St Aloysius College (Autonomous)
Mangaluru

Re-accredited by NAAC with 'A' Grade with CGPA 3.62/4
Recognised by UGC as "College with Potential for Excellence"
Conferred "College with "STAR STATUS" by DBT, Government of India.
Centre for Research Capacity Building under UGC-STRIDE

Course structure and syllabus of

B.Sc. BIOCHEMISTRY (HONOUR'S)

NEP SCHEME-2021 0NWARDS

ಸಂತ ಅಲೋಶಿಯಸ್ ಕಾಲೇಜು (ಸ್ವಾಯತ್ತ)
ಮಂಗಳೂರು– 575 003
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Date: 17-08-2022

NOTIFICATION

Sub: Syllabus of **B.Sc. BIOCHEMISTRY** under NEP Regulations, 2021.
(As per Mangalore University guidelines)

Ref: 1. Decision of the Academic Council meeting held on 18-12-2021 vide Agenda No: 6.13 2021-22)
2. Decision of the Academic Council meeting held on 09-07-2022 vide Agenda No: 14
3. Office Notification dated 21-02-2022
4. Office Notification dated 17-08-2022

Pursuant to the above, the Syllabus of **B.Sc. BIOCHEMISTRY** under NEP Regulations, 2021 which was approved by the Academic Council at its meeting held on 18-12-2021 & 09-07-2022 is hereby notified for implementation with effect from the academic year **2021-22**.

PRINCIPAL

ST. ALOYSIUS COLLEGE MANGALURU 575 003 AUTONOMOUS

REGISTRAR

To:

1. The Chairman/Dean/HOD.
2. The Registrar Office
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Head of the Department
Biochemistry
St. Aloysius College
Mangalore-575003

SEMESTER -I

COURSE TITLE : CHEMICAL FOUNDATION OF BIOCHEMISTRY	**COURSE CREDITS : 4**
TOTAL CONTACT HOURS: 56	**DURATION OF ESA: 02 hours.**
Formative assessment marks: 40	**Summative assessment marks: 60**

Course Outcome:

This will inculcate confidence and clarity of mind in students to understand the chemistry of Biomolecules and Biological reactions.

UNIT-I

SCOPE OF BIOCHEMISTRY & UNITS OF MEASUREMENT:- **14 HOURS**

What is Biochemistry, brief historical overview, future and scope of Biochemistry, applications of Biochemistry, chemical composition of living organisms. 1hr.

Units of measurement: CGS and SI system, units of length, mass, time, temperature and amount (Mole), derived units, (velocity, density, specific gravity, frequency, power, force, pressure, and energy) SI prefixes (milli, micro, nano, pico, femto, kilo, mega, giga, tera)

3hr.

Atoms, atomicity, element, compound, molecules, isotopes, isotope notation, A-Z notation, isobars,Natural abundance, atomic weight, average mass, molecular weight..

4hr.

Avogadro`s number mole, mole concept, Dalton's concept, molarity, molality, percent composition of atoms. Concentration, molar solution, percent solution, ppm, equivalent weight, normality. 6 hr.

UNIT-II

ATOMIC STRUCTURE AND CHEMICAL BONDS:- **14 HOURS**

Structure of an atom, electrons and Quantum numbers, orbitals, shapes of orbitals, s, p, d, and f subshells, K, L, M, N, O, P, and Q shells. Illustration of Pauli`s exclusion principle, Aufbau principle, and Hund`s rule, electron configuration, octet rule. 6 hr.

Chemical bonding: formation of ionic bond, covalent bond (sigma and pi bonds), co-ordinate bond with examples. Hydrogen bonds, bonding in water molecule, Water as a fluid of life, special properties of water- (boiling point and melting point, surface tension, viscosity, high specific heat) bonding of water in ice and its significance. Weak forces of interaction, van der Waals interactions, London forces, dipole-dipole interactions, electrostatic interactions, and hydrophobic interactions. 8 hr.

UNIT-III

BUFFERS AND COLLIGATIVE PROPERTIES: - **14 HOURS**

Acids, bases, conjugated acids and bases. Arrhenius concept, Lewis concept, Lowry and Bronsted concepts.Strong and weak acids and bases. Strength of acids and bases. Ionic product of water, pH scale, Buffers, Henderson-Hasselbalch equation, buffers in blood-carbonic acid buffer. Titration curve of an amino acid. pK value, zwitterionic structure of aspartic acid isoelectric pH. 7hr.

Water as a solvent. Solutions and types-ionizable solutes, non- ionizable solutes (sugar & salt). Colligative properties and anomalous colligative properties of solutions, vapor pressure and its application in distillation, boiling point, freezing point, de-icing.

Osmotic pressure: Osmosis and osmotic pressure determination, reverse osmosis, isotonic, hypo and hypertonic solution and its effects on blood cells. Donnan membrane equilibrium. 7hr.

UNIT-IV

ELECTROCHEMISTRY AND REDOX REACTIONS:-

Electrochemistry: - electrochemical cells, electrode potential and its measurement, electrodes, half cell reaction,standard electrodes-glass electrode 4 hr.

Laws of thermodynamics-I, II and III law. Concept of entropy and enthalpy, their relation, Gibb`s energy, free energy change. Oxidation and reduction- oxidation number and its significance redox reactions, redox potential, application of redox potential. 6 hr.

Chemical Kinetics: Rate of a reaction, Molecularity and order of a reaction. First and second order reaction, Half life of a first order reaction, Energy of activation. 4 hr.

REFERENCES:

- Advanced Inorganic Chemistry: A comprehensive Text,1999, Cotton A and GeoffreyWilkinson, 6th edition , Wiley publication
- Inorganic Chemistry, 2014, Miessler GL , Paul Fischer PJ, and Tarr DA, 5th edition, PearsonPublication
- Inorganic Chemistry, 2004, Catherine E and Sharpe AG, ACS publication
- Inorganic Chemistry , 2015, Overton, Rourke , Weller , Armstrong and Hagerman ,Oxford Press
- Physical Chemistry: A molecular approach, 2019, Donald A, McQuarrie and Simon JD, Viva Books Publication.
- Physical chemistry 2019, Atkins P, Paula JD, Keeler J , 11th edition , Oxford press.

SEMESTER-1 PRACTICALS – 1

COURSE TITLE: VOLUMETRICANALYSIS & ESTIMATIONS – PRACTICALS-1	**COURSE CREDITS: 2**
TOTAL CONTACT HOURS: 4 Hours/ Week	**DURATION OF ESA : 03 hrs**
Formative assessment marks: 25	**Summative assessment marks: 25**

Course Outcome:

This course aims to familiarize students with the principles of analytical chemistry and basic analytical techniques such as volumetric analysis. Course objective is to provide experimental practice of quantitative volumetric analysis. Upon successful completion students should be able to make solutions of various molar, normal concentrations and determine the amount of a substance in a given sample.

Experiments:

1. Concept of molarity, molality and normality. Calculation and preparation of molar solutions. (Problems to be given in exams). Calculation and preparation of normal solutions and percent solutions and dilute solutions.
2. Calibration of volumetric glassware's (Burette, pipette).
3. Preparation of standard sodium carbonate solution, standardization of HCl (Methyl orange) and estimation of NaOH in the given solution. (Methyl orange or phenolphthalein).
4. Preparation of buffer.
5. Estimation of amino acid Glycine by formal titration method
6. Titration curve for an amino acid and determination of pKa value.
7. Preparation of Isotonic, hypotonic & hypertonic solution.
8. Effect of Isotonic, Hypotonic & hypertonic solutions on RBC.
9. Redox reactions
10. Dialysis & Reverse Dialysis

REFERENCES:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Dr. O. P. Pandey, D. N. Bajpai, Dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.
4. Principles of Practical Chemistry- M. Viswanathan
5. Instrumental Methods of chemical Analysis B.K Sharma.

SEMESTER – II

COURSE TITLE : CHEMICAL FOUNDATION OF BIOCHEMISTRY -2	**COURSE CREDITS: 4**
TOTAL CONTACT HOURS: 56	**DURATION OF ESA : 02 hrs**
Formative assessment marks : 40	**Summative assessment marks : 60**

Course Outcome

These topics will enable students to understand the fundamentals of chemical processes in biological systems.

UNIT- I

CHEMICAL CATALYSIS:- **14 HOURS**

Homogeneous and Heterogeneous – Definition and examples. theories of catalysis, types- homogeneous, heterogeneous, Bio catalysis. Enzyme as catalyst. 4 hr.

Colloids: true solutions, classification of colloids (Examples: Fog, cloud, steam, smog, vehicle exhaust- PM, milk, jelly). 4 hr.

Protein as a colloidal solution. Ultra filtration, Brownian movements, electric properties, coagulation, salting in and salting out of protein. Emulsion, types, (Example Butter) micelles with lipids, emulsifiers. 6 hr.

UNIT- II

NOMENCLATURE OF ORGANIC COMPOUNDS: **14 HOURS**

Classification, naming- IUPAC nomenclature, compounds containing one and two functional groups. Stereochemistry, geometric isomerism-cis and trans (Example of fatty acids) 4 hr.

Structural Isomerism, conformation example glucose- enantiomers, epimer, anomer, mutarotation, chair and boat conformations. Optical isomerism, D and L plane polarized light and optical rotation d and l glucose. 5hr.

Nomenclature of racemic mixture, resolution. Fischer and Newmann projection formulae, molecule with one and two chiral and achiral centers. Priority rules; E and Z (CIP rules), R and S (alanine),D and L(Glucose) notations,. Role of stereochemistry in biological systems. 5 hr.

UNIT- III

INORGANIC CHEMISTRY: **14 HOURS**

Coordination compounds–simple, double and complex salts-definition, differences with examples, IUPAC nomenclature. Werner's theory, ligands- uni, bi, and polydentate. Coordination number. 5hr.

Trace metals in biological systems: selenium, molybdenum, cobalt. Toxicity of heavy metals:

Lead, mercury, cadmium, arsenic. Bulk elements in biological systems (Na, K, Ca, Mg, Fe, Co, Zn and I). Structural role of calcium, zinc in enzymes. 7hr.

Reactive oxygen, oxygen and nitrogen free radicals. 2hr.

UNIT- IV

ORGANOMETALLIC COMPOUNDS: **14 HOURS**

Metal atom linked organic compounds.

Para chloro mercury benzoate- structure, uses. Methyl mercury toxicity 2hr.

Porphyrins: definition, classification. Important metalloporphyrins occurring in nature; structure and their biological importance. 2hr.

(Hemoglobin, cytochrome, chlorophyll, myoglobin, vitamin B12 iron-sulphur clusters with suitable

Examples and their role in biological systems). 10hr.

REFERENCES:-

1. Physical Chemistry 2006, Peter Atkins. 8th edition, W.H. Freeman and Company

2. Inorganic Chemistry: Principles of structure and Reactivity, 2006, Huheey JE, Keiter EA, Keiter RL , Pearson Education India
3. A text book of Organic Chemistry 2016, Raj K Bansal, 6th edition, New Age International Publications
4. Advanced Inorganic Chemistry 1999, Cotton et al , 6th edition, A Wiley – International
5. Principles of physical Chemistry by Puri, Sharma and Pathania.
6. Physical Chemistry by R. L. Madan, G. D. Tuli. S. Chand and Co
7. Advanced Organic Chemistry by Bahl and Bahl

SEMESTER - II

PRACTICALS - 2

COURSE TITLE: QUALITATIVE AND QUANTITATVE ANALYSIS – PRACTICALS – 2	**COURSE CREDITS: 2**
TOTAL CONTACT HOURS: 4 Hours/Week	**DURATION OF ESA : 03**
Formative assessment marks : 25	**Summative assessmentmarks : 25**

Course Outcome:

The Course Objective is to provide experimental practice of quantitative and qualitative analysis. Also it provides training in physical chemistry laboratory techniques. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

Experiments:

1. Salting in and salting out of milk.
2. Estimation of calcium in Ragi
3. Estimation of Fe in Edible leaves
4. Reactive Oxygen species
5. Verification of Beer's Law. Estimation of unknown concentration of a biomolecule by using colorimeter
6. Partition Coefficient of Amino Acid (Phenylalanine/ Glycine) in n-octane: water system
7. Oxidation and reduction of cytochrome

8. Calibration of pH meter and determination of pH of aerated soft drinks.
9. Lab safety measures.

REFERENCES:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Dr. O. P. Pandey, D. N. Bajpai, dr. S. Giri, Practical Chemistry S. Chand and Co. Ltd.,
4. Principles of Practical Chemistry- M. Viswanathan

SEMESTER -I

OPEN ELECTIVE

COURSE TITLE	**BIOCHEMISTRY OF CELL**
COURSE CREDITS	**03**
TOTAL CONTACT HOURS	**42**
DURATION OF ESA	**02hrs**
FORMATIVE ASSESSMENT MARKS	**25**
SUMMATIVE ASSESSMENT MARKS	**50**

Course Outcome:

This open elective course offering to students of various streams gives knowledge about biomolecules in their cellular environment. Further, they will learn basic chemistry of amino acids, peptides, sugars, polysaccharides, nucleosides, nucleotides, nucleic acids, lipids, vitamins, coenzymes and metal ions.

UNIT - I

BIOMOLECULES IN THEIR CELLULAR ENVIRONMENT: 14 HOURS

The cellular basis of life. Cellular structures – prokaryotes and eukaryotes. Chemical principles in biomolecular structure. Major classes of biomolecules. Role of water.

Amino acids and peptides:

Structure of amino acids, classification of amino acids based on polarity, derivatives of amino acids and their biological role. Peptide bond, Properties of a peptide, biologically important peptides

UNIT - II

SUGARS AND POLYSACCHARIDES: 14 HOURS

Basic chemistry of sugars, optical activity. Disaccharides, trisaccharides and polysaccharides - their distribution and biological role.

Nucleosides, nucleotides and nucleic acids:

DNA structures and their importance, different types of RNA. Unusual DNA structures, other functions of nucleotides.

UNIT -III

LIPIDS: **14 HOURS**

Different classes of lipids and their distribution, storage lipids, structural lipids in membranes, lipids as signal molecules, cofactors and pigments.

Vitamins, coenzymes and metal ions:

Occurrence and nutritional role. Coenzymes and their role in metabolism. Role of metal ions in biological system and theirsignificance - heme, porphyrins and cyanocobalamin.

REFERENCES:

1. Lehninger- Principles of Biochemistry-DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications (2012).
2. Biochemistry Ed. Donald Voet & Judith G. Voet, John Wiley & Sons, Inc.(2010).

SEMESTER-II

OPEN ELECTIVE

COURSE TITLE	**PROTEINS AND ENZYMES**
COURSE CREDITS	**02**
TOTAL CONTACT HOURS	**42**
DURATION OF ESA	**02**
FORMATIVE ASSESSMENT MARKS	**25**
SUMMATIVE ASSESSMENT MARKS	**50**

Course Outcome:

- Proteins: The course aims to introduce proteins and their importance to modern Biochemistry, highlighting their structural features and unique characteristics that help them participate in

every physiological process in life.

- Enzymes: The objective of this course is to integrate the practical aspects of enzymology with the kinetic theories to provide a mechanistic over view of enzyme activity and regulation in the cell.
- To prepare students to confidently and competently work with enzyme systems in both Academia and industry.

UNIT - I

Classification of amino acids based on structure, Zwitterion structure, Isoelectric point, pKa. Properties of peptide bonds. Classification of proteins based on structure and functions. Overview of Primary, Secondary, Tertiary and Quaternary structures of proteins. Structure of myoglobin and hemoglobin, Ramachandran plot, Helices, sheets and turns.

Determination of N-terminalamino acid (by DNFB and Edman method), and C- terminal amino acid (by thiohydantoin andwithcarboxypeptidaseenzyme). Overview on proteinfolding.

14 HOURS

UNIT – II

Introduction of Biocatalysts, Nomenclature and classification of enzymes, enzyme specificity, Active site and its models, fundamentals of enzyme assay. Enzyme Kinetics: Order of reactions, Michalis – Menten equation for Uni-Substrate reaction (derivation not necessary), significance of Km and Vmax. Enzyme inhibition: Over view on Reversible and irreversible inhibition Regulation of enzyme activity: Allosterism and cooperativity, feedback inhibition. Outline of Mechanism of enzyme action: Acid – base catalysis, covalent catalysis,. Mechanism of Chymotrypsin.Applications of enzymes.

14HOURS

UNIT – III

Separation and characterization of Proteins and enzymes: Ammonium sulphate fractionation, solvent fractionation, dialysis and lyophilization, Ion exchange chromatography, molecular sieve chromatography, affinity chromatography, Native and SDS – PAGE electrophoresis.

14 HOURS

REFERENCES

1. Lehninger Principles of Biochemistry, 6th Edition , David L Nelson, 2017
2. Fundamentals of Biochemistry, 4th Edition , Donald Voet and Judith Voet , 2015
3. Biochemistry Jeremy Berg , Lubert Stryer and John Tymoczko, Gregory Gatto, 2019
4. Protein Purification. Principles and Practice. Robert K Scopes, Springer, ISBN 978-1-4737-2333-5

SEMESTER -III

COURSE TITLE : BIO-ORGANIC CHEMISTRY	**COURSE CREDITS : 4**
TOTAL CONTACT HOURS: 56	**DURATION OF ESA: 02 hours.**
Formative assessment marks: 40	**Summative assessment marks: 60**

Course Outcome:

These topics will enable students to understand the fundamentals of organic chemistry pertinent to their importance in understanding biochemical reactions.

Course outcomes /Programoutcomes	1	2	3	4	5	6	7	8	9	10	11	12
Aptitude	X	X	X	X								
Critical thinking		X										
Subject clarity	X	X				X	X	X		X		X
Analytical skill	X				X	X	X	X	X			X

UNIT-I

REACTION MECHANISMS AND HYDROCARBONS **14 HOURS**

Introduction, meaning of the term, kinetic and non-kinetic. Fundamental aspects: Homo and heterolytic cleavage. Classification of organic reactions (substitution, addition, elimination,

and re- arrangement), with two examples for each. Reactive intermediates-examples of free radicals, carbo cations and carbanions, free radicals, carbenes, nucleophiles and electrophiles

06 Hr.

Aromatic compounds - Aromaticity, criteria for aromaticity, anti-aromatic, and non-aromatic compounds with examples, POLYCYCLIC benzenoid hydrocarbons , their structure and role

03 Hr.

Biological occurrence -Structural formula and importance of Furan, Pyrrole, Thiopene, Pyridine, Pyran, Thiazole, Pyrimidine, Purine, Indole, Imidazole, Quinoline and Isoquinoline. 05 Hr.

UNIT -II

MECHANISM OF SUBSTITUTION, ELIMINATION, AND ADDITION REACTIONS 14 HOURS

Examples of Electrophilic substitution (nitration of Benzene), example of S_N1(from DNA synthesis) and S_N2 (S-Adenosyl Methionine methyl transferase) reactions , Stereochemistry (Retention of configuration and inversion of configuration).Addition and elimination reactions (Examples), 1,2 and 1,4 addition reactions. Addition of oxygen to C=C in fatty acids. 6 Hr.

Alcohols

Monohydric, Dihydric, Trihydric alcohols with examples. Primary, secondary and tertiary alcohols reactions: oxidation and reduction. Distinguishing test.

Function of phenols and phenolics (in plants) 3 Hr.

Amines

Classification, properties, Amino functional group - Basicity of amines acylation. Reaction with HNO_2 and Schiff's base formation. Distinguishing reactions of primary, secondary and tertiary -amines. 5 Hr.

UNIT -III

MECHANISM OF ELECTROPHILIC SUBSTITUTION REACTIONS 14 HOURS

Coenzymes- introduction, structure**,** Role of Coenzymes in reaction mechanism

Water soluble Vitamins- definition, sources, structures of thiamine, riboflavin, niacin, pyridoxine, biotin. The reaction of the coenzymes- thiamine pyrophosphate and its role in decarboxylation. Vit B_2 (FAD) role in redox reactions with suitable examples. Biotin its role in carboxylation reaction.

Mechanism of antioxidant activity of vitamin C and vitamin E

Antivitamins- sources and effects of avidin, Dicumarol & Antinutrition factors – Canavanin, Hypoglycin A

UNIT- IV

BIO-ORGANIC COMPOUNDS **14 HOURS**

Introduction to Bioorganic chemistry

Terpenes: Definition, Isoprene rule, classification, isolation, structure and biological importance of menthol, camphor, farnesol, phytol, lanosterol, lycopene and dolichols. 4Hr.

Steroids: Basic ring structure in steroids. Structure and biological importance of cholesterol, phytosterols, ergosterol, cortisol, β-estradiol, testosterone, and aldosterone. Bile acids (Mono, Di & Tri cholic acids). 4Hr.

Alkaloids: Definition, classification based on their structure and biological functions, Isolation ofalkaloids, structure and physiological action of morphine, nicotine and atropine. 4Hr.

Food Adulteration

Natural toxicants (Lathyrus sativus) and adulterants (Butter yellow, Lead chromate & malachite green) 2 Hr.

REFERENCES

1. Textbook of Organic Chemistry 22nd Edition S. Chand Publishers 2019.
2. Organic Chemistry. Vol. I Fundamental Principles. I. L. Finar. 6th Edn. ELBS, 2002
3. Organic Mechanisms, Peter Sykes, Longman, 1977
4. Organic Chemistry. R.T. Morrison and R.N. Boyd. 6th Edn. Prentice Hall, India, 2018
5. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn.Macmillan Publications 2012

SEMESTER-III

PRACTICALS – 3

COURSE TITLE: BIOORGANIC CHEMISTRY -3	**COURSE CREDITS: 2**
TOTAL CONTACT HOURS: 4 Hours/ Week	**DURATION OF ESA : 03 hrs**
FORMATIVE ASSESSMENT MARKS: 25	**SUMMATIVE ASSESSMENT MARKS: 25**

Course Outcome:

This course aims to familiarize students with the principles of organic chemistry and basic qualitative analysis of organic compounds. Course objective is to provide experimental practice of preparation of organic compounds and extraction of biologically important compounds.

Experiments:

1. Estimation of Cholesterol by Zak's method.
2. Estimation of Vitamin C by titration method/ colorimetric method
3. Estimation of Flavones by colorimetric method
4. Estimation of Vitamin E
5. Qualitative analysis of food adulterants
6. Estimation of Phenolics
7. Extraction of casein from milk
8. Extraction of starch from potatoes
9. Extraction of caffeine from tea leaves

REFERENCES:

1. Practical Organic Chemistry: Qualitative Analysis by S.P. Bhutani, A. Chhikara 2009
2. Textbook of Practical Organic Chemistry Including Qualitative OrganicAnalysis by Arthur Israel Vogel 2003

3. Comprehensive practical organic chemistry- preparation and quantitative analysis. V. K.Ahluwalia and Renu Aggarwal 2004

SEMESTER -IV

COURSE TITLE : ANALYTICAL BIOCHEMISTRY	**COURSE CREDITS : 4**
TOTAL CONTACT HOURS: 56	**DURATION OF ESA: 02 hours.**
Formative assessment marks: 40	**Summative assessment marks: 60**

Course Outcome:

These topics will enable students to develop competence in handling various chromatographic, electrophoretic and isotopic techniques and apply them in isolating and characterizing different biological molecules.

UNIT-I

BIOLOGICAL SAMPLE PREPARATION AND FRACTIONATION

14 HOURS

Introduction and objectives of bioanalysis. Occurrence of proteins and polysaccharides in nature. Extraction of proteins and polysaccharides from tissues and cells. Extraction of phytochemicals from plants.

Centrifugation

Introduction, principles of centrifugation, relative centrifugal field(RCF). Types of centrifugations- Preparative and analytical. Differential, density gradient, ultra-centrifugation. Basic instrumentation; types of rotors. Laboratory centrifuge, AnalyticalCentrifuges- Sedimentation coefficient, maintenance of instrument.

UNIT- I I

CHROMATOGRAPHY **14 HOURS**

General principles and historical developments in chromatography. Classification based on the types of separation (adsorption, partition,ion exchange and affinity).Paper chromatography - ascending, descending and circular, 2-D chromatography, Rf values. TLC. Gel-filtration, ion exchange and affinity-chromatography. Advanced chromatography- GLC, HPLC, FPLC and UPLC

UNIT III

ELECTROPHORETIC AND RADIO ISOTOPIC METHODS **14 HOURS**

Electrophoresis: General principle of electrophoresis, Types- paper, agarose, polyacrylamide, polymerization of acrylamide, methodology and applications of native PAGE and SDS- PAGE, 2-D electrophoresis, Staining of proteins post electrophoresis. Isoelectric focusing. Principle and applications of immuno electrophoresis. 10Hr.

Radioisotopic methods: Radioisotopes and heavy Isotopes

Types of radioactive decay- α, β, γ radiations. Half-life period. Detection of radioactivity – GM counter and liquid scintillation counters (only principle and working) Applications of radioisotopes – ^{3}H, ^{14}C, ^{131}I, ^{60}Co and ^{32}P. Biological effects of radiations, safety measure in handling radio isotopes. 4Hr.

UNIT IV

SPECTROSCOPIC METHODS OF BIO-ANALYSIS **14 HOURS**

Spectroscopic methods: Electromagnetic spectrum. Beer-Lambert's law and its limitations. Principle, design, application of Colorimeter and UV-Vis spectrophotometer. Determination of molar absorption coefficient of molecules. Working principle and application of flame photometer and fluorimeter. Principle and application of IR, Raman, ESR and NMR spectroscopy, MRI.

SEMESTER-IV

PRACTICALS – 4

COURSE TITLE: ANALYTICAL BIOCHEMISTRY-3	**COURSE CREDITS: 2**
TOTAL CONTACT HOURS: 4 Hours/ Week	**DURATION OF ESA : 03 hrs**
FORMATIVE ASSESSMENT MARKS: 25	**SUMMATIVE ASSESSMENT MARKS: 25**

Course Outcome:

This course aims to provide experimental practice of analytical techniques in Biochemistry. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

- Sourcing and handling biological samples.
- Develop skill and proficiency in basic techniques
- Centrifugation
- Chromatography
- Electrophoresis and
- Spectroscopy

Experiments

1. Identification of amino acids by circular chromatography.
2. Ascending (amino acids) and descending (carbohydrates) Chromatography
3. Demonstration of separation of plant pigments by column chromatography
4. Separation of Leaf pigments by Thin Layer Chromatography
5. Demonstration of Agarose gel electrophoresis
6. Demonstration of SDS PAGE
7. Estimation of DNA by diphenylamine method
8. Isolation of chloroplast by centrifugation.

9. Recording the absorption spectrum of Riboflavin
10. Estimation of Na and K ions by flame photometer

REFERENCES

1. Practical Book of Analytical Chemistry (First Edition) (English, Paperback, Ms. pooja R. Popat)

SEMESTER - III

OPEN ELECTIVE

COURSE TITLE : BIOCHEMICAL TECHNIQUES	**COURSE CREDITS: 3**
TOTAL CONTACT HOURS: 42	**DURATION OF ESA : 02**
FORMATIVE ASSESSMENT MARKS : 40	**SUMMATIVE ASSESSMENT MARKS : 60**

Course outcome:

These topics will enable students to develop competence in handling various chromatographic, electrophoretic and isotopic techniques and apply them in isolating and characterizing different biological molecules.

UNIT I

CHROMATOGRAPHY **14 Hours**

General Principles of Chromatography and applications of - Adsorption Chromatography, Paper chromatography, Rf value, Principle and applications of TLC, Ion exchange chromatography, Affinity chromatography, Gel filtration chromatography, Gas liquid chromatography, HPLC

UNIT II

14 Hours

ELECTROPHORESIS –Introduction, Principles of Electrophoresis, Types- Paper and Zone electrophoresis, Basic principles of agarose electrophoresis, SDS-PAGE, 2D -electrophoresis

UNIT III

SPECTROSCOPY- Introduction, principle and application of Spectrophotometer, UV-spectroscopy, X- ray diffraction, Fluorimeter, principle of IR, NMR, Mass Spectroscopy, its application.

14 Hours

SEMESTER-IV

OPEN ELECTIVE

COURSE TITLE : **PLANT BIOCHEMISTRY**	COURSE CREDITS: 3
TOTAL CONTACT HOURS: 42	DURATION OF ESA : 02
FORMATIVE ASSESSMENT MARKS : 25	SUMMATIVE ASSESSMENT MARKS : 60

Course outcomes:

These topics will enable the students to

- Understand the plant cell, photosynthesis, transporters, and important primarymetabolites.
- Illustrate plant growth regulators, plant's responses to various biotic and abiotic stresses.
- Explain about plant secondary metabolites and their functional importance.

UNIT I **14 hours**

Plant cell- structure and molecular components: Cytoskeleton- an overview. Plant cell division, cell cycle.

An overview of photosynthesis: C3, C4 plants and crussulacean acid metabolism (CAM); photorespiration; Phytochromes.

Plant cell membranes and membrane transport: Introduction to plant cell membranes and membrane constituents. Organization of transport systems across plant membranes; Different types of pumps operate at plant cell and organelle membranes; classification and importance of H^+-ATPases. Ion channels-properties and significance; Aquaporins and water transport.

Important Primary metabolites of plants: Cellulose, starch, sucrose, oligosaccharides; fructans, gums, mucilages, poly unsaturated fatty acids, lignin, suberin, surface waxes, sulfides and sweet proteins.

UNIT II **14 hours**

Plant growth regulators: Auxins, cytokinins, gibberellins, abscisic acid, ethylene, brassinosteroids, polyamines, jasmonic acid, salicylic acid

Brief history of plant tissue culture, Principle, Laboratory requirements and general techniques involved in micro propagation techniques (Equipments, Media-types, preparation, explants, and sterilization techniques)

UNIT III **14 hours**

Plant secondary metabolites (Natural products):
Introduction; secondary metabolites (natural productions) definition; classification of plant secondary metabolites (natural products).

Alkaloids: Classification of alkaloids; Contribution of amino acids for alkaloid biosynthesis; Isolation, purification and characterization of alkaloids. (S)-Seticuline-the chemical chameleon.

Phenolics: Classification of phenolic compounds; Classification of flavonoids; Classification of anthocyanins; Isolation, purification and characterization of phenolics.

Terpenoids: Classification of terpenoids, biogenic isoprene rule; volatile compounds; plant growth regulator terpenoids – saponins. Isolation, purification, and characterization of terpenoids

REFERENCES:

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