

S.V.K.P& Dr K.S.RAJU ARTS & SCIENCE COLLEGE (A), PENUGONDA
Recognized by UGC as “College with Potential for Excellence”
Accredited by NAAC with “A” Grade
(Affiliated to ADIKAVI NANNAYA UNIVERSITY)



**B.Sc., BIOCHEMISTRY
SYLLABUS
SEMESTER I TO V
2023-2024**



I Semester Syllabus

BIOCHEMISTRY

(w.e.f. 2023-24 Admitted Batch)

23BSC11 INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5

Credits:4

Unit1: 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

Unit4: 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, non-covalent– Vander Waals, hydrophobic, hydrogen bonds.
- 5.4 Green chemistry

References

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



I Semester Syllabus
BIOCHEMISTRY
(w.e.f. 2023-24 Admitted Batch)
23BSC12 INTRODUCTION TO APPLIED BIOLOGY

Hours/Week: 5

Credits:4

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– Immuno blotting 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. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E. C. S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th 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. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st 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. 5th Edition. Oxford publishers.
10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.



II Semester Syllabus
BIOCHEMISTRY HONOURS (23BC21 MAJOR/MINOR)
(w.e.f. 2023-24 Admitted Batch)
BIOMOLECULES

Hours/week-3

Credits-3

UNIT-I

Fundamentals of Biochemistry: History, scope and avenues of Biochemistry. Water as a biological solvent. Measurement of PH, Buffers, Biological relevance of Buffers. Outlines of surface tension, adsorption and osmosis and their biological relevance.

UNIT-II

Carbohydrates: Classification, monosaccharides, D and L designation, open chain and cyclic structures, epimers and anomers, mutarotation. Reactions of carbohydrates (due to functional groups - hydroxyl, aldehyde and ketone. Amino sugars, Glycosides. Structure and biological importance of disaccharides (sucrose, lactose, maltose, isomaltose, trehalose), trisaccharides (raffinose, melezitose). Structural polysaccharides (cellulose, chitin, pectin) and storage polysaccharides (starch, inulin, glycogen). Glycosaminoglycans.

Additional Inputs:- Glycoproteins & Glycolipids

UNIT- III

Lipids Classification, saturated and unsaturated fatty acids, structure and properties of fats and oils (acid, saponification and iodine values, rancidity). General properties and structures of phospholipids. Prostaglandins-structure, types and biological role. Lipoproteins-types and functions

UNIT-IV

Amino Acids and Proteins Classification, structure, stereochemistry, chemical reactions of amino acids due to carbonyl and amino groups. 2. Titration curve of glycine and pK values. Essential and non essential aminoacids, non-protein aminoacids.3.Peptide bond –nature and conformation. Naturally occurring peptides - glutathione, enkephalin. 4. Proteins: Classification based on solubility, shape, and function. Determination of amino acid composition of proteins. 5. General properties of proteins, denaturation, and renaturation of proteins. 6. Structural organization of proteins- primary, secondary, tertiary, and quaternary structures (Eg. Hemoglobin and Myoglobin).

UNIT-V

Nucleicacids and porphyrins, Types of RNA and DNA. Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphor diester linkages.2.Effect of acids, alkali and nucleases on DNA and RNA. 3. Structure of Nucleic acids- Watson-Crick DNA double helix structure, denaturation and renaturation of nucleic acids, Tm-values and their significance, cot curves and their significance. 4. Structure and properties of porphyrins: Heme, cytochromes and chlorophylls.

Additional Inputs:- Chemistry and types porphyrins

S.V.K.P& Dr K.S.RAJU ARTS & SCIENCE COLLEGE (A), PENUGONDA
II Semester Syllabus (w.e.f. 20203-24 Admitted Batch)
BIOCHEMISTRY
PRACTICAL SYLLABUS

Hours/week-2

Credits-1

1. Preparation of buffers (acidic, neutral, and alkaline) and determination of pH.
2. Qualitative identification of carbohydrates- glucose, fructose, ribose/xylose, maltose, sucrose, lactose, starch/glycogen.
3. Qualitative identification of aminoacids- histidine, tyrosine, tryptophan, cysteine, arginine.
4. Qualitative identification of lipids- solubility, saponification, acrolein test, Salkowski test, Lieberman-Burchard test.
5. Preparation of Osazones and their identification
6. Estimation of proteins in biological samples:
 - a. Biuret method.
 - b. Folin-Lowry method.
 - c. UV method.
 - d. Bradford's dye binding method
7. Estimation of amino acid by Ninhydrin method.
8. Estimation of tyrosine by Million's-reaction

Recommended Books

1. Fundamentals of Biochemistry–Jain,J.L., Jain,S.,Jain, N.S. Chand & Co.
2. Biochemistry–Satyanarayana.U and Chakrapani.U,Books & Allied Pvt.Lt
- 3.Nelson.D.L.andCox.M..M-Lehninger's Principles of Biochemistry-Freeman&Co.- 7th Edition



II Semester Syllabus

BIOCHEMISTRY

(w.e.f. 2023-24 Admitted Batch)

23BC22 CELL BIOLOGY

UNIT-I

Prokaryotic and Eukaryotic cells: Cell organelles Structure, Composition and functions of nucleus, mitochondria plastids, endoplasmic reticulum, Golgi, lysosomes, vacuole, micro bodies, ribosomes, cytoskeleton.

UNIT-II

Cell division: mitosis, meiosis, cell cycle and its regulation, different phases of cell cycle. Apoptosis, Regulation of cell cycle, Cyclins, MPF, Cyclin dependent kinases, Growthfactors, Nuclear Laminins, inhibition of cell cycle progression, MPF and progression to Metaphase, Proteolysis and MPF, Regulation of MPF activity. Check points in cell cycle regulation.

UNIT-III

Cell communication: general principles of cell communication, cell adhesion and roles of different adhesion molecules, cell junction/gap junctions, extracellular matrix, integrins. Signal transduction: Cell surface receptor, G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signalling pathways, bacterial and plant two component systems, bacterial chemotaxis, and quorum sensing.

UNIT-IV

Protein Sorting and Targeting: Overall pathway of synthesis of nuclear coded, secretory, lysosomal and membrane proteins. Import across ER – Signal hypothesis, post translational modifications of secretory/membrane proteins in ER, sorting of lysosomal proteins, Mannose - 6 - Phosphate receptors, synthesis, trafficking, and localization of mitochondrial proteins. Protein traffic into and out of nucleus.

UNIT-V

Bio membranes: Chemical composition of Membranes, Composition of plasma and organelle membranes of animal and plant cells. Lipids, proteins, and Carbohydrates of membranes Distribution of membrane lipids. Assembly of membrane components. Molecular structure of membranes: Miscelle, and liposomes, biological membrane; Symmetry of the membrane; Membrane fluidity; fluid mosaic model of biological membranes. Nanomaterials and their applications.

Membrane Transport: Donnan membrane equilibrium, Diffusion across cellular membranes Mediated transport; Energetics of transport systems; Passive transport anion exchange proteins; Active transport; Active transport of Na^+ K^+ (Sodium potassium ATPase) Ca^{2+} (Ca^{2+} -ATPase). Active transport of sugars coupled to Phosphorylation; group translocation (Y-Glutamyl cycle). Proton motive force in bacterial transport processes. Ionophores Gap junctions; Endocytosis, Exocytosis. Nature of receptors.

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II Semester Syllabus (w.e.f. 20203-24 Admitted Batch)
23BC22P BIOCHEMISTRY
PRACTICAL SYLLABUS

Hours/week-2

Credits-1

1. Estimation of Chlorophyll
2. Isolation of chloroplast
3. Isolation of mitochondria from the liver
4. Mitosis experiment
5. Meiosis experiment
6. Nuclei staining by DAPI /PI
7. Apoptosis-DNA Ladder Pattern, Annexin V staining
8. Low cytometric analysis

Recommended Books

1. Goldman, Emanuel, and Lorrence H.Green, eds. Practical hand book of microbiology. CRC Press, 2015.
2. Dubey,R.C.,andD.K.Maheshwari.Practicalmicrobiology.S.Chand,2002.
3. Microbiology: A laboratory manual by Cappuccino and Sherman, Pearson Education, 6th

**III Semester Syllabus (w.e.f. 2020-21 Admitted Batch)****B.Sc. BIOCHEMISTRY****20BC3 - ENZYMOLOGY, BIOENERGETICS AND INTERMEDIARY METABOLISM****UNIT I****12 hours**

Enzymology: Introduction to Biocatalysis, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Active site, Enzyme specificity. Principles of energy of activation, transition state. Interaction between enzyme and substrate-lock and key, induced fit models. Fundamentals of enzyme assay, enzyme units. Outlines of mechanism of enzyme action, factors affecting enzyme activity. Commercial application of enzymes.

UNITII:**12 hours**

Bioenergetics and Biological oxidation: Bioenergetics: Thermodynamic principles – Chemical equilibria; free energy, enthalpy (H), entropy (S). Free energy change in biological transformations in living systems; High energy compounds. Energy, change, oxidation-reduction reactions. Organization of electron carriers and enzymes in mitochondria. Classes of electron-transferring enzymes, inhibitors of electron transport. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation. Mechanism of oxidative phosphorylation.

UNITIII:**12 hours**

Carbohydrate Metabolism: Concept of anabolism and catabolism. Glycolytic pathway, energy yield. Fate of pyruvate-formation of lactate and ethanol, Citric acid cycle, regulation, energy yield, amphipathic role. Anaplerotic reactions. Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis. Photosynthesis- Light and Dark reactions, Calvin cycle, C4 Pathway. Disorders of carbohydrate metabolism- Diabetes Mellitus.

UNITIV:**12 hours**

Lipid Metabolism: Catabolism of fatty acids (β - oxidation) with even and odd number of carbon atoms, Ketogenesis, de novo synthesis of fatty acids, elongation of fatty acids in mitochondria and microsomes, Biosynthesis and degradation of triacylglycerol and lecithin. Biosynthesis of cholesterol. Disorders of lipid metabolism.

UNITV:**12 hours**

Metabolism of Amino acids: General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle and regulation, Catabolism of carbon skeleton of amino acids- glycolytic and ketogenic amino acids. Metabolism of glycine, serine, aspartic acid, methionine, phenylalanine and leucine. Biosynthesis of creatine. Inborn errors of aromatic and branched chain amino acid metabolism.

RECOMMENDED BOOKS:

1. Understanding enzymes: Palmer T., Ellis Harwood ltd.,2001.
2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co.1997
3. Principles of enzymology for food sciences: Whitaker Marc Dekker1972.
4. Principles of Biochemistry, White. A, Handler, P and Smith.
5. Biochemistry, Lehninger A.L.
6. Biochemistry, Lubert Stryer.
7. Review of physiological chemistry, Harold A.Harper.
8. Text of Biochemistry, West and Todd.
9. Metabolic pathways –Greenberg.
10. Mitochondria,Munn.
11. Biochemistry, 2nd Edition, G.Zubay.



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PENUGONDA-534 320, West Godavari District., (A.P.)

III Semester Syllabus
(w.e.f. 2020-21 Admitted Batch)

B.Sc. BIOCHEMISTRY

20BC3P - ENZYMOLOGY, BIOENERGETICS AND INTERMEDIARY METABOLISM

Details of Lab/Practical/Experiments/Tutorials syllabus:

List of practical 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 glucose by DNS method.
6. Estimation of glucose by Benedict's titrimetric method.
7. Estimation of total carbohydrates by Anthrone method.
8. Tests for lipids- Salkowski test, Lieberman-Burchard test.
9. Estimation of amino acid by Ninhydrin method.
10. Estimation of protein by Biuret method.



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IV Semester Syllabus (w.e.f. 2020-21 Admitted Batch)

B.Sc. BIOCHEMISTRY

20BC4A- PHYSIOLOGY, NUTRITIONAL AND CLINICAL BIOCHEMISTRY

UNIT I: 12hours

Digestion and Blood: Digestion and absorption of carbohydrates, lipids and proteins. Role of enzymes and gastrointestinal hormones in digestion. Composition of blood, Blood groups, coagulation of blood and disorders of blood coagulation (haemophilia). Hemoglobin and transport of gases in blood (oxygen and CO₂). Types of anemias, haemoglobinopathies-sickle cell anemia.

UNIT II: 12hours

Nervous system and excretory system: Introduction to nervous system, general organization of nervous system, Neurons-structure, types, properties and functions; Neurotransmitters, Cerebrospinal fluid-composition and functions, Reflex-types and properties. Introduction to excretory system. Organization of kidney, Structure and functions of nephron, Urine formation, Role of kidneys in maintaining acid-base and electrolyte balance in the body.

Unit III: 12 hours

Endocrinology: Endocrinology- organization of endocrine system. Classification of hormones. Outlines of chemistry, physiological role and disorders of hormones of thyroid, parathyroid, pituitary and hypothalamus. Introduction of gastrointestinal hormones. Mechanism of hormonal action- signal transduction pathways for glucocorticoids and insulin. Adrenalin, estrogen and progesterone.

UNIT IV: 12hours

Nutritional Biochemistry: Balanced diet. Calorific values of foods and their determination by bomb calorimeter. BMR and factors affecting it. Specific dynamic action of foods. Energy requirements and recommended dietary allowance (RDA) for children, adults, pregnant and lactating women. Sources of complete and incomplete proteins. Biological value of proteins. Malnutrition- Kwashiorkor, Marasmus and PEM. Vitamins-sources, structure, biochemical roles, deficiency disorders of water and fat soluble vitamins. Introduction to nutraceutical and functional foods. Bulk and trace elements-Ca, Mg, Fe, I, Cu, Mo, Zn, Se and F.

UNIT V: 12hours

Clinical Biochemistry: Plasma proteins in health and disease. Liver diseases-jaundice. Liver function tests-conjugated and total bilirubin in serum, albumin: globulin ratio, Serum enzymes in liver diseases-SGOT, SGPT, GGT, CPK, Acid and alkaline phosphatases. Serum lipids and lipoproteins. Normal and abnormal constituents of urine. Renal function tests-Blood urea, creatinine, GFR, creatinine clearance. GTT and gastric and pancreatic function tests.

RECOMMENDED BOOKS:

1. Essentials of Food and Nutrition, Vol. I & II, M.S.Swaminathan.
2. Text Book of Biochemistry with clinical correlations. Thomas M. Devlin (JohnWily)
3. Harper's Review of Biochemistry, Murray et al(Longman).
4. Biochemical aspects of human disease – R.S. Elkeles and A.S. Tavit. (Blackwell Scientific Publications).
5. Clinical chemistry in diagnosis and treatment–Joan F.Zilva and P.R.Pannall (Lloyd-Luke Medical Books,1988).
6. Varley's Practical clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London,1988).

S.V.K.P& Dr K.S.RAJU ARTS & SCIENCE COLLEGE (A), PENUGONDA

**IV Semester Syllabus
(w.e.f. 2020-21 Admitted Batch)**

B.Sc. BIOCHEMISTRY

20BC4AP- PHYSIOLOGY, NUTRITIONAL AND CLINICAL BIOCHEMISTRY

List of practical Experiments

1. Estimation of calcium by titrimetry
2. Estimation of iron by Wong's method.
3. Estimation of vitamin C by 2, 6 -dichlorophenol indophenol method. 4.
Determination of iodine value of an oil.
4. Estimation of hemoglobin in blood.
5. Total count - RBC and WBC. Differential count.
6. Determination of blood group and Rhtyping.
7. Visualization of antigen antibody reactions (Ouchterlony technique).
8. Urine analysis for albumin, sugars and ketone bodies.
9. Estimation of urinary creatinine.
10. Estimation of blood Glucose.
11. Estimation of serum total cholesterol.

**Semester – IV****B.Sc. BIOCHEMISTRY****Paper – IVB****20BC4B****MICROBIOLOGY, IMMUNOLOGY AND MOLECULAR BIOLOGY****UNIT I:**

12hours

Microbiology: Introduction to microbiology and microbial diversity. Classification of microorganisms- prokaryotic and eukaryotic microorganisms. Bacterial structure, growth curve and kinetics of growth. Introduction to viruses-plant and animal viruses, structure, life cycle, Food and dairy microbiology. Nitrogen Fixation Nitrogen cycle, Non-biological and biological nitrogen fixation, photosynthetic and non-photosynthetic systems, Nitrogenase system. Utilization of nitrate ion, Ammonia incorporation into organic compounds

UNIT II:

12 hours

Microbial techniques: Preparation of different growth media, isolation and culturing and preservation of microbes, Gram's staining- Gram positive and Gram-negative bacteria, motility and sporulation, Sterilization techniques -Physical methods, chemical methods, radiation methods, ultrasonic and antibiotic resistance.

UNIT III:

12 hours

Applied Biochemistry: Fermentation Technology: Batch, continuous culture techniques, principle, types of fermentors. Pasteur Effect. Industrial production of chemicals- alcohol, acids (citric acid), solvents (acetone), antibiotics (penicillin), Enzyme Technology: Immobilization of enzymes and cells, industrial applications, enzymes in Bioremediation.

UNIT IV:

12hours

Immunology: Organs and cells of immune system. Innate and acquired immunity, Cell mediated and humoral immunity (T-cells and B-cells). Classification of immunoglobulins, structure of IgG. Epitopes / antigenic determinants. Concept of haptens. Adjuvants. Monoclonal antibodies. Antigen- antibody reactions- agglutination, immunoprecipitation, immunodiffusion. Blood group antigens. Immunodiagnosics- ELISA, RIA. Vaccines and their classification. Traditional vaccines-live and attenuated. Modern vaccines-recombinant and peptide vaccines. Outlines of hypersensitivity reactions.

UNIT V:

12 hours

Molecular biology: Types of RNA and DNA, DNA replication-leading and lagging strands, Okazaki fragments, inhibitors of DNA replication. Genetic code, Protein synthesis-transcription, translation, inhibitors of protein synthesis. Outlines of cloning technology, vectors, restriction enzymes, PCR, applications of cloning in agriculture, industry and medical fields.

RECOMMENDED BOOKS:

1. Willey MJ, Sherwood, LM & Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGrawHill.
2. Atlas RM. (1997). Principles of Microbiology. 2nd edition. W. M. T. Brown Publishers.
3. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
4. Fermentation Technology (2nd ed.) Standury (Pergmanpress)
5. Biotechnology: Textbook of Industrial microbiology 2nd Edit. by Crueger and Crueger(2000).
6. Principles of Biochemistry, White. A; Handler P and Smith.
7. Ivan M. Roitt; Essential Immunology (Latest Edition). Blackwell Scientific Publication
8. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition
9. W.H. Freeman and Company, New York.
10. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
11. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson Publication
12. Molecular biology by David Freifelder.

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(w.e.f. 2020-21 Admitted Batch

Semester – IV Paper-V

B.Sc. BIOCHEMISTRY

20BC4BP- MICROBIOLOGY, IMMUNOLOGY AND MOLECULAR BIOLOGY

Details of Lab/Practical/Experiments/Tutorials syllabus:

List of Practical Experiments

1. Biosafety and good laboratory practices (GLP) of Microbiology.
2. Sterilization of microbial media by autoclave.
3. Isolation of pure cultures: (i) Streak plate method. (ii) Serial dilution method.
4. Demonstration of alcohol fermentation.
5. Antibiotic sensitivity by Course disc method.
6. Effect of nitrogen sources on growth of E.coli
7. Immunodiffusion by Ouchterlony method.
8. Blood group analysis.
9. Isolation of DNA from plant tissues.
10. Spotters.

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PENUGONDA-534 320, West Godavari District., (A.P.)

V Semester Syllabus

BIOCHEMISTRY

(w.e.f. 2020-21 Admitted Batch)

20BC5A1 – CLINICAL BIOCHEMISTRY

UNIT – I

Introduction:

Organization of Clinical laboratory. Introduction to instrumentation and automation in Clinical biochemistry laboratories, safety regulations and first aid. General comments on specimen collection, Type of specimen for biochemical analyses. Precision, accuracy, quality control, precautions and limitations.

UNIT – II

Basics of Hepatic and Renal physiology:

Evaluations of biochemical changes in liver and kidney diseases, Liver function tests (LFTs), Renal function tests (RFTs), GFR. Diagnostic biochemical profile.

UNIT – III

Glucose metabolism

Digestion, absorption and assimilation of carbohydrates. Enzymes and hormones (Insulin, Glucagon) in regulation of blood glucose levels. Clinical significance of variations in blood glucose levels, disorders - Diabetes mellitus, Insulin resistance

UNIT – IV

Lipid profile: Lipids, fats, Triglycerides, cholesterol, fatty acids, PUFAS. Digestion and absorption of lipids. Composition and functions of lipoproteins. Clinical significance of elevated lipoproteins.

Exercises

Estimation of triglycerides, cholesterol, LDL, VLDL and HDL cholesterol.

UNIT – V

Cardiovascular diseases: Basic cardiovascular physiology, biochemical symptoms associated with cardiovascular diseases and their evaluation. Involvement of enzymes in diagnosis of heart diseases including Aspartate transaminase, Isoenzymes of creatine kinase and lactate dehydrogenase and troponin.

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
BIOCHEMISTRY

BSc	Semester:V(SkillEnhancementCourse-Elective)	Credits:1
Course:20BC 5A1	Clinical BiochemistryLab	Hrs/Wk:2

1. Collection of blood, separation of plasma, serum and their storage
2. Estimation of bilirubin (direct and indirect method)
3. Estimation of serum transaminases (AST, ALT) and serum alkaline phosphatases (ALP)
4. Quantitative determination of serum urea and creatine
5. Use of urine strips / dip strip method for urine analysis
6. Estimation of blood glucose by glucose oxidase - peroxidase method
7. GTT (Glucose Tolerance Test)
8. Estimation of cholesterol
9. Estimation of creatine kinase (CK)
10. Estimation of LD

SUGGESTED READING

1. Medical laboratory technology a procedure manual for routine diagnostic tests. Volume 1, Mukherjee, K.L., Tata Mc Graw hill publishing Company Limited, (New Delhi). ISBN 9780070076594/ISBN-978007007663
2. Medical laboratory technology a procedure manual for routine diagnostic tests. Volume 2, Mukherjee, K.L., Tata Mc Graw hill publishing Company Limited, (New Delhi). ISBN 9780070076648
3. Medical Biochemistry 2005, 2 nd Edition, Bayner, J.W, and Dominiazak, M.H, Elsevier, Mosby Ltd (Philadelphia). ISBN-0/7234/3341/0
4. Experimental Biochemistry, A student companion (2005), Rao, B.S, and Deshpande, V., IK international Pvt.Ltd(NewDelhi) ISBN-8188237/41
5. Clinical diagnosis and management by Lab methods (John Bernard Henry, W.B. Salunders Company, 1984).
6. Clinical Biochemistry – S. Ramakrishnan and Rajiswami.



V Semester Syllabus

BIOCHEMISTRY

(w.e.f. 2020-21 Admitted Batch)

20BC5A2- HAEMATOLOGICAL AND IMMUNOLOGICAL TECHNIQUES

UNIT - I

Introduction

Organization of Clinical Immunology laboratory. Introduction and maintenance of clinical Immunology laboratory; hazards in clinical laboratory; units; 'normal range', reference values. Factors affecting reference values quality control in laboratory – use of external and internal standards; use of WHO standards.

UNIT - II

Composition of blood and Lymph

Plasma and cells-RBC, WBC, platelets, blood clotting, plasma proteins, separation and applications, plasma therapy. Lymph.

UNIT - III

Advanced diagnostic methods

Identification of viral, bacterial and other diseases - ELISA, Western blot, RT-PCR, Tissue Histopathology, fixing, staining (H&E) and microtome sections

UNIT - IV

Auto immunity

Introduction, Auto recognition, classes of auto immuno diseases. (Hashimoto disease, thyrotoxicosis, Systemic lupus erythematosus, Autoimmune haemolyticanaemia, Rheumatoid arthritis).

UNIT – V

Immunoglobulins (Igs) ,Types of Igs, nature and structure of Igs –Light chain, heavy chain and functions.

Adjuvants, Antibody production,enzymaticcleavageofIgs,Haptens.

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
BIOCHEMISTRY

BSc	Semester:V(SkillEnhancementCourse-Elective)	Credits:1
Course:20BC5A2	Haematological and Immunological Techniques Lab	Hrs/Wk:2

1. Determination of human blood groups
2. Differential Leucocyte count in human peripheral blood by Leishmans staining
3. Separation of mononuclear cells from human peripheral blood
4. Determination of Erythrocyte Sedimentation Rate (ESR)
5. Determination of Packed Cell Volume (PCV)
6. Estimation of Haemoglobin (Hb) by Sahlis acid hematin method
7. Detection of HCG by latex agglutination inhibition test
8. Widal test
9. Ouchterlony double immuno diffusion
10. Single Radial Immunodiffusion

REFERENCE BOOKS

1. Essential Immunology - By I. Roitt, Publ: Blackwell
2. Immunology - By G. Reeve& I. Todd, Publ: Blackwell
3. Abbas AK, Lichtman AH, Pillai S. Cellular and Molecular Immunology. Saunders Publication, Philadelphia
4. Golds by RA, Kindt TJ, Osborne BA. Kuby's Immunology. W.H. Freeman and Company, New York
5. Ronald Hoffman, Edward J. Benz Jr., Leslie E. Silberstein, Helen Heslop, Jeffrey Weitz, John Anastasi - Hematology: Basic Principles and Practice, Elsevier Health Sciences, 201



V Semester Syllabus

BIOCHEMISTRY

(w.e.f. 2020-21 Admitted Batch)

20BC5B1-FOOD TECHNOLOGY

UNIT-I

Food Regulations and Standards

Sampling methods - Sample preparation for analysis; Statistical evaluation of analytical data - Official Methods of Food Analysis. Moisture in foods - determination by different methods - ash content of foods, wet, dry ashing, microwave ashing methods; Significance of Sulphated Ash, water soluble ash and acid insoluble ash in foods determination of dietary fibre and crude fibre.

UNIT-II

Analysis of major food components

Determination of total fats in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants; different methods of determination of protein and amino acids in foods; determination of total carbohydrates, starch, disaccharides and simple sugars in foods

UNIT-III

Processing and preservation of foods

Blanching, pasteurization, sterilization, microwave heating. Low Temperature-refrigeration, freezing, dehydro-freezing. Food irradiation. Processing and preservation by drying, concentration and evaporation. Non-thermal methods like High pressure, pulsed electric field, hurdle technology. Use and application of enzymes and microorganisms in processing and preservation of foods.

UNIT-IV

Environmental contaminants and drug residues in food:

Fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs (e.g. Malachite green in fish and β -agonists in pork); other contaminants in food, radioactive contamination of food, Food adulteration and potential toxicity of food adulterants. Endocrine disrupters in food.

UNIT-V

Fermentative food Products

Foods: Processes for preparing fermented products including Yogurt (curd) and other Traditional Indian Products like idli, dosa, dhokla, shrikhand, Soya based products like soya sauce, natto, Cheese.; Alcoholic Beverages based on fruit juices (wines), cereals (whisky, beer, vodka.), sugar cane (rum) Process description, quality of raw materials, fermentation process controls.

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BIOCHEMISTRY

BSc	Semester: V (Skill Enhancement Course-Elective)	Credits:1
Course:6B	Food Technology Lab	Hrs/Wk:2

1. Titratable Acidity in foods.
2. Determination of proteins, fats and carbohydrates
3. Methods for Processing and preservation of foods
4. Determination of Glucose content by enzymatic method (amylase, invertase)
5. Qualitative detection of adulterants in foods
6. Wine preparation from fruit juices and molasses
7. identification of microbial strains in yogurt
8. MBRT of milk

Reference Books

1. A first course in food analysis By A. Y. Sathe.
2. Hand book of analysis and quality control for fruit & vegetable products By S. Ranganathan.
3. Handling and storage of food grains by S. V. Pingale.
4. Food science chemistry & experimental food By Dr. M. Swaminathan.
5. Food chemistry by William Hogland Meyer.
6. Food adulteration By Thankamma Jacob.
7. Food Microbiology by William C. Frazier.
8. Preservation of Fruits and Vegetables Giridharilal.



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BIOCHEMISTRY
(w.e.f. 2020-21 Admitted Batch)
7B- FOOD MICROBIOLOGY

UNIT I

History and development of Microbiology-Importance and significance of microorganisms in food science. Bacterial growth curves, Factors affecting the growth of microorganisms in food – Intrinsic and Extrinsic parameters

UNIT II

Determination of microorganisms and their products in food: Sampling, sample collection, transport and storage, sample preparation for analysis. Microscopic and culture dependent methods- Direct microscopic observation, culture, enumeration and isolation methods; Chemical and Physical Methods-Chemical, immunological and nucleic acid-based methods;

UNIT III

Protection and preservation of Foods:

Chemical, Modified atmosphere, Radiation in foods from the microbiological angle. Indicators of water and food safety and quality: Microbiological criteria of foods and their Significance.

UNIT IV

Food spoilage: characteristic features, dynamics and significance of spoilage of different groups of foods - Cereal and cereal products, vegetables and fruits, meat poultry and sea foods, milk and milk products, packed and canned foods.

UNIT V

Food borne diseases: *Bacterial borne diseases* (Staphylococcal intoxication, Botulism, Salmonellosis, Shigellosis, Enteropathogenic *Escherichia Coli Diarrhoea*, *Clostridium Perfringens* gastroenteritis, *Bacillus cereus Gastroenteritis*). *Mycotoxins:* Aflatoxicosis, Deoxynivalenol Mycotoxicosis, Ergotism. Drug resistance - phenomena and mechanism.

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BIOCHEMISTRY

BSc	Semester: V(Skill Enhancement Course-Elective)	Credits:1
Course:7B	Food Microbiology Lab	Hrs/Wk:2

1. Preparation of common laboratory media and special media.
2. Bacterial count by standard plate method (SPC)
3. Isolation and Identification of bacteria
4. Gram's staining
5. acid-fast staining
6. Microbiological analysis of typical processed foods
7. Coli form test
8. Microbiological analysis of food born bacterial pathogens

Text books and reference materials

1. Prescott LM Harley JP and Klein DA (2006). Microbiology (7th edition) McGraw Hill, Newyork.
2. Frazier, W.C. (1988) Food Microbiology, Mc Graw Hill Inc. 4th Edition.
3. Vijaya Ramesh,K. (2007) Food Microbiology. MJP publishers, 2007
4. Yasmine Motarjemi and Martin Adams. (2006) Emerging Food borne pathogen- Wood Head Publishing England.
5. Arun, K Bhunia. (2008) Food borne microbial pathogens: Mechanisms and pathogenesis. Springer.
6. Thomas J. Montville, Karl R. Matthews, Kalmia E. Knierl (2012). Food Microbiology: An Introduction, American Society for Microbiology.
7. Dubey, R.C. and Maheswari, D.K. (2008) Text book of Microbiology. S Chand Publishing.



V Semester Syllabus

BIOCHEMISTRY

(w.e.f. 2020-21 Admitted Batch)

6C-GENETIC ENGINEERING

UNIT -I

Basics of Genetic engineering

Introduction, historical perspective, basics of cloning, Vectors, Restriction enzymes, plasmids PBR 322, PUC vector, Cosmids, YACs, cDNA libraries.

UNIT -II

Genetic Engineering in Animals

Gene transfer methods in Animals. Transfection. Microinjection, Embryonic-stem cells Gene transfer and Retrovirus Gene transfer methods to create transgenic animals. Applications of transgenic animals in agriculture, medicine and pharmaceuticals.

UNIT -III

Genetic engineering in Plants

Manipulation of Plant Genes-Electroporation, Shotgun method, *Agrobacterium* mediated gene transfer. Applications in Crop improvement, disease and pest resistance, tolerance to environmental stress. Genetically engineered foods.

UNIT- IV

Genetic engineering in Microorganisms

Gene transfer methods in microorganisms - transformation, transduction and conjugation. Transposons.

UNIT- V

Genetic engineering-Environment

Bioremediation Biodegradation, Biofuels and Bioplastics from genetically engineered rape oil seed and other

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BIOCHEMISTRY

BSc	Semester: V(Skill Enhancement Course-Elective)	Credits:4
Course:6C	Genetic Engineering Lab	Hrs/Wk:4

1. PCR
2. Restriction mapping
3. CaCl₂ mediated transfection
4. Restriction Fragment Length Polymorphism (RFLP)
5. Random Amplified Polymorphic DNA (RAPD)
6. Plasmid isolation from E. coli

Suggested books

1. Genes and Probes, A Practical Approach Series (1995) by Hames and SJ Higgins; Oxford
2. Gel Electrophoresis of Nucleic Acids, A practical Approach (1990) by D Rickwood and BD Hames. Oxford Univ. Press.
3. Genetics by Gardinar
4. Biotechnology by U.Satyanarayana



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BIOCHEMISTRY
(w.e.f. 2020-21 Admitted Batch)
20BC5C2-BIOINFORMATICS

UNIT- I

Scope of Bioinformatics No. of Hours:6

Genomics, structural and functional genomics, genome annotations, gene production approaches and tools. DNA microarray and computational analysis tools. Computer aided drug design and systems biology.

UNIT- II

Biological data bases No. of Hours:6

Introduction to biological databases. Primary, secondary and composite databases, NCBI, EBI, Nucleic acid databases (Gene Bank), EMBL, DDBJ, NDB) protein database, (PIR, Swissport, TrEMDL, PDB) Metabolic databases (KEGG, EcoCyc).

UNIT -III

Sequence Alignments:

Similarity, identities and homology. Concept of alignment pairwise sequence alignment, gaps, gap-penalties, scoring matrices, PAM 250, BLOSUM62, Local and Global Sequence alignment, multiple sequence alignment, progressive alignment, Logarithm alignment. Application of multiple sequence alignment- CLUSTAL W, BLAST-blastn, blastp and blastx

UNIT- IV

Genome projects

General introduction to genome projects (rice and *Mycobacterium tuberculosis* genome project). Special emphasis on Human Genome Project (HGP). Science behind HGP, benefits of HGP, genetic testing standard, quality and commercialization.

UNIT- V

Proteomics

Introduction, principle, technique of swiss- 2D PAGE data base. Gel analysis, post gel analysis, MALDITOF. Significance and application of proteomics in modern biology

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
BIOCHEMISTRY

BSc	Semester:V (Skill Enhancement Course-Elective)	Credits:1
Course:7C	Bioinformatics Lab	Hrs/Wk:2

1. Searching data from Biological data bases
2. Demonstration on Nucleic acid and protein databases
3. Simple and multiple Sequence alignment
4. Searching structural data from PDB
5. Database search using BLAST
6. SDS-PAGE
7. IEF (2-D gel analysis)
8. Demonstration of MALDI -TOF

Suggested books

1. Genome Mapping: A practical approach. Dear P (Editor). 1st Ed. 2000. Oxford University.
2. Developing Bioinformatics Skills. Alfonso Valencia and Blaschke. L (2005) Oreilles
3. Bioinformatics sequence, structure and data banks ed. By Des Higgins Willie Taylor (2006).
4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins" (Andreas D. Baxevanis, B. F. Ouellette), Paperback, 2nd ed., 470 pp., ISBN: 0471383910, Publisher: Wiley, John & Sons, Inc.Pub.
5. David W. Mount, Bioinformatics: Sequence and Genome Analysis, 2nd edition, Cold Spring Harbor Laboratory, 2004.
6. Introduction to Bioinformatics by T.K. Altwood and D.J Parry-Smith (Pearson Education Asia1999).