

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

Recognized by UGC as “College with Potential for Excellence”

(Affiliated to ADIKAVI NANNAYA UNIVERSITY)



B.Sc.,BIOCHEMISTRY

SYLLABUS

2019-2020



I Semester Syllabus (w.e.f. 2019-20 Admitted Batch)

BIOCHEMISTRY

19BC1: BIOMOLECULES

Unit – I: Biophysical Concepts 12 hours

Water as a biological solvent and its role in biological processes. Biological relevance of pH, measurement of pH, pKa values, Biopolymers such as proteins and nucleic acids. Importance of buffers in biological systems, ion selective electrodes, and oxygen electrode. Donnan membrane equilibrium. Significance of osmotic pressure in biological systems,

Unit – II: Carbohydrates 12 hours

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, Bacterial cell wall polysaccharides. Outlines of glycoproteins, glycolipids and blood group substances.

Unit – III: Lipids 12 hours

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, sphingolipids and cholesterol and lipoproteins.

Biomembranes: Behavior of amphipathic lipids in water- formation of micelles, bilayers, vesicles, liposomes. Membrane composition and organization – Fluid mosaic model, transportation of ions (Active and passive transport).

Unit-IV: Amino Acids and Peptides 12 hours

Amino Acids: Classification, structure, stereochemistry, chemical reactions of amino acids due to carbonyl and amino groups. Titration curve of glycine and pK values. Essential and non-essential amino acids, non-protein amino acids. Peptide bond - nature and conformation. Naturally occurring peptides – glutathione, enkephalin.

Unit-V: Proteins 12 hours

Proteins: Classification based on solubility, shape and function. Determination of amino acid composition of proteins. General properties of proteins, denaturation and renaturation of proteins. Structural organization of proteins- primary, secondary, tertiary and quaternary structures (Eg. Hemoglobin and Myoglobin), forces stabilizing the structure of protein.

Practical : 19BC1P: Qualitative Analysis

List of Experiments:

1. Preparation of buffers (acidic, neutral and alkaline) and determination of pH.
2. Titration curve of glycine and determination of pK and pI values.
3. Qualitative identification of carbohydrates- glucose, fructose, ribose, maltose, sucrose, lactose, starch/glycogen.
4. Preparation of Osazones and their identification.
5. Qualitative identification of amino acids – Alanine, histidine, tyrosine, cysteine, glutamic acid.
6. Qualitative identification of lipids- solubility, saponification, acrolein test, Salkowski test,

**II SEMESTER (w.e.f. 2019-20 Admitted Batch)****B.Sc. BIO-CHEMISTRY****60 hrs****(5 periods/week)****19BC2-Nucleic acids and Biochemical Techniques****Unit-I : Nucleic Acids 12 hours**

Nature of nucleic acids. Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. Effect of acids, alkali and nucleases on DNA and RNA. Structure of Nucleic acids- Watson-Crick DNA double helix structure, introduction to circular DNA, super coiling, helix to random coil transition, denaturation of nucleic acids, hyperchromic effect, T_m -values and their significance. Reassociation kinetics, cot curves and their significance. Types of RNA and DNA.

Unit-II: Porphyrins 9 hours

Structure and types of porphyrins; Protoporphyrin, porphobilinogen properties Structure, properties & biological importance of metalloporphyrins – Heme, cytochromes and chlorophylls.

Unit-III: Biochemical Techniques I 15 hours

Methods of tissue homogenization: (Potter-Elvehjem, mechanical blender, sonicator and enzymatic). Principle and applications of centrifugation techniques- differential, densitygradient. Ultracentrifugation- preparative and analytical. Principle and applications of chromatographic techniques- paper, thin layer, gel filtration, ionexchangeand affinity chromatography.

Unit-IV: Biochemical Techniques II

Electrophoresis- principles and applications of paper, agarose gel electrophoresis and polyacrylamide (native and SDS) Elementary treatment of an enzyme purification. Tracertechniques: Introduction to Radio activity Radio isotopes, units of radio activity, half life, β and γ - emitters, use of radioactive isotopes in biology

Unit-V: Biochemical Techniques III 12 hours

Spectrophotometry: Laws of light absorption- Beer-Lambert law, Instrumentation of UV and visible spectrophotometry and its Applications. Colorimetry: Principles and its applications, Principle of fluorimetry

Practical 19BC2P- : Nucleic acids and Biochemical Techniques**List of Experiments:**

1. Isolation of DNA from plants
2. Qualitative Identification of DNA, RNA and Nitrogen Bases
3. Isolation of egg albumin from egg white.
4. Isolation of cholesterol from egg yolk.
5. Isolation of starch from potatoes.
6. Isolation of casein from milk.
7. Separation of amino acids by paper chromatography.
8. Determination of exchange capacity of resin by titrimetry (Record with Demo)
9. Separation of proteins by Agarose electrophoresis.
10. Separation of plant pigments by TLC.



III Semester Syllabus (w.e.f. 2019-20 Admitted Batch)

B.Sc. BIOCHEMISTRY

19BC3- Enzymology and Bioenergetics

Unit-I: Classification of Enzymes and Structure

Introduction to biocatalysis, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Enzyme specificity. Active site. Principles of energy of activation, transition state. Interaction between enzyme and substrate- lock and key, induced fit models. Definition of holoenzyme, apo-enzyme, coenzyme, cofactor. Fundamentals of enzyme assay, enzyme units.

Unit II: Influence of Physical factors and Inhibitors on Enzyme activity.

Factors affecting the catalysis- substrate concentration, pH, temperature. Michaelis - Menten equation for uni-substrate reaction (derivation not necessary), significance of K_M and V_{max} . Enzyme inhibition-irreversible and reversible, types of reversible inhibitions- competitive and non-competitive.

Unit-III: Mechanism of enzyme action

Outline of mechanism of enzyme action - acid-base catalysis, covalent catalysis, electrostatic catalysis, and metal ion catalysis. Regulation of enzyme activity- allosterism and cooperativity, ATCase as an allosteric enzyme, covalent modulation - covalent phosphorylation of phosphorylase, zymogen activation - activation of trypsinogen and chymotrypsinogen. Isoenzymes (LDH). Multienzyme complexes (PDH). Ribozyme.

Unit- IV: Bioenergetics

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.

Unit V : Biological Oxidations in Mitochondria

Organization of electron transport chain and enzyme complexes, inhibitors of electron transport. Oxidative phosphorylation. Uncouplers and inhibitors of oxidative phosphorylation.

Mechanism

of oxidative phosphorylation.

SEMESTER-3

Practical paper 19BC3P Enzymology

Minimum of FIVE experiments to be done and recorded

1. Assay of amylase
2. Assay of urease
3. Assay of catalase.
4. Assay of phosphatase
5. Determination of optimum temperature for amylase.
6. Determination of optimum pH for phosphatase.

Reference Books:

1. Fundamentals of Enzymology – Price.N.C.and Stevens.L., Oxford University Press.
2. Understanding Enzymes – Palmer.T., Ellis Harwood.
3. Enzymes – Biochemistry, Biotechnology, Clinical Chemistry – Palmer.T., Affiliated East-West Press.
4. Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M., Freeman & Co.
5. Biochemistry – Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.
6. Biochemistry – Voet.D and Voet., J.G., John Wiley & Sons

**IV Semester Syllabus (w.e.f. 2019-20 Admitted Batch)****B.Sc. BIOCHEMISTRY****19BC4- Intermediary Metabolism****Unit- I : Carbohydrate Metabolism**

Concept of anabolism and catabolism. Glycolytic pathway, energy yield.

Fate of pyruvate formation of lactate and ethanol, Pasteur effect. 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.

Unit- II : 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 triacyl glycerol and lecithin. Biosynthesis of cholesterol.

Unit- III: 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.

Unit- IV: Metabolism of Nucleic acid, heme

Biosynthesis and regulation of purine and pyrimidine nucleotides, de novo and salvage pathways.

Catabolism of purines and pyrimidines. Biosynthesis of deoxyribonucleotides- ribonucleotide reductase and thymidylate synthase and their significance. Biosynthesis and degradation of heme.

Unit- V : Integration and Inborn Errors of Metabolism

Out lines of Metabolism, Integration of Major organs in metabolic pathway of carbohydrate, lipid. Protein metabolisms, Starvation. Disorders of carbohydrate Metabolism : hypoglycemia, hyperglycemia, glycosuria, renal threshold value. *Diabetes mellitus*-classification, glucose tolerance test (GTT), diabetic ketoacidosis. Disorders of Amino acid metabolism:

Phenylketonuria, Alkaptonuria, Albinism, Maple syrup urine disease (MSUD).

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

Disorders of Lipid Metabolism: lipoproteinemias, hypercholesterolemia, atherosclerosis

Reference Books:

1. Lehninger's Principles of Biochemistry – Nelson.D.L. and Cox.M.M.,Freeman & Co.
2. Biochemistry – Berg.J.M., Tymoczko.J.L. and Stryer.L., Freeman & Co.
3. Biochemistry – Voet.D and Voet., J.G., John Wiley & Sons
4. Biochemistry-Lippincott's Illustrated Reviews. Champe, P.C. and Harvey, R.A. Lippincott
5. Fundamentals of Biochemistry –Jain, J.L., Jain, S., Jain, N. S. Chand & Co.
6. Biochemistry – Satyanarayana. U and Chakrapani. U, Books & Allied Pvt.Ltd.
7. Biochemistry – Rama Rao. A and Ratna Kumari. D, Kalyani Publishers.
8. Harpers -Biochemistry
9. Strayer – Biochemistry

Practical paper 19BC4P - Quantitative Analysis
Minimum of FIVE experiments to be done and recorded

1. Estimation of amino acid by Ninhydrin method.
2. Estimation of protein by Biuret method.
3. Estimation of protein by Lowry method.
4. Estimation of glucose by DNS method.
5. Estimation of glucose by Benedict's titrimetric method.
6. Estimation of total carbohydrates by Anthrone method.

**Semester-V : BIO-CHEMISTRY PAPER -V****Theory: BCT-501-Physiology, Clinical Biochemistry and Immunology 60 hrs****(5periods/12 hours week)****Unit- I : Physiology**

Digestion and absorption of carbohydrates, lipids and proteins. Composition of blood and coagulation of blood. Transport of gases in blood (oxygen and CO₂). Muscle: Structure of myofibril and mechanism of muscle contraction.

Unit II: Endocrinology**12 hours**

Endocrinology- organization of endocrine system. Classification of hormones. Outlines of chemistry, physiological role and disorders of hormones of hypothalamus, pituitary, thyroid, parathyroid, adrenal gland, pancreatic hormones and gonads. . Introduction of hormones of gastrointestinal tract and placenta.

Unit- III : Nutritional Biochemistry**12 hours**

Classification of Nutrients, calorific values of foods and their determination by bomb calorimeter. BMR and factors affecting it. Significance of BMR. Specific dynamic action of foods[SDA]. Energy requirements and recommended dietary allowance (RDA) for pregnant and lactating women. Biological value of proteins. . Sources of complete and incomplete proteins, Bulk and trace elements-Ca, Mg, Fe, I, Cu, Mo, Zn, Se and F.

Unit- IV : Clinical Biochemistry**12 hours**

Disorders of blood coagulation (haemophilia). Types of anemias, haemoglobinopathies-sickle cell anemia.

Liver : Structure and functions of Liver, jaundice . Liver function tests- conjugated and total bilirubin in serum, albumin: globulin ratio, Hippuric acid , Rose Bengal dye ,Serum enzymes in liver diseases- SGPT, GGT and alkaline phosphatase.

Kidneys-structure of nephron, urine formation, normal and abnormal constituents of urine. Biological buffers. Role of kidneys in maintaining acid-base and electrolyte balance in the body.

Unit- V : Immunology**12 hours**

Organization of immune system. Innate and acquired immunity. Organs and cells of immune system. Cell mediated and humoral immunity . structure of Ig G , Classification of immunoglobulins,. Epitopes / antigenic determinants. Concept of haptens. Adjuvants. Monoclonal antibodies. Antigen-antibody reactions- agglutination, Precipitation immunoprecipitation, immunodiffusion. . Immunodiagnostics- ELISA,RIA. Vaccines and their classification. Traditional vaccines-live and attenuated. Modern vaccines- recombinant and DNA vaccines.

Practical: BCP-501-Nutritional and Clinical Biochemistry

45 hrs

List of Experiments:

(3 periods/week)

1. Estimation of vitamin C by 2, 6 -dichlorophenol indophenol method
2. Estimation of hemoglobin in blood.
3. Total count - RBC and WBC.
4. Differential count Of WBC
5. Determination of blood group and Rh typing. .
6. Urine analysis for albumin, sugars and ketone bodies.
7. Estimation of Serum creatinine.
8. Estimation of blood Glucose Folin-wu method.
9. Estimation of serum total cholesterol.



Semester-V : BIO-CHEMISTRY PAPER -VI

Theory: BCT-601- Molecular Biology and Recombinant DNA technology

Unit- I : DNA Replication and Transcription

12 hours

Nature and structure of the gene. DNA as genetic material . DNA replication- models of replication, Meselson-Stahl's experimental proof for semi-conservative model. DNA polymerases I, II and III of *E.coli*, helicase, topoisomerases, primase, ligase. Mechanism DNA Replication in *E.Coli* . Inhibitors of DNA replication.

Transcription - RNA polymerases of prokaryotes, Mechanism of Transcription -. Initiation- sigma factors and their recognition sites, Promoters,. Elongation, Termination- rho dependent and rho independent. Inhibitors of Transcription .

Unit- II: Protein Synthesis and Regulation of Gene Expression

12 hours

Genetic code : features of genetic code, wobble hypothesis, degeneracy of genetic code.

Protein synthesis- Ribosome structure, t-RNA , activation of amino acids (aminoacyl t-RNA synthetases). Initiation, elongation and termination of protein synthesis.

Post- translational modifications, signal hypothesis. Inhibitors of protein synthesis.

Regulation of prokaryotic gene expression- induction and repression. Ex: Lac operon in *E.coli*

Unit- III: Recombinant DNA technology

12 hours

Basic steps in r-DNA technology. Tools of r-DNA technology: Enzymes- Restriction endonucleases, ligase, phosphatases, reverse transcriptase, polynucleotide kinases, terminal transferase nucleases- S_1 and RNAase H. Restriction mapping. Cloning vectors- Plasmids, Cosmids, λ phages vectors

Applications of gene cloning- production of insulin and human growth hormone, production of Bt cotton and edible vaccines.

Unit-IV Molecular biology Techniques and Bioinformatics

Construction of c-DNA and genomic libraries. Isolation and sequencing of cloned genes- colony hybridization, nucleic acid hybridization, using β - galactosidases, green fluorescent proteins (GFP) DNA sequencing- Maxam Gilbert and Sanger's methods. Polymerase chain reaction- principle and applications. Outlines of blotting techniques-Southern, Northern and Western.

DNA Fingerprinting .

Introduction to Bioinformatics- definitions of proteomics and genomics. Gene bank, NCBI, DDBJ, Swissprot, PDB. Sequence alignments- BLAST and FASTA.

Unit V-Applied Biochemistry

12 hours

Fermentation Technology: types of fermentations .Batch, continuous culture techniques, design of fermentor, principle types of fermentors. . Industrial production of chemicals- alcohol, acids (citric acid), solvents (acetone), antibiotics (penicillin)

Enzyme Technology: Immobilization of enzymes and cells, different methods. Industrial applications of immobilization

**Practical: BCP-601: Molecular Biology & Recombinant DNA
technology**

45 hrs

List of Experiments:

(3 periods/week)

1. Isolation of DNA from onion/liver/coconut endosperm.
2. Estimation of DNA by diphenylamine method.
3. Estimation of RNA by orcinol method.
4. Sequence alignments of insulin/BSA with other proteins using BLAST and FASTA.
5. Immobilization of microorganisms.
6. Ethyl alcohol production from grapes.

**B.SC .BIOCHEMISTRY SYLLABUS UNDER CBCS****VI th SEMESTER****Elective –A: Basic Microbiology****60 hrs****Unit –I: History of Development of Microbiology****12hrs**

Development of microbiology as a discipline, Spontaneous generation vs. biogenesis.

Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming.

Role of microorganisms in fermentation,

Germ theory of disease

Establishment of fields of medical microbiology and immunology through the work of Paul Ehrlich, Elie

Metchnikoff, Edward Jenner

Unit-II: Diversity of Microbial world**12hrs**

classifications of microorganisms [Whittaker's five kingdoms and Carl Woese's three kingdom]

Difference between prokaryotic and eukaryotic microorganisms.

General characteristics of different groups: a cellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence and mode of reproduction.

Unit-III : Viruses, Bacteria and Protozoa**12hrs**

An introduction to viruses with special reference to the structure and replication of the following: Poxvirus and Poliovirus.

Bacterial Diseases- Cholera and Typhoid.

Viruses: TMV and T₄ .

Protozoan Diseases- Amebiasis and Malaria.

Unit- IV: Algae**12hrs**

History of phycology;

General characteristics of algae: occurrence, thallus organization

Algae cell ultra structure, pigments, flagella, eyespot food reserves

Vegetative, asexual and sexual reproduction.

Applications of Algae in agriculture, industry, environment and food.

Unit- V: Fungi**12hrs**

General characteristics of fungi - habitat, distribution, nutritional requirements,

fungal cell ultra- structure, thallus organization and aggregation, fungal wall structure and synthesis,

Asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism.

Economic Importance of Fungi in Agriculture, environment, Industry, medicine, food, biodeterioration, mycotoxins

(3 per/week) List of Experiments:

1. Microbiology Laboratory Practices and Bio safety.
2. To study the principle and applications of important instruments Autoclave, Incubator, , hot air oven, light microscope, laminar air flow)
3. Preparation and sterilization of culture media for bacterial cultivation
4. Study of different shapes of bacteria, fungi, algae, protozoa using permanent slides/ pictographs
5. Staining of bacteria using Gram stain
6. Isolation of pure cultures of bacteria by streaking method.
7. WIDAL test

SUGGESTED READINGS

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. W M.T.Brown Publishers.
2. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company
3. Prescott, Harley, Klein's Microbiology (2008) 7th Ed., Willey, J.M., Sherwood, L.M., Woolverton, C.J. Mc Graw Hill International Edition (New York) ISBN: 978-007126727.
4. Mandell, Douglas and Bennett.S, Principles and practices of Infectious diseases, 7edition, Volume, 2. Churchill Livingstone Elsevier. \
5. Sherris Medical Microbiology: An Introduction to Infectious Diseases by Kenneth J.Ryan, C. George Ray, Publisher: McGraw-Hill
6. Medical Microbiology by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller, Elsevier Health Sciences



Cluster Elective: VIII-A-I

CLINICAL BIOCHEMISTRY

Hours 60
Marks 100
UNIT – I: Basic Medical Laboratory Principles and Procedures:
10 Hours

Introduction to clinical biochemistry.

Glassware. Solutions and Reagents – Normal, Molar, percent, buffer solutions and indicators.

Equipments and Instruments – Centrifuges, Hot air oven, Incubator, Water bath, Photometer, Spectrophotometer, Analyzers.

Quality Control.

UNIT – II: Clinical Biochemistry of Carbohydrates, Proteins & Lipids: 20 Hours

Elementary classification and metabolism of carbohydrates.

Regulation of blood sugar and Diabetes.

Glucose Tolerance Test, Glycosylated Hemoglobin.

General classification of proteins. Structure of proteins.

Summary of protein digestion and amino acid metabolism.

Determination of plasma proteins and its importance

General lipid metabolism, functions and disorders of plasma lipoproteins

UNIT – III: Clinical Biochemistry of Enzymes:
10 Hours

Enzymes as catalysts.

structure and Functions of Isoenzymes. (LDH, CK, ALP)

Enzymes classification and nomenclature.

Enzymes in clinical diagnosis.

Laboratory determinations of enzymes in diagnosis of Liver, Kidney, Heart, brain disorders

Clinical significance of SGOT, SGPT, S.ALP, S.ACP, Serum Amylase etc

UNIT- IV: Water & Mineral Metabolism and Acid-Base Balance:
10 Hours

Body fluid distribution (Electrolyte and Water)

Factors which influence the distribution of body water.

Mineral metabolism- Importance of the trace elements (Cobalt, Molybdenum, Selenium and Chromium)

Acid-Base balance in body

Buffer systems in body to regulate acid-base balance

UNIT - V: Function Tests:
10 Hours

Diseases of the kidneys.

Creatine metabolism.

Bile pigment metabolism.

Disordered Bilirubin metabolism.

Hepatic Jaundice and Post hepatic jaundice. Ischemic heart disease.

Clinical significance of gastric analysis.

Practicals:

1. Glucose Tolerance Test
2. Determination of Glycosylated Hemoglobin
3. Determination of serum protein levels
4. Assay of SGOT
5. Assay of SGPT
6. Determination of serum bilirubin
7. Gastric analysis [demo with record]

SUGGESTED READINGS

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology.
- Robbins and Cortan, Pathologic Basis of Disease, VIII Edition.
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.



Cluster Elective Paper: VIII-A-II

HAEMATOLOGY

Hours 60

Marks 100

UNIT – I: Laboratory Preparation in Hematology:

10 Hours

Introduction to practical's in clinical laboratory

Basic requirements & principle in clinical laboratory

Collection of blood sample (phlebotomy)

Anticoagulants and effects of anticoagulants on blood cells.

Blood smear preparation, effects of storage of blood.

UNIT – II: Hematology:

15 Hours

Composition of blood.

Haemoglobin synthesis. Various haemoglobins.

Haemopoietic system of the body. Erythropoiesis, Leucopoiesis and development of blood corpuscles.

Thrombopoiesis.

Blood cell counts: Clinical significance of Total erythrocyte count, total leucocyte count, differential count

Erythrocyte sedimentation rate and platelet count.

UNIT – III: Haemostasis and Hematological Disorders:

15 Hours

General consideration of blood coagulation.

Mechanism of coagulation. The fibrinolytic mechanism. Clinical significance of routine coagulation tests.

Anaemia. Various types of anaemias – Iron deficiency anemia, Aplastic anemia, Pernicious anemia, Sideroblastic anemia and Sickle cell anemia.

Other hematological diseases – HDNB, Thalassemia, Leukemia

UNIT- IV: Automation in Hematology:

10 Hours

4.1 General consideration- Blood cell counters.

4.2 Flow through cytochemical differential counter.

Automated coagulated systems.

automation in serum analysis

UNIT - V: Immuno hematology and Blood banking:

10 Hours

Human Blood Group Systems (random and cross check).

Inheritance of blood group systems.

5.3 Transfusion and blood components

5.4 Platelets separation, plasma separation

(3 per/week)

List of Experiments:

1. Separation of Serum
2. Separation of plasma
3. Erythrocyte sedimentation Rate SR
4. Platelet counting
5. Total count of RBC
6. Total count of WBC
7. Differential Count of WBC

Note: ** FIELD VISIT TO NEAREST DIAGNOSTIC CENTER & BLOOD BANK

SUGGESTED READINGS

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology.
- Robbins and Cortan, Pathologic Basis of Disease, VIIIEdition.
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
- Medical laboratory technology by Mukaraje



Cluster Elective Paper: VIII-A-III

MEDICAL MICROBIOLOGY

Hours 60

Marks 100

Unit –I Beneficial Microbial Interactions with Human: Normal microbial population of healthy human body - Skin, mouth, upper respiratory tract, intestinal tract, urino-genital tract, eye.

Unit –II Harmful Microbial Interactions with Human : Entry of pathogens into the host, types of bacterial pathogens, Mechanism of bacterial pathogenicity, colonization and growth, Virulence, Virulence factors – exotoxins, enterotoxins, endotoxins, neurotoxins

Unit –III General Account of Epidemiology: Principles of epidemiology, Current epidemics (AIDS, Nosocomical, Acute respiratory Syndrome,) Measures for prevention of epidemics –Global health consideration, Emerging and reemerging infectious diseases Biological warfare and biological weapons.

Unit –IV Person to person Microbial disease: Names of pathogen, disease symptoms, and preventive measures
airborne transmission of diseases by airborne pathogens: Streptococcal diseases, Corynebacterium Diphtheria, and Whooping cough, Mycobacterium Tuberculosis

Direct contact transmission of diseases: Staphylococcus, Hepatitis viruses.

Sexually transmitted diseases: Gonorrhoea and syphilis

Unit –V Animal transmitted, Artropod transmitted, Soil borne and Water borne microbial diseases:

Animal transmitted disease: Rabies

Artropod transmitted disease: Malaria

Soil borne diseases: Tetanus

Water borne microbial diseases: Cholera, Giardiasis,.

List of Experiments:**Project work****SUGGESTED READINGS**

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology.
- Robbins and Cortan, Pathologic Basis of Disease, VIII Edition.
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.



VI th SEMESTER

Elective B : Biochemical Correlations in Disorders

60 hrs (5 periods/week)

Unit- I: Hormonal Imbalances and Autoimmune diseases

12 Hrs

Outline of hormone action and imbalances leading to disease - precocious puberty, hyper and hypo pituitarism.

Hyper and hypo thyroidism.

Hyper and hypo disorders of adrenal gland.

Unit- II: Nutritional Deficiency and Life style Disorders

12Hrs

Protein calorie malnutrition - Kwashiorkor, Marasmus,

DISORDERS OF VITAMINS WATER SOLUBLE: Beri-beri, Scurvy, Pellagra, Pernicious anaemia,

DISORDERS OF VITAMINS FAT SOLUBLE: Night blind ness, Rickets, Osteomalacia, and Osteoporosis

Obesity, Cardiovascular diseases, Inflammatory Bowel Disease (IBD).

Unit- IV: Disorders caused due to misfolded proteins and deficiency of minerals

12 Hrs

Alzheimer's, Huntington's disease,

Creutzfeldt-Jakob disease,

Haemoglobinopathies : Sickle cell anaemia, Thalassemia.

Wilson's disease, Menkes' disease, Goitre

Unit- IV: Autoimmune disorders

12 Hrs

Concepts in immune recognition - self and non self discrimination,

organ specific autoimmune diseases – Hashimoto's thyroiditis, Grave's disease,

myasthenia gravis

; Systemic diseases - SLE, rheumatoid arthritis; Diabetes Mellitus-I.

Unit- IV: Organ Specific disorders \

Digestive system: Gastritis, peptic ulcers, pancreatitis, steatorrhea, cirrhosis of liver, gallstones, appendicitis

Renal Disorders: Acute and chronic renal failure, kidney stones [Renal calculi] Acute and Chronic Glomerular nephritis

Cancer: Types, mechanism, Etiology, metabolic changes, treatment (drugs, chemotherapy and radio therapy)

1. Glucose tolerance test.
2. Lipid profile: triglycerides and total cholesterol.
3. Obesity parameters.
4. RBC counting and haemoglobin estimation.
5. Blood pressure measurements.
6. Bone density measurements (visit to a nearby clinic).
7. T₄/TSH assays.
8. Tridot Test/ Lateral flow test for viral diseases

SUGGESTED READINGS

1. Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York), ISBN: 978-0-4710-28173-4.
2. Immunology: A Short Course (2009) 6th ed., Coico, R and Sunshine, G., John Wiley & sons, Inc (New Jersey), ISBN: 978-0-470-08158-7
3. Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J.L. and Stryer, L., W.H Freeman and Company (New York), ISBN: 13:978-1-4292-7635-1.
4. Genetics (2012) 6th ed., Snustad, D.P. and Simmons, M.J., John Wiley & Sons. (Singapore), ISBN: 978-1-118-09242-2.



VI th SEMESTER

Elective cluster-602 Cluster Electives –VIII-B-I Organization of cell structure

Unit-I Basics of Cell Biology (structure & function)

Discovery of cell and Cell Theory.

Comparison between plant and animal cells.

Comparison between of prokaryotic And eukaryotic cell

Membrane structure & transport – Models of membrane structure, Membrane lipids, proteins and carbohydrates.

Solute transport by Simple diffusion, Facilitated diffusion and Active transport

Unit- II: CELL SIGNALING

Introduction to types of cell signalling (exocrine, endocrine and paracrine) ,

types of cell membrane receptors: G-Protein linked receptors.

Secondary messengers - cAMP, cGMP, IP₃, , diacyl glycerol, Ca²⁺, NO.

Enzyme linked receptors

Ion-channel linked receptors

Unit –III STRUCTURE OF CELL ORGANELLES

structure and functions of cell organelles - Endoplasmic reticulum, Golgi complex, glycosylation of proteins

Lysosomes, ribosomes, peroxisomes

Mitochondria: Structure and Functions. Oxidative Metabolisms in the Mitochondrion, The Role of Mitochondria in the formation of ATP .

Chloroplast: structure and functions & an overview of photosynthesis.

Unit-IV CYTOSKELETON & Nucleus

Cytoskeleton – components of Cytoskeleton, Microtubule and Microfilaments

Structure of nucleus

Extracellular matrix

Cell-cell interactions

Unit –V Organization of genes and chromosomes

Organization of genes and chromosomes (definitions of unique and repetitive DNA, interrupted genes, gene families)

cell division: Mitosis and meiosis, their regulation,

steps in cell cycle, regulation and control of cell cycle

Programmed cell death (Apoptosis)

PRACTICALS:

1. Mitosis in onion root tip
2. Cell Meiosis in onion flower buds
3. Karyotyping
4. Problems on monohybrid ratio, dihybrid ratio, gene interaction, linkage and crossing over – 2 point test crossing over

Suggested Books:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
4. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
5. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
6. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.



VI th SEMESTER

Cluster Electives –VIII-B-II

GENETICS & ECOLOGY

Unit-I Mendel's Laws and Inheritance

Mendel experiments-Mendel Laws and deviations: incomplete dominance and Co dominance

Penetration and pleiotropism

Recessive and Dominant epistatic gene interactions.

Concept of multiple alleles.

Unit II -Genes and their variations:

Structure of gene, gene and environment

gene copies and heterogeneity

Eukaryotic chromosome organization, histone proteins.

Gene transfer in bacteria (Conjugation, transformation and transduction).

linkage, recombination, interference and coincidence

sex determination

Unit III Mutations and Repair:

Gene mutations-Spontaneous, missense, nonsense, frame shift and induced mutations

Mutagens –Physical and chemical mutagens

Repair Mechanisms- Light induced repair, Mismatched repair, post – replicational repair, excisional repair, SOS repair.

Unit IV chromosomal disorders

4.1 Haemophilia, sickle cell anemia, Thalassemia

4.2 Phenyl ketonuria

colour Blindness, cystic fibrosis

klinefelter's syndrome, Turner's syndrome

Edward syndrome, Patau syndrome

Cri-du-chat syndrome, Down's syndrome

chronic myelogenous leukaemias

Unit V ECOLOGY

Concept of an ecosystem

Ecosystem structure & function;

producers, consumers and decomposers

food chains, food webs and ecological pyramids

characteristic features of the following ecosystems: forest ecosystem, desert ecosystem and aquatic ecosystem.

energy flow and mineral cycling (C,N,P);

conservation of biodiversity.

Practicals:

1. To determine basal cover of trees in forest ecosystem-forest plantation.
2. Qualitative of analysis of soil organic carbon
3. Qualitative analysis of soil pH
4. To study pore space, water holding capacity and bulk density of soil.
5. Identification of rocks and minerals on the basis of physical characters.
6. Problems and assignments in Mendilian genetics

Suggested Books:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
4. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
5. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
6. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.



Cluster Electives –VIII-B-III

APPLIED BIOCHEMISTRY

Unit-1 Methods in Molecular biology

Methods for measuring nucleic acid and protein interactions – foot printing, CAT assay, gel Shift analysis.

DNA markers in genetic analysis – RFLP, Minisatellites, Microsatellites, PCR based RAPD markers,

Chromosomal Walking, Chromosomal jumping.

RNA silencing – siRNAs and anti- sense RNAs- their design and applications.

Principle and applications of Nanotechnology

Unit: 2 Plant tissue culture

Plant tissue culture: Culture media – Composition and preparation,

Totipotency, Organogenesis and plant regeneration,

Somatic embryogenesis, Artificial seeds, Micropropagation.

Isolation and culture of protoplasts, Somatic hybridization.

Unit: 3 Animal tissue culture:

Animal tissue culture: Composition and preparation of culture media,

Primary cultures, established/continuous cell lines. T

Tissue and organ culture.

gene therapy-types and its applications

Unit –IV stem cells

Stem cells – Sources embryonic stem cells, adult stem cells, cord blood stem cells.

Generation of stem cells by cloning, stem cell differentiation, stem cell plasticity, preservation of stem cells.

Organogenesis through stem cells for transplantation.

Applications of stem cell therapy- Parkinson's disease and Alzheimer's disease.

Unit: V Vaccines

Vaccines Classification

Principles of vaccination, Design of vaccines.

Conventional vaccines – Whole organism, live and attenuated, purified macromolecules.

New generation vaccines- Recombinant antigen vaccines, recombinant vector antigens, DNA vaccines, synthetic vaccines, edible vaccines.

Vaccine delivery systems – Liposomes, micelles, ISCOMS.

Practical's :

Project work

Suggested Books:

1. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
6. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
7. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.
8. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bios scientific publishers.
9. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology- Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.
10. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA Genes and genomes- A short course. III Edition. Freeman and Co., N.Y., USA.