Immunology

- 1.1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
- 1.2. Groups of Microorganisms –Structure and characteristics of Bacteria, Fungi, Archaea and Virus.
- 1.3. Applications of microorganisms in –Food, Agriculture, Environment, and Industry.
- 1.4. Immune system –Immunity, types of immunity, cells and organs of immune system.

### Unit 2: Essentials of Biochemistry

- 2.1. Biomolecules I –Carbohydrates, Lipids.
- 2.2. Biomolecules II –Amino acids & Proteins.
- 2.3. Biomolecules III –Nucleic acids -DNA and RNA.
- 2.4. Basics of Metabolism –Anabolism and catabolism.

### Unit 3: Essentials of Biotechnology

- 3.1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.
- 3.2. Environmental Biotechnology –Bioremediation and Biofuels, Biofertilizers and Biopesticides.
- 3.3. Genetic engineering –Gene manipulation using restriction enzymes and cloning



vectors; Physical, chemical, and biological methods of gene transfer.

3.4. Transgenic plants –Stress tolerant plants (biotic stress –BT cotton, abiotic stress –salt tolerance).  
Transgenic animals –Animal and disease models.

#### **Unit 4: Analytical Tools and techniques in biology – Applications**

4.1. Applications in forensics –PCR and DNA fingerprinting

4.2. Immunological techniques –Immunoblotting and ELISA.

4.3. Monoclonal antibodies –Applications in diagnosis and therapy.

4.4. Eugenics and Gene therapy

#### **Unit 5: Biostatistics and Bioinformatics**

5.1. Data collection and sampling. Measures of central tendency –Mean, Median, Mode.

5.2. Measures of dispersion –range, standard deviation and variance. Probability and tests of significance.

5.3. Introduction, Genomics, Proteomics, types of Biological data, biological databases-NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment

5.4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

#### **REFERENCES**

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11<sup>th</sup> Edition. Pearson publications, London, England.

2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5<sup>th</sup> Edition. McGraw Education, New York, USA.

3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4<sup>th</sup> Edition. Elsevier publishers.

4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.

5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.

6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3<sup>rd</sup> Edition. Cambridge Publishers.

7. U. Sathyanarayana, 2005. Biotechnology. 1<sup>st</sup> Edition. Books and Allied Publishers pvt. ltd., Kolkata.

8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.

9. Arthur M. Lesk. Introduction to Bioinformatics. 5<sup>th</sup> Edition. Oxford publishers.

10. AP Kulkarni, 2020. Basics of Biostatistics. 2<sup>nd</sup> Edition. CBS publishers.

**COURSE OUTCOMES:**

- CO-1. Recall fundamental biomolecule principles, like amino acid structures, showcasing memory retention of key concepts.
- CO-2. Explain classification, functions and relationships between biomolecules, demonstrating comprehension of their contributions to cellular processes.
- CO-3. Apply basic knowledge of monomers to construct oligomers & polymers
- CO-4. Analyze & predict structures from theoretical & experimental data related to biomolecules, demonstrating the ability to draw conclusions and assess significance and to create scientific temper.

**Unit 1:**

- Fundamentals of Biochemistry: History, Scope & avenues of Biochemistry
- Water as biological solvent., Definition of pH, Buffers
- Classification of carbohydrates -Monosaccharides, Oligosaccharides & Polysaccharides
- Configuration (D & L), Optical isomerism, Mutarotation, Definitions of Epimers and anomers
- Open chain structure of Glucose, Mannose & Galactose, Fructose & Ribose
- Cyclic structures: Pyranose structure of Glucose, Furanose structure of Fructose
- Chemical reactions of carbohydrates (Due to functional group & hydroxyl group)
- Structural & Biological importance of disaccharides: Sucrose, lactose, maltose, Isomaltose
- Structural Polysaccharides: cellulose & chitin; Storage polysaccharides: Starch, Inulin & Glycogen.
- Glycosaminoglycans: Heparin & Hyaluronic acid

**Unit - II: Lipids :**

- Functions of lipids; Classification of lipids: Simple, compound, derived lipids
- Saturated and unsaturated fatty acids.
- Triacylglycerols; Properties of Triacylglycerols: Acid number, saponification, iodine values, and rancidity.
- Phospholipids: Glycerophospholipids -Lecithins, Cephalins & Plasmalogens; and Sphingophospholipids. Functions of Phospholipids.
- Structure and importance of Cholesterol
- Types & Functions of Lipoproteins

**Unit-III: Amino Acids & Peptides :**

- Structure, stereochemistry of amino acids
- Classification of amino acids based functional group, polarity, nutritional requirement and metabolic fate.; Non-protein amino acids
- Physical & Chemical properties of amino acids; Titration curve of glycine;
- Peptide bond - nature and conformation.
- Naturally occurring peptides - Glutathione and oxytocin.

**Unit-IV: Proteins:**

- Classification of proteins based on function, solubility (Simple, Conjugated & derived) & shape (Globular & Fibrous)
- General properties of proteins, denaturation & characteristics of denaturation of proteins.
- Organization of proteins: Primary, secondary, tertiary and quaternary structures.
- Structure of Myoglobin & Hemoglobin.

**Unit - V: Nucleic Acids :**

- Introduction to nucleic acids. Structure of purines (A, G) and pyrimidines (C, T & U), nucleosides, nucleotides (AMP, ADP, ATP). Formation of phosphodiester linkage.
- Structure of Watson & Crick DNA. Types of DNA: A, B & Z DNA
- Denaturation of DNA - hyperchromic effect -  $T_m$  value & its significance; cot curves & its significance.
- Types of RNA: mRNA, tRNA & rRNA. Differences between DNA & RNA.

**Additional Inputs:**

- Donnan membrane equilibrium
- Structural & Biological importance of Trisaccharides: Raffinose, Melizitose
- Membrane composition and organization - Fluid mosaic model
- Definition of micelles, bilayers, liposomes, Emulsions
- Forces stabilizing the structure of protein: Hydrogen bonds, disulphide bonds, ionic bonds, hydrophobic interactions.

**REFERENCES**

- Biochemistry by Dr. U. Satyanarayana, and Chakrapani.U
- Biochemistry by J.L. Jain., S. Jain., N. Jain
- Lehninger's Principles of Biochemistry – Nelson,D.L and Cox.M.M., Freeman &co.
- Biochemistry by Stryer.L., Berg.J.M., Tymoczko.J.L., Freeman & co.
- Biochemistry by Voet.D and Voet.JG., John Wiley & sons.
- Biochemistry by Conn and Stumpf
- Experimental Biochemistry A Student Companion - V. Deshpande and B. Sasidhar Rao
- Practical Biochemistry – Upadhayay, and Nath
- An introduction to Practical Biochemistry - T. Plummer Biochemistry – Viva Series
- Lab manual in Biochemistry – Pattabhiraman
- Lab manual in Biochemistry – Jayaraman

Introduction to Good Laboratory Practice (GLP). Principles of Laboratory Hygiene and Safety.

List of experiments:

1. General reactions for identification of Carbohydrates
2. Qualitative identification of carbohydrates- Glucose, fructose, maltose, sucrose, lactose, starch
3. Preparation of Osazones and their identification.
4. General reactions for identification of Amino acids
5. Qualitative identification of amino acids - His, Tyr, Trp, Cys, Arg & Pro.
6. Qualitative tests for lipids: solubility, saponification, acrolein test, Salkowski test, Lieberman-Burchard test.
7. pH meter & Measurement of pH
8. Preparation of Acetate buffer.
9. Absorption maxima of colored substances-p-Nitrophenol / Methyl orange.
10. Absorption spectra of DNA.
11. Isolation of DNA and RNA from tissues / cells.

**COURSE – IV****Title: CELL BIOLOGY****SEMESTER – II****Course Code: 2BC-04****Course Outcomes:**

1. This gives them a strong foundation on the basic unit of life, its structure and various cellular events
2. Explain the role of compartmentalization and signaling in cellular biology;
3. Evaluate and apply knowledge of modern techniques in cellular biology.
4. Interpret, analyse, describe and present new experimental data.

**UNIT-I (CO-1, 3, 4)**Cell and subcellular organelle:

- Difference between Prokaryotic and Eukaryotic cells
- Structure and functions of nucleus
- Structure and functions of mitochondria
- Structure and functions of endoplasmic reticulum, cytoskeleton
- Structure and functions of golgi, lysosomes, ribosomes.

**Unit – II (CO-1, 2, 4)**Biomembranes:

- Chemical composition of Membranes; Lipids, proteins, and Carbohydrates Distribution of membrane lipids; fluid mosaic model of biological membranes
- Molecular structure of membranes: bilayer, miscelle, and liposomes.

Membrane Transport:

- Passive transport- Simple, facilitated & ion channels
- Active transport- types of pumps – P class, V class, F class
- Bulk transport- Endocytosis, exocytosis, phagocytosis.

**UNIT-III (CO-1, 2, 4)**Protein Sorting and Targeting:

- Signal hypothesis, signal peptide, NLS, NES
- Import across ER – post translational modifications of proteins in ER
- Sorting of lysosomal proteins- secretory, membrane proteins
- Trafficking and localization of mitochondrial proteins.

#### **UNIT-IV (CO-1, 2, 4)**

##### Cell communication:

- General principles of cell communication- Signaling molecules, reception, transduction, cellular response.
- Cell adhesion and roles of different adhesion molecules (immunoglobulin, integrins)
- Cell junction (tight junction, gap junction, desmosomes)
- Extracellular matrix.

##### Signal transduction:

- Cell surface receptor (G-protein coupled receptors)
- Second messengers (cAMP, Ca<sup>+2</sup>)
- Signal transduction pathways and regulation (cAMP, inositol mediated).

#### **UNIT-V (CO-1, 2, 3)**

##### Cell cycle and its regulation:

- Cell cycle - phases of cell cycle
- Cell division - mitosis, meiosis.
- Regulation of cell cycle- Cyclins, MPF, Cyclin dependent kinases, Growth factors(EGF, IGF), Nuclear Laminins, Check points. Inhibition of cell cycle progression. Apoptosis

##### **Additional Inputs:**

- Plastids, vacuole, micro bodies
- Membrane fluidity- role of unsaturated fatty acids and cholesterol
- Na<sup>+</sup> K<sup>+</sup> pump, Transport systems- uniport, symport, antiport.

##### **Recommended Books**

1. Cooper, G.M. & R.E. Hausman (2009) The Cell – A Molecular Approach, A.S.M. Press, Washington
2. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky, James Darnell; Molecular cell biology, 5<sup>th</sup> ed
3. Goldman, Emanuel, and Lorrence H. Green, eds. Practical handbook of microbiology. CRC Press, 2015.
4. Thomas D. Pollard, William C. Earnshaw, Jennifer Lippincott-Schwartz, Graham T. Johnson; Elsevier, 3<sup>rd</sup> ed 2017
5. Dubey, R. C., and D. K. Maheshwari. Practical microbiology. S. Chand, 2002.
6. Microbiology: A laboratory manual by Cappuccino and Sherman, Pearson Education, 6th Ed.
7. P.S. Verma, V.K. Agarwal Cell biology, genetics, molecular biology, evolution and ecology. S. Chand, 2008.
7. S. C. Rastogi (2008) Cell Biology, New Age International (P) Ltd. Publishers, New Delhi
8. P. K. Gupta (2002) Cell and Molecular biology, Rastogi Publications, New Delhi

1. Microscopic observation of plant and animal cells
2. Estimation of Chlorophyll
3. Isolation of chloroplast
4. Isolation of mitochondria from the liver
5. Mitosis experiment
6. Meiosis experiment

**COURSE – I****Title: Principles of Genetics****SEMESTER – II****Course Code: 1MGB-01****COURSE OUTCOMES**

Upon successful completion of course the student will be able to understand

1. To know about structure of a cell and the differences between a prokaryotic and a Eukaryotic cell
2. To understand the structure of DNA and morphology of chromosome
3. Understand Mendel's Law's and their deviations
4. Gene interactions and their outcome through gene mapping and genetic recombination

**UNIT-1: CELL AND ITS ORGANELLE**

- Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell;
- Ultra-structure of a bacterial cell, plant cell, animal cell.
- Ultra-structure of plasma membrane and various theories on its organization.
- Ultrastructure of mitochondria, ER, golgi, ribosomes

**UNIT-2 HUMAN CHROMOSOME ORGANIZATION**

- Structure of DNA
- Packaging of DNA – multiple hierarchies of DNA folding
- Morphology of Chromosomes –size, shape, structure, centromere & kinetochore, telomere, satellite, Karyotype, ideogram, heterochromatin and euchromatin,

**UNIT-3 HISTORY OF GENETICS**

- Pre-mendelian Genetic concepts, Heredity, environment, the concept of phenotype and genotype, pure lines and inbred lines, alleles.
- Mendel's experiments on pea plants, Mendel laws
- Deviations of Mendelism - Incomplete dominance and codominance; Multiple alleles, Lethal alleles, Pleiotropy, Penetrance, and Expressivity, Epistasis

**UNIT- 4 SEX LINKED INHERITANCE AND SEX DETERMINATION**

- Sex linked inheritance (hemophilia, hairy ear rims), sex limited (cock-hen feathering) and sex influenced inheritance (horned character in sheep)
- Sex determination in invertebrates (Drosophila), vertebrates (Man);

- Chromosome theory of Sex determination: Drosophila (ZZ-ZW), man (XX- XY, XX-XO)

### **UNIT-5 LINKAGE, CROSSING OVER, AND GENE MAPPING**

- Linkage - Definition, Linkage group- Drosophila and man; Types of linkage-complete linkage and incomplete linkage, Significance of linkage.
- Crossing over - definition; recombination and recombination frequency  
Mechanism of crossing over: Chiasma Interference and coincidence; Coupling and Repulsion hypothesis.
- Gene Mapping – physical mapping and genetic mapping, mapping in eukaryotes

#### **Additional inputs**

- Giant chromosomes
- Genic balance theory of Bridges, Intersexes and super sexes in Drosophila

#### **REFERENCES**

1. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
2. Ghosh, A.K., K.Bhattacharya&G. Hait (2011) A Text Book of Botany, Volume-III, New Central Book Agency Pvt. Ltd., Kolkata
3. A.V.S.S. Sambamurty (2007) Molecular Genetics, Narosa Publishing House, New Delhi
4. S. C. Rastogi (2008) Cell Biology, New Age International (P) Ltd. Publishers, New Delhi
5. P. K. Gupta (2002) Cell and Molecular biology, Rastogi Publications, New Delhi
6. B. D. Singh (2008) Genetics, Kalyani Publishers, Ludhiana
7. Cooper, G.M. & R.E. Hausman (2009) The Cell – A Molecular Approach, A.S.M. Press, Washington

#### **Minor Course -1**

#### **Practical Syllabus**

#### **Course Code: MGB -01P**

1. Study of Mendel's laws through seed ratios & Drosophila mutants
2. Study of linkage, recombination, and chromosome mapping using test cross data.
3. Study of human genetic traits: Sickle cell anemia, Xeroderma Pigmentosum, Albinism.
4. Demonstration of Mitosis & Meiosis using squash technique
5. Blood Typing: ABO groups & Rh factor.
6. Observation of various stages of Mitosis in permanent slides
7. Observation of various stages of Meiosis in permanent slides

## THREE MAJOR SYLLABUS

**COURSE – III**

**Title: ENZYMOLOGY AND INTERMEDIARY METABOLISM**

**SEMESTER – III**

**Course Code: BC-403-3**

### **Learning Outcomes:**

- Understand the concepts of enzymes and thereby get insight on reactions happening inside our body
- The basic understanding of metabolisms occurring in our body and energy production used in various reactions
- Students were able to understand the function of biological molecules through the study of their metabolic reactions
- Students were able to analyse the cause of metabolic disorders used for the diagnosis

### **Unit-I: Enzymes.**

- 1.1 Introduction to biocatalysts, Differences between chemical and biological catalysis.
- 1.2 Nomenclature & classification of enzymes. Definitions: Activation energy, holo-enzyme, apo enzyme, coenzyme, cofactor, zymogen, enzyme units- Katal, IU.
- 1.3 Enzyme specificity: Stereo specificity, reaction specificity & substrate specificity. Active site definition & its features;
- 1.4 Enzyme substrate interaction - lock & key, induced fit models.
- 1.5 Factors affecting enzyme activity - pH, temperature; substrate concentration, significance of  $k_m$ ,  $V_{max}$
- 1.6 Enzyme inhibition: Reversible - Competitive and non-competitive and irreversible inhibition.

### **Unit-II: Enzyme Regulation:**

- 2.1 Allosterism & co-operativity; ATCase as an allosteric enzyme
- 2.2 Covalent modulation - phosphorylation of phosphorylase.
- 2.3 Zymogen activation-activation of trypsinogen and chymotrypsinogen.
- 2.4 Isoenzymes (LDH), Multienzyme complexes (PDH).
- 2.5 Enzymes used in diagnosis of myocardial infarction, liver diseases & Muscle diseases

### **Unit-III: Carbohydrate & Lipid Metabolism**

- 3.1 Introduction to metabolism - Anabolism and catabolism.;
- 3.2 Carbohydrate Metabolism: Glycolytic pathway, energy yield; Fate of pyruvate - formation of acetyl CoA, lactate and ethanol; alcoholic fermentation, Pasteur effect.
- 3.3 Citric acid cycle, energy yield, amphipathic role, anaplerotic reactions.
- 3.4 HMP shunt pathway; Gluconeogenesis, Glycogenesis and Glycogenolysis.
- 3.5 Disorders of carbohydrate metabolism- Diabetes Mellitus.
- 3.6 Lipid Metabolism: B-oxidation of fatty acids with even and odd no. of carbon atoms
- 3.7 de novo synthesis of fatty acids, elongation of fatty acids in mitochondria, Ketogenesis.
- 3.8 Biosynthesis and degradation of triacylglycerol and lecithin; Biosynthesis of



cholesterol

3.9 Disorders of lipid metabolism- Niemann Pick and Tay Sachs disease.

**Unit- IV: Amino acid metabolism:**

4.1 General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Glycogenic and ketogenic amino acids

4.2 Metabolism of glycine, serine, leucine, phenylalanine and tyrosine.

4.3 Biosynthesis of creatinine

4.4 Urea cycle and its regulation

4.5 Inborn errors of amino acid metabolism - Phenyl ketonuria & alkaptonuria.

**Unit-V: Nucleotide & Heme metabolism**

5.1 de novo and salvage pathways of purine and pyrimidine nucleotides and regulation.

5.2 Significance of Ribonucleotide reductase and Thymidylate synthase

5.3 Catabolism of purines and pyrimidines.

5.4 Disorders of nucleotide metabolism- Gout, Lesch- Nyhan syndrome.

5.5 Biosynthesis and degradation of Heme.

**Additional Inputs:**

Photosynthesis, errors of glycogen metabolism

Metabolism of phosphotidyl serine, phosphotidyl ethanolamine

Inborn errors of heme degradation.

**Course -3 Enzymology And Intermediary Metabolism**

**Course Code: BC-403-3P**

**List of Experiments:**

1. Assay of amylase.
2. Assay of urease.
3. Assay of catalase
4. Effect of pH, temperature and substrate concentration on enzyme activity.
5. Estimation of total carbohydrates by Anthrone method.
6. Estimation of glucose by DNS method.
7. Tests for lipids- Salkowski test, Lieberman-Burchard test.
8. Estimation of Cholesterol by Zaks method
9. Estimation of protein by Biuret method.

**Text Books:**

- Biochemistry by Dr. U. Satyanarayana, and Chakrapani.U
- Biochemistry by J.L. Jain., S. Jain., N. Jain
- Lehninger's Principles of Biochemistry - Nelson,D.L and Cox.M.M., Freeman &co..

- Biochemistry by Stryer.L., Berg.J.M., Tymoczko.J.L., Freeman & co.
- Biochemistry by Conn and Stump Lab manual in Biochemistry Jayaraman
- An introduction to Practical Biochemistry - T. Plummer Biochemistry - Viva Series

**COURSE – IV**  
**Title: MOLECULAR BIOLOGY & MICROBIOLOGY**

**SEMESTER – IV**  
**Course Code: BC-403-4**

**Course Outcomes :**

*After the completion of the course, the student will be able to:*

- CO1** - Recall essential concepts in molecular biology and microbiology, such as DNA replication and microbial classification, demonstrating memory of foundational principles.
- CO2** - Explain the mechanisms of molecular processes and microbial functions, illustrating comprehension of how they contribute to the broader context of biological systems.
- CO3** - Apply molecular and microbiological knowledge to analyze experimental data theoretically & practically, conduct laboratory techniques, and solve practical & theoretical problems in the field.
- CO - 4** Critically analyze experimental results, and complex biological phenomena, showcasing the ability to evaluate, synthesize, and draw conclusions within molecular biology and microbiology.

**Unit-I: DNA Replication:**

- 1.1 Structure of chromosome - Concept of Heterochromatin & Euchromatin, Organization of genome - Nucleosome model
- 1.2 Experiments to prove DNA as genetic material
- 1.3 Replication: Definition, Basic rules of replication;
- 1.4 Models of Replication -Meselson-Stahl's experimental proof for semi-conservative model.
- 1.5 Enzymes in replication: DNA polymerase-1, II & III of E. coli, Mechanism of DNA ligase; Helicase, Primase, Topoisomerase
- 1.6 Mechanism of replication in prokaryotes: Initiation, Elongation and Termination.

**Unit - II: Transcription & Translation**

- 2.1 RNA polymerase in prokaryotes, Role of Sigma factor
- 2.2 Mechanism of transcription: Initiation, elongation and termination
- 2.3 Eukaryotic RNA polymerases (I, II & III).
- 2.4 Post transcriptional modifications - mRNA capping, poly-adenylation, Introns, exons, splicing mechanism.
- 2.5 Salient features of genetic code & Wobble hypothesis
- 2.6 Structure of tRNA & Activation of amino acids;
- 2.7 Mechanism of translation in prokaryotes: Initiation, elongation and termination (Essay).

**Unit-III: DNA Repair & Gene Regulation :**

- 3.1 DNA Repair: Definitions: Mutations, Mutagen.
- 3.2 Spontaneous mutations and Induced mutations - chemical & Physical mutagenic agents (Essay).

3.3 DNA Repair - Mismatch repair, Base excision repair, Nucleotide excision repair & Direct repair (Essay).

3.4 Gene regulation: Definitions: Constitutive gene expression, Induction, Repression.

3.5 Gene expression in prokaryotes - Operon concept- Lac Operon

#### **Unit IV: Microbiology – I**

4.1 History & scope of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Antony von Leeuwenhoek

4.2 Outline classification of living organisms: Haeckel, Whittaker and Carl Woese systems

4.3 Ultrastructure of a bacterial cell: cell wall, cell membrane, ribosomes, nucleoid.

4.4 Structure & Life cycle of TMV (4m) and Structure of HIV, Symptoms, Diagnosis & treatment of AIDS

4.5 Structure and multiplication of bacteriophage - $\lambda$  (Lytic & Lysogeny cycle).

#### **Unit - V: Microbiology - II:**

5.1 Definitions: Sterilization, Disinfection

5.2 Physical agents of sterilization: Dry heat, Moist heat, filtration & radiation.

5.3 Chemical agents of sterilization: Alcohols, Aldehydes, Halogens, Phenols, Gases.

5.4 Culture Media: Types of media based on consistency; Simple & Complex media, Defined, Selective, enriched and differential media.

5.5 Isolation of pure cultures by streak plate, spread plate & pour plate methods.

5.6 Preservation of microbial cultures - Sub culturing, in mineral oil, Lyophilization.

5.7 Bacterial growth curve and kinetics.

#### **Additional inputs:**

Human values & Ethical concerns in AIDS (Care to be taken);

### **COURSE – IV Molecular Biology & Microbiology**

**Course Code: BC-403-4P**

#### **List of Experiments:**

##### Molecular Biology

1. Isolation of DNA from onion.
2. Isolation of DNA from E.coli
3. Isolation of plasmids.
4. Ultraviolet absorption spectrum of DNA.
5. Determination of purity of nucleic acids by UV-spectrophotometric method.
6. Estimation of DNA by diphenylamine method.
7. of nucleic acids and visualization under UV transilluminator.
8. Estimation of RNA by orcinol method.
9. Determination of DNA and RNA concentration by A260nm

##### Microbiology:

10. Equipment used in Sterilization -Autoclave, Hot air oven.
11. Preparation of culture media - Nutrient Broth & Agar media
12. Serial dilution method

13. Isolation of pure cultures: (i) spread plate, (ii) Streak plate method.(iii) Pour plate method
14. Simple staining
15. Gram staining.
16. Motility of bacteria by hanging drop method.
17. Bacterial growth curve.
18. Antibiotic sensitivity by paper disc method.

**Text Books:**

- Molecular Biology- Freifelder;
- Molecular Biology of the Gene (2008) 6th ed.;
- Lehninger: Principles of Biochemistry (2013) 6th ed;
- Principles of Genetics (2010) 5th ed.;
- Biochemistry by Stryer.L., Berg.J.M., Tymoczko.J.L., Freeman & co.

**COURSE – V**  
**Title: PHYSIOLOGY, NUTRITION & CLINICAL BIOCHEMISTRY**

**SEMESTER – IV**  
**Course Code: BC-403-5**

**Course Outcomes :**

*After the completion of the course, the student will be able to:*

- *CO1 – Recall the structure and functions of digestive, heart and nervous system and illustrate the mechanism*
- *CO2 – Identify the role of vitamins and minerals*
- *CO3 – Analyze the biochemical tests and discuss on disorders*
- *CO4 – Recommend diet as per nutritional requirements of a person*
- *CO5 – Discussion of mechanisms of the blood clotting its related disorders*

**Unit-I: Human physiology:**

- 1.1 Digestion and absorption of carbohydrates, lipids & proteins. Anatomy of heart;
- 1.2 Relationship between cardiac cycle and heart sound.
- 1.3 Kinds of muscles; Structure of myofibril - organization of contractile proteins.
- 1.4 Mechanism of muscle contraction, biochemical changes during muscle contraction.
- 1.5 Organization of nervous system - Central and Peripheral; Structure of neuron.
- 1.6 Sodium potassium pump, ligand gated channels, action potential; Propagation of nerve impulse, Synapse, synaptic transmission
- 1.7 Neurotransmitters - excitatory and inhibitory neurotransmitters

**Unit-II: Dietary biomolecules in health**

- 2.1 Balanced diet, BMR and factors affecting BMR, RDA for adolescent, pregnant and lactating

women

2.2 Carbohydrates: Source, Dietary requirements, Utilization and storage of carbohydrates.

2.3 Lipids: Source, Dietary requirements, Utilization and storage of lipids; Essential Fatty Acids; Functions of EFA.

2.4 Proteins: Source, Dietary requirements, Utilization and storage of proteins; Essential and Nonessential amino acids;

2.5 PEM, Kwashiorkor and Marasmus.

### **Unit-III: Vitamins and Minerals:**

3.1 History, Classification of vitamins.

3.2 Source, Structure, Absorption, Distribution, biochemical role and Deficiency of vitamin A, C, D, E, & K vitamins.

3.3 Source, Structure, Absorption, Distribution, biochemical role and Deficiency of B complex vitamins B1, B2, B6, B7 & B12

3.4 Minerals: Ca, P and Fe - Sources, Absorption, Utilization, Deficiency; I, F, Mg, Cu, Zn, Se, Distribution, Toxicity in the human body.

### **Unit-IV: Clinical Biochemistry - I:**

4.1 Composition of blood, coagulation of blood and disorders of blood coagulation (hemophilia).

4.2 Plasma proteins in health and disease.

4.3 Hemoglobin and transport of gases in blood (oxygen and CO<sub>2</sub>).

4.4 Types of anemia, hemophilia, SCD, thalassemia

4.5 Clinical significance of variations in blood glucose - hypoglycemia, hyperglycemia, glycosuria, renal threshold value, GTT, diabetic ketoacidosis

### **Unit-V: Clinical Biochemistry - II:**

5.1 Hepatic function tests - conjugated & total bilirubin, albumin globulin ratio, hippuric acid and bromsulphathelin tests

5.2 Serum enzymes in liver diseases - SGOT, SGPT, GGT and alkaline phosphatases.

5.3 Renal function tests - creatinine and urea clearance tests, phenol red test.

5.4 Lipid profile for cardiovascular diseases - HDL, LDL, cholesterol, creatinine kinase, SGOT, LDH, CRP

## **COURSE – IV Physiology, Nutrition & Clinical Biochemistry**

**Course Code: BC-403-4P**

### **List of Experiments:**

1. Estimation of hemoglobin in blood.
2. Total count of RBC, WBC, Differential count of WBC
3. Determination of blood group and Rh typing.
4. Estimation of calcium by titrimetry
5. Estimation of iron in apple juice by phenanthroline method.
6. Estimation of vitamin C by 2, 6-dichlorophenol indophenol method.
7. Determination of iodine value of an oil.
8. Determination of acid value of an oil.
9. Urine analysis for albumin, sugars and ketone bodies.

10. Estimation of urinary creatinine.
11. Estimation of blood urea.
12. Estimation of cholesterol by ZAK's method

**Textbooks:**

- Medical Laboratory Technology - a Procedure Manual for Routine Diagnostic Tests Vol. I & II - Mukherjee, K.L., Tata Mc Graw–Hill Publishing Company Limited (
- Medical Biochemistry - Baynes, J.W. and Dominiczak, M.H., Elsevier Mosby Ltd.
- Vander's Human Physiology - Widmaier, E.P., Raff, H. and Strang, K.T., McGraw Hill International Publications
- Textbook of Medical Physiology - Guyton, A.C. and Hall, J.E., Reed Elseviers India Pvt. Ltd.
- Krause's Food and Nutrition Care process - Mahan, L.K Strings,S.E, Raymond,J. Elsevier's Publications.
- The vitamins, Fundamental aspects in Nutrition and Health - G.F. Coombs Jr. Elsevier's Publications.
- Principles of Nutritional Assessment - Rosalind Gibson. Oxford University Press.
- Lab manual in Biochemistry – Pattabhiraman
- Lab manual in Biochemistry – Jayaraman

**COURSE – VI**  
**Title: GENETIC ENGINEERING & BIOINFORMATICS**

**SEMESTER – V**  
**Course Code: BC-403-6A**

**Course Outcomes :**

*After the completion of the course, the student will be able to:*

- CO1 – Recall key principles of genetic engineering & bioinformatics including gene manipulation techniques and molecular tools used in the field.*
- CO2 - Explain the underlying concepts of genetic engineering & bioinformatics, demonstrating comprehension of gene transfer mechanisms, cloning, and genetic modification.*
- CO3 - Apply genetic engineering techniques bioinformatics to design and execute experiments, demonstrating practical skills in genetic manipulation and modification.*
- CO4 - Analyze ethical, social, and scientific implications of genetic engineering advancements, evaluating their impact on individuals and society & predict similarity among organisms using in-silico tools*

**Unit 1 Basic tools in rDNA technology**

- 1.1 Basic steps in gene cloning. Isolation of DNA: isolation of genomic DNA & plasmid DNA from bacteria.
- 1.2 DNA manipulating enzymes: polymerases, nucleases, ligase, phosphatase reverse transcriptase;
- 1.3 Restriction endonucleases- nomenclature, types and properties

**Unit-II: Cloning vectors, Ligation, DNA libraries:**

- 2.1 Cloning vectors:** characteristics of plasmids, pBR 322 as cloning vector, bacteriophage  $\lambda$ ., cosmids,
- 2.2 Brief introduction to bacterial artificial chromosome (BAC) & yeast artificial chromosome (YAC) Shuttle vectors & Expression vectors.
- 2.3 Ligation:** Mechanism of action of T4 DNA ligase
- 2.4 Joining of DNA fragments:
- 2.5 Sticky end, blunt end ligation, linkers and adapters, Synthetic oligonucleotides.
- 2.6 DNA libraries:** Genomic DNA library; cDNA synthesis & cDNA library

**Unit-III: Introduction and selection of recombinants**

- 3.1 Methods for introducing rDNA into host cells - Transformation, Electroporation, Microinjection, gene gun methods.
- 3.2 Any four features of E.coli & Yeast as host cells.
- 3.3 Identification for recombinants - Insertional inactivation (colony hybridization).
- 3.4 Methods based on detection of the translation product of cloned gene - Hybrid released translation (HRT) & Hybrid arrest and released translation (HART).

**Unit-IV: Techniques & Applications**

- 4.1 Principle, Method & applications of Polymerase chain reaction (PCR).
- 4.2 DNA sequencing by Sanger's method.
- 4.3 Principle & method of Southern, Northern & Western blotting techniques.
- 4.4 Applications of r DNA technology in Agriculture: Short note on Bt cotton, Golden rice.
- 4.5 Applications of r DNA technology in Medicine: Production of Insulin, Growth hormone

4.6 Ethical concerns of genetically engineered plants & animals.

### **Unit-V: Bioinformatics**

5.1 History & scope of Bioinformatics

5.2 NCBI - Resources available at NCBI

5.3 Databases – characteristics and applications of biological (primary, secondary and composite), nucleic acid (Genbank, EMBL, DDBJ), protein (Swiss Prot, PDB)

5.4 Genomics – definition of structural and functional genomics; Human genome sequencing – BAC to BAC method, whole genome shotgun sequencing

5.5 Types of Proteomics; Applications of proteomics

5.6 Sequence alignment algorithms – BLAST, CLUSTAL-W

### **Additional inputs:**

Human genome project;

## **COURSE – VI GENETIC ENGINEERING & BIOINFORMATICS**

**Course Code: BC-403-6AP**

### **List of Experiments:**

1. Isolation of genomic DNA from E. Coli
2. Isolation of plasmids.
3. Electrophoretic separation of DNA and visualization by UV Transilluminator.
4. Restriction digestion of DNA with any two restriction enzymes.
5. Preparation of Competent E.coli for transformation
6. Transformation of E.coli by Cac12
7. Polymerase chain reaction: Principle & problem solving
8. Sequencing of DNA by sangers method: Retrieving sequence from gel.
9. Southern blotting of DNA
10. Western blotting of proteins - Virtual lab exercise.
11. Other Virtual lab exercise on recombinant DNA techniques.
12. Sequence information retrieval (protein & gene) from NCBI
13. BLAST suit of tools for pairwise alignment
14. Multiple sequence alignment using CLUSTAL W

### **Text Books :**

- rDNA technology
- Gene Cloning and DNA Analysis (2010) 6th ed., Brown, T.A., Wiley-Blackwell
- Principles of Gene Manipulation and Genomics (2006) 7th ed., Primrose
- Molecular Biotechnology: Principles and Applications of Recombinant DNA (2010) 4th ed.
- “Bioinformatics”- CSV Murthy, Himalaya Publishing House
- Introduction to Bioinformatics - M. Lesk Oxford University Press
- Bioinformatics sequence and genome analysis - David W.Mount, Cold spring harbor laboratory press
- Bioinformatics: A Modern Approach - Vittal R. Srinivas, published by PHI Learning Pvt. Ltd
- Bioinformatics and Functional Genomics Pevsner, J., John Wiley & Sons



**Course Outcomes:**

After the completion of the course, the student will be able to:

- CO1 – Recall Types of immunity, understand the structure of immunoglobulins
- CO2 – Study antigen-antibody interaction Imagine the power of immune system during health, illness.
- CO3 – Categorize hypersensitivity reactions and list out auto immune diseases.
- CO4 – Understand the organization of Endocrine system, the influence of hormones on metabolism and deficiency disorders.

**Unit-I: Immunology – I**

- 1.1 Organization of immune system
- 1.2 Types of immunity: Innate immunity (Anatomical, biochemical, phagocytic, inflammation) and acquired immunity (Active & passive immunity)
- 1.3 Organs of immune system: Primary lymphoid organs -Thymus & Bone marrow  
Secondary lymphoid organs - Lymph node & spleen
- 1.4 Cells of immune system: T-lymphocytes, B-lymphocytes, Macrophages, Dendritic cells, Mast cells & NK cells, Neutrophils, Eosinophils, Basophils
- 1.5 Immune Response: Humoral & Cell mediated Immune response

**Unit - II: Immunology – II**

- 2.1 Antigens and Concept of haptens, Adjuvants, epitopes and determinants of antigenicity,
- 2.2 Structure & biological functions of IgG; Classification of immunoglobulins
- 2.3 Antigen antibody reactions - precipitation, agglutination, complement fixation, opsonization
- 2.4 Types of Immunodiagnostic tests - RIA, ELISA

**Unit - III: Immunology – III**

- 3.1 Role of MHC class I & class II proteins, exocytic and endocytic pathways of antigen processing & presentation
- 3.2 Outlines of hypersensitivity reactions: Type I, Type II, Type III, & Type IV hypersensitivity
- 3.3 Outlines of autoimmunity – organ specific auto immune disease (Type I diabetes mellitus), systemic auto immune disease (Systemic lupus erythematosus)
- 3.4 Vaccines and their classification. Traditional vaccines-live and attenuated, toxoids. Modern vaccines- recombinant and peptide vaccines

**Unit IV: Endocrinology – I**

- 4.1 Organization of endocrine system; Classification of hormones based on chemical composition and location of hormone receptors.
- 4.2 Mechanism of hormonal action - signal transduction pathways for adrenaline, glucocorticoids and insulin
- 4.3 Hypothalamic hormones and their functions - GHRH, TSRH, GnRH, GHRH
- 4.4 Physiological and biochemical actions of pituitary hormones - GH, prolactin, TSH, LH,

FSH, oxytocin and vasopressin;

4.5 Disorders – gigantism, acromegaly and diabetes insipidus

### **Unit V: Endocrinology – II**

5.1 Physiological role of thyroid hormone; Disorders - Goiter, cretinism, myxedema

5.2 Physiological role of insulin, glucagon; Disorders - diabetes type I and type II

5.3 Physiological role of Adrenal hormones - Aldosterone, cortisol, corticosterone, epinephrine and norepinephrine; Disorders - Addison's disease, Cushing syndrome

5.4 Physiological role of gonadal hormones - Androgens (testosterone), Estrogens (estrone), Progestogens (progesterone)

## **COURSE – VII IMMUNOLOGY & ENDOCRINOLOGY**

**Course Code: BC-403-7AP**

### **List of Experiments:**

1. Isolation of lymphocytes from blood
2. WBC-Differential count
3. Determination of blood group and Rh typing.
4. Visualization of antigen antibody reactions (ODD).
5. Visualization of antigen antibody reactions (RID)
6. ELISA
7. Glucose tolerance test
8. Estimation of serum  $Ca^{+2}$
9. Case studies

### **Recommended Textbooks:**

- Immunology – Kuby
- Immunology – Roitt
- Harper's Biochemistry - Murray, R.K., Granner, D.K., Mayes and P.A., Rodwell, V.W., Lange Medical Books/McGraw Hill.
- Text book of Medical Biochemistry – Vasudevan
- Text book of Medical Biochemistry – Chatterjee and Shinde
- Essentials of Medical Biochemistry - RC Gupta
- An introduction to Practical Biochemistry - T. Plummer Biochemistry – Viva Series
- Lab manual in Biochemistry – Pattabhiraman
- Lab manual in Biochemistry – Jayaraman