Syllabus for

B.Sc. Biochemistry

(Semester Pattern)

(For Candidates admitted in the Colleges affiliated to Periyar University from 2017-2018 onwards)
REGULATIONS

1. **Preamble and objectives of the Course:**
   The syllabus strengthens to acquire an advanced knowledge and understanding of the core principles of Biochemistry.

   The major objectives of B.Sc., Biochemistry course are,
   - To study the structures and functions of biomolecules.
   - To understand the principles, instrumentation and applications of bioanalytical techniques.
   - To study the enzyme catalysis, bioenergetics and major metabolic pathways.
   - To study the techniques to understand molecular and gene expression.
   - To understand human physiology and nutritional requirements.
   - To study molecular concepts of body defenses and its mechanisms.
   - To impart knowledge in principles and applications of clinical Biochemistry.
   - To obtain knowledge in Pharmaceutical, Microbial and Industrial Biochemistry.
   - To acquire skills for laboratory experiments.
   - To prepare candidates for a career in Pharmaceutical industries, food industries etc.

2. **Eligibility for Admission**
   A candidate who has passed Higher Secondary Examination of Tamilnadu Higher Secondary Board or an equivalent Examination other state board accepted. Candidates +2 passed with any one of the following subjects namely Chemistry, Botany and Zoology or Biology and Vocational stream shall be eligible for admission into B.Sc., course in Biochemistry.

3. **Duration of the Course:**
   The course for the degree of Bachelor of Science shall consist of three academic years into six semesters

4. **Course of study:**
   The course of study for the B.Sc. Degree in Biochemistry Branch shall comprise the following subjects according to the syllabus,
   i) Foundation Courses (Languages and English)
   ii) Core Courses: (Major and Allied and Skilled Based Elective Course and Non Major Elective Course subjects) Major: Biochemistry

   Allied I- Chemistry (Compulsory) Allied II- Chemistry (Compulsory) Allied III- Biostatistics (Compulsory)
Allied IV- Computer Applications in Biology (Compulsory)

Non major elective course subjects may be chosen by the respective colleges and the same must be communicated to the University.

I - SEMESTER:
1. Language - Paper I
2. English - Paper I
3. Core - Paper I
4. Allied I - Paper I
5. Value Education - Yoga

II - SEMESTER
6. Language – Paper II
7. English - Paper II
8. Core - Paper II
9. Allied I - Paper II
10. Major - practical – I
11. Allied – I Practical
12. Environmental Studies

III - SEMESTER
13. Language - Paper III
14. English - Paper III
15. Core - Paper III
16. Allied II - Paper I
17. Skill Based Elective Course - I
18. Non Major Elective Course I

IV - SEMESTER
19. Language – Paper IV
20. English – Paper IV
21. Core - Paper IV
22. Allied II - Paper II
23. Major - Practical II
24. Allied - Practical
25. Skill Based Elective Course - II
26. Non Major Elective Course - II

V - SEMESTER
27. Core Paper - V
28. Core Paper – VI
29. Core Paper – VII
30. Elective Paper - I
31. Skill Based Elective Course III
32. Major Practical – III

VI - SEMESTER
33. Core Paper - VIII
34. Core Paper - IX
35. Core Paper - X
36. Elective Paper - II
37. Skill Based Elective Course IV
38. Major Practical – IV
39. Mini Project (Group project)

5. Examinations

There shall be six examinations for three years – two examination each years, two in the first year, two in the second year and two in the third year. Candidates failing in any subject / subjects will be permitted to reappear for failed subject / subjects in subsequent examinations. The syllabus has been divided into six semesters. Examinations for I, III and V semesters will be held in November / December and for II, IV and VI semesters will be held in April / May. The practical examination I will be held at the end of I year (II-semester). II will be held at the end of II year (IV-semester). III will be held at the end of V-semester and IV will be held at the end of III year (VI-semester). The mini project group should contain a maximum of 5 students and their report should be submitted and presented before the examiners at the end of VI- semester.

6. Passing Minimum

A candidate shall be declared to have passed the examination if he /she secure not less than 40% of the
marks in each paper/practical. Candidates who do not secure the required minimum marks for pass in a paper/practical shall be required to reappear for and pass the same at a subsequent appearance. For practical, the minimum pass includes the record mark too. There is no passing minimum for the record. However, submission of a record notebook is a must.

7. **Classification of Successful Candidates**

Candidates who secured not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in **First Class**. Candidates secured above 50% less than 60% shall be declared to have passed in **Second Class**.

Candidates who obtain 75% and above in the aggregate shall be declared to have passed the examination in **First Class with Distinction** provided they pass all the examination in prescribed period at first appearance.

8. **Ranking**

Candidates who pass all the examinations prescribed for the course in the first attempt/appearance and within a period of three academic years from the year of admission to the course only are eligible for **University Ranking**.

9. **Maximum Duration for the completion of the UG Programme:**

The maximum duration for completion of the UG Programme shall not exceed twelve semesters.

10. **Commencement of this Regulation:**

These regulations shall be effect from the academic year 2017-2018 onwards for candidates admitted during the academic year 2017-2018 and thereafter.

11. **Transitory Provision**

Candidates who were admitted to the UG course of study before 2015-2016 shall be permitted to appear for the examinations under those regulations for a period of three years i.e. up to April/May 2020 examination. Thereafter, they will be permitted to appear for the examination only under the regulations there in force.

12. **Courses given by the board as Non – Major Elective Course**

**Semester - III**

Fundamentals of Human physiology (or) Biochemistry in Nutrition

**Semester - IV**

Biochemistry and Health (or) Biochemistry in Diagnosis
# COURSE OF STUDY AND SCHEME OF EXAMINATIONS

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### B Sc BIOCHEMISTRY

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13. Pattern of Question Paper (For Major, Allied, SBEC and NMEC)

Maximum marks – 75

Section – A (10 x 1 = 10 marks)
(2 questions from each unit)
(Multiple choice questions) Answer all the questions

Section – B (5 x 2 = 10 marks)
(1 question from each unit)
Answer all the questions

Section – C (5 x 5 = 25 marks)
(Internal choice from the same unit)
Answer all the questions
UNIT-I

Carbohydrates:
Introduction and general classification of carbohydrates.

Monosaccharides:
Structures, properties and biological functions of monosaccharides. Isomerism - structural and stereo isomerism, interconversion of sugars, mutarotation.

Oligosaccharides: Dissaccharides - structures, properties and functions.

Polysaccharides:
Classification, structures and functions.

UNIT-II

Amino acids:
Structure, classification, physical, chemical and electrochemical properties, Non standard aminoacids, Non protein aminoacids.

Peptides:
Peptide bond, biologically important peptides – Glutathione.

Proteins:
Classification, structural organization of proteins - Primary, secondary, tertiary and quarternary structures, forces stabilizing the structure, properties of proteins.

UNIT-III

Fatty acids:
Classification, structure and properties of fatty acids.

Lipids:
Classification, structure and properties of lipids.

Lipoproteins:
Types and functions.
UNIT-IV

Nucleic acids:
Introduction, structure of nitrogenous bases - purines and pyrimidines, nucleosides, nucleotides, formation of phosphodiester bonds. Structure, types, properties, functions of DNA and RNA. Nucleoproteins with example. Special base sequences of DNA.

UNIT-V

Vitamins:
Introduction, structures, sources, RDA, functions, deficiency diseases of fat soluble and water soluble vitamins.

REFERENCE
UNIT - I
Acids and bases:
Basis of acidity and basicity, pH and buffers.

General principles of Biochemical investigation:
In vivo and in vitro studies - organ and tissue slice techniques, tissue homogenization. Methods of cell disruption, basic principles of cell sorting and counting. Maintenance and preservation of cells.

UNIT - II
Chromatography:
Principles, sample preparation, methods and applications of paper chromatography, thin layer chromatography, column chromatography - ion exchange chromatography, gel filtration chromatography, affinity chromatography. GLC, HPLC and HPTLC.

UNIT - III
Centrifugation:
Basic principles of sedimentation, types of centrifuges – desk top, high speed and ultracentrifuges. Types of Rotors - swinging bucket, fixed angle, vertical tube and zonal rotor. Types of centrifugation: Preparative centrifugation - differential and density gradient centrifugation with applications, Analytical centrifugation – molecular weight determination.

UNIT - IV
Electrophoresis:
Principles, techniques and applications of paper electrophoresis, gel electrophoresis - agarose, PAGE, SDS-PAGE. Capillary electrophoresis, isoelectric focusing, Factors affecting electrophoresis.

Colorimetry and spectroscopy:
Basic principles - the laws of absorption (Beer - Lambert's law). Principles, instrumentations and applications of colorimetry, spectrophotometry, spectrofluorimetry and flame photometry.
UNIT - V

Radioisotopic techniques:


REFERENCE

B Sc BIOCHEMISTRY

B.Sc. BIOCHEMISTRY

SEMESTER - II

CORE PRACTICAL – I

I. Preparation of Buffers and determination of pH. II. Qualitative Analysis
   1. Monosaccharides, Disaccharides and Polysaccharides.
   2. Aminoacids.
   3. Lipids.

III. Quantitative Analysis
   2. Estimation of Glycine- Formal Titration.
   3. Determination of Acid number.
   4. Determination of Saponification number.
   5. Determination of Ascorbic acid – DCPIP method.

IV. Biochemical Preparations
   1. Starch from potato.
   2. Casein from milk.
   3. Lecithin from egg yolk.

REFERENCE

UNIT - I

Enzyme:
History and terminology, nomenclature and classification of enzymes. Holoenzymes, metalloenzymes, metal activated enzymes, monomeric enzymes, oligomeric enzymes, ribozymes. Enzyme specificity, units of enzyme activity.

UNIT - II

Active site:
Characteristics, theories of ES complex - Lock and key, induced fit and substrate strain theory.

Catalytic mechanisms:
Acid - base catalysis, Covalent catalysis, Metal ion catalysis, Electrostatic catalysis. Mechanism of action of lysozyme.

UNIT - III

Enzyme Kinetics:
MM Equation, LB Plot, Eadie Hofstee Plot, Hanes Plot, Factors affecting enzyme activity.

Enzyme inhibition:

UNIT - IV

Coenzymes:
Structure and functions of TPP, NAD, NADP, FMN, FAD, Coenzyme A, Lipoate, Folate and biotin (Mechanism not required).

Isoenzymes - LDH,

Allosteric enzymes - ATCase, multienzymes complex - PDC

UNIT - V

Immobilised Enzymes- Principles, methods and applications. Isolation and purification of enzymes – localization and extraction of free enzymes and membrane bound enzymes, methods of purification of enzymes, criteria of purity.
B Sc BIOCHEMISTRY

REFERENCE


5. Protein Biochemistry and Biotechnology, Gary Walsh and John Wiley and Sons Ltd. 2002.
B.Sc. BIOCHEMISTRY
SEMESTER – III
SKILL BASED ELECTIVE COURSE
SBEC I - CELL BIOLOGY

UNIT I
Cell: Introduction, cell theory, types of cell - Prokaryotic cell and eukaryotic cell structure, difference between plant cell and animal cell. Structure, composition, functions of cell membrane, bacterial cell wall and plant cell wall.

UNIT II
Cell organelles:
Structure and functions of nucleus, mitochondria, chloroplast, endoplasmic reticulum, golgi bodies, ribosomes, lysosomes, peroxisomes and cytoskeleton.

UNIT III
Chromosome organization:
Structure of chromatin, types of euchromatin and heterochromatin, structure of chromosome, special types of chromosome.

UNIT IV
Cell Cycle:
Stages of cell cycle, cell division - various stages and significance of Mitosis and Meiosis, difference between Mitosis and Meiosis.

UNIT V
Extracellular matrix and cell interactions:

REFERENCE
2. VK Agarwal and PS Varma Cytology (Cell Biology and Molecular Biology), 2000 4/e S Chand & Company, New Delhi.
UNIT – I

Introduction to metabolism:

Types of metabolic reactions. Bioenergetics - Principles of thermodynamics, concepts of free energy, standard free energy, Biological oxidation-reduction reactions, redox potential, high energy phosphate compounds.

UNIT – II

Carbohydrate metabolism:


UNIT - III

Lipid metabolism:

Fatty acid oxidation – α, β, ω oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides and ketone bodies.

UNIT - IV

Protein metabolism:


Nucleic acid metabolism:

Biosynthesis and degradation of purine and pyrimidine nucleotides.

UNIT - V

Biological oxidation:

Mitochondrial Electron Transport Chain: electron carriers, sites of ATP production, inhibitors of ETC, Oxidative phosphorylation:- structure of ATPase complex, chemiosmotic theory, inhibitors of oxidative phosphorylation and uncouplers, Mitochondrial shuttle system.
REFERENCE


UNIT - I

Physiology of plants:
Diffusion and Osmosis in plants and their significance, relationship among turgor pressure, wall pressure and osmotic pressure, water potential concept. Mechanism of water absorption, Ascent of sap, Transpiration: types, mechanism of transpiration and factors affecting transpiration.

UNIT - II

Photosynthesis:
Photosynthetic apparatus, Photosynthetic pigments, Light reactions - cyclic and non cyclic phosphorylation, Calvin cycle, Photorespiration, C4 plants, CAM plants. Glyoxylate cycle.

UNIT - III

Nitrogen metabolism and Nitrogen cycle:
Nitrogen in soil, nitrate reduction in plants, Nitrogen fixation: Nonbiological and biological nitrogen fixation, biochemistry of symbiotic and nonsymbiotic nitrogen fixation, nitrogen cycle, sulphur cycle, phosphorus cycle.

UNIT – IV

Biochemistry of plant growth:
Biochemistry of seed development: dormancy and germination. Phytochrome, photoperiodism and vernilization.

UNIT - V

Plant growth regulators:
Chemistry, biosynthesis, distribution, mode of action and physiological effects of Auxins, Gibberllins, Cytokinins, ABA and Ethylene.

Phytochemicals:
Classification and medicinal value of phytochemicals.
REFERENCE

3. Plant Biochemistry and Molecular Biology, Peter Jhea, Richard C. Leegood,
5. Handbook of medicinal plants by Prajapathi, Purohit and Sharma kumar.
6. Plant Biochemistry by P.M. Dey and J.B. Harborne
7. Biochemistry and Molecular Biology of plants by Buchannan, Grvissem and Jones.
I. ANALYTICAL TECHNIQUES
1. Separation of sugar & amino acid by paper chromatography
2. Separation of lipid by thin layer chromatography
3. Separation of plant pigments by column chromatography
4. Separation of serum proteins by paper electrophoresis

II. COLORIMETRIC ANALYSIS
1. Estimation of glucose – O T method
2. Estimation of fructose – Seliwanoff’s method
3. Estimation of Ribose- Bial’s method
4. Estimation of Protein - Biuret method
5. Estimation of Cholesterol- Zak’s method
6. Estimation of Phosphorus – Fiske Subbarow method

III. ENZYME ASSAY
1. Determination of specific activity, effect of pH, temperature and substrate concentration of:
   a. Salivary Amylase    b. Urease

REFERENCE
UNIT – I
Approaches to clinical Biochemistry:
Automation and quality control, collection, processing, preservation and transport of clinical specimens, normal, abnormal constituents and clinical significance of urine.

UNIT – II
Hematology:

UNIT – III
Disorders in carbohydrate metabolism:
Diabetes mellitus:- Types, Clinical features, complications, GTT, galactosaemia, fructosuria, and glycogen storage diseases.
Disorders in lipid metabolism:
Atherosclerosis – aetiology, clinical features and its complications. Lipid storage diseases and fatty liver.

UNIT – IV
Disorders in protein metabolism:
Phenylketonuria, alkaptonuria, cystinuria, albinism and tyrosinemia.
Disorders in nucleic acid metabolism:
Gout:- Types, aetiology and clinical features.
Disorders in bilirubin metabolism:
Jaundice:- classification, clinical features.

UNIT – V
Liver function tests:
Detoxification and excretory function.
Renal function test:
Glomerular filtration tests, tests for renal blood flow and tests of tubular function.
Enzymology:
Clinical significance of SGOT, SGPT, ALP, ACP, CPK and LDH.
B Sc BIOCHEMISTRY

REFERENCE
2. Textbook of Medical Laboratory Technology by Praful B. Godkar and Darshan P. Godkar
UNIT – I
Replication: Experimental evidence to prove DNA as genetic material, Semiconservative replication, experimental evidence for semiconservative replication, replication in prokaryotes and eukaryotes, enzymes involved in replication, mechanism of replication, inhibitors of DNA replication.

UNIT – II
Transcription: Basic features of RNA synthesis, E.Coli RNA polymerases, initiation, chain elongation and termination of transcription, RNA processing. Inhibitors of transcription.

UNIT - III
Translation: Genetic code and its features, tRNA and amino acyl tRNA synthetases. Initiation, elongation and termination of translation, post translational modifications, Inhibitors of protein synthesis.

UNIT – VI
Regulation of gene expression: General aspects, operon model in prokaryotes – lac operon, tryp operon and arab operon.

UNIT – V
DNA damage and repair: Types of mutation:- Base substitution, insertion, deletion, inversion, duplication, translocation, mutagens. DNA Repair mechanisms:- Excision repair, mismatch repair, phoreactivation, direct demethylation, double strand break repair. Regulation of DNA repair:- SOS repair.

REFERENCE
1. Text Book of Cell and Molecular Biology by Dr. Ajay Paul, 2015, Arunabha Sen, Books & Allied (P) Ltd.,
B.Sc. BIOCHEMISTRY

SEMESTER – V

CORE VII - HUMAN PHYSIOLOGY

UNIT – I

**Digestive System:** Overview of the digestive system, secretions of digestive tract, digestive hormones, process of digestion, absorption, assimilation of carbohydrates, proteins, fats, nucleic acids. Absorption of vitamins, minerals and water.

UNIT – II

**Respiratory System:** Overview of the respiratory system, pulmonary ventilation, pressure changes during pulmonary ventilation, lung volumes and capacities, transport and exchange of respiratory gases.

UNIT – III

**Muscle physiology and cardiovascular system:** overview of muscle tissue, contraction and relaxation of skeletal muscle, cardiac muscle tissue and cardiac conduction system, cardiac cycle, cardiac output, blood pressure and E.C.G.

UNIT – IV

**Renal system:** Overview of renal system, Renal physiology:- glomerular filtration, tubular reabsorption and secretion, production of dilute and concentrated urine.

**Reproductive system:** Overview of male and female reproductive system, spermatogenesis, oogenesis and follicular development, menstrual cycle, physiology of pregnancy, parturition and lactation.

UNIT – V

**Nervous system:** Overview of nervous system, classification of nervous system, signal transmission at synapse, neurotransmitters.

**Special senses:** Physiology of Olfaction, gustation, vision, hearing and equilibrium.

**REFERENCE**

UNIT – I

**Nutritional profile of principal foods:** Cereals, pulses, vegetables, fruits, nuts, oil seeds, animal foods, milk and milk products, egg, fish, meat, drinks and spices. Role of dietary carbohydrates, proteins, fats, fiber and antioxidants.

**Energy content of foods:** Determination of calorific value by Bomb calorimeter.

UNIT – II

**Dietary requirements:** Balanced diet, Recommended dietary allowances for infants, children, adolescent, pregnant, lactating women, athletes and geriatrics.

Measurement of energy expenditure, respiratory quotients of food stuffs, specific dynamic action. BMR: Measurement of BMR and factors influencing BMR.

UNIT-III

**Dietary protein:** Biological value of proteins and nitrogen balance. Essential and non-essentials aminoacids. Protein energy malnutrition – aetiology, management of kwashiorkor and marasmus.

UNIT – IV

**Minerals:** Nutritional significance of dietary macro minerals (Ca, P, Mg, S, K, Na, Cl) and trace minerals (Iron, Iodine, Zinc and copper). Disorders related to the deficiency of minerals. **Nutraceticals:** Introduction and classification of nutraceticals.

UNIT-V

**Nutrition and body defenses:** Drug - nutrient interaction, nutritional therapy for inborn errors of metabolism, role of diet and nutrition in the prevention and treatment of diseases:- Diabetes mellitus, Jaundice, Peptic ulcer, Gout, blood pressure, cardiovascular diseases, nephritis.

REFERENCE

1. Human nutrition by B. Srilakshmi, New age International Pvt Ltd, 2009
3. Human nutrition and dietetics, IS Garraw, WPT James, 10th edition
4. Modern nutrition in health and diseases, Whol and Good hart.
5. Mechanism and theory in food chemistry, DWS Wong, CBS New Delhi, 1996.
B Sc BIOCHEMISTRY

B.Sc. BIOCHEMISTRY  
SEMESTER V  
SKILL BASED ELECTIVE COURSE  
SBEC III - GENETIC ENGINEERING  

UNIT - I  
**Introduction to genetic engineering:** Introduction to rDNA technology, DNA manipulative enzymes: - Nucleases, Ligases, Polymerases, DNA modifying enzymes, Topoisomerases. Restriction-modification system: Restriction endonucleases and its types.  

UNIT - II  

UNIT - III  
**Screening of recombinants:** Reporter gene based screening, selection by the use of antibiotic resistance, blue white screening, Immunological methods, screening through protein activity.  

UNIT - IV  
**Techniques in genetic engineering:** Isolation and purification of genomic DNA, plasmid DNA and λ phage. Molecular probes: - Types and its uses. Methods of nucleic acid labeling. Blotting techniques: - southern, northern and western blotting. DNA sequencing methods. PCR: - Procedure, important considerations of PCR for primer designing, Applications of PCR.  

UNIT - V  
**Genomic and cDNA libraries:** Methods of generating genomic and cDNA library, comparison between two types of libraries, advantages and disadvantages of cDNA library.  
**Applications of rDNA technology:** Recombinant DNA products in medicine (insulin, GGH), recombinant vaccines, gene therapy, DNA finger printing, transgenic plants and transgenic animals.  

REFERENCE  
B.Sc. BIOCHEMISTRY

SEMESTER - V

CORE PRACTICAL – III

I. HEMATOLOGY
1. Estimation of Hemoglobin – colorimetric method
2. Enumeration of RBC & WBC
3. Differential Smear – Blood cells count
4. Bleeding time & Clotting time
5. Identification of blood grouping & typing
6. Evaluate ESR & PCV

II. ASSAY OF SERUM Marker Enzymes
1. Determination of activity of SGOT and SGPT
2. Determination of activity Acid Phosphatase and Alkaline Phosphatase

III. BLOOD ANALYSIS
1. Estimation of blood glucose by Asatoor and King method.
2. Estimation of serum creatine and creatinine by – Alkali-Picrate method.
3. Estimation of Determination of Total proteins in whole blood – Biuret method
4. Determination of urea in serum- DAM –TSC method
5. Estimation of Cholesterol in serum- Zak's method

IV. URINE ANALYSIS
1. Estimation of Urea in urine by DAM –TSC method
2. Determination of Creatine and Creatinine in urine – Alkali-Picrate method
3. Estimation of Uric acid – Caraway's method
4. Determination Chloride by VanSlyke's method
5. Physical properties of urine : Microscopic and visual observation for normal and abnormal constituents, color, density, crystals and pH etc
REFERENCE


UNIT-I

Introduction to Immunology: Immunity, types of immunity, mechanism of immunity, cells of the immune system, lymphoid organs. Humoral and cell mediated immune response, primary and secondary immune response, Antigen processing and presentation.

UNIT-II


UNIT-III


UNIT-IV

Immunization: Vaccine and its types.

Major histocompatibility complex: Classification and role of MHC in immune response.

Hypersensitivity: Types – I to V. Transplantation Immunology: mechanism of graft acceptance and rejection.

UNIT-V

Complement system:- Classical and Alternative pathway, Auto immunity:- auto immune disorders, immune deficiency disorders with special reference to AIDS.

REFERENCE
1. Immunology and Immunotechnology by M. Rajasekara Pandian & B. Senthil Kumar, Panima Publishing Corp, New Delhi, 2007.
UNIT – I

Introduction to Endocrine system: Hormones as messengers, classification of hormones, circulating and local hormones, receptors of hormones, mechanism of action, hormone interactions:- Permissive effect, synergistic effect and antagonistic effect.

Second messengers:- Role of cAMP, cGMP, IP3, DAG, Ca2+ ions and calmodulin in hormonal action.

UNIT – II


UNIT – III

Thyroid and parathyroid glands: Chemical nature, secretion, circulation, biological function, disorder of thyroid and parathyroid hormones.

Pancreas: Chemical nature, secretion, circulation, biological function, disorder of Insulin and Glucagon.

UNIT – IV

G.I. Tract hormones: Chemical nature, secretion, circulation, biological function, disorders of Gastrin, Secretin and Cholecystokinin.

Adrenal gland: – Chemical nature, secretion, circulation, biological function, disorders of adrenal medullary and Cortical hormones.

UNIT – V

Gonadotropic hormones: Chemical nature, secretion, circulation, biological function, disorders of male and female reproductive hormones.

Others: Local hormones in tissues – Prostaglandins and Thromboxanes, Local hormones in blood – Kinins.

REFERENCE
UNIT I

Introduction: Sources of drugs, routes of drug administration, dosage forms, drug dosage.

Bioavailability:- Bioavailability of drugs, determination and its importance, Bioequivalence. Combined effect of drugs:- Synergism, antagonism.

UNIT II


UNIT III


UNIT IV

Adverse drug reactions: Classification:- Pharmacologic ADRs, Non-pharmacological ADRs, disease-related ADRs, multiple drug reactions, miscellaneous ADRs, Acute poisoning:- General principles and management. Drug dependence, drug tolerance and intolerance.

UNIT V

Drug discovery: Random screening, serendipity, molecular modification of a known drug, rational approaches in drug designing

Drug development: Preclinical research, clinical research, FDA review and FDA post-market safety monitoring.

REFERENCE

5. Lippincotts Illustrated review Pharmacology, Mary J. Mycek, Richards, Pamela.
UNIT – I

**Microscopy:** Simple, Light, Dark, Phase Contrast, Fluorescence, SEM and TEM. Sterilization and disinfection, Bacterial Growth curve, Continous growth, Diauxic growth. Staining principles and techniques: Gram +ve and Gram –ve staining. Structure and biosynthesis of cell wall components, Phosphotransferases, Porins and Iron uptake.

UNIT II

**Microbial metabolism:** Entner Doudoroff pathway, Bacterial photosynthesis, pectin and aldo hexuronate pathway, cellulose degradation, fermentative diversity- clostridium and propionic acid fermentation- stickland reaction and bioenergitics of methanotrophy, methanogenesis, Biochemistry of sulphur reaction.

UNIT III

**Introduction to fermentation technology:** Isolation and screening of industrially important microbes, Inoculum preparation, strain improvement for better yield. Fermentation-Submerged and solid state fermentation, Fermentor design, Downstream processing.

UNIT IV

**Industrial applications of microbes:** Industrial production of alcohol, alcoholic beverages – Wine and Beer. Microbes in mineral recovery - Bioleaching and Biosorption, Production of Biomass, Production of Single cell protein and Mushrooms.

UNIT V

**Microbial production of bioactive compounds:** Production of bacterial and fungal polysaccharide, Industrial Production of Penicillin and streptomycin. Vitamins - B12 and riboflavin.

**REFERENCE**

UNIT I

UNIT II
Biological Databases: Uses of sequence databases-Nucleic acid - NCBI, EMBL, DDBJ, Proteins-SWISSPROT, PIR, Structural databases- CATH, SCOP, Specialised databases – KEGG, OMIM.

UNIT III

UNIT IV
Protein digestion techniques: 2D Electrophoresis, Isoelectric focusing (IEF), High Performance Liquid Chromatography- Mass Spectroscopy (HPLC-MS). Microarrays, ISH, FISH.

UNIT V

REFERENCE
2. Introduction to Bioinformatics - S.Sundararajan and Balaji.
4. Bioinformatics basic skills and applications – Rastogi.
I. PLANT TISSUE CULTURE
1. Media preparation
2. Callus induction
3. Micropropagation

II. GENETIC ENGINEERING
1. Restriction Digestive Enzymes identification
2. Isolation of Plasmid DNA and Separation in Electrophoresis
3. Isolation of genomic DNA

III. IMMUNOLOGY
1. Single [Radial] Immunodiffusion
2. Double [Outcherlony] immunodiffusion
3. Immunolectrophoresis

IV. MICROBIOLOGY
1. Sterilization: Wet and Dry methods
2. Preparation of Agar and broth media [Slant and plate]
3. Culture Techniques: Streak, Pour and Spread plate
4. Enumeration of microbes from soil, air and water
5. Staining techniques: Simple and Gram’s staining
6. Identification of microbes by Biochemical tests [all tests]

REFERENCE
4. Sundararaj T. Microbiology – Laboratory Manual. Revised and Published by Aswathy Sundararaj, No.5. 1st Cross Street, Thirumalai Nagar, Perundgudi, Chennai.
UNIT - I


UNIT - II

Amino acids: Structures and Classifications of aminoacids, Essential and Non essential amino acids, properties of aminoacids.

Protein: Classification and functions of proteins, bonds involved in protein structure, structural levels of organization: primary, secondary, tertiary and quaternary structures with examples.

UNIT - III

Enzymes: Holoenzyme, Apoenzyme, coenzymes, cofactors/prosthetic groups, IUB classification of enzymes with example. Active site: characteristic features and theories of ES compex, enzyme units, Enzyme kinetics: MM equation and LB plot, factors affecting enzyme activity.

UNIT - IV

Lipids: Classifications of lipids, physical and chemical properties of fats, structure and functions of saturated and unsaturated fatty acids.

Nucleic acids: Nitrogenous bases, structures of Ribonucleotides and deoxyribonucleotides, structure and functions of DNA and RNA.

UNIT - V

Vitamins: Sources, RDA, biochemical functions, deficiency disorders of fat soluble and water soluble Vitamins.

REFERENCE

UNIT I


Biochemical Techniques: Principles and Applications of paper, thin layer and affinity Chromatography.

UNIT II

Carbohydrate metabolism: Glycolysis, Citric acid cycle, guconeogenesis, glycogen metabolism and HMP shunt.

UNIT III

Protein metabolism: Transamination, oxidative and non-oxidative deamination, decarboxylation, urea cycle.

Lipid metabolism: Beta and omega oxidation, Biosynthesis of Saturated fatty acids. Interrelationship between carbohydrates, proteins and fat metabolism.

UNIT IV

Bioenergetics: Redox potential, Electron transport chain, Oxidative phosphorylation, inhibitors of ETC, uncouplers of oxidative phosphorylation, High energy compounds.

UNIT V

Introduction to Endocrine system: Classification of hormones, mechanism of hormone action, hormone interactions: Permissive effect, synergistic effect and antagonistic effect.

Second messengers: Role of cAMP, cGMP, IP₃, DAG and Ca²⁺.
REFERENCE


I. Qualitative Analysis
   a. Analysis of carbohydrates
   b. Analysis of Amino acids
   c. Test for proteins
   d. Test for lipids – cholesterol

II. Biochemical preparation
   a. Starch from Potato
   b. Casein from milk
   c. Lecithin from egg yolk

III. Quantitative Analysis
   a. Reducing Sugar – Benedict's method
   b. Amino acid – formal titration
   c. Ascorbic acid – using 2, 6 Dichloro phenol Indophenol method.

IV. Techniques
   a. Separation of sugar & amino acid by paper chromatography
   b. Separation of lipid by thin layer chromatography

REFERENCE
UNIT – I
41Digestive System: Overview of the digestive system, process of digestion, absorption of carbohydrates, proteins and fats.

UNIT – II
Respiratory System: Overview of the respiratory system, transport and exchange of gases.

UNIT – III
Cardiovascular system: overview of cardiovascular system, structure and function of heart,

UNIT – IV
Renal system: Kidney and nephron structure, mechanism of glomerular filtration, tubular reabsorption and secretion.

UNIT – V
Nervous system: Classification of nervous system, Structure of neuron, Action potential, signal transmission at synapse, neurotransmitters.

REFERENCE
UNIT – I
Nutritional profile of foods:– Cereals, pulses, vegetables, fruits, nuts, oil seeds, animal foods, milk and milk products, egg, fish, meat, drinks and spices. Role of dietary carbohydrates, proteins, fats, fiber and antioxidants.

UNIT -II
Determination of calorific value of foods by Bomb calorimeter. Measurement of energy expenditure, respiratory quotients of food stuffs, specific dynamic action. BMR:- Measurement of BMR and factors influencing BMR. RDA for patients:– Anemic, Diabetic, Blood pressure and obese.

UNIT – III
Recommended dietary allowances for infants, children, adolescent, pregnant, lactating women, athletes and geriatrics.

UNIT- IV
Drug - nutrient Interactions, food toxins, food allergy, adverse effects of alcohol, tobacco, tea, Acidic and alkaline foods. Nutraceticals:- Introduction and classification of nutraceticals.

UNIT- V
Nutritional therapy for inborn errors of metebolism, role of diet and nutrition in the prevention and treatment of diseases:– Diabetes mellitus, peptic ulcer, jaundice, hypertension and cardiovascular diseases.

REFERENCE
1. Human nutrition by B. Srilakshmi, New age International Pvt Ltd, 2009
3. Human nutrition and dietetics, IS Garraw, WPT James, 10th edition.
4. Mechanism and theory in food chemistry, DWS Wong, CBS New Delhi, 1996.
5. Modern nutrition in health and diseases, Whol and Good hart.
UNIT – I
Carbohydrate: Sources of carbohydrates, importance of carbohydrates in living organisms, Normal level of sugar in blood, factors influencing blood glucose, renal threshold value, Diabetes mellitus:- Types, Complications, management-monitoring methods of blood glucose level and GTT.

UNIT – II
Proteins: Sources of proteins and amino acids, essential and non-essential amino acids, Importance of proteins in living organisms, normal level of serum proteins, protein deficiency disorders:- Kwashiorkor and Marasmus.

UNIT – III
Lipids: Sources of lipids, essential and non-essential fatty acids, importance of fats and lipids in living organism, role of lipoproteins in human body. Normal levels of cholesterol and TG. Disorders:- Hypertension and Atherosclerosis.

UNIT – IV
Vitamins: Sources, RDA, importance, deficiency disorders of water soluble and fat soluble vitamins in humans.

UNIT – V
Minerals: - Sources, Biological importance and deficiency disorders of Na, K, Ca, Mg, P, Fe, Zn, Se and Iodine in humans.

REFERENCE
UNIT - I
Approaches to clinical biochemistry: Quality control: Concepts of accuracy, precision, sensitivity and reproducibility, Collection of clinical specimens, preservatives for blood and urine, transport of biological samples.

UNIT - II
Hematology: Composition and functions of blood, Haemoglobin, PCV, ESR, RBC count, WBC count, Platelet count, Differential count, ESR and PCV.

UNIT - III

UNIT - IV
Stool examination: Collection of fecal specimen, preservation, physical examination:- volume, colour, odour and appearance. Chemical examination:- reducing sugar, occult blood test, detection of steatorrhoea. Microscopic examination of stool.

UNIT - V
Estimation of Biochemical components in Blood: Glucose, GTT, Glycosylated haemoglobin, Protein, cholesterol, Urea, Uric acid and Creatinine. Determination of enzyme activity: SGOT, SGPT and LDH.

REFERENCE
1. Who coined the term enzyme?  
   a) Traube  b) Kuhn  c) Buchner  d) Sumner

2. Complete enzyme including the prosthetic group is called  
   a) Apoenzyme  b) Holoenzyme  c) Prosthetic group  d) All of the above

3. Multiple forms of enzymes with the same catalytic activity but differ in structure are called  
   a) Holoenzymes  b) Isoenzymes  c) Prosthetic groups  d) Apoenzymes

4. The optimal pH for the enzyme pepsin is  
   a) 1.0–2.0  b) 4.0–5.0  c) 5.2–6.0  d) 5.8–6.2

5. The coenzyme not involved in hydrogen transfer  
   a) FMN  b) FAD  c) NADP+  d) FH4

6. The coenzyme directly concerned with the synthesis of biogenic amines  
   a) TPP  b) Biotin  c) NADP+  d) Pyridoxal phosphate

7. The Which of the following statements about Michaelis-Menten kinetics is correct?  
   a) Km, the Michaelis constant, is defined as the concentration of substrate required for the reaction to reach maximum velocity  
   b) Km the Michaelis constant, is defined as the dissociation constant of the enzyme-substrate complex.  
   c) Km, the Michaelis constant, is expressed in terms of the reaction velocity.  
   d) Km, the Michaelis constant, is a measure of the affinity the enzyme has for its substrate.

8. A sigmoidal plot of substrate concentration ([S]) versus reaction velocity (V) may indicate  
   a) Michaelis-Menten kinetics  b) Co-operative binding  
   c) Competitive inhibition  d) Non-competitive inhibition

9. Immobilized enzymes:  
   a) Potentiation of activity  b) Presentation of activity  c) Preparation of activity  d) All of these

10. The purity of an isolated protein can be tested by employing various methods.  
    a) Solubility curve  b) Molecular weight  c) Ultra Centrifugation  d) All of these
SECTION – B (5X2=10)

Answer ALL the questions

11. Define: Apo enzymes
12. Write down the significance of Km.
13. Define metal ion catalysis.
14. What is an allosteric enzyme.
15. Give the principle of chromatography.

SECTION – C (5X5=25)

Answer ALL the questions

16. Define active site and give its characteristic features (Or) explain Lock and Key theory.
17. Derive MM equation (Or) write down the diagnostic importance of isoenzymes.
18. Explain the mechanism of action of chymotrypsin (Or) Explain the mechanism of action of Lysozyme.
19. Explain feed back inhibition with an example (Or) Explain Covalent modification.
20. Differentiate the characteristic properties of ordinary enzyme with immobilized enzyme (Or) Explain the criteria of purity of enzymes.

SECTION – D (3X10=30)

Answer any THREE of the questions

21. Explain Multi enzyme complex with an example.
22. List out the various factors that affect enzyme activity.
23. Explain Covalent catalysis.
24. Differentiate Non competitive enzyme inhibition from un competitive enzyme inhibition.
25. Explain any four methods of immobilization of enzyme.