

THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE

B.Sc. BIOCHEMISTRY

DEGREE COURSE

UNDER CBCS

(With effect from 2017 - 2018)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
SEMESTER I									
1	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2	II	English	Paper-1	6	4	English	25	75	100
3	III	Core Theory	Paper-1	6	4	Cell Biology	25	75	100
	III	Core Practical	Practical-1	3	0		0	0	0
4	III	Allied -1	Paper-1	4	4	Chemistry I	25	75	100
	III	Allied	Practical - 1	3	0		0	0	0
5	IV	Environmental Studies		2	2	Environmental Studies	25	75	100
				30	18		125	375	500
SEMESTER II									
6	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
7	II	English	Paper-2	4	4	English	25	75	100

B.Sc. Biochemistry: Syllabus (CBCS)

8	III	Core Theory	Paper-2	6	4	Bio molecules	25	75	100
9	III	Core Practical	Practical-1	3	4	1. Experiment Involving Titrimetric Procedures 2. Qualitative Analysis	25	75	100
10	III	Allied-1	Paper-2	4	4	Chemistry II	25	75	100
11		Allied Practical - 1	Practical-1	3	2	Chemistry – I & II	25	75	100
12	IV	Value Education		2	2	Value Education	25	75	100
13	IV	Soft Skill		2	1	Soft skill	25	75	100
				30	25		200	600	800

S.NO.	Part	Study Components		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
		SEMESTER III					CIA	Uni. Exam	Total
14	I	Language	Paper-3	6	4	Tamil / Other Languages	25	75	100
15	II	English	Paper-3	6	4	English	25	75	100
16	III	Core Theory	Paper-3	3	3	Biochemical Techniques I	25	75	100
17	III	Allied-2	Paper-3	4	4	(Choose one out of two) 1. Microbiology – I 2. Zoology - I	25	75	100

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		Allied Practical - 2	Practical-2	3	0		0	0	0
18	IV	Skill Based Subject	Paper-1	3	3	Fundamentals of Computer	25	75	100
19	IV	Non-Major Elective	Paper-1	2	2	Health and Nutrition	25	75	100
				30	20		150	450	600
SEMESTER IV							CIA	Uni. Exam	Total
20	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
21	II	English	Paper-4	6	4	English	25	75	100
22	III	Core Theory	Paper-4	3	3	Biochemical Techniques II	25	75	100
23	III	Core Practical	Practical-2	3	4	1. Biochemical Preparations 2. Chromatographic Separation 3. Preparation of buffers 4. Colorimetric Estimation	25	75	100
24	III	Allied-2	Paper-4	4	4	Choose one out of two 1. Microbiology – II 2. Zoology - II	25	75	100
25	III	Allied Practical - 2	Practical-2	3	2	Microbiology – I & II/ Zoology – I & II	25	75	100
26	IV	Skill Based Subject	Paper-2	3	3	Computer Applications	25	75	100
27	IV	Non-Major Elective	Paper-2	2	2	First Aid	25	75	100
				30	26		200	600	800

S.NO.	Part	Study Components		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		Course Title							
		SEMESTER V					CIA	Uni. Exam	Total
28	III	Core Theory	Paper-5	6	6	Enzymes & Intermediary Metabolism	25	75	100
	III	Core Practical	Practical-3	3	0		0	0	0
29	III	Core Theory	Paper-6	6	5	Genetics and Molecular Biology	25	75	100
		Core Practical	Practical-4	3	0		0	0	0
30	III	Core Theory	Paper-7	5	4	Human Physiology & Nutritional Biochemistry	25	75	100
31	III	Elective	Paper-1	4	3	Medical Laboratory Technology-I	25	75	100
32	IV	Skill Based Subject	Paper-3	3	3	Bio Statistics-I	25	75	100
				30	21		125	375	500
		SEMESTER VI					CIA	Uni. Exam	Total
33	III	Core Theory	Paper-8	6	6	Clinical Biochemistry	25	75	100
34	III	Core Theory	Paper-9	6	6	Bio Technology	25	75	100
35	III	Core Practical	Practical-3	5	5	1. Colorimetric Estimation 2. Experiments on Enzymes 3. Biotechnology Experiments 4. Demonstration Experiments	25	75	100
36	III	Elective	Paper-2	4	3	Medical Laboratory Technology-II	25	75	100
37	III	Elective	Paper-3	3	3	Immunology	25	75	100
38	III	Elective Practical	Practical-4	3	3	Medical Laboratory Technology	25	75	100

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39	IV	Skill based Subject	Paper-4	3	3	Bio Statistics-II	25	75	100
40	V	Extension Activities		0	1		100	0	100
		TOTAL		30	30		275	525	800

Part	Subject	Papers	Credit	Total	Marks	Total
				credits		Marks
Part I	Languages	4	4	16	100	400
Part II	English	4	4	16	100	400
Part III	Allied (Odd Semester)	2	4	8	100	200
	Allied (Even Semester)	2	6	8	100	200
	Allied Practical	2	2	4	100	200
	Electives	3	3	9	100	300
	Elective Practical	1	3	3	100	100
	Core	9	(3-7)	42	100	900
	Core Practical	3		14	100	300
Part IV	Environmental Science	1	2	2	100	100
	Soft skill	1	1	1	100	100
	Value Education	1	2	2	100	100
	Lang. & Others/NME	2	2	4	100	200
	Skill Based	4	3	10	100	400
Part V	Extension	1	1	1	100	100
	Total	40		140		4000

University practical Examination marks

Subject	Exam Hrs	CIA	Uni. Exam	Total Marks
Core practical I	6	25	75	100
Core practical II	6	25	75	100
Core practical III	6	25	75	100
Elective practical IV	6	25	75	100
Allied Practical I	3	25	75	100
Allied practical II	3	25	75	100

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SEMESTER I
PAPER - 1
CELL BIOLOGY

UNIT - I

An overall view of cells - origin and evolution of cells. Cell theory. Classifications of cell - Prokaryotic and Eukaryotic cells. Differences between prokaryotic and eukaryotic cells. Molecular composition of Cells - Water, Carbohydrates, Lipids, Nucleic acids and Proteins.

UNIT - II

Cell membrane- Fluid Mosaic Model of membrane structure. Membrane proteins and their properties. Membrane carbohydrates and their role. Transport across membranes- diffusion, active and passive transport.

UNIT - III

Endoplasmic reticulum - types, structure and functions. Golgi apparatus- structures and functions. Lysosomes- structure and functions, Ribosomes - types, structure and functions.

UNIT - IV

Mitochondria: Structure and function. Cytoskeleton: Types of filaments and their functions. Microtubules: Chemistry and function (esp. cilia and flagella)

UNIT – V

Chromosome-chromatin structure, the cell cycle - phases of cell cycle. Meiotic and mitotic cell divisions, cell- cell communications, cell recognition, cell adhesion and cell functions.

References:

1. Cell biology structure and functions-David and Sadava, Jones Bartlett publishers.
2. Molecular Cell Biology - Lodish, Berk, Zipursky, Baltimore, Freeman.
3. Cytology-P.S. Verma, V.K. Agarwal, S. Chand Publications.
4. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan Worth Publishers.
5. Biochemistry - Garrett Grishmam. 3rd edition. International student's edition.
6. Biochemistry by L . Veerakumari , MJP publishers,Chennai-5.

**ALLIED
CHEMISTRY – I**

OBJECTIVE:

- Basic knowledge on Metallurgy, Cycloalkanes, Polarising Effects, Stereochemistry, Chemical Kinetics, Catalysis, Photochemistry, VSEPR Theory, Fuels, Osmosis, Nuclear Chemistry, Petroleum Chemistry, Chemistry of Naphthalene, Conductors and Applications wherever necessary are to be taught for I- Semester.

UNIT – I

1.1 General Metallurgy - Extraction of Metals - Minerals and Ores- Difference between Minerals and Ores – Minerals of Iron, Aluminum and Copper - Ore Dressing or Concentration of Ores - Types of Ore Dressing- Froth Floatation process, Gravity separation and Magnetic separation.

1.2 Calcination, Smelting, Roasting, Flux, Slag - Definition - Reduction methods - Goldschmidt Aluminothermic process and Carbon Reduction method - Refining of Metals - Electrolytic, Van Arkel and Zone Refining.

1.3 Ores of Titanium and Cobalt - Extraction of Titanium and Cobalt.

UNIT – II

2.1 Cycloalkanes - Preparation – Wurtz reaction and Dieckmann's condensation - Properties of Cycloalkanes – Substitution and Ring opening reactions.

2.2 Polarisation - Inductive effect, Mesomeric effect and Steric effect (Acid and Base Strength).

2.3 Stereoisomerism – Types - Cause of Optical Activity – Enantiomers - Diastereomers - Meso form - Optical Activity of Lactic acid and Tartaric acid - Racemisation and Resolution – Definition and Methods - Geometrical isomerism – Definition and example - Maleic and Fumaric acid – Differences.

UNIT – III

3.1 Chemical Kinetics – Rate of a reaction – Definition of Order and Molecularity – Distinction between Order and Molecularity - Derivation of First order rate equation – Half Life Period of first order reaction.

3.2 Catalysis - Catalyst - Autocatalyst - Enzyme catalyst - Promoters - Catalytic poisons – Active Centre - Differences between Homogeneous and Heterogeneous Catalysis - Industrial Applications of Catalysts.

3.3 Photochemistry – Grothus-Draper's law – Stark-Einstein's law - Quantum yield – Photosynthesis - Phosphorescence – Fluorescence.

UNIT – IV

4.1 VSEPR Theory – Hybridisation and Shapes of simple molecules BF_3 , PCl_5 , SF_6 and XeF_6 .

4.2 Fuels – Classification of Fuels - Calorific value of Fuels – Water gas, Carbureted Water gas and Producer gas – Composition and Uses - Non-Conventional fuels - Need of Solar Energy - Applications - Biofuels – Oil gas, Natural gas and LPG – Uses.

4.3 Osmosis - Osmotic pressure - Reverse osmosis – Definition - Desalination of Sea water.

UNIT – V

5.1 Nuclear Chemistry – Atomic number, Mass number - Isotopes, Isobars and Isotones – Definition and Examples - Definition of Half life period - Nuclear Binding Energy, Mass Defect and N/P ratio - Nuclear Fission and Nuclear Fusion (Elementary idea) - Applications of Radioisotopes in Medicine, Agriculture and Industries – Carbon Dating.

5.2 Crude Oil - Petroleum - Petroleum Refining - Cracking - Applications of Cracking – Naphthalene – Preparation – Haworth's method – Properties – Oxidation, Reduction and Uses of Naphthalene - Structure of Naphthalene (Structural elucidation not necessary).

5.3 Conductors, Insulators, Semiconductors, N- and P- Type Semiconductors – Definitions and Examples.

SEMESTER II
PAPER – 2
BIOMOLECULES

UNIT-I: Carbohydrates

Classification of carbohydrates, stereo isomerism and optical isomerism of sugars, anomeric form and mutarotation. Occurrence, structure and biological importance of mono, di and polysaccharides (esp. starch, glycogen and cellulose). Reaction of Carbohydrates due to the presence of hydroxyl, aldehyde and ketone groups.

UNIT-II: Proteins

Classification and structure of amino acids based on structure. Introduction, classification of proteins based on solubility, size and shape. Structure of proteins - primary, secondary, tertiary and quaternary.

UNIT-III: Lipids

Introduction, definition, classification and functions of Lipids - simple lipids, compound lipids - phospholipids (esp. lecithin cephalin, phosphotidyl inositol and phosphotidyl serine) and derived lipids - steroid (cholesterol).

UNIT-IV: Nucleic acids

Nature of genetic material, structure of purine and pyrimidine nucleotides. Composition of DNA and RNA-Watson crick model of DNA. Types of nucleic acid (DNA and RNA).

Properties of nucleic acids-Tm, denaturation and renaturation, hypo and hyper chromicity.

UNIT-V: Vitamins

Dietary Sources, deficiency manifestation and biological functions of fat soluble and water soluble vitamins.

References:

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan Worth Publishers.
2. Harper's Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
6. Biomolecules-C.Kannan , MJP Publishers, Chennai-5.

CORE PRACTICAL - I**Objectives**

1. Students should know the principles, theory and calculations of each experiment.
2. They should know to prepare all the solutions by themselves. They should standardize their solutions individually.

1. EXPERIMENT INVOLVING TITRIMETRIC PROCEDURES

- a. Estimation of amino acids by formal titration.
- b. Estimation of ascorbic acid by titrimetric method using 2, 6-dichlorophenol indo phenol.
- c. Determination of saponification value of edible oil.
- d. Determination of Acid number of edible oil.
- e. Estimation of reducing sugar from biological fluids by Benedict's titrimetric method.
- f. Iodine number of oil.

2. QUALITATIVE ANALYSIS.

- a. Reactions of simple sugars including glucose, fructose, galactose, mannose, pentose, maltose, sucrose, lactose, starch, glycogen and dextrin.
- b. Reactions of proteins - solubility, Biuret, Millon's, Xanthoproteic test, denaturation by heat, pH change and precipitation by acidic reagents. Color reactions of amino acids like tryptophan, tyrosine, cysteine, methionine, arginine, proline and histidine.
- c. Reactions of lipids - solubility, saponification tests for unsaturations, Liebermann-Burchard test for Cholesterol.

ALLIED – 2
CHEMISTRY – II

OBJECTIVE:

- Basic knowledge on Coordination Chemistry, Industrial Chemistry, Carbohydrates, Aminoacids, Proteins, Electrochemistry, Paints and Pigments, dyes, Vitamins, Medicinal Chemistry, Corrosion and Applications wherever necessary are to be taught for II- semester.

UNIT – I

1.1 Coordination Chemistry - Nomenclature of Coordination Compounds - Ligands, Central Metal Ion and Complex Ion – Definition and Examples – Coordination Number - Werner’s Theory of Coordination Compounds - Chelates - Functions and Structure of Haemoglobin and Chlorophyll.

1.2 Industrial Chemistry - Fertilisers and Manures – Biofertilisers - Organic Manures and their importance - Role of NPK in plants - Preparation and Uses of Urea, Ammonium Nitrate, Potassium Nitrite and Super Phosphate of Lime.

1.3 Contents in Match Sticks and Match Box - Industrial making of Safety Matches – Preparation and Uses of Chloroform, DDT, Gammexane and Freons.

UNIT – II

2.1 Carbohydrates - Definition and Examples - Classification – Oxidation and Reduction Reactions of Glucose - Structure of Glucose (Structural elucidation not necessary) - Uses of Starch - Uses of Cellulose Nitrate and Cellulose Acetate.

2.2 Amino Acids – Definition and Examples - Classification of Amino Acids - Preparation - Gabriel Phthalimide Synthesis – Properties – zwitterion and Isoelectric point - Structure of Glycine.

2.3 Proteins – Definition - Classification of Proteins based on Physical properties and Biological functions - Primary and Secondary Structure of Proteins (Elementary Treatment only) – Composition of RNA and DNA and their Biological role - Tanning of Leather - Alum (Aluminum chloride tanning) - Vegetable tanning – Chrome Tanning.

UNIT – III

3.1 Electrochemistry - Electrolytes – Definition and Examples – Classification - Specific and Equivalent Conductance - their determination – Variation of Specific and Equivalent conductance with Dilution – Ostwald’s Dilution Law and its Limitations.

3.2 Kohlrausch’s Law - Determination of Dissociation Constant of weak Electrolytes using Conductance measurement - Conductometric titrations.

3.3 pH – Definition and pH determination by indicator method - Buffer solutions - Buffer action - Importance of buffers in the living systems.

UNIT – IV

4.1 Paints - Components of Paint – Requisites of a Good Paint - Pigments – Classification of Pigments on the basis of Colour – Examples - Dyes – Definition – Chromophores and Auxochromes – Examples - Colour and Dyes - Classification based on Constitution and Application – Examples.

4.2 Vitamins – Definition – Classification – Water Soluble and Fat Soluble – Occurrence - Biological Activities and Deficiency Diseases caused by Vitamin A, B, C, D, E and K - Hormones – Definition and Examples – Biological Functions of Insulin and Adrenaline.

4.3 Chromatography - Principles and Applications of Column and Paper chromatography- R_f value.

UNIT – V

5.1 Drugs - Sulpha Drugs – Preparation and Uses of Sulphapyridine and Sulphadiazine - Mode of Action of Sulpha Drugs - Antibiotics - Uses of Penicillin, Chloramphenicol and Streptomycin - Drug Abuse and Their Implication - Alcohol – LSD.

5.2 Anaesthetics - General and Local Anaesthetics - Antiseptics - Examples and their Applications - Definition and One Example each for Analgesics, Antipyretics, Tranquilizers, Sedatives - Causes, Symptoms and Treatment of Diabetes, Cancer and AIDS.

5.3 Electrochemical Corrosion and its Prevention – Electroplating – Applications.

**ALLIED PRACTICAL
CHEMISTRY**

VOLUMETRIC ANALYSIS

1. Estimation of HCl – Standard sulphuric acid.
2. Estimation of Borax - Standard Sodium Carbonate.
3. Estimation of NaOH – Standard Oxalic Acid.
4. Estimation of FeSO₄ – Standard FAS.
5. Estimation of Oxalic acid – Standard FeSO₄.
6. Estimation of FAS – Standard Oxalic Acid.
7. Estimation of Oxalic acid – Standard Oxalic Acid.
8. Estimation of Fe²⁺ using Diphenylamine / N- Phenyl Anthranilic acid as indicator.

ORGANIC ANALYSIS

Systematic Analysis of Organic Compounds containing One Functional Group and Characterisation by Confirmatory Tests.

Reactions of Aromatic Aldehyde, Carbohydrates, Mono and Dicarboxylic acids, Phenol, Aromatic Primary Amine, Amide and Diamide.

REFERENCE BOOKS

- ❖ Inorganic Chemistry - P. L. Soni - Sultan Chand (2006).
- ❖ Inorganic Chemistry - B. R. Puri, L. R. Sharma and K. C. Kallia – Milestone Publications (2013).
- ❖ Selected Topics in Inorganic Chemistry - W. U. Malik, G. D. Tuli and R. D. Madan - S. Chand Publications (2008).
- ❖ Text Book of Inorganic Chemistry – R. Gopalan, Universities Press – 2012.
- ❖ Text Book of Organic Chemistry - P. L. Soni - Sultan Chand & Sons - 2007.
- ❖ Advanced Organic Chemistry - Bahl and Arun Bahl - Sultan Chand and Co. Ltd – 2012.
- ❖ Organic Reaction Mechanisms - Gurdeep Chatwal- Himalaya Publishing House.
- ❖ A Text Book of Organic Chemistry K. S. Tewari, N. K. Vishol, S. N. Mehrotra- Vikas Publishing House – 2011.
- ❖ Principles of Physical Chemistry - B. R. Puri, Sharma and Madan S. Pathania, Vishal Publishing Company – 2013.
- ❖ Text Book of Physical Chemistry - P. L. Soni, O. P. Dharmarha and U. N. Dash - Sultan Chand & Co – 2006.
- ❖ Understanding chemistry – C. N. R. Rao, Universities Press – 2011.

SEMESTER III**PAPER – 3****BIOCHEMICAL TECHNIQUES – I****UNIT - I**

Units of measurements of solutes in solution, e.g. Normality, Molality, Molarity, Ionic strength, Millimoles. Osmosis, Osmotic pressure, Osmolarity and its application. Concept of isotonic, hyper and hypotonic solution and its importance in biology.

UNIT - II

Concept of pH, pOH, buffer and its application, buffer capacity. Henderson - Hasselbalch equation and its importance. Buffer in body fluids, Red blood cells, white blood cells, tissues and its role.

UNIT - III

Principle, instrumentation and applications of hydrogen electrode, glass electrode in determination of pH. Principle, instrumentation and applications of Clark oxygen electrode.

UNIT - IV

General principle of chromatography. Partition and adsorption chromatography. Principle, operation procedure and applications of paper chromatography and their types. Principle, instrumentation, application of thin layer chromatography, ion exchange chromatography, and molecular gel exclusion chromatography and its application in separation of macromolecules.

UNIT – V: Basic principle of centrifugation techniques, sedimentation rate, Svedberg unit / sedimentation coefficient. Preparative ultracentrifuge, Differential centrifugation, density gradient centrifugation, rate zonal, isopycnic, equilibrium centrifugation. Analytical ultracentrifuge method - determination of molecular weight by sedimentation in an ultra centrifuge.

References:

1. A Biochemical Guide to Principles and techniques of Practical Biochemistry- Keith Wilson and Kenneth Goulding, Cambridge Press.
2. Principles and Techniques of Practical Biochemistry- Keith Wilson And John Walker, Cambridge Press.
3. Introduction to Practical Biochemistry - Shawney, Randhir Singh, Naraso Pub, N. Delhi.
4. Analytical Biochemistry - R.B. Turner, Elsevier, N.Y.
5. Biochemistry Laboratory: Modern theory and techniques -Rodney Boyer, Prentice Hall
6. Instrumental methods of chemical analysis - Chatwal -Anand, Himalayan Publication.
7. Biophysical Chemistry - Upadhyay and Upadhyay Nath, Himalayan Publication.

ALLIED - 3**1. MICROBIOLOGY – I****UNIT - I**

Definition and scope of Microbiology, History and Recent Developments, Spontaneous generation, Biogenesis, Contribution of Louis Pasteur, Leewen Holk, Lazzarn - Spallanzani, John Tyndall, Joseph Lister, Robert Koch, Microscopy - Simple, Compound, Light Microscopy Dark ground, Phase contrast, Flurescence and Election microscopy.

UNIT - II

Five Kingdom consept cell Theory, Binomial Nomendature of microbes, species concept, classical approach with examples, Anatomy of Prokaryotes and Eukaryotes, ultra structure and function of cellwall and cell organelles.

UNIT - III

Culture Techniques, Media preparation, Preservation of cultures, Aerobic and Anaerobic culture techniques, Microbial morphology - wet mount, Hanging drop staining methods, Dyes, Simple - Differential and Special staining techniques Acid fast staining spore stain, Capsule stain, staining for met achromatic Granules, Development of Laboratory Techniques for pure and Mixed culture.

UNIT - IV

Antimicrobial chemotheraphy - Antibiotics - source, classification mode of action - Antimicrobial resistance - Tests for Sensitivity to Antimircrobial agents and its Quality control classical techniques of Microbial identification - Morphological, Physiological and Biochemical properties.

UNIT - V

Measurement of microbial growth Batch and continuous culture, Growth Determination - Growth curve. Structural characteristics of algae - Cholrella, Fungi - Mucor and Protozoa - Entamoeba.

ALLIED – 3**2. ZOOLOGY I****Objective:**

To acquire knowledge about different kinds of animal species.

To study the systematic and functional morphology of invertebrates and chordates.

UNIT – I:

Type study includes life history.

Protozoa - Entamoeba, **Porifera** - Sycon. **Coelenterata** - Obelia geniculata.

Platyhelminthes - Teania solium.

UNIT - II

Annelida - Earthworm, **Arthropoda** - Prawn, **Mollusca** - Fresh water mussel, **Echinodermata** - Sea star.

UNIT – III:

Type study includes Morphology, digestive system, respiratory system, circulatory system and urinogenital system of Chordate.

Chordata - General characters, **Prochordata:** Morphology of Amphioxus.

Vertebrates: Pisces - Shark.

UNIT - IV

Amphibia: Frog, **Reptiles:** Calotes

UNIT - V

Aves: Pigeon, **Mammalia:** Rabbit.

REFERENCES:

1. Ayyar, E.K. and T.N. Ananthakrishnan. 1992. Manual of Zoology. Vol I & II, S. Viswanathan (printers and publishers) Pvt. Ltd., Madras, 891 p.
2. Kotpal series, 1998 - 1992. Rastogi Publications, Meerut.
3. Jordan E.L. and P.S. Verma. 1993. Invertebrate Zoology 12th edition, S. Chand & Co., Ltd., New Delhi.
4. Jordan, E.L., and P.S. Verma. 1995. Chordate Zoology and Elements of Animal Physiology, S. Chand & Co., Ltd., New Delhi.

SKILL BASED SUBJECT**PAPER – 1****FUNDAMENTALS OF COMPUTER****UNIT - I**

Computer fundamentals - Introduction, Definition, importance and advantages. Binary number system, types of computer, computer language, package, operating system, network. Differences between computer and human being.

UNIT - II

Classification of computers - digital, analog, hybrid, micro, mini and super computers. Generations of computer, personal and advanced computers and their types. Microsoft windows - windows fundamental. Managing the file system, printing in windows, windows accessories, control panel.

UNIT - III

Memory unit- primary and Auxiliary. Computer hardware - Input unit, Central processing Unit (CPU), output unit, UPS and external modem. MS Word - Introduction, starting MS Word, Standard menus–file, edit, view, Formatting a text, layouts, inserting a diagram, graph, page numbers, borders, bullet and numbering, spelling and grammar, letter and mailing, mail merge, tables and its applications.

UNIT - IV

MS Excel - Introduction, starting MS excel, creating a worksheet, page setup, print area, paste special, formula. Insert and formatting - cells, rows, columns and sheets. Functions, hyperlink, pivot charts, sorting, filters, header and footers, formula bars, status bar, options and its application.

UNIT - V

MS Power point- - Introduction, power point file types, creating a presentation, using color schemes, viewing a presentation, managing slide shows , adding pictures, transition effects, animations, action setting and action buttons and its application.

References:

1. Computer fundamental, V.K. Jain
2. Working in Microsoft office, Ron Mansfield

NON MAJOR ELECTIVE**PAPER – 1****HEALTH AND NUTRITION****UNIT-I**

Introduction and definition of food and Nutrition. Basic Food groups-Energy yielding, Body Building, Protective Foods. Basic concepts of Energy Expenditure, Unit of Energy, Calorific values of Proteins, Carbohydrates and Fats. BMR.

UNIT-II

Physiological role and Nutritional significance of Carbohydrates, Proteins, Lipids, Vitamins and Minerals. Biological value of Proteins (Animal and Plant), Single cell Proteins.

UNIT-III

Composition of Balanced Diet, RDA for Infants, Children, Adolescent, Adult male, female, Pregnant, Lactating women and Old age.

UNIT-IV

Food processing, Food Preservation. Principles of Diet therapy, therapeutic diets for Anaemia, heart diseases, obesity and Diabetes Mellitus.

UNIT-V

Protein Malnutrition (Kwashiorkar), Undernutrition (Marasmus) their preventive and curative measures. Deficiency diseases of Vitamins.

References

1. Text Book of Physiology and Nutrition-M.Swaminathan.
2. Human Nutrition &Dietetics-Davidson and Passmore.
3. Nutrition and Dietetics-Shubangini Joshi.

SEMESTER IV**PAPER – 4****BIOCHEMICAL TECHNIQUES – II****UNIT - I**

Principles of electrophoresis, factors affecting electrophoretic mobility - sample, electric field, supporting medium, composition of buffer. Sodium dodecyl sulphate, polyacrylamide gel electrophoresis (SDS- PAGE) and its application. Determination of molecular weight of protein by SDS PAGE.

UNIT - II

Principle, methodology and application of immuno electrophoresis. Tiselius moving boundary electrophoresis and its application in serum protein separation. Principle, methods and application of Agarose gel electrophoresis.

UNIT - III

Basic principle of electromagnetic radiation, energy, wavelength, wave number, frequency. Absorption and emission spectra. Beer Lambert's law. Basic principle, instrumentation, application of colorimetry techniques. Principle, instrumentation, application of UV- visible spectroscopy.

UNIT - IV

Principle and instrumentation of spectrofluorimetry techniques. Principle, instrumentation and application in atomic absorption spectroscopy. Principle and instrumentation of flame photometry. Application in analysis of trace elements- sodium and potassium.

UNIT - V

Radiation, type of radioactive decay, half-life, unit of radioactivity. Detection and measurement of radioactivity - Methods based upon ionization (GM Counter), excitation (Scintillation counter). Application of radioisotopes in the elucidation of metabolic pathways, clinical scanning and radio dating, RIA. Biological hazards of radiation and safety measures in handling radio isotopes.

References :

1. A Biochemical Guide to Principles and the techniques of Practical Biochemistry- Keith Wilson and Kenneth Goulding, Cambridge Press.
2. Principles and Techniques of Practical Biochemistry- Keith Wilson And John Walker, Cambridge Press.
3. Introduction to Practical Biochemistry - Shawney, Randhir Singh, Narosa Pub, N.Delhi.
4. Analytical Biochemistry - R.B. Turner, Elsevier, N.Y.
5. Biochemistry Laboratory: Modern theory and techniques -Rodney Boyer, Prentice Hall
6. Instrumental Methods of chemical analysis - Chatwal -Anand,Himalayan Publication.
7. Biophysical Chemistry - Upadhyay and Upadhyay Nath, Himalayan Publication.

CORE PRACTICAL – II**1. BIOCHEMICAL PREPARATIONS**

- a. Isolation of Lecithin from egg yolk.
- b. Isolation of Cholesterol from egg yolk and its estimation.
- c. Isolation of Starch from potato.
- d. Isolation of Casein and Lactalbumin from milk.
- e. Isolation of Lipids by Folch's methods.
- f. Isolation of Chromosomal DNA from liver cells.

2. CHROMATOGRAPHIC SEPARATION

- a. Paper chromatographic separation and detection of amino acid & Simple sugars.
- b. Chromatographic separation of Chlorophyll & Carotenes of flower pigments by using Column chromatography.
- c. Verification of Chargaff's rule by paper chromatography (Demonstration only).

3. PREPARATION OF BUFFERS

Phosphate buffer, Tris buffer and Citrate buffer.

4. COLORIMETRIC ESTIMATION

- a) Estimation of Amino acid by Ninhydrin method.
- b) Estimation of Protein by Biuret method.
- c) Determination of DNA by Diphenylamine method.
- d) Determination of RNA by Orcinol method.

ALLIED - 4**1. MICROBIOLOGY – II****UNIT - I**

Soil Microbiology - Soil structure, Soil formation, Characterisation of Soil Types and importance, Biofertilizers.

UNIT - II

Aquatic Microbiology, Sewage Treatment - Physiological and Biological. Microbes in air, Distribution and Source of Airborne Organisms.

UNIT - III

Food Microbiology, Microbial Spoilage of food, food preservation techniques, Microbes in Milk and their source, Pasteurisation techniques. Industrial Production - Pencillin.

UNIT - IV

Morphology, Classification, Characteristics Pathogenecity, Laboratory diagnosis and prevention of Infections caused by following organisms mycobacteria, dermatophytes, Hepatitis, Entamoeba histolytica, Antigens - Antibody reactions.

UNIT - V

Biotechnology - Definition of a Gene, structure, Cloning Techniques, Genomic library. Nan technology - SCP production. Gene Therapy methods.

ALLIED**2. ZOOLOGY II****Objective:**

To study the principles of cell biology, genetics, developmental biology, physiology, ecology and evolution.

UNIT - I

Cell Biology - structure of animal cell, **Genetics:** molecular structure of gene - gene function, sex linked inheritance. Genetic Engineering and its application.

UNIT - II

Embryology - cleavage and gastrulation of Amphioxus.

Human Physiology: Digestion, Circulation - blood components, structure of heart, heart function.

UNIT - III

Diseases of Circulatory system - blood pressure, heart disease - Ischemia, Myocardial Infarction, Rheumatic heart disease, stroke.

Excretion - structure of kidney and mechanism of urine formation.

UNIT - IV

Environmental Biology - Biotic factors and Abiotic factors, food chain and food web. Pollution - Environmental degradation, (Air, Water and Land) - Green house effect - Bioremediation, Biodegradation - Global warming - acid rain.

UNIT - V

Evolution: Theories of Lamarkism & Darwinism.

REFERENCES:

1. Ekambaranatha Ayyar, and Ananthkrishnan, T.N. 1993. Outlines of Zoology, Vol I & II, Viswanathan and Co, Madras.
2. Sambasiviah, I, Kamalakara Rao, A.P., Augustine Chellappa, S. 1983. Text book of Animal Physiology, S. Chand & Co., New Delhi.
3. Verma and Agarwal. 1983. Text book of animal Ecology, S. Chand & Co., New Delhi.
4. Verma and Agarwal and Tyagi. 1991. Chordate Embryology, S. Chand & Co., New Delhi.
5. Rastogi and Jayaraj. 2000. Text book of Genetics. Rastogi publications, Meerut.
6. Verma and Agarwal. 2000. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Co., New Delhi.

ALLIED PRACTICAL**1. MICROBIOLOGY – I & II**

1. Clearing of glassware, sterilization techniques.
2. Gram stain, Motility (Hanging drop)
3. Enumeration of soil microbes.
4. Enumeration of sewage microbes.
5. Assessment of milk quality by MBET test.
6. Streak plate, pour plate techniques.
7. Isolation of puncture techniques.
8. Wet mount preparation fungal material.
9. Serial dilution techniques.
10. Slant preparation.
11. Study of SCP, blue greens algee
12. Assessment of Air quality
13. Plant viral diseases like TMV, Tomato milting HIV, Virus structure diseases.
14. Micro photographs in Biotechnology of Microbes and Microbial products demonstration and identification.
15. Diseases like Tuberculosis, Chorine beefier diphtheria demonstration identification.
16. Medically important pathogens micro photographs demonstration.
17. Root Nodules Rhizobium isolation and identification methods.

ALLIED PRACTICAL**2. ZOOLOGY****I MAJOR PRACTICAL****DISSECTIONS**

Cockroach: Digestive and nervous system

Prawn: Nervous system

II MINOR PRACTICAL**MOUNTING**

1. Mouth parts of **Mosquito** and **Honey bee**

2. **Earthworm** - Body setae

3. Placoid scales of **shark**

III SPOTTERS

Entamoeba, Sycon, Obelia, Taenia solium (entire, scolex) earthworm (entire, Pineal setae) Prawn (entire), Fresh water mussel, Sea star, Amphioxus - Entire, Amphioxus - T.S. through pharynx, Shark, Frog, Calotes, Pigeon, feathers of pigeon and Rabbit.

Sphygmomanometer, Stethoscope, Rain gauge.

REFERENCES:

1. Verma. P.S. 2011. A manual of practical Zoology - INVERTEBRATES. Chand & Co., Ltd., Ram Nagar, New Delhi.
2. Verma. P.S. 2011. A manual of practical Zoology - CHORDATES. Chand & Co., Ltd., Ram Nagar, New Delhi.

SKILL BASED SUBJECT**PAPER – 2****COMPUTER APPLICATIONS****UNIT - I**

Operating system - MS DOS, DOS Features, MS DOS opening and closing, DOS commands, Batch Files. Windows XP- opening and closing, background setting, date and time adjustment, note pad, word pad, painting. Unix features and commands.

UNIT - II

Introduction to telecommunication, Networking. Internet - Introduction, Importance, requirements for internet. Electronic mailing, chatting, search engine, web pages.

Multimedia - Introduction, applications, components and its uses. Multimedia design, multimedia concept.

UNIT – III

Computer maintenance - causes of failure, components failure, temperature and humidity, dust and other particle, power line problems. Downloading software and files, copying CD/DVD. Computer virus- introduction, types, symptoms, virus avoiding methods, antivirus programs.

UNIT – IV

Computer application in banking, industries, educational institutions, hospitals, Research institutions - ISRO, BARC. Network - local area network, wide area network.

UNIT – V

HTML – Introduction – history – basic tags – tables – frames – images – anchor tags – hyperlinking documents – web browsers.

References :

1. Computer fundamental, V.K. Jain
2. Multimedia, System design, Prabhat k. Andleigh, Kiran Thakrar.
3. Internet & World Wide Web, third edition, Dietel, Dietel, Gold Berg.
4. Rastogi.S.C, Namita -Mendiratta and Parag Rastogi, (2004) BioInformatics – Concepts, Skills and applications.
5. Mani.K and Vijayraja (2005), BioInformatics – A practical approach

NON MAJOR ELECTIVE**PAPER – 2****FIRST AID****Unit I**

First Aid: Important Rules of First Aid, First Aid Box. Injuries (Head, Spinal, Eye, Ear), Sprains and Strains.

Unit II

Cuts and Abrasions, Bleeding, Fractures, Dislocations of bones, Burns, Amputations, Nose bleeds, Electric Shock, Radiation burns.

Unit III

Common medical emergencies - First aid during Chest pain, Stroke, Seizures, Breathing difficulties, Epilepsy.

Unit IV

Common medical emergencies - First aid during Diabetic emergencies, Choking, Fainting, Heart attack, Low Blood Pressure.

Unit V

Poisonous Bites (Insects and Snakes) and Stings (Honey bee) - Animal bites (Dog) – Some Common Poisons and their antidotes – Acid Poisoning – Alkali Poisoning – Poisoning by Disinfectant.

Reference

1. Jayashree Ghosh – A Textbook of Pharmaceutical Chemistry, 1st Ed – S.S. Chand & Company

SEMESTER V**PAPER – 5****ENZYMES AND INTERMEDIARY METABOLISM****UNIT-I: Enzymes**

Definition, units, various classifications, nomenclature, specificity, isoenzymes, factors affecting enzyme activity - pH, temperature, enzyme concentration. Lock and key mechanism, Induced Fit theory. Michaelis Menten equation, Line weaver Burk plot. Enzyme inhibition - Competitive, Non competitive and Uncompetitive (Concepts with example) inhibition.

UNIT-II: Carbohydrates Metabolism

Role of high energy compounds-Electron transport chain and Oxidative phosphorylation. Glycolysis, Glycogenesis and glycogenolysis, Citric acid cycle, Gluconeogenesis, HMP shunt.

UNIT III: Lipid Metabolism

Oxidation of fatty acids – Beta oxidation, alpha oxidation and omega oxidation. Oxidation of fatty acids with odd number of carbon atoms. Ketogenesis. Biosynthesis of saturated fatty acids and unsaturated fatty acids. Biosynthesis and degradation of triacyl glycerol and phospholipids. Biosynthesis and degradation of cholesterol.

UNIT-IV: Protein Metabolism

Degradation of proteins, Oxidative, Non-oxidative, deamination and decarboxylation of amino acids, Urea Cycle and Creatinine formation.

UNIT-V: Nucleic acid Metabolism

Biosynthesis and degradation of purine and pyrimidine nucleotides, uricotelic and urotelic system, inhibitors of nucleotides biosynthesis.

References:

1. Enzymes - Dixon and Webb
2. Understanding enzymes - Palmer
3. Enzyme kinetics – Segel, I.H.
4. Lehninger's principles of Biochemistry - Nelson and Cox
5. Lippincott's Biochemistry - P.C. Champe
6. Harper's Biochemistry - Murray
7. Biochemistry - Voet and Voet

PAPER – 6**GENETICS AND MOLECULAR BIOLOGY****UNIT-I**

Mendelian genetics: Mendel's law of inheritance, test cross, back cross and law of incomplete dominance.

UNIT-II

Definition of gene, organization of genes and non coding DNA in prokaryotes. Eukaryotes – unique, moderately repetitive and highly repetitive DNA sequence, satellite DNA. Cot value. DNA is the genetic material - experimental evidence – Griffith, McLeod, McCarty and Avery, Hershey – Chase experiments. Definition and types of replication, experimental proofs for semi-conservative replication. Replication in prokaryotes and inhibitors of replication - requirements and mechanism of prokaryotic DNA-Replication.

UNIT-III

Prokaryotic transcription-RNA polymerases, role of sigma factor, initiation, elongation and termination. (Rho - dependent and independent). Post transcriptional modification in prokaryotes. Post-transcriptional modifications of mRNA, rRNA and tRNA. Inhibitors of transcription. Reverse transcription.

UNIT-IV

Translational activation of amino acids, initiation, elongation and termination of protein synthesis in prokaryotes. Inhibitors of protein synthesis. Post translational modification of proteins. Genetic code - definition, deciphering and salient features of genetic code. Composition of prokaryotic and eukaryotic ribosomes. Structure of t-RNA. Coding and non coding strands of DNA. Role of signal peptides.

UNIT - V

DNA repair mechanism-excision, SOS and UV repair. Prokaryotic gene regulation – Operon concept, Lac operon, positive and negative control. Gene mutation types - point, transition, transversion, frame shift, insertion and deletion.

References:

1. Genes VIII 2004. Benjamin Lewin, Oxford Univ press.
2. Cell and Molecular Biology - 3rd Edition (2002).G Karp. John Wiley and Sons N.Y
3. Molecular cell biology - David Freifielder 2nd Edition, Narosa publishing House.
4. Lehninger's principle of Biochemistry (2000), Nelson and Cox.
5. Harper's Biochemistry - Rober K. Murray, Daryl K.Grammer, McGrawHill, Lange Medical Books
6. Biochemistry of Nucleic acids - Adam et al
7. Molecular biology - SC Rastogi CBS publishing 2nd Edition
8. Cell biology and Genetics - P.S. Verma and V.K.Agarwal, S. Chand publication
9. Advanced molecular cell biology - R.M.Twyman.W.wisden Viva book House Yadav - Ist Edition 1998.
10. Genetics - Manju yadav Ist Edition 2003, Discovery publishing House.

PAPER – 7**HUMAN PHYSIOLOGY AND NUTRITIONAL BIOCHEMISTRY****UNIT-I: Respiratory and Circulatory Systems**

Respiratory System: Components of transport of Oxygen and Carbon dioxide, Role of hemoglobin in transport. Mechanism of respiration, Chloride shift, Bohr's effect.

Circulatory System: Structure and functions of Heart, Blood vessels and its types, cardiac cycle, factors controlling blood pressure, electrocardiogram.

UNIT-II: Digestive and Excretory systems

Digestive system: Components of Digestive system, Digestion, absorption of carbohydrates, proteins and lipids. Mechanism of HCl formation, Role of various enzymes involved in digestive process.

Excretory System: Physiology of excretion, Kidney, GFR, Urine formation, Urine concentration, Micturition, Renin-Angiotensin system.

UNIT-III: Endocrine and Nervous systems

Endocrine glands: Hormones and its types, Functions of hormones. Brief outline of various endocrine hormones and their functions.

Nervous System: Brain, spinal cord, nerve cells, and nerve fibers. Synapse, chemical and electrical synapses, nerve impulses, action potential and neurotransmission.

UNIT-IV: Nutrition and Dietary Systems

Definition of food nutrition, basic food groups, Physiological role and nutritional significance of carbohydrates, protein, lipids, vitamins and minerals. Protein calorific malnutrition – Aetiology, management of Marasmus and Kwashiorkor. Nutrigenetics, Nutrigenomics (brief outline).

UNIT-V: Nutritive and Calorific Value of Food

Unit of energy measurements of food stuffs by Bomb calorimeter, calorific value and RQ of food stuffs. Basic metabolic rate (BMR) - its measurements and influencing factors, SDA of food. Essential amino acids. Nutritive value of protein. Composition of balanced diet for infants, pregnancy and lactating women and old age.

References :

1. Human physiology, 2nd edition- BJ Mejer, HS Meij, AC Meyer, AITBs publishers and distributors.
2. Cell physiology by Giese, 5th edition, W.B saunderscompany, Tokyo, Japan.
3. A text book of animal physiology, KA Goel, KV Sastri, Rastogi publications Meerut.
4. Animal physiology and Biochemistry- RA Agarval, Anil. K, Srivastava, Kausshal Kumar, S. Chand & Co.
5. A Hand Book of Basic Human physiology- K. Saradha subramanyam, S. Chand & Co., Ltd.
6. Guide to physiology- Y. Rajakshmi, S. Chand & Co., Ltd.

ELECTIVE**PAPER – 1****MEDICAL LABORATORY TECHNOLOGY – I****UNIT-I: Laboratory care and instrumentation**

Code of conduct for laboratory personnel - safety measures in the laboratory- chemical/Reagents, labelling, storage and usage. First Aid in laboratory accidents - Precautions and first aid equipments.

UNIT-II: Laboratory equipments

Working of microscope - Phase contrast, Fluorescence, Electron microscope. Centrifuge, analytical balance, colorimeter - Usage and care. Glass wares, serological water bath, incubator.

Reporting laboratory tests and keeping records. Sterilization, preparation of reagents. General approach to quality control, quality control of quantitative data.

UNIT-III: Urine Analysis

Composition, collection, preservation, gross examination, interfering factors, chemical examination. Significance of sugar in urine, ketone bodies in urine, bile pigments, hematuria, uric acid, microscopic examination of the urinary sediment.

UNIT- IV: Stool Examination

Specimen collection- inspection of faeces- odour, pH, Interfering substance. Test for occult blood, faecal fat, microscopic examination of stool specimen.

UNIT-V: Clinical Hematology

Collection of blood - Anticoagulant, preservation, Estimation of Hb, PCV, WBC, RBC, Platelets, ESR. Clotting time, bleeding time - normal value, clinical interpretation.

SKILLED BASED SUBJECT**PAPER – 3****BIOSTATISTICS – I****UNIT - I**

Nature and scope of statistical methods and their limitations. Collection, classification, tabulation of statistical data.. Organization of data - Individual series, discrete series, continuous series / class interval. Diagrammatic and graphical representation of statistical data (bar diagram, line diagram, pictogram, histogram & horizontal and vertical bar diagram).

UNIT - II

Measure of central tendency - Introduction, Characteristics of a good average, Mean, Median, Mode (Raw, Discrete & Continuous data) Merits and demerits.

UNIT - III

Measure of Dispersion- Introduction, definition, classification & properties. Range - Introduction, definition, location of range in individual, discrete, continuous series, merits and demerits of Range. Standard deviation, Variance, Coefficient of Variation.

UNIT - IV

Probability - Introduction, Definition, Kinds of Probabilities. Sample Space - Addition and Introduction, definition of mean deviation, quartile deviation – simple problems. Permutation and Combination - Definition, Factorial symbol, formula with example.

UNIT - V

Correlation Analysis - Introduction, Definition, uses, correlation and causation, kinds of correlation. Types of correlation - Positive and negative, linear and non linear, simple and multiple, partial and total correlation.

Books for References:

1. Sundar Rao - Biostatistics.
2. Daniel - Biostatistics, John wiley & sons
3. Lewis, A. E (1971) - Biostatistics
4. Gupta S.P,(1997) Biostatistical Methods, S. Chand & Sons
5. Sundar Rao P.S.S, Jesudian.G& Richard.J [1987], An Introduction for Biostatistics [2nd edition] Prestographit, vellore, India
6. Biostatistics - P. Rama Krishna, Saras Publication [1995].
7. elhance D.N [1972], Fundamentals of statistics kitab mahal, allahabad.
8. Lewis, A.E [1971]- Bio-Statistics.
9. Daniel: Biostatistics, John Wiley 7 Sons.
10. Zar. J - BioStatistical analysis, prentice Hall of India.

SEMESTER VI**PAPER – 8****CLINICAL BIOCHEMISTRY****UNIT-I: Diseases related to carbohydrate metabolism**

Regulation of blood sugar, Glycosuria - types of glycosuria. Oral glucose tolerance test in normal and diabetic condition. Diabetes mellitus and Diabetes insipidus - hypoglycemia, hyperglycemia. Ketonuria, ketosis.

UNIT-II: Diseases related to lipid and lipoproteins metabolism

Lipids and lipoproteins: Classification, composition, mode of action. Cholesterol - Factors affecting blood cholesterol level. Dyslipoproteinemias, IHD, atherosclerosis- risk factor, fatty liver.

UNIT-III: Inborn errors of metabolism

Introduction - clinical importance, phenyl ketonuria, cystinuria, alkaptonuria, Fanconi's syndrome, galactosemia, albinism, tyrosinemia and hemophilia.

UNIT-IV: Organ function test

Liver function tests: Metabolism of bilirubin, jaundice - types, differential diagnosis. Liver function test - Icteric index, Vandenberg test, plasma protein changes, PT.

Renal function tests: Clearance test – Urea, Creatinine, Inulin, PAH test, Concentration and dilution test.

Gastric function tests: Collection of gastric contents, examination of gastric residuum, FTM, stimulation test, tubeless gastric analysis.

UNIT-V: Clinical enzymology

Functional and non-functional plasma enzymes. Isoenzymes with examples. Enzyme patterns in acute pancreatitis, liver damage, bone disorder, myocardial infarction and muscle wasting.

References:

1. Text book of Clinical Biochemistry - Carl A. Burdis and Edward R Ashwood
2. Text book of Medical Biochemistry - Dr. M.N. Chatterjee and rane shinde
3. Clinical chemistry in diagnosis and treatment - Philip D. Mayne
4. Clinical chemistry – William Hoffman
5. Clinical Biochemistry with clinical correlation – Devin, Wiley
6. Practical clinical biochemistry – Harold Varley, CBS, New Delhi

PAPER – 9**BIOTECHNOLOGY****UNIT – I**

Biotechnology: Definition and scope, types and branches of biotechnology. Enzymes for in vitro manipulation - Restriction endonucleases, SI nucleases, DNA ligases, Alkaline phosphatase, Reverse transcriptase, DNA polymerase, polynucleotide kinase, terminal transferase. Use of Linkers and Adapters. Cloning vectors, Plasmids - properties of ideal vectors and its types – pBR322, pUC18, pUC19. Bacteriophage λ , Cosmid, YAC, and Shuttle vector.

UNIT - II

Methods of gene transfer - transfection, microinjection, electroporation. Recombinant selection and screening methods, Insertional inactivation. Blotting Techniques - Southern, Northern and Western blotting techniques, DNA hybridization techniques, PCR.

UNIT - III

Plant tissue culture - Media composition, nutrients, growth regulators, initiation and differentiation. Callus and suspension culture. Micro propagation, Somatic embryogenesis and somoclonal variation. Protoplast isolation, protoplast fusion and regeneration of plants.

UNIT - IV

Equipments and requirements for animal cell culture - laminar flow, CO₂ incubator, natural media, synthetic media, substrate for cell culture, substrate treatment, disaggregation of tissues, Cell lines – types and properties.

UNIT - V

Applications of genetic engineering: Transgenic plants, transgenic mice (SCID and KNOCK OUT mice), transgenic sheep, transgenic fish, diagnostic and therapeutic applications of monoclonal antibodies.

References:

1. Concept in biotechnology - D. Balasubramiam et al., Universal press India 1996.
2. Plant tissue culture - Razdan, Oxford IBH Publisher.
3. Animal cell culture - Freshney, IRL Press.
4. Animal Biotechnology - 2005. A.K. Srivastava, R.K. Singh and M.P. Yadav Oxford & IBH.
5. Molecular biotechnology 2006 - Channarayappa Univ. Press
6. Molecular Biology & Biotechnology - H.D. Kumar(1997), Vivas publishing house Pvt .Ltd
7. Molecular biotechnology - principle and application of recombinant DNA 3rd edition Bernard, R. Glick Jack, J. Pasternak 2003, Library of Congress cataloging in publication data.
8. A text book of Biotechnology - R. C. Dubey, S. Chand & co
9. Biotechnology - Prakash S. Lohar, MJP publisher, Chennai -5.

CORE PRACTICAL – III**COLORIMETRIC ESTIMATION**

1. Estimation of creatinine by Jaffe's method.
2. Estimation of urea by Diacetyl monoxine method.
3. Estimation of glucose by Folin Wu method
4. Estimation of glucose by O- Toluidine method

EXPERIMENTS ON ENZYMES

1. Effect of pH, temperature and substrate concentration and determination of K_m for amylase and Urease.
2. Assay of activity of alkaline phosphatase in serum.
3. Assay of serum Transaminases (SGOT, SGPT).

BIOTECHNOLOGY EXPERIMENTS

1. Preparation of media – liquid, solid, slant
2. Culture techniques – streak plate, pour plate, spread plate
3. Immuno diffusion – single diffusion

DEMONSTRATION EXPERIMENTS

1. Separation of proteins by SDS-PAGE
2. Isolation of plasmid DNA and separation by electrophoresis

ELECTIVE**PAPER – 2****MEDICAL LABORATORY TECHNOLOGY – II****UNIT - I: Blood Banking**

Blood grouping- ABO System, ABO Grouping, Rh typing. Coomb's test. Blood transfusion - Blood donors, donor screening, drawing of blood, compatibility testing, cross matching, blood transfusion complications.

UNIT - II: CSF and Other Body Fluids

Cerebrospinal fluid analysis. Semen analysis, sputum examination, pregnancy test - Interpretation.

UNIT - III: Endocrine Function Test

Thyroid function test - thyroid hormones and its function. Clinical disorder - diagnosis. T₄, ¹³¹I Uptake, TSH, Stimulation test, FT₄, FTI, TSH, TBG.

UNIT - IV: Medical Parasitology

Amoebiasis, malarial parasites – life cycle, pathogenesis of malaria – acute and chronic filariasis – diagnosis.

UNIT - V Medical Microbiology

Culturing of organisms from various specimens. Culture media and antibiotic sensitivity test (pus, urine, stool, sputum, throat swab, gram staining, Ziehl –Neilson staining (TB, Leptra bacilli). Safety procedure in microbiological techniques.

References:

1. Medical Laboratory Technology - K. Mukherjee. Vol. I, II, III. Tata Mcgraw-Hill Publishing Company Ltd.
2. Medical Laboratory Technology – V.H. Talib
3. Clinical Laboratory practices in CMC procedure, CMC, Vellore.
4. Medical Lab Technology - Ramnik Sood.

ELECTIVE**PAPER – 3****IMMUNOLOGY****UNIT - I**

Immunity: Types of immunity-Innate and Acquired immunity, Humoral and cell mediated immune response, primary and secondary lymphoid organs, structure of T, B and NK cell, structure and function of Neutrophils, Eosinophils and Basophils, Macrophages – Phagocytosis and inflammation.

UNIT - II

Antigens: Properties, Specificity, Immunogenicity, antigenic determinants, haptens and adjuvants, Major Histocompatibility Complex [MHC]. Antibodies: Properties, Structure, Classes, Subclasses of Immunoglobins, Monoclonal antibodies - Production and its applications, complement pathways.

UNIT - III

Allergy and Hypersensitivity – types – I, II, III and IV and their clinical manifestations. Autoimmunity, mechanism of autoimmunity, Autoimmune diseases – Rheumatoid arthritis and Myasthenia gravis.

UNIT - IV

Transplantation – Immunologic response, Graft vs Host reaction, mechanism and prevention of graft rejection (skin), immunosuppressive drugs. Immunology of malignancy: Tumour antigens, immune response in malignancy and immunotherapy of cancer.

UNIT - V

Antigen and antibody interactions - precipitation and agglutination reactions, Precipitation in gel (Ouchterlony procedure, radial immunodiffusion, Immuno electrophoresis), Electro immunediffusion. RIA and ELISA.

References:

1. Immunology - J. Kannan, MJP Publishers, Chennai-5
2. Immunology - Roitt Ivan, Jonathan Brastoff, David Male, 1993.
3. Immunology - Janis Kuby, 4th edition, 2000.
4. Immunology - An introduction, Tizarrd, R. 1995.
5. Fundamentals of Immunology - Lippincot Praven publications, 4th edition.
6. Essential and clinical Immunology - Halen chapel, Mansal Haney, Siraj Misbah and Nial Snowdan.
7. Immunology - Geoffrey Zubay, W.M.C, Brown publishers, 4th edition 1992.
8. Immunology - The immune system in health and disease, 3rd edition.

ELECTIVE PRACTICAL**MEDICAL LABORATORY TECHNOLOGY****1. HAEMATOLOGY**

Hematology – Haemoglobin by Sahli's method, RBC count, PCV, ESR, Total and differential WBC count, Platelet count, Blood grouping, ABO system, Rh System, Clotting time, Bleeding time.

Serology – VDRL, CRP, RA, HIV, HBsAg, Pregnancy test.

2. MICROBIOLOGY

Sterilization and disinfection, culture, gram staining, media preparation, antibiotic sensitivity testing

3. URINE AND FAECES ANALYSIS

1. Collection of urine and faecal samples
2. Faecal analysis to detect fats, undigested food and blood
3. Qualitative analysis of urine for normal and pathological conditions.

References:

1. Practical clinical Biochemistry - Harold Varley, CBS, New delhi
2. Medical Laboratory Technology – Kanai L. Mukherjee, Tata McGraw Hill Publication and co. ltd., Vol, I, II, III
3. Clinical chemistry – Ranjana Chawla
4. laboratory Manual in Biochemistry – Jayaraman
5. Biochemical methods – S.Sadasivan And Manickam
6. Introduction to practical biochemistry – David T. Plummer.

SKILLED BASED SUBJECT**PAPER – 4****BIostatISTICS – II****UNIT - I**

Theoretical Distribution – Definition, Type of Theoretical Distribution, Binomial distribution and Poisson distribution- Definition, characteristics and Properties. Normal distribution, normal curve, standard Normal distribution - characteristics and Properties.

UNIT - II

Regression Analysis – Introduction, Definition, uses, types of regression- Positive and negative, linear and non linear, simple and multiple, partial and total. Regression equation – Regression equation of X on Y and Y on X.

UNIT - III

F-test and it's application, testing of Hypothesis – Null hypothesis, alternative hypothesis, standard error.

UNIT – IV

Chi- Square test- Introduction, Characteristics of Chi- Square test, Assumption, degree of freedom, application of chi- square test, t-test – Application and its Uses.

UNIT - V

Analysis of Variance- Introduction, techniques of Analysis of variance (ANOVA) – One way and two way classification, steps involved in analysis.

Books for References:

1. Sundar Rao- Biostatistics.
2. Daniel – Biostatistics, John wiley & sons
3. Lewis, A. E (1971) – Biostatistics
4. Gupta S.P,(1997) Biostatistical Methods, S. Chand & Sons
5. Sundar Rao P.S.S, Jesudian.G& Richard.J [1987], An Introduction for Biostatistics [2nd edition]
1. Prestographit, vellore, India
6. Biostatistics – P. Rama Krishna, Saras Publication [1995].
7. elhance D.N [1972], Fundamentals of statistics kitab mahal, allahabad.
8. Lewis, A.E [1971]- Bio-Statistics.
9. Daniel: Biostatistics, John Wiley & Sons.
10. Zar. J – BioStatistical analysis, prentice Hall of India.s