SEMESTER – I

BASIC COMPUTER SKILLS

1. Course Description:

Programme: BA/B.Sc./B.Com./BMS

Course Code: U24/BCS/AECC/101

Type of course: AECC

No. of credits: 2

Max. Hours: 30

Hours per week: 2

Max. Marks: 50

2. Course Objectives:

To impart a basic level understanding of working of a computer and its usage.

3. Course Outcome:

On completion of the course the student will be able to:

CO1: ***Interpret*** basics of computers and ***Use*** word processing software (Cognitive levels – 3)

CO2: ***Define*** Internet Technologies and ***Use*** Spreadsheets and Presentation Software (Cognitive level – 3)

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4. Course Content:

MODULE I: BASICS OF COMPUTERS AND WORD PROCESSING (15 Hrs)

Understanding Of Computer: Introduction to computers - functions, features, classification; Computer Architecture - components; Computer Hardware - input devices, output devices; Computer Memory -primary memory, secondary memory, cloud; Computer Software - system software, application software, special purpose software, system utilities, open-source software, and proprietary software; Operating Systems - functions, types, real time operating systems,

Windows Ui And Word Processing: Windows desktop – icons, task bar, start menu, understanding of local system drives, folders and files – creating, viewing, renaming, deleting; MS-Word - opening , closing, saving of documents, title bar, ribbon and tabs, ruler; text creation and manipulation – insert, delete, select, cut, copy and paste, find and replace, correct errors - spell; formatting text – font size, size, colour, bold, underline, italic, changing text case, text alignment; creating first line indent of paragraphs; formatting page – inserting header and footer, page breaks; modifying page layout - changing page orientation , page size, page margins; tables – inserting, adding and deleting rows and columns, converting text to table, working with lists, using symbols as bullets, printing documents

MODULE II: INTRODUCTION TO INTERNET TECHNOLOGY, SPREADSHEETS AND PRESENTATION SOFTWARE (15Hrs)

Overview of Internet and Future Technology: Internet – advantages and disadvantages of internet; Terms related to internet – WWW, web page, website, web browser, web address and URL, blog, search engine; Services of Internet – chatting, e-mail, video- conferencing, e-learning, e-banking, e-shopping, e-reservation; Social networking sites – LinkedIn, Facebook, Instagram; Computer Security – sources of cyber-attack, malware, threats to computer security, solutions to computer security threats; Future Technology – Internet of Things(IoT), Big Data Analytics, Virtual Reality, Artificial Intelligence,

Spreadsheet and Presentation Software: Spreadsheets - Workbook, worksheet, MS Excel vs Google sheets; basics of spreadsheet – enter, select, delete, move, copy and paste data, fill numbers, text, date; adding borders to cells, functions – count, sum, average; formulas – simple, relative reference, absolute reference, printing worksheet; Presentation – introduction to slide, placeholder, notes, adding slides, changing layouts of slides, applying styles and background, adding text box and pictures, adding animations, setting slide transitions, saving single slide as image, saving presentation in different formats (ppt, pdf, video)

5. References:

1. Microsoft Office Step by Step (Office 2021 and Microsoft 365), Joan Lambert, 1st edition, 2022
2. Computer Basics with Office Automation, Archana Kumar, Wiley publications,2019
3. Introduction to Computers, Peter Norton, McGraw-Hill ,2012.
4. Fundamentals of Computers, Reema Thareja,2nd Edition 2019.

6. Syllabus Focus

a) Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
GLOBAL DEVELOPMENT	Basic computer skills such as word processing, spreadsheets, presentations, and the internet, are essential for most jobs and are considered valuable skills in the workforce. Good computer skill aligns with an individual's career goals and enhances productivity and effectiveness in the workplace.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD, EMP	Module 1	Assignment
SD, EMP	Module 2	Skill practical test

7. Course Assessment Plan

a) Weightage of Marks in Formative and Summative Assessments

Formative Assessment - FA (40%)	Summative Assessment - SA (60%)
CIA-20 marks Mini project/Assignment/ Problem solving/Case studies	End Semester Exam-30 Marks

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b) Model Question Paper - End Semester Exam

BASIC COMPUTER SKILLS

Course Code: U24/BCS/AEEC/101 **Max Time: 1 Hr**
Credits: 2 **Max. Marks: 30**

Answer any 5 of the following: **5 X 6 = 30 M**

1. Explain Computer Architecture.
2. Differentiate between Primary and Secondary Memory.
3. Explain functions of an Operating System.
4. Define types of Software.
5. Write a short note on the Internet.
6. List and explain the services of the Internet.
7. Explain with example the concept of IoT.
8. Explain various threats to computer systems.

Prepared by	Checked & verified by	Approved by
Ms. Prabhmeet **Teaching Faculty**	**Ms. D. Sowjenya** **HOD**	**Dr. Uma Joseph** **Principal**

PROFESSOR
Department of Computer Science & Engineering
University College of Engineering (A)
Osmania University,
Hyderabad-500 007.

SEMESTER - II

BIOLOGICAL CHEMISTRY & MICROBIOLOGY

1. Course Description

Programme: B.Sc.
Course Code: U24/BIT/DSC/201
Course Type: DSC-2
No. of credits: 4

Max. Hours: 60
Hours per week: 4
Max. Marks: 100

2. Course Objectives

- To provide students with a comprehensive understanding of the fundamental principles and intricacies of biochemistry, enabling them to comprehend the molecular basis of life processes.
- To learn about the principles of microbiology and acquire an understanding of fundamental microbiological concepts as well as several ways for isolating pure cultures

3. Course Outcomes

On completion of the course the student will be able to:

CO1: Recall, Identify, understand, and derive the basic structure, properties and biological importance of various biomolecules (**REMEMBER, UNDERSTAND, APPLY**)

CO2: Retrieve, interpret and analyse the different cellular and metabolic processes that lead to production and utilization of energy. (**REMEMBER, UNDERSTAND, ANALYZE**)

CO3: Recognize and summarize the contributions of scientists in the field of Microbiology, gain an insight into classification, characterization of microorganisms and apply skills in handling microscopes. **((REMEMBER, UNDERSTAND, APPLY)**

CO4: Outline, apply and evaluate microbiological practices like Sterilization techniques, isolation, and culturing of microorganisms to study the microbial cells. **(UNDERSTAND, APPLY, EVALUATE)**

4. Course Content

MODULE I : BIOMOLECULES (15 HRS)

- Carbohydrates - importance, classification; structure and functions of monosaccharides (glucose & fructose), disaccharides (sucrose, lactose & maltose) and polysaccharides (starch, glycogen & inulin)
- Amino acids- importance, classification, structure, physical and chemical properties of amino acids; peptide bond formation
- Proteins- importance, structure of proteins- primary, secondary, tertiary and quaternary
- Lipids- importance, classification- simple lipids (triacyl glycerides & waxes), complex lipids (phospholipids & glycolipids), derived lipids (steroids, terpenes &carotenoids)
- Introduction to Nucleic acids, Structure of DNA.
- Enzymes- importance, classification, and nomenclature; Michaelis-Menton Equation, factors influencing the enzyme reactions; enzyme inhibition (competitive, uncompetitive & mixed), co-enzymes

MODULE II– BIOENERGETICS (15 HRS)

- Glycolysis, Tricarboxylic Acid (TCA) Cycle
- Electron Transport, Oxidative Phosphorylation
- Gluconeogenesis and its significance
- Transamination and Oxidative deamination reactions of amino acids
- B-Oxidation of Fatty acids
- Glyoxalate cycle

MODULE III: FUNDAMENTALS OF MICROBIOLOGY (15 Hrs)

- Historical development of Microbiology and contributors of microbiology (Edward Jenner, Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming)
- Microscopy: Bright field microscopy, Dark field microscopy, Phase contrast microscopy, fluorescent microscopy, Scanning and Transmission electron microscopy
- Outlines of classification of microorganisms.

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Osmania University
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- Structure and general characteristics of bacteria and virus
- Structure and general characteristics of micro-algae and fungi.

MODULE IV : CULTURE AND IDENTIFICATION OF MICROORGANISMS

(15 Hrs)

- Methods of sterilization- physical and chemical methods
- Bacterial nutrition, nutritional types of bacteria, essential macro, micronutrients, and growth factors
- Bacterial growth curve-batch and continuous cultures, synchronous cultures
- Measurement of bacterial growth-measurement of cell number and cell mass.
- Factors affecting bacterial growth.
- Culturing of anaerobic bacteria and viruses
- Pure cultures and its characteristics

5. Reference Books:

1. Tortora G.J., Funke B.R. and Case C.L. (2008). Microbiology: An Introduction. (IX. Edition): Pearson Education
2. Wiley J.M., Sherwood L.M. and Woolverton C.J. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
3. Pelczar M.J., Chan E.C.S and Krieg N.R. (1993). Microbiology. 5th edition: McGraw Hill Book Company.
4. Jain, J.L., S. Jain and Nitin Jain. (2008). Fundamentals of Biochemistry. New Delhi:S. Chand & Company Ltd.
5. Nelson, D.L. and Cox, M.M. (2008). Lehninger: Principles of Biochemistry. (V Edition). New York:W.H. Freeman and Company.
6. Satyanarayana U, Chakrapani U. (2008). Biochemistry: Books& Allied (P) Ltd.

6. Syllabus Focus

a) Relevance to Local , Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
National Development (Module 1, 2 & 3)	Addressing Health, Agriculture, Environment, and industry challenges through Research Innovation with an interdisciplinary collaboration in Biochemistry and Microbiology.
Global development (Module 4)	The course addresses global imperatives by fostering interdisciplinary scholarship, innovation, and sustainable solutions for pressing societal challenges.

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	**Syllabus Content**	**Description of Activity**
Skill Development	(Module 1 & 3)	Seminar presentations, Art projects, group discussions to understand and evaluate the basics of Biochemistry and Microbiology.
Employability	(Module 2 & 4)	Hands on training on different media preparations, biochemical estimate analysis, pure culture procedures and handling of varied microscopes are useful in enhancing employability across a range of diagnostic labs.

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Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Participative Learning	Seminar
2.	Experiential Learning	Quiz
3.	Participative Learning	Group Discussion
4.	Participative Learning	Presentation
5.	Experiential Learning	Art projects
6.	Problem Solving	Research projects
7.	Experiential Learning	Science experiments
8.	Experiential Learning	Internship opportunities

8. Course Assessment Plan

A) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments- CIA (40%)	End Semester Examination - (60%)
CO1	CIA-1 Written Exam	Written Exam
CO2	CIA-2 Quiz/ Assignment/Seminar Presentation	
CO3	CIA-1 Written Exam	
CO4	CIA-2 Presentation/ Art projects/ Science experiments/ Case studies	

b) Model Question Paper- End Semester Exam

BIOLOGICAL CHEMISTRY & MICROBIOLOGY

Course Code: U24/BIT/DSC/201 **Max. Marks: 60**

Credits: 4 **Time: 2 Hrs**

SECTION – A

I. Answer the following **4 x 10 = 40 M**

1. Classify the types of carbohydrates. Add a note on their nomenclature and biological significance.

OR

2. How do you apply Michaelis-Menton Equation in enzyme kinetics.

3. How would you describe the TCA cycle

OR

4. Illustrate the process of β-Oxidation of Fatty acids

5. How would you summarize the principle and working of Transmission Electron Microscopy

OR

6. Illustrate the salient features of bacterial cell structure with well labelled diagrams

7. Explain about Batch culture. Add a detailed note on bacterial growth curve.

OR

8. Define sterilization. Compare the different physical sterilization methods.

SECTION – B

II. Answer any <u>FOUR</u> of the following **4 x 5 = 20 M**

9. How would you classify the types of Phospholipids
10. What are the features of Oxidative phosphorylation
11. Summarize the contributions of Louis Pasteur.
12. Describe the factors affecting bacterial growth
13. Report the chemical properties of Amino acids.
14. Compare the isolation of different pure culture techniques

SEMESTER-END MODEL QUESTION PAPER

SECTION A - INTERNAL CHOICE 4 Q X 10 M = 40 M				
Question Number	**Question**	**Question**	**CO**	BTL(Blooms Taxonomy Level)
1	Module 1	Classify the types of carbohydrates. Add a note on their nomenclature and biological significance.	CO 1	II
2	Module 1	How do you apply Michaelis-Menton Equation in Enzyme kinetics	CO 1	III
3	Module 2	How would you describe the TCA cycle	CO 2	I
4	Module 2	Illustrate the process of β-Oxidation of Fatty acids	CO 2	II
5	Module 3	How would you summarize the principle and working of Transmission Electron Microscopy	CO 3	II
6	Module 3	Illustrate the salient features of bacterial cell structure with well labelled diagrams	CO 3	II
7	Module 4	Explain about Batch culture. Add a detailed note on bacterial growth curve	CO 4	V
8	Module 4	Define sterilization. Compare the different physical sterilization methods	CO 4	II

SECTION B - ANSWER ANY 4 OUT OF 6 4 Q X 5 M = 20 M (To compulsorily have **ONE** question from **each** module)				
9	Module 1	How would you classify the types of Phospholipids	CO 1	II
10	Module 2	What are the features of Oxidative phosphorylation	CO 2	IV
11	Module 3	Summarize the contributions of Louis Pasteur	CO 3	II
12	Module 4	Describe the factors affecting bacterial growth	CO 4	II
13	Any Module	Report the chemical properties of Amino acids	CO 1	II
14	Any Module	Compare the isolation of different pure culture techniques	CO 4	V

Prof. SMITA C. PAWAR
Department of Genetics
T.S.

SEMESTER-II
BIOLOGICAL CHEMISTRY & MICROBIOLOGY- PRACTICAL

1. Course description

Programme: B.Sc
Course Code: U24/BIT/DSC/201/P
Course Type: DSC-2
No. of credits: 1

Max. Hour: 30
Hours per week: 2
Max. Marks: 50

2. Course objective:

- To provide students a practical exposure in biochemical techniques to develop proficiency in laboratories skills that prepares them for future research or professional endeavors.
- To aid students gain hands on experience in basic Microbiological techniques including aseptic handling, staining and culture methods and apply this knowledge in research or clinical findings.

3. Course Outcomes:

On completion of the course the student will be able to

CO-1: Recall, perform and evaluate biochemical tests of various biomolecules (**REMEMBER, EVALUATE**)

CO-2: Classify and apply skills to prepare and sterilize media for culturing of microorganisms. (**APPLY & ANALYSE**)

CO-3: Distinguish and analyze the isolated microorganisms by differential staining techniques. (**ANALYSE**)

PRACTICAL SESSIONS

1. Estimation of reducing sugar by DNS reagent.
2. Estimation of proteins by Biuret method.
3. Estimation of cholesterol by Zak and Henly's method.
4. Paper chromatography- using Amino acids samples.
5. Preparation of media & Inoculation methods- pour, plate and streak.
6. Staining techniques- gram staining.
7. Special staining technique- Negative staining.
8. Antibiotic sensitivity test.

Spotters:

1. Osazone
2. Globular protein
3. Lock and Key model
4. Competitive inhibition
5. RUBISCO
6. ATP synthase
7. Autoclave
8. Laminar air flow
9. Tyndalization
10. Bacterial growth curve
11. Hot air oven
12. Serial dilution technique

SEMESTER-II

BIOLOGICAL CHEMISTRY & MICROBIOLOGY-PRACTICAL

Course Code: U24/BIT/DSC/201/P **Max. Marks: 50**

Credits: 1 **Time: 2Hrs**

I. MAJOR: **(20M)**

Estimate the concentration of protein present in the given unknown sample using colorimetric estimation method. Write the principle and procedure of the experiment. Calculate and report the results.

II. MINOR: **(10M)**

Perform negative staining using the given sample and report the results. Write the principle and procedure for the same.

III. IDENTIFY THE GIVEN SPOTTERS: **(10M)**

IV. VIVA **(5M)**

V. RECORD **(5M)**

Prepared by	Checked & verified by	Approved by
4/3/24 (Ms. Shouni Nivedita) Name and Signature of the teaching faculty	4/3/24 (Ms. Shouni Nivedita) Name and Signature of HoD	Name and Signature of Principal

Prof. SMITA C. PAWAR
Department of Genetics
Osmania University
Hyderabad-500 007. T.S.

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET HYDERABAD-500016 (An Autonomous College Affiliated to Osmania University)

DEPARTMENT OF CHEMISTRY

DISCIPLINE SPECIFIC CORE I
CHEMISTRY PAPER I
B.Sc. I - SEMESTER- II 60 Hrs

Module 1: Inorganic Chemistry

p-block elements

Interhalogen Compounds

Chemistry of Zero group elements

Boranes and Carboranes

Metal carbonyls

Module 2: Physical Chemistry

Electrochemistry

Module 3: Organic Chemistry

Aromatic Hydrocarbons
Halogen compounds
Alcohols, Phenols, Ethers

Module 4: General Chemistry

Solutions
Symmetry of molecules
Stereochemistry of Carbon Compounds

CHEMISTRY – II

Course Description

Programme: **B.Sc.** Max. Hours: **60 Hrs**

Course Code: **U24/CHE/DSC/201** Hours per week: **4 Hrs**

Course Type: **DSC-2** Max. Marks: **100**

No. of credits: **4**

Course Objectives

- To study about the elements of p block and the properties of their compounds.
- To understand the behavior of electrolytes in solution and to know the applications of electrode

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process.

- To learn the methods of preparation and reactivity of hydrocarbons with mechanisms and to classify and identify organic molecules by their functional groups.

- To learn the structures of basic organic molecules, the types of reactions they undergo and their stereochemistry and to foster acquisition of knowledge on the concepts of solutions.

Course Outcomes

On completion of the course the student will be able to:

CO1: Acquire knowledge on p-block elements.

CO2: Understand the theory of electrical conductance, transformation of chemical energy into electrical energy in Galvanic cells.

CO3: Interpret the concept of aromaticity and familiarize with the various types of aliphatic and aromatic reactions. Recognize functional groups in organic molecules and predict their reactivity through mechanisms.

CO4: Application of the behaviour of solutions and acquire a fundamental understanding of the relationships between molecular structure and reaction mechanisms.

Course Content

MODULE I: Inorganic Chemistry **(15 Hrs)**

p-block elements **(10 Hrs)**

General Characteristics of p block elements.

Group – 13: Synthesis and structure of diborane and higher Boranes (B_2H_6 and B_4H_{10}) Preparation and structure of boron-nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of the BX.

Group – 14: Classification (ionic, covalent, interstitial) and industrial applications of Carbides. Preparation, classification (straight chain, cyclic and cross-linked) and applications of silicones, Preparation and applications of graphitic compounds.

Group – 15: Preparation, structure and reactions of hydrazine, hydroxylamine, Phosphazenes
Group – 16: Classifications of oxides based on (i) Chemical behavior and (ii) Oxygen content. Normal: acid, basic, amphoteric and neutral, Mixed oxides, Sub oxides, Peroxides, Super oxides.

Oxyacids of N, P, S and Cl – structure, acidic nature and redox

properties

Interhalogen Compounds

Classification- general preparation- structures of AB, AB_3, AB_5 and AB_7 type and reactivity. Poly halides- definition and structure of ICl_2^-, ICl_4^- and I_3^-.Comparison of Pseudo halogens with halogens.

Chemistry of Zero group elements

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General preparation, structure, bonding and reactivity of Xenon compounds – Oxides, Halides. Clathrate compounds.

Boranes and Carboranes **(2 Hrs)**

Definition of clusters. Structures of boranes and carboranes- Wade's rules, closo, nido, arachno Boranes and carboranes

Metal carbonyls **(3 Hrs)**

Preparation and properties of $Ni(CO)_4$. Structural features of $Ni(CO)_4$, $Fe(CO)_5$, $Fe_2(CO)_9$ and $Cr(CO)_6$-18 valence electron rule.

MODULE II: Physical Chemistry (15 Hrs)

Electrochemistry

Electrical transport – conduction in metals & in electrolyte solutions, specific conductance & equivalent conductance and measurement of equivalent conductance, variation of specific and equivalent conductance with dilution. Migration of ions and Kholrausch's law. Arrhenius theory of electrolytic dissociation and its limitation, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye- Huckel- Onsagar's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method for attackable and non-attackable electrodes. Applications of conductivity measurements. Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of sparingly soluble salt, conductometric titrations. Electrolytic and Galvanic cell – reversible and irreversible cells, conventional representation of electrochemical cell. EMF of a cell and its measurement. Computation of EMF. Types of reversible electrodes gas electrode, metal - metal ion, metal - insoluble salt and redox electrode. Electrode reactions, Nernst equation, cell EMF and single electrode potential, stanard Hydrogen electrode – reference electrodes (calomel electrode) – standard electrode potential, sign conventions, electrochemical series and its significance. Calculation of thermodynamic quantities of cell reaction – ΔG, ΔH and K .Determination of pH using Hydrogen electrode, Glass electrode, quinhydrone electrode, solubility product of AgCl. Potentiometric titrations.

MODULE III: Organic Chemistry (15 Hrs)

Aromatic Hydrocarbons **(6 Hrs)**

Concept of aromaticity –definition, Huckel's rule – application to Benzenoids and Non – Benzenoids (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation).
Preparations: From acetylene, phenols, benzene carboxylic acids and sulphonic acids
Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation,and halogenation, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. Orientation – (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - carboxyl, nitro, nitrile, carbonyl and sulphonic acid & halo groups.

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Halogen compounds **(4 Hrs)**

Nomenclature and classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl. Chemical reactivity - reduction, formation of RMgX, Nucleophilic substitution reactions – classification into S_N1 and S_N2. Mechanism and energy profile diagrams of S_N1 and S_N2 reactions. Stereochemistry of S_N2 (Walden Inversion) 2-Bromobutane, S_N1 (Racemisation) 1-Bromo-1-phenylpropane explanation of both by taking the example of optically active alkyl halide.Structure and reactivity – Ease of hydrolysis - comparison of alkyl, vinyl, allyl, aryl, and benzyl halides.

Alcohols, Phenols, Ethers **(5 Hrs)**

Alcohols: Preparation of 1°, 2° and 3° alcohols using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification (mechanism), oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppenauer oxidation

Diols: oxidation of diols, Pinacol – Pinacolone rearrangement.

Phenols: Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, Halogenation and sulphonation. Reimer- Tiemann Reaction (with mechanism), Gattermann Aldehyde Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction, Azo coupling reactions

Ethers (aliphatic and aromatic): Preparation: Williamson synthesis, Reaction: Cleavage of ethers with HI.

MODULE IV: General Chemistry **(15 Hrs)**

Solutions **(6 Hrs)**

Liquid- liquid mixtures – ideal liquid mixtures, Raoult's and Henry's law. Non – ideal systems. Azeotropes: HCl-H_2O, ethanol – water systems. Fractional distillation. Partially miscible liquids – phenol – water, trimethyl amine – water system, Nicotine - water

Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation.

Symmetry of molecules (3 Hrs)

Symmetry operations and symmetry elements in molecules. Definition of Axis of symmetry types of Cn, Plane of symmetry (σh, σv, σd) Center of symmetry and improper rotational axis of symmetry (Sn). Explanation with examples.

Stereochemistry of Carbon Compounds (6 Hrs)

Conformations with respect to ethane, butane and cyclohexane. Molecular representation: Wedge Formula, Newmann, Sawhorse and Fischer representations. Optical isomerism: optical activity, optical rotation and specific rotation, Concept of chirality. Examples: Glyceraldehyde, Lactic acid, Alanine. Molecules with similar chiral carbons (Tartaric acid), Enantiomers and Meso compounds. Molecules with dissimilar chiral carbons (2,3 – Dibromopentane). Diastereomerism. Configuration: Relative (D and L) and Absolute configuration, CIP Rules: R/S Racemic mixture racemization and resolution techniques (chemical method only) Geometrical isomerism with reference to alkenes and cycloalkanes: cis – trans and E/Z configuration.

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SEMESTER-1I

ENZYMES & ANALYTICAL TECHNIQUES

1. Course Description

Programme	**: B.Sc.**	**Max. Hours:**	**60**
Course Code	**: U24/BIC/DSC/201**	**Hours per week:**	**4**
Type of course	**: DSC 2**	**Max. Marks:**	**100**
No. of credits	**: 4**		

2. Course Objectives

- To acquire knowledge about concepts of enzymes, thermodynamics and energy transformations observed in living systems.
- To learn various important techniques of separation like chromatography, electrophoresis, centrifugation, and spectroscopy.

3. Course Outcomes

After the successful completion of the course, the student will be able to:

CO1: Describe enzymes, nomenclature, mechanism of enzyme action and kinetics. (L2)

CO2: Demonstrate the influence of thermodynamics of biochemical reactions. (L3)

CO3: Illustrate the separation techniques like chromatography, electrophoresis and centrifugation. (L3)

CO4: Analyze the principle and applications of spectrophotometry and radioactivity(L4).

4. Course Content –

Module I: ENZYMES **(15 hrs)**

Introduction to bio catalysis, Difference between chemical and biological catalysis.Nomenclature and classification of enzymes. Characteristic features of enzymes. Introduction to the principles of activation energy, transition state, Active site. Outline of mechanism of enzyme action – lock and key model, induced fit model.

Factors affecting catalysis – substrate concentration, pH, temperature, activators and inhibitors (competitive and non-competitive types). Michaelis constant (Km) and its significance. Line Weaver – Burk plots, Isoenzymes, zymogen activation – activation of trypsinogen and chymotrypsinogen, allosteric enzymes (elementary treatment). Ribozyme, abzyme (definitions only).

Module II: BIOENERGETICS **(15 hrs)**

Energy transformations in the living system, First and second laws of Thermodynamics; Concept of enthalpy, entropy, free energy, exergonic and endergonic reactions. Helmholtz &Gibbs free energy. Relationship between standard free energy change and equilibrium constant.

High energy compounds and their role. Ultrastructure of mitochondria – F_0 F_1 ATPase; Oxidative phosphorylation- mitochondrial electron transport chain and carriers involved, sites of ATP production.

Outline of mechanism and Theories of oxidative phosphorylation:

- Chemical coupling hypothesis
- Conformational coupling hypothesis
- Chemiosmotic coupling hypothesis.

Oxidation of extramitochondrial NADH – Shuttle systems,

- Malate Aspartate shuttle
- Glycerol 3 phosphate shuttle

ATP yield and P/O ratio. Inhibitors and uncouplers of oxidative phosphorylation.

Module III: SEPARATION TECHNIQUES **(15 hrs)**

Chromatography - Principles and applications of separation methods like paper, thin layer, Ion exchange, gel-filtration, Affinity Chromatography.

Electrophoresis –Principles and applications of paper, agarose, and polyacrylamide - native and SDS gel electrophoresis.Centrifugation – Principles and applications of centrifugation techniques – Differential, density gradient. Dialysis.

Module IV: SPECTROSCOPIC&RADIO ISOTOPIC TECHNIQUES **(15 hrs)**

Colorimetry and Spectrophotometry – Laws of light absorption- Beer Lambert's law, UV and Visible absorption spectra, molar extinction coefficient. Biochemical applications of spectrophotometer. Principles of fluorimetry& Flame photometry.

Nature of radioactivity; Radio isotopes; types of radioactive decay; β and γ emitters; Units of Radioactivity, Half-life. Uses of radioisotopes in biology.

5. Reference Books

1. Lehninger: Principles of Biochemistry (2013) 6thed.,Nelson, D.L. and Cox, M.M.W.H. Freeman and Company (New York).
2. Trevor Palmer: Enzymes (Biochemistry, Biotechnology, Clinical Chemistry), (2001) Horwood Publishing, ISBN 1-898563-78-0.
3. Wilson & Walker : Principles & Biochemical Techniques of Practical Biochemistry,(2000) Cambridge University Press. (Fifth Edition)
4. Upadhyaya &Upadhyaya. Biophysical Chemistry (2009) Himalayan Publishers.
5. Mathews: Biochemistry –3rd edition. Pearson Education Limited. (2003). ISBN: 81-297-0215-0.

6. Syllabus Focus

a) Relevance to Local , Regional , National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
Global Development needs	Analytical techniques play a crucial role in various fields and industries, providing valuable insights and information
Global Development needs	Studying thermodynamic principles aid in easy understanding of cellular processes and energy flow

b) Components on Skill Development/Entrepreneurship Development/Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD/EMP	Chromatography	Practicals
SD/EMP	Centrifugation	Practicals
SD/EMP	Electrophoresis	Practicals

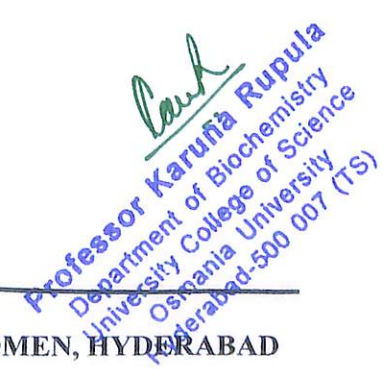
7. Pedagogy

S. No	Student Centric Methods Adopted	Type / Description of Activity
1.	Science experiments	Experiential Learning
2.	Field trip	Experiential Learning
3.	Presentations/Assignments	Participative Learning

8. Course Assessment Plan

a) Weightage of Marks in Continuous Internal Assessments and End Semester Examination

COs	Continuous Internal Assessments – CIA (40%)	End Semester Examination (60%)
CO1	CIA-1	End Semester examination
CO2	CIA-1	
CO3	CIA-2 - Objective	
CO4	CIA-2 - Assignment/ model making/ PPT	



b) **Model Question Paper**

ENZYMES & ANALYTICAL TECHNIQUES

Code : U24/BIC/DSC/201
Credits : 4

Max Marks : 60
Time : 2 Hrs

I. Answer the following questions **(4x10=40M)**

1. (a) Explain the factors affecting the enzyme catalysis.
   OR
   (b) Give the classification of enzymes with suitable examples.

2. (a) Illustrate the mitochondrial electron transport chain.
   OR
   (b) Explain the laws of thermodynamics

3. (a) Demonstrate the principle & applications of Ion exchange chromatography.
   OR
   (b) Demonstrate the principle & application of Affinity chromatography.

4. (a) Distinguish Colorimetry & Spectrophotometry
   OR
   (b) Analyze the types of Isotopes? Enumerate the uses of Radioisotopes.

II. Write Short notes on any 4 questions **(4x5=20M)**

5. Lock and key hypothesis
6. Malate aspartate shuttle
7. Principle of paper chromatography
8. Dialysis
9. Molar extinction coefficient
10. Half life

CBCS-2024

GUIDELINES FOR MODEL PAPER SETTING AS PER BLOOMS TAXONOMY LEVEL (BTL)

Semester II : Enzymes & Analytical Techniques

SECTION A - INTERNAL CHOICE (4 X 10 M = 40 M)				
Question Number	**Question**	**Question**	**CO**	**BTL (Blooms Taxonomy Level)**
1	**Module 1**	Explain the factors affecting the enzyme catalysis.	**CO 1**	**2**
2	**Module 1**	Give the classification of enzymes with suitable examples	**CO 1**	**1**
3	**Module 2**	Illustrate the mitochondrial electron transport chain.	**CO 2**	**3**
4	**Module 2**	Explain the laws of thermodynamics	**CO 2**	**2**
5	**Module 3**	Demonstrate the principle & applications of Ion exchange chromatography	**CO 3**	**3**
6	**Module 3**	Demonstrate the principle & application of Affinity chromatography	**CO 3**	**3**
7	**Module 4**	Distinguish Colorimetry & Spectrophotometry	**CO 4**	**4**
8	**Module 4**	Analyze the types of Isotopes? Enumerate the uses of Radioisotopes.	**CO 4**	**4**
SECTION B - ANSWER ANY 4 OUT OF 6 (4Q X 5M = 20M) (To compulsorily have **ONE** question from **each** module)				
9	**Module 1**	Lock and key hypothesis	**CO 1**	**2**
10	**Module 2**	Malate aspartate shuttle	**CO 2**	**3**
11	**Module 3**	Principle of paper chromatography	**CO 3**	**3**
12	**Module 4**	Dialysis	**CO 3**	**3**
13	**Any Module**	Molar extinction coefficient	**CO 4**	**4**
14	**Any Module**	Half life	CO 4	**4**

ENZYMES & ANALYTICAL TECHNIQUES

PRACTICAL

1. Course Description:

Max. Hours: 30
Course Code: U24/BIC/DSC/201/P
Type of course: DSC

Hours per week: 2
No. of credits: 1
Max. Marks: 50

2. Course objective:

- Acquire skills of important separation techniques.

3. Course Outcome:

CO1: Demonstrate their skills in qualitative identification of amino acids.

CO2: Apply the knowledge of separation techniques of biomolecules.

PRACTICAL SESSIONS

1. Qualitative Analysis of Amino acids (4 sessions)
2. Separation of Sugars by Paper Chromatography
3. Separation of Amino Acids by Paper Chromatography
4. Separation of Lipids by TLC
5. Separation of Plant Pigments on Alumina Column
6. Gel Filtration Chromatography
7. Paper Electrophoresis
8. Dialysis
9. Formal Titration of Amino Acid – Glycine

MODEL QUESTION PAPER
PRACTICAL

Course Code: U24/BIC/DSC/201/P
Credits: 1

Max Time: 2 Hrs
Max. Marks: 50

Answer the following: -

1. Write the schematic representation (flowchart) for the qualitative analysis of
   c. Amino acids
   d. Principle involved in Gel filtration chromatography (10 M)
2. Identify the given amino acid present in the given solutions **A** and **B** (10 + 10 M)
3. Perform Paper chromatography of amino acids & calculate the Rf value of the mixture. (10 M)
4. Viva (5M)
5. Record (5M)

Prepared by Course Teacher [Name & Signature]	Checked & Verified by HOD [Name & Signature]	Approved by the Principal
Dr. G. Sony	(S. Malathi Varma) 21/2/24	

HOD Biochemistry
St. Francis College for Women
Begumpet, Hyderabad-16.

Professor Karuna Rupula
Department of Biochemistry
University College of Science
Osmania University
Hyderabad-500 007 (TS)

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated To Osmania University)
FACULTY OF SCIENCE- DEPARTMENT OF CHEMISTRY
PRACTICAL SYLLABUS CBCS-2024
SEMESTER -II
QUANTITATIVE ANALYSIS II
(Volumetric Analysis)

Program: B.Sc.
Course Code: U24/CHE/DSC/201/P
Course: DSC-2
No. of Credits: 1

Max. Hours: 20 Hrs
Max. Marks: 50
Hours per week: 2 Hrs

Course Objectives

- To develop analytical skills using the principles of quantitative analysis.

Course Outcomes

CO 1: Interpret and apply the principles of redox and complexometric titrations.

CO 2: Quantitative estimation of salts using gravimetric principles.

Volumetric Analysis

1. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using an internal indicator.
2. Estimation of Cu (II) ions using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard.
3. Estimation of Iodine content in Iodized salt.
4. Estimation Nickel by back titration using $MgSO_4$.
5. Estimation of Zinc using EDTA.
6. Estimation of calcium or magnesium ions in milk.
7. Estimation of hardness of water.

References:

1. Vogel's Qualitative Inorganic Analysis, *Svehla, G.* Pearson Education, 2012.
2. J. Vogel's Quantitative Chemical Analysis, *Mendham,* Pearson, 2009.

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6. Syllabus Focus

a. Relevance to Local, Regional, National and Global Development Needs

Local /Regional/National /Global Development Needs	Relevance
local	In manufacturing processes, local energy production and storage techniques, production of solvents and other materials, drug formulation and dosage calculations.
Regional	Preparation of fertilizers impacting agriculture, metal refining process, food and pharmaceutical applications, useful for analytical techniques.
National	Optimizing the use of P - block elements, focus on electrochemical principles, preparation of polymers, phase transformations of various systems.
Global	Electronic industry, advancements in electrochemical technologies, sustainable industrial processes impacting the environment, formulation of solutions.

b. Components on Skill Development/Entrepreneurship Development/ Employability

SD/ED/EMP	Syllabus Content	Description of Activity
SD	Module No. 1	Encourage them to compare and discuss trends in reactivity and chemical behaviour
EMP	Module No. 2	Engage students in electrochemical cell design and analysis
ED	Module No. 3	Invite professionals or researchers who can share their insights from organic chemistry.
EMP	Module No. 4	Divide students into groups and share some real time applications.

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7. Pedagogy

S. No.	Student Centric Methods Adopted	Type / Description of Activity
1.	Experiential Learning	Field trips
2.	Participative Learning	Presentations
3.	Problem solving	Case studies

8. Course Assessment Plan

a. Weightage of Marks in Continuous Internal Assessments and End Semester Examination

CO	Continuous Internal Assessments CIA - 40%	End Semester Examination-60%
CO1	CIA 1 written exam	Written Exam
CO2	CIA 2 (Quiz/Assignment/3D model making)	
CO3	CIA 1 written exam	
CO4	CIA 2 (Crossword/Problem solving/Assignment)	

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b. Model Question Paper - End Semester Exam

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated to Osmania University)
Faculty of Science – Department of Chemistry
MODEL PAPER
B. Sc. I YEAR SEMESTER -II

TIME: 2 hrs **Course Code: U24/CHE/DSC/201**
Max. Marks: 60 M

SECTION –A (Essay Questions)

I. Answer the following **4X10M=40 Marks**

1. a). Classify the oxides based on the oxygen content. (CO 1) **L1** 4M
   b). What are interhalogen compounds? Explain the structure of the AX5 type of molecule. (CO 1) **L1** 6M

OR

2. a). Discuss the structure of Diborane. (CO 1) **L2** 5M
   b). What are silicones? Classify them. (CO 1) **L1** 5M
3. a). Describe the Hittorf method for the determination of transport number (CO 2) **L2** 5M
   b) Explain Debye –Huckle's theory and the role of inter-ionic effect. (CO 2) **L2** 5M

OR

4. a) Explain the working and construction of S.H.E. (CO 2) **L2** 5M
   b) State Kohlrausch law of independent migration of ions and list out its applications. (CO 2) **L2** 5M
5. a) Give the mechanism of Nitration on Benzene. (CO3) **L1** 5M
   b) Write a note on directive influence of methyl group. (CO3) **L1** 5M

OR

6. Explain S_N1 and S_N2 reactions with their mechanism, stereochemistry, and energy profile diagram. (CO 3) **L2** 10M
7. a) What are azeotropes? Explain ethanol-water system. (CO 4) **L2** 5M
   b) State and explain Raoult's law with its limitations. (CO 4) **L2** 5M

OR

8. a) Justify that the chair form of cyclohexane is the most stable conformation. (CO4) **L4** 6M
   b) Define proper axis of symmetry. Illustrate with 2 examples. (CO4) **L1** 4M

SECTION – B (Short Answer Questions)

II. Answer any four **4x5=20 Marks**

9. Discuss the structure of XeO_3. (CO1) **L1**
10. Calculate the EMF of Cd, $Cd^{+2}//Cu^{+2}$, Cu E^0 (Cu^{+2}, Cu) = 0.34V.
    $E^0(Cd^{2+}, Cd)$ = -0.488 V. (CO 2) **L5**
11. How can you interpret aromatic character in a molecule? (CO3) **L5**
12. State and explain Henry's Law and its limitations. (CO 4) **L2**
13. Write a note on Williamson synthesis. (CO3) **L1**
14. What are carbides and give their classification. (CO1) **L1**

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b. Model Question Paper - End Semester Exam

St. FRANCIS COLLEGE FOR WOMEN, BEGUMPET, HYDERABAD-500016
(An Autonomous College Affiliated to Osmania University)
Faculty of Science – Department of Chemistry
B. Sc. I YEAR SEMESTER -II

Time: 2 Hrs **Course Code: U24/CHE/DSC/201**
Max. Marks: 60M **Credits: 4**

SECTION A - INTERNAL CHOICE			**4 Q X 10 M = 40M**	
Question Number	**Question**		**CO**	**BTL**
1	**Module 1**	a)Classify the oxides based on the oxygen content. 4M b) What are interhalogen compounds? Explain the structure of AX_5 type of molecule. 6M **OR**	**CO 1**	**(Level II)**
2	**Module 1**	a) Discuss the structure of Diborane. 5M b)What are silicones? Classify them 5M	**CO 1**	**(Level II)**
3	**Module 2**	a) Describe the Hittorf method for the determination of transport number 5M b) Explain Debye –Huckle's theory and explain the role of inter-ionic effect. 5M **OR**	**CO 2**	**(Level II)**
4	**Module 2**	a) Explain the working and construction of S.H.E. 5M b) State Kohlrausch law of independent migration of ions and list out application 5M	**CO 2**	**(Level II)**
5	**Module 3**	a) Give the mechanism of Nitration on Benzene. 5M b) Write a note on directive influence of methyl group. 5M **OR**	**CO 3**	**(Level I)**
6	**Module 3**	Explain the hydrolysis of primary and tertiary alkyl halides with mechanism, stereochemistry and energy profile Diagram. 10M	**CO 3**	**(Level II)**

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7	**Module 4**	a) What are azeotropes? Explain ethanol-water system. 5M b) State and explain Raoult's law with its limitations. 5M **OR**	**CO 4**	**(Level II)**
8	**Module 4**	a) Justify that the chair form of cyclohexane is the most stable conformation. 6M b) Define proper axis of symmetry. Illustrate with 2 examples. 4M	**CO 4**	**(Level IV)**
SECTION B – (Short answer questions) **ANSWER ANY 4 OUT OF 6** **4 X 5M = 20 M**				
9	**Module 1**	Discuss the structure of XeO_3	**CO 1**	**(Level I)**
10	**Module 2**	Calculate the EMF of $Cd,Cd^{+2}//Cu^{+2},Cu$ $E^0(Cu^{+2},Cu) = 0.34V$. $E^0(Cd^{2+},Cd) = -0.488V$.	**CO 2**	**(Level V)**
11	**Module 3**	How can you interpret aromatic character in a molecule?	**CO 3**	**(Level V)**
12	**Module 4**	State and explain Henry's Law and its limitations.	**CO 4**	**(Level II)**
13	**Module 3**	Write a note on Williamson synthesis.	**CO 3**	**(Level I)**
14	**Module 1**	What are carbides and give their classification.	**CO 1**	**(Level I)**

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