Sardar Patel University

Vallabh Vidyanagar, Gujarat

(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)

Syllabus with effect from the Academic Year 2022-2023

Master of Science, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester - IV

Course Code	PS04CICH51	Title of the Course	Energy Technology
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	To provide an idea of the challenges in the field of energy management and to provide a perspective on energy technology. Students will learn the systems dimensions of the energy prolems and its historical perspective on energy technology and system development. For different types of energy sources utilization in industries, the procedure of power generation, transportation along with conventional and advanced application in different sectors should be known by the students. This subject will guide students in the same direction.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	**(a) Solar Energy** Solan constatn, solar radiation & related terms, measurement of solar radiation, solar energy collectors- flat plate collector,	25%

	air collector, collectors with porous absorbes, concentrating collectors, applications & advantages of various collectors, selective absorber coatings, solar energy storage systems (thermal electrical, chemical & mechanicla), solar pond, applications of solar energy. **(b) Wind Energy** Basic principles, power in wind, force on blades & turbines, wind energy conversion, site selection, basic componets of wind energy conversion system (WECS), classification of WECS, wind energy collectors, applications of wind energy.	
2.	**(a) Geothermal Energy** Geothermal resources, hydrothermal resources, liquid dominated systems, geo pressured resources, petro thermal systems, magma resources, energy conservation & comparison with other resources, applications of geothermal energy. **(b) Nuclear Energy** Fission, fusion, fuel for nuclear fission reactor (exploration, mining, milling, concentrating, refining, enrichment, fuel fabrication, fuel use, reprocessing, waste disposal), storage & transportation, fast & slow neutrons, multiplication factors & reactor control, uranium enrichment process, nuclear reactor power plant, fast breeder reactor, boiling water reactor, pressurised heavy & light water reactor.	25%

3.	**(a) Energy From Oceans** OTEC, methods (open cycle & close cycle) energy from tides, components of tidal power plants, operation, methods of utilization of tidal energy, storage, ocean waves, wave energy conversion devises. **(b) Energy from Biomass** Types of biogas plants construction details, applications biogas from plant wastes, thermal gasification of biomass, properties & utilization of bigras.	25%
4.	**Fuels and Fuel Cell** **(a) Fuels** Wood & charcoal, peat, lignite, sub-bituminous & bituminous coals, semi anthracite and anthracite coals, cannel & bighead coal, origin of coal, composition of coal, analysis & properties of coal gasification & liquefaction of solid fuels. **(b) Fuel Cell** Introduction, hydrogen- oxygen fuel cell, ion exchange membrane cell, fossil fuel cell, molten carbonate cell, advantages & disadvantages, conversion efficiency, polarization, type of electrodes, applications of fuel cells.	25%

Teaching Learning Methodology:-	To meet the effective teaching and the learning requirements, teaching-learning methodology comprises classroom teaching, use of e-resources, library books, encouraging students to participate in seminars, presentation by students, assigning work based upon subject requirements.

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage* (%)**
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva- Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R. 6.8.3)	15%
3.	University Examination	70%

Course Outcomes: having completed this course, the learner will be able to	
	After learning the course the students should be able:
1.	To make students aware about all the energy sources avaialable and the ways to turn it into power.
2.	To understand the principles behind different non covnentional energy sources.
3.	To make student understand the global scenario of energy sector and to work on better economical solutions of it.
4.	To utilize the renewable energy in problem solwing where conventional energy are not fruitful and reqire replacement.
5.	To understand the design and applications of power generating devices using renewable energy sources as per industrial requirements

Suggested References

Sr. No.	References
1.	Energy sources 2nd Ed. by G.D. Raj, Khanna Publications, New Delhi
2.	Fuels & combustion by Samir Sarkar, Orient Longmans (1974)
3.	Solar Energy by Sukatame, Tata McGraw Hill, New Delhi.
4.	Energy Technology by Rao & Parulaker

Online- Resources

On-line Resources:- From time to time are many online resources, including websites, databases, e-books, bibliographies and platforms that offer educational videos, lectures on a range of topics can be suggested or displayed tot he students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Sodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University

Vallabh Vidyanagar, Gujarat

(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)

Syllabus with effect from the Academic Year 2022-2023

Master of Science, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester - IV

Course Code	PS04CICH52	Title of the Course	Spectroscopy- II
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	1. Know how nuclear spins are affected by a magnetic field, & be able to explain what happens when radiofrequency radiation is absorbed. 2. Be able to predict the splitting pattern in the NMR & CMR signal expected from a compound given its structure. 3. Be able to predict the fragmentation patterns expected to arise in the mass specturm of alkanes, alkyl, halides, ethers, alcohols & ketones. 4. Be able to use the mass specturm of a compound to find the molecules mass & to help identify the structure of a compound. 5. Provide students with a basic under standing of the design, operation & control of an HPLC system.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	**Nuclear Magnetic Resonance (NMR) Spectroscopy:-** Principles of NMR spectroscopy, nucler spin states, nuclear magnetic moments, absorption of energy, chemical shift & its measurement shilding & deshilding of protons, anisotropy, chemical shift & chemical equivalence, integrals, spin-psin, splitting, N+1 rule, mechanism of coupling & cooling constant, presentation of spectra, magnetic equivalence, allylic coupling, exchangeable protons, Interpretation of NMR spectra of simple organic compounds effect of enantiotropy, diastereotopic protons, karplus curves- variation of coupling constant with dihedral angles. Techniques of simplifying NMR. Spectra, doble resonance, shift reagents & deputation.	25%
2.	**Carbon - 13 NMR Spectroscopy:-** Carbon-13 nucleus, operating frequency, carbon-13 chemical shifts & their calculation, spin-spin coupling, proton-coupled, proton- decoupled & off resonance carbon spectra. use of 13c Sepctra- differentiating stereoisomers, nuclear overhauser effect. 13 C Dept Spectra- Dept Spectra - Differentiation in primary, secondary And Tertiary carbons By Dept-45, Dept-90, Dept-135 Spectra.	25%

3.	**Mass Spectroscopy:-** Basic Principles, interpretation of mass spectra, molecular ions, metastable ions & isotopes ion, ion abundances fragmentation process representation of fragmentation, basic fragmentation types & rules. Malafferty rearrangement. Fragmentation of organic compounds with respect to their structure determination associated with functional groups- alkanes, alkene cycloalkanes, aromatic hydrocarbons, Halides, alcohols, phenols, ethers, aldehydes, ketones, carboxylic acids esters, amides, acid chlorides, nitro compounds & amine, retro Diels- Alder Fragmentation & Nitrogen rule.	25%
4.	**High Performance Liquid chromatography (HPLC)** Principle , instrumentation, identification of peaks, effect of temperature & packing material, types of HPLC: partion, adsorption, ionexchange, size-exclusion or gel derivatization in HPLC: Post & Pre coloumns, applications.	25%

Teaching Learning Methodology:-	To meet the effective teaching & the learning requirements teaching learning methodology comprises classroom teaching use of e-resources, library books, IT tools, encouraging students to participate in seminars/ workshops, presentation by students assigning work based upon subject requirement etc.

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage* (%)**
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva- Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R. 6.8.3)	15%
3.	University Examination	70%

Course Outcomes: having completed this course, the learner will be able to	
1.	Relate NMR & CMR parameters such as chemical shift, coupling constant etc.
2.	The ability to investigate & determine the structure of typical organic chemical compounds using suitable NMR & CMR spectra.
3.	Explain the theory behind mass spectroscopy.
4.	Describe how ionization of molecules can take place.
5.	Compare different technologies & applications of HPLC.

Suggested References

Sr. No.	**References**
1.	"Spectroscopic methods in organic chemistry" D.H. Williams & Ian Fleming.
2.	"Organic mass spectroscopy", K.G. Das & E.P. James, Oxford & IBH Publishing Co.

3.	"Spectroscopy" Pragati Prakashan by H.Kaur.
4.	Introduction to Spectroscopy D.L. Pavia, G.M. Lampman & G.S. Kriz, 3rd Edition (Thomson Books/ Cole)
5.	Spectroscopic methods in organic chemistry, D.H. Williams. & I.Fleming 4th Edution. (McGraw-Hill Book Company)
6.	Chromatography: Basic Principles, Sample Preparations & Related Methods by Elsa Lundanes, Leon. Reubsaed, Type Greibrok, John. Willey & Soncs.
7.	Principles & Practicies of chromatography by R.P.W. Scott, Library for Science.
8.	Practical HPLC Method Development By Lloyd R. Snyder, Wiley-Interscience.
9.	Organic Analytical Chemistry Theory & Practice Jag Mohan, Narosa Publishing House 2003.
10.	Spectrophotometric Identificationof Organic Compounds 6th Ed. John Wiley & Sons, Inc, New York, 2004.

Online- Resources

On-line Resources:- From time to time are many online resources, including websites, databases, e-books, bibliographies and platforms that offer educational videos, lectures on a range of topics can be suggested or displayed tot he students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Sodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University

Vallabh Vidyanagar, Gujarat

(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)

Syllabus with effect from the Academic Year 2022-2023

Master of Science, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester - IV

Course Code	PS04CICH53	Title of the Course	Analytical Chemistry
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	1. One will be able to understand different techniques of analysis. 2. Different types of chromatographic techniques are covered. 3. Able to perform electroanalysis of chemical. 4. Learning of advanced instrumental techniques.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	**Titration techniques** Precipitation phenomena: Precipitation from homogeneous solutions, organic precipitants in inorganic analysis. Solvent extraction of metal ions, nature of extractant, distribution law, partition coefficients, types of extractions and	25%

	applications. Theories of redox indicators, titration curves, feasibility of redox titrations. Chelometric titrations-titration curves with EDTA, feasibility of EDTA titrations, selective masking and demasking techniques, industrial applications of masking.	
2.	UNIT II Chromatography Chromatographic Techniques: Principles, classifications and theory of chromatographic separations. Gas Chromatography: Principles, columns, detectors-TCD, FID, ECD and column efficiency, capacity factors, resolution. Practical aspects of GC-Hypernated techniques. Liquid Chromatography HPLC: Principles, equipment, columns, detectors, choice of column, materials GC, GCMS and LCMS. Ion exchange chromatography: Structures of resins, selectivity, capacity of resins, ion exchange equilibria, applications-removal of interfering ions, concentration and recovery of traces, anion and cation separations and application for the separation of lanthanides and actinides. Techniques of column chromatography and size exclusion chromatography. Thin layer chromatography, efficiency of TL plates, selection of stationary and mobile phases. Qualitative and quantitative analysis Paper chromatography: Theory and principle. Techniques:	25%

	one, two- dimensional and circular paper chromatography. Mechanism of separation, structure of cellulose and types of paper. Methodology- Factors affecting Rf values. Advantages and applications.	
3.	**Electroanalytical Techniques** Introduction, theory, principle, methodology, instrumentation and application of the following techniques: Conductometry, Potentiometry, Colometry, Voltammetry. **Fluorometry and Phosphorimetry:** Introduction fluorescence and phosphorescene, factors affecting fluorescence and phosphorescence, internal conversion intersystem crossing (radiationless proceses) quenching theory, relatiponship between intensity of fluorescence and concentration, instrumentation- basic difference in the measurement of fluorescence and phosphorescence, spectrofluorometers, advantages, limitations and precautions.	25%
4.	**Advanced instrumental techniques:** Spectrophotometry, atomic spectroscopy Thermal Analysis:- T.G, DTA and DSC- Principles and applications. X-ray differaction techniques- Powder and single crystal XRD, Principal applications.	25%

Teaching Learning Methodology:-	We have forged over traditional and some of the innovative approaches as teaching learning methodologies such as direct instructions, flipped class rooms, class room discussion unit based quiz, problem solving unit activities student presentation etc. This method tends to increase the self confidence among the students, increase the ability of providing and convincing.

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage* (%)**
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva- Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R. 6.8.3)	15%
3.	University Examination	70%

Course Outcomes:	
1.	It includes various techniques of chemical analysis. - Will be able to understand the aspects of some advanced techniques of analysis. - Able to perform various types of chromatographic techniques. - Principle technique and performance of absorption spectra and X-ray diffraction will be cleared.

Suggested References

Sr. No.	References
1.	G.D. Christian, Analytical Chemistry, John Wiley, 1986.
2.	R-A. Day and A.L. Underwood: Quantitative Analysis, (Prentice Hall, India), 1998.
3.	B.K. Sharma, Instrumental methods of chemical analysis, Goel publishing House, 2000.
4.	Skoog, Holler and Nieman: Principles of Instrumental Analysis, Harcourt Acta, 2001.
5.	B.K. Sharma, Chromatogarphy, Krishna Prakashan media, 1997.
6.	S. K. Chatterjee , X-Ray Diffraction theory and application, ISTE, 2007.
7.	A.G. Jackson: Handbook of Crystallography For Electron Microscopists and Others Library of Congress Cataloging-in-Publication Data Jackson, A. G. (Allen G.) ISBN-13: 978-1-4612-7776-7 1, 1991.

Online- Resources

On-line Resources:- From time to time are many online resources, including websites, databases, e-books, bibliographies and platforms that offer educational videos, lectures on a range of topics can be suggested or displayed tot he students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Sodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University

Vallabh Vidyanagar, Gujarat

(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)

Syllabus with effect from the Academic Year 2022-2023

Master of Science, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester - IV

Course Code	PS04CICH54 PS04CICH55	Title of the Course	Practical's
Total Credits of the Course	8	Hours Per Week	16

Course Objectives:	1.	The students are trained to handle the experimental set up including standardization.
	2.	Qualitative Analysis of Organic Compounds.
	3.	Estimation of Organic functional group/ molecules by titrimetric methods.
	4.	Be able to interpret the spectrum of any organic compounds / molecules.
	5.	This course gives an idea of various analytical techniques.

Course Code	PS03CICH54	Title of the Course	Industrial Organic Chemistry II
Total Credits of the Course	4	Hours Per Week	8

Description
Spectrum Analysis (5 Practical's)
Estimation 1. Determine the amount of phenol in the given solution. 2. Determine the amount of crotonic acid in the given solution. 3. Determine the No and percentage of Hydroxy / goup (-OH) of a given sample. 4. To determine % of Vitamin C in a given table. 5. To determine the amount of acetic acid and acetamide in the given soultion

Course Code	PS04CICH55	Title of the Course	Analytical aspects in Industries
Total Credits of the Course	4	Hours Per Week	8

1.	To determine the rate of acid-catalyst Iodination of acetone in presence of excess acid and acetone at room temperature.	
2.	To determine the transition temperature of alauber's salt by solubility method.	
3.	To determine the amount of aspirin in a given tablet by conduct metrically.	

4.	To determine the rate constant of the saponification of ethyl acetate at different temperatures conductometrically and calculate the energy of activation of the reaction.	
5.	To determine the neutralisation capacity of given antacid tables.	
6.	Preparation of pure sample of ferrous ammonium sulphate.	
7.	Preparation of pure sample of potash alum	
8.	To determine % Fe in iron tablet by colorimetry.	
9.	Assay of Fe in pharmaceutical preparation using potassium thiocynate by colorimetric.	
10.	Determination of distribution co-efficient of ammonia between chloroform & water.	
11.	Proximate analysis of coal	

Teaching Learning Methodology:-	Demonstration/ Hands on training of various types of analysis with or without instruments.

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage* (%)**
1.	Internal Practical Examination (As per CBCS R. 6.8.3)	30%
2.	University Examination	70%

Course Outcomes:	
1.	Be able to perform hydroxy/ group estimation, phenol estimation, crotonic acid estimation, ascorbic acid estimation and acetic acid and acetamide estimation.
2.	To get an expertise in spectrum analysis.
3.	Students will be able to understand rate of reaction with/ without catalyst.
5.	Determine the amount of aspirin in drugs.
6.	Students will know about the colorimetric analysis.

Suggested References

Sr. No.	**References**
1.	Comprehensive practical organic chemistry Preparationa nd quantitative. Analsys. By V.K Ahluwalia and Renu Agarwal
2.	Comprehensive practical organic chemistry Qualitative Analysis By V.K. Ahluwalia and Renu Agarwal.
3.	A Laboratory Manual of Experiments in Physical Chemistry By D. Breman and C.F.H. Tipper. (Mcgraw Hill Publishing Company Ltd. London)
4.	Systematic Experimental Physical Chemistry by S.W. Rajbhoj and T.K. Chondhekar (Anjali Publication Auran Gabad)
5.	Advanced Practical Inorganic chemisty by Gurdeep Raj (Goel Publishing House)

Online- Resources

On-line Resources:- From time to time are many online resources, including websites, databases, e-books, bibliographies and platforms that offer educational videos, lectures on a range of topics can be suggested or displayed tot he students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Sodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University

Vallabh Vidyanagar, Gujarat

(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)

Syllabus with effect from the Academic Year 2022-2023

Master of Science, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester - IV

Course Code	PS04CICH56	Title of the Course	Comprehensive Viva
Total Credits of the Course	1	Hours Per Week	1

Course Objectives	1. To assess the overall knowledge of the student in the relevant subjects covered in core as well as elective courses.

Sardar Patel University

Vallabh Vidyanagar, Gujarat

(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)

Syllabus with effect from the Academic Year 2022-2023

Master of Science, Industrial Chemistry

M.Sc. Industrial Chemistry, Semester - IV

Course Code	PS04EICH51	Title of the Course	Natural Products
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	1. The student is able to understand basic importance of Natural products. 2. Learn the different types of alkaloids, Vitamins, Steroids & Terpenoids. 3. The student is able to learn about the synthesis of alkaloids, vitamins, steroids & Terpenoids. 4. Learn the different biogenesis of Alkaloids, Terpenoids, Carotenoids & Steroids.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	Introduction of natural products, General methods for the structure determination of natural products. Vitamins: Structure & Synthesis of Vitamin Al, Vitamin B_1 (Thiamine), Vitamin B6 (Pyriodoxine) and Biotin (Vitamin	25%

	H), Synthesis of Vitamin C.	
2.	Alkaloids: Introduction of opium alkaloids, Structure and Synthesis of Morphine, rearrangement in opium alkaloids, structure and synthesis of Sceletium alkaloid A4, Structure and synthesis of Mahanimbine, Synthesis of Resperpine and Tylophorine, biogenesis of Alkaloids	25
3.	Terpenouids and Cartenoids: Structure and synthesis of cyclic sesqiterpenoids eudesmol and cadinene, Structure and Synthesis of B- Carcotene, Synthesis of Caryophyllene and Khusimone, molecular rearrangement of Caryophyllene and Logifolene, biogenesis of Terpenoids and Carotenoids.	25
4.	**Steroids:** Structure and Synthesis of Cholestrol, Synthesis of Cortisone, Androgens and Oestrogens, Chemistry of bile acids, Biogenesis of Steroids.	25

Teaching Learning Methodology:-	To meet the effective teaching & the learning requirements, teaching learning methodology, comprises, classroom teaching, use of e-sources, library books, IT tools, encouraging students to participate in Seminar/ workshops, presentation by students, assigning work based upon subject requirements etc.

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage* (%)**
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva- Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R. 6.8.3)	15%
3.	University Examination	70%

Course Outcomes:	
1.	Able to classify natural products from their chemical structure & to indicate their possible biosynthesis.
2.	Students able to know about structure, synthesis & different biogenesis of Alkaloids, Terpenoids, Carotenoids & Steroids.
3.	Students able to know about the significance & importance of Alkaloids, Terpenoids carotenoids & steroids.

Suggested References

Sr. No.	**References**
1.	The Chemistry of Natrual Products, K.W. Bentley, Vol. I-V, (interscience)
2.	Organic Chemistry, Vol.2, I.L. Finar, 5th Edition (1994), ELBS Publications.
3.	Natrual Products Chemistry Vil. I & II, Nakanishi et al., Academic Press Pub. (1974)

4.	The molecules of Natre, J.B. Hendrickson, W.A. Benjamin Inc (1965)
5.	Selected Organic Synthesis, Ian Fleming, John Wiley (1977)
6.	Chemistry of Natrual Products, N.R. Krishnaswamy, University Press Ltd. (1999)

Online- Resources

On-line Resources:- From time to time are many online resources, including websites, databases, e-books, bibliographies and platforms that offer educational videos, lectures on a range of topics can be suggested or displayed tot he students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Sodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.

Sardar Patel University

Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)
Syllabus with effect from the Academic Year 2022-2023
Master of Science, Industrial Chemistry
M.Sc. Industrial Chemistry, Semester - IV

Course Code	PS04EICH52	Title of the Course	Introduction to Biochemistry
Total Credits of the Course	4	Hours Per Week	4

Course Objectives:	The objective of the course 1. To provide basic understanding of the Chemistry of biomolecules. 2. To study the properties, classification and function of various biological molecules such as vitamins, proteins, carbohydrates and nucleic acids. 3. To gain knowledge about enzymes, erzyme kinetics and their regulation. 4. To enlighten students about the role of water in interaction of biomolecules.

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	**Vitamins:** Classification, introduction, chemistry absorption, transport, mobilization and biochemical functions of Vitamins: A, E,K,C,B_1,B_2,B_6, B_{12}, H, CoA, Folic acid Niacin.	25%

	Lipids: Nomenclature, Structure and physical properties of some natrually occurring fatty acids, triacelgylycerol and waaxes as sources of stored energy, insulation and water repellents, Types of membrane lipids, Introduction to glycerophospho lipids, galacto lipids, sphingo lipids, phospho lipids and sterols.	
2.	**Proteins:** Properties, Classification and Conventions of common amino acids, stereoisomerism in a - amino acids, Peptides: Formation, Merrifelds Synthesis, compositions and sizes, protin separation, purificationa nd Characterization: Sequencing of Peptides: Sanger's method Adman degradation, outline of other mehtods: Protein Sequences and Evoluation: Oxygen binding proteins- hemoglobin and Myoglobin in Oxygen transport and storage.	25%
3.	**Carbohydrates:** Classification and stereochemistry, Biologically important hexose derivatives, Nomenclate for disaccharides, strcutre and role of some Homo and Hetero Polysaccharides, Glycoconjugates: Proteoglycans, Glycoproteins and Glycolipids, Introduction to Glycobiology (The Sugar Code) **Water:** Interaction among biomolecules in aquenous systems, Buffering aginst pH changes in biological systems, participation of water in biological rections.	25%

4.	**Enzymes:** Classification Nomenclature & extraction factors affections, catalytic activity and specificity in action, regulation of enzyme activity, enzyme inhibition. Illustrative enzymatic recations using Chymotrypsin, Hexokinase, enolase and Lysozyme **Nuclelc acids:** Components of nucleic acids, nomenclature of nucleotides, strucre of DNA Chargaff's Rule of DNA Composition, Watson and Crick Model, structure and types of RNA.	25%

Teaching Learning Methodology:-	- Topics in the course will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power-point presentations & videos. - Course material will be provided from primary and secondary sources of information. - To develop critical thinking and conceptual knowledge, group discussions and seminar presentations will be conducted by the students.

Evaluation Pattern		
Sr. No.	**Details of the Evaluation**	**Weightage* (%)**
1.	Internal Written/ Practical Examination (As per CBCS R 6.8.3)	15%

2.	Internal Continuous Assessment in the form of Practical, Viva- Voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R. 6.8.3)	15%
3.	University Examination	70%

Course Outcomes:	
1.	After the successful competition of the course, the learner will be able to: 1. Carry out laboratory experiments using biomolecules. 2. Get trained & work with the application of bimolecular industries. 3. Describe all the biomolecules with their classification & function 4. Explain the importance of water in biological relations.

Suggested References

Sr. No.	**References**
1.	Lehninger Principles of Biochemistry, David L. Nelson and Michael M. Cox {Palgrave MacMillan / W.H. Freeman & Company, New York]
2.	Principles of Biochemistry, Donald J. Voet, Judith G. Voet, Charlottee W. Pratt [John Wiley & Sons]
3.	Biochemistery, U. Satyanarayana, Books & Allied (p) Ltd., Kolkata (India)

Online- Resources

On-line Resources:- From time to time are many online resources, including websites, databases, e-books, bibliographies and platforms that offer educational videos, lectures on a range of topics can be suggested or displayed tot he students.

Major websites used for chemical education such as:- Swayam, e-pg Pathshala, Swayam Prabha, NDLI, E-Sodh Sindhu, NPTEL, Virtual Labs, Process Oriented Guided Inquiry Learning (POGIL) etc.