Shri Vile Parle Kelavani Mandal's

MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS (AUTONOMOUS)

NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),

Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India

Best College (2016-17), University of Mumbai

Affiliated to the

UNIVERSITY OF MUMBAI

Program: B.Sc.

Course: CHEMISTRY

Semester: I

Choice Based Credit System (CBCS) with effect from the Academic year: 2018-2019

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

On completion of the B.Sc Chemistry the learners should be enriched with knowledge and be able to-

PSO1: To have sound knowledge about the fundamentals and applications of various chemical and scientific theories.

PSO2: To introduce the different branches of chemistry like analytical, organic, inorganic, physical, environmental, polymer and biochemistry etc.

PSO3: To explain nomenclature, stereochemistry, structures, reactivity, chemical formulae, and mechanism of the chemical reactions.

PSO4: To apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO5: To develop better understanding of good laboratory practices and safety.

PSO6: To develop research oriented skills, analytical skills and problem solving skills requiring application of chemical principles.

PSO7: To recognize causes of environmental pollution, environmental pollution act and the methods for environmental pollution control.

Preamble

The well-organized curriculum including basic as well as advanced concepts in chemistry from first year to third year shall inspire the students for pursuing higher studies in chemistry and for becoming an entrepreneur and also enable students to get employed in the Research Institutes, Industries, Educational Institutes and in the various concerning departments of State and Central Government based on subject chemistry.

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Details of Continuous Assessment (CA)

25% of the total marks per course:

Continuous Assessment	Details	Marks
Component 1 (CA-1)	Class Test	15 marks
Component 2 (CA-2)	Class Test	10 marks

b) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be two and half hours.

Question Number	Description	Marks	Total Marks
Q.1	Attempt **any four out of six**	5 marks each	20
Q.2	Attempt **any four** out of six	5 marks each	20
Q.3	Attempt **any four** out of six	5 marks each	20
Q.4	Attempt **any five** out of six	3 marks each	15
		Total Marks	**75**

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HOD Approved by Vice –Principal Approved by Principal

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B.Sc.				**Semester: I**	
Course: CHEMISTRY				**Course Code: USMACH101**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
03	03	NIL	1+1 = 2	25	75

Learning Objectives:

After completion of the course, learners would be introduced to different aspects of:

* Thermodynamics.
* Periodic table.
* Types of analysis.
* Reaction mechanism.

Course Outcomes:

After completion of the course, learners would be able to understand:

CO1: Basics of thermodynamics
CO2: Basics of periodic table.
CO3: Types of analysis.
CO4: Use of organic chemistry in society.
CO5: Nomenclature of organic compounds.
CO6: Fundamentals of reaction mechanisms.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Lectures**
1	Chemical Thermodynamics	15
2	2.1 Periodic table and periodicity of properties 2.2 Concepts of Qualitative analysis 2.3 Introduction to acid-base theories	15
3	1 Chemistry and society 3.2 Nomenclature 3.3 Bonding and structure of organic compounds 3.4 Fundamentals of organic reaction mechanism 3.5 Hydrogen bonding 3.6 POP's (Persistent Organic Pollutants)	15
	Total	**45**
PRACTICALS		

Unit	Topic	No. of Lectures/Credits
Module 1	**Chemical Thermodynamics(15L)** Thermodynamic terms: system, surrounding, boundaries, open, closed and isolated system, intensive and extensive properties, state function and path function, zeroth law of thermodynamics. First law of thermodynamics, internal energy, enthalpy, different processes viz. isothermal, adiabatic, endothermic, exothermic, etc. Pressure, volume and temperature relationship in isothermal and adiabatic processes. Second law of thermodynamics, Carnot's cycle, mechanical efficiency, entropy changes of system and surrounding for reversible and irreversible processes. Physical significance of entropy, entropy changes for an ideal gas in isothermal, isobaric and isochoric changes. Entropy changes accompanying fusion, vaporisation and transition.	**15 L**
Module 2	2**.1 Periodic table and periodicity of properties (5L)** Periodic table and periodicity of properties Long form of periodic table Classification of elements as main group, transition and inner transition elements Atomic and ionic radii Ionisation of atoms (formation of cations and anions) Effective nuclear charge and its calculation using Slater's rules Electronegativity Determination of electronegativity using Pauling's, Mulliken's, Allred Rochow methods Polarizability (Fajan's rules) (Numericals are expected wherever possible **2.2 Concepts of Qualitative analysis (8L)** Types of qualitative analysis Factors affecting solubility product in qualitative analysis (Numerical problems expected) Common ion effect, pH effect, Complexation Ionic strength (Uncommon ion effect) Oxidation states	**15 L**

	(Examples to illustrate the above mentioned factors may be selected from the schemes for qualitative analysis in the laboratory work) **2.3 Introduction to acid-base theories (2L)** Lowry-bronsted, Lewis Theory Hard and soft acids and bases (Definition, classification with 2/3 examples expected)	
Module 3	**3.1 Chemistry and society (2L)** Hospital, Human body, Food, Agriculture, Clothings, Shelters, Personal care, Cosmetics, Kitchen, Fuels, Religious rituals, Defence, Sports, Intoxications, Medicines and Modern lifes. **3.2 Nomenclature (4L)** Review of basic rules of IUPAC nomenclature.Nomenclature of mono and bi-functional aliphatic compounds on the basis of priority order of the following classes of compounds: alkanes, alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones, carboxylic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines; including their cyclic analogues. **3.3 Bonding and structure of organic compounds (3L)** sp^3, sp^2, sp hybridization of carbon and nitrogenoxygen in Organic compounds (alcohol, ether, aldehyde, ketone, carboxylic acid, ester, cyanide, amine and amide) **3.4 Fundamentals of organic reaction mechanism (3L)** Inductive, electromeric, resonance effects, hyperconjugation and their applications, dipole moment, organic acids and bases their relative strength. **3.5 Hydrogen bonding (2L)** Definitions, types and effects on physical and chemical properties. **3.6 POP's (Persistent Organic Pollutants) (1L)** Definitions, examples, sources, effects on environment and human health.	**15 L**
	Practicals	
	1) Determination of heat of solution (KNO_3) 2) Determination of heat of displacement ($Zn + CuSO_4$) 3) Heat of neutralization ($NaOH + HCl$)	

	4) Semi-micro Qualitative Analysis (Identification of one cation and two anions from mixture) 5) Organic preparations: a) 2,4,6 – DNP derivative of acetone b) Phthalic anhydride from phthalic acid c) Iodoform derivative of acetone	

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: B.Sc.				**Semester: I**	
Course: CHEMISTRY				**Course Code: USMACH102**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical** (Hours per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
03	03	NIL	1+1 = 2	25	75

Learning Objectives:

After completion of the course learner would be introduced to different aspects of:

- Stereochemistry
- Chemical bonding
- Organic reaction mechanism
- Green chemistry

Course Outcomes:

After completion of the course, learners would be able to:

CO1: Solve basic quantitative problems.
CO2: Represent the experimental data efficiently.
CO3: Understand theories of chemical bonding.
CO4: Explain stereochemistry of organic compounds.
CO5: Identify environmentally benign routes of chemical synthesis.

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Lectures**
1	1.1 Stoichiometry 1.2 Presentation of experimental data	15
2	2.1 Ionic bond 2.2 Covalent bond 2.3 Valence bond theory 2.4 VSEPR theory	15
3	3.1 Fundamentals of organic reaction mechanism 3.2 Stereochemistry 3.3 Chemistry of aliphatic hydrocarbons 3.4 Green Chemistry	15
	Total	**45**
PRACTICALS		

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

Unit	Topic	No. of Lectures/Credits
Module 1	**1.1 Stoichiometry (12L)** Methods of expressing the concentration of solutions on volume basis, weight basis and their inter-conversions. Normality (N), molarity (M), molality (m) and mole fraction (X), dilutions of solutions Standard solutions, primary standard, secondary standard their characteristics and examples. Solutions. Concentration of milliequivalents, millimoles, ppm, ppb. Calculations based on chemical equations pertaining to: (a) Oxidation-reduction (Balancing by Oxidation Number Method and Ion Electron Method) (b) Precipitation (c) Decomposition (d) Neutralization **1.2 Presentation of experimental data(03L)** Significant figures: Concept, rules for adding, subtracting, multiplying, dividing and rounding off Graphical representation of experimental data: Equation of straight line, slope intercept and their significance	**15 L**
Module 2	**2.1 Ionic bond (4L)** Formation of ionic bond, Lattice energy, Solvation energy Born-Haber cycle and Kapustinski's equation (Numerical problems expected) **2.2 Covalent bond (1L)** Lewis electron dot structure, Single and multiple bonding Co-ordinate bonding **2.3 Valence bond theory (7L)** Sigma and pi-bonding, Theory of hybridization with respect to equivalence of contributing atomic orbitals in following examples: CH_4, NH_3, H_2O Energetics of hybridization Types of hybridization: sp, sp2, sp3 with examples ($BeCl_2$, BF_3, $SiCl_4$)	**15 L**

	2.4 VSEPR theory (3L) Basic VSEPR theory for molecules with and without lone pairs of electrons Shapes of chemical species on the basis of VSEPR theory (NH_3, ClF_3, BrF_3, ICl_2^-, TeF_5^-, PX_3) Limitations	
Module 3	**3.1 Fundamentals of organic reaction mechanism (3L)** Reactive intermediates (Carbocations, Carbanions and Free radicals) and their shapes and relative stability. Homolytic and Heterolyticfission with suitable examples.Electrophiles and Nucleophiles; Nucleophilicity and basicity; **3.2 Stereochemistry (5L)** Concept of isomerism, types of isomerism, chiral and achiral molecules with two similar and disimiliarstereogeniccentres, enantiomers, diastereomers, threo and erythro, meso compounds, resolution of enantiomers and racemization, Projection formulae: Fischer Projection, Newman and Sawhorse Projection formulae and their interconversions; **3.3 Chemistry of aliphatic hydrocarbons (5L)** Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity. Formation of alkene and alkynes by elimination reactions Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. **3.4 Green Chemistry (2L)** Definition, principles and examples	**15 L**
	Practicals	
	1) Preparation of standard solution of acid (Succinic acid or KHP) and standardize the supplied base 2) Preparation of standard solution of base (Na_2CO_3) and standardize the supplied acid 3) Preparation of standard solution of oxidizing agent ($K_2Cr_2O_7$) and standardize the supplied Fe^{2+} ion solution in acidic medium 4) <u>Gravimetric Analysis</u> a) $BaSO_4 + NH_4Cl$ b) $ZnO + ZnCO_3$	

	c) Na_2CO_3 + $NaHCO_3$ Organic compound Characterization (only with C, H, (O) elements, minimum 6 compounds)	

PRACTICAL II
(If applicable)

Suggested Readings

Physical Chemistry:

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
5. Engel T. and Reid P., Physical Chemistry, 3rd Ed., Pearson (2013).
6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd.,New Delhi (2004).
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13. Khosla B.D., Garg V.C. and Gulati A., Senior Practical Physical Chemistry, R. Chand and Co., New Delhi (2011).
14. Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical Chemistry, 8th Ed., McGraw-Hill, New York (2003).
15. Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).
16. Athawale V.D. and Mathur P., Experimental Physical Chemistry, New Age International, New Delhi (2001).

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
3. Atkins, P.W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.
4. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications, 1962.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

Organic Chemistry

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
6. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
7. Frank L. Wiseman, Chemistry in the Modern World- Concept and Applications
8. Nivaldo J. Tro, Chemistry in Focus- A Molecular View of Our World, 3rd Ed.
9. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
10. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
11. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall

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Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India

Best College (2016-17), University of Mumbai

Affiliated to the

UNIVERSITY OF MUMBAI

Program: Bachelor of Science (B.Sc.)

Course: CHEMISTRY

Semester : II

Choice Based Credit System (CBCS) with effect from the Academic year 2018-19

PROGRAMME SPECIFIC OUTCOMES (PSO'S)

On completion of the B.Sc Chemistry, the learners should be enriched with knowledge and be able to-

On completion of the B.Sc. – CHEMISTRY, the learners should be enriched with knowledge and be able -

PSO1: To have sound knowledge about the fundamentals and applications of various chemical and scientific theories.
PSO2: To familiarize with the different branches of chemistry like analytical, organic, inorganic, physical, environmental, polymer and biochemistry etc.
PSO3: To explain nomenclature, stereochemistry, structures, reactivity, chemical formulae, and mechanism of the chemical reactions.
PSO4: To apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.
PSO5: To use modern chemical tools, models and other scientific equipment's for better understanding of the topic.
PSO6: To develop better understanding of good laboratory practices and safety.
PSO7: To develop research oriented skills, analytical skills and problem solving skills requiring application of chemical principles.
PSO8: To handle the instruments/equipments.
PSO9: To recognize causes of environmental pollution, environmental pollution act and the methods for environmental pollution control.

Preamble

The well-organized curriculum including basic as well as advanced concepts in chemistry from first year to third year shall inspire the students for pursuing higher studies in chemistry and for becoming an entrepreneur and also enable students to get employed in the Research Institutes, Industries, Educational Institutes and in the various concerning departments of State and Central Government based on subject chemistry.

Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

c) Details of Continuous Assessment (CA)

25% of the total marks per course:

Continuous Assessment	Details	Marks
Component 1 (CA-1)	TEST/ASSIGNMENT	15 marks
Component 2 (CA-2)	TEST/ASSIGNMENT	10 marks

d) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be two and half hours.

Question Number	Description	Marks	Total Marks
1	Attempt any 4 of the following	5 marks each	20
2	Attempt any 4 of the following	5 marks each	20
3	Attempt any 4 of the following	5 marks each	20
5	Attempt any 5 of the following	3 marks each	15
		Total Marks	**75**

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HOD Approved by Vice –Principal Approved by Principal

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: BSc	**Semester : II**
Course : Chemistry I	**Course Code: USMACH201**

Teaching Scheme				**Evaluation Scheme**	
Lecture (lecture per week)	**Practical** (lecture per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks -25)**	**Term End Examinations (TEE) (Marks- 75 in Question Paper)**
03	03	Nil	02+01	10+15	75

Pre-requisite/Preamble:

The well-organized curriculum including basic as well as advanced concepts in chemistry from first year to third year shall inspire the students for pursuing higher studies in chemistry and for becoming an entrepreneur and also enable students to get employed in the Research Institutes, Industries, Educational Institutes and in the various concerning departments of State and Central Government based on subject chemistry.

Objectives:

Introduce students to basics of Real gases, Atomic structure, Comparative chemistry of transition metals, Comparative study of group 13 elements, Stereochemistry and Aromaticity.

Course Outcomes:

After completion of the course, learners would be able to:**:**

CO1: Understand behaviour of Ideal and Real gases,

CO2: Explain Atomic structure and effect on reactivity,

CO3: Comprehend the comparative chemistry of transition metals and group 13 elements.

CO4: Identify the stereoisomers and aromaticity organic molecules.

Detailed Syllabus: (per session plan)

module	**Description**	**Duration**
1	**1.1 Real gases (7L)** Gas laws, Kinetic theory of gases, Maxwell distribution of velocities, Ideal and real gases, Deviation of gases from ideal behavior and reasons for deviation. Compressibility factor, van der Waal's equation and its applicability to explain the deviation of gases from ideal behavior. Critical phenomenon, Andrew's and Thomson's isotherms, critical constants of a gas in terms of van der Waal's constant. **1.2 Atomic structure (8L)** Bohr's model of hydrogen atom, quantization of energy. Hydrogen spectrum, Ritz combination principle, the spectral series of hydrogen atom Somerfield's modification (only qualitative discussion), wave particle dualism, de Broglie equation, experimental verification of wave nature of electron.	**15L**

	Heisenberg's uncertainty principle, Qualitative interpretation of Schrodinger's wave equation (Derivation not expected)	
2	**2.1 Comparative chemistry of transition metals (8L)** 2.1.1 Electronic configuration of transition elements Metallic character, Oxidation States, Ability to form complexes, Size of atom and ions, Melting point and boiling point, density and ionization enthalpy 2.1.2 Color 2.1.3 Magnetic property 2.1.4 Catalytic Property 2.1.5 Differences between first row and the other two rows – M-M bonding in cluster compounds, stability of oxidation states, complexes, size and magnetism **2.2 Comparative study of group 13 elements (7L)** Trends in metallic character, oxidation states, melting and boiling points Inert pair effect Structures of electron deficient compounds with reference to boron hydrides Chemistry of Aluminum compounds: halides, oxides and alkyls	**15L**
3	**3.1 Stereochemistry (5L)** Relative and absolute configuration, D- and L- system of nomenclature, geometric isomerism, determination of configuration of geometric isomers, geometric isomerism in oximes and alicyclic compounds and unsymmetrically substituted cyclopropanes, cyclobutanes. Conformation and conformational analysis of ethane, propane and its derivatives (2-methyl propane, 2,2-dimethylpropane) and butane. Difference between conformation and configuration **3.2 Aromaticity (7L)** Huckel's rule, anti-aromaticity, aromatic character of arene, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution reaction: Nitration, Sulphonation, Halogenation, Friedal craft reaction with mechanism **3.3 Bio-molecules (2L)** Carbohydrates, Proteins, Nucleic acids and lipids: Brief Introduction and importance **3.4 Prospectus of chemistry (1L)** Higher education, research and development, Military and law enforcement, manufacturing, environment and health quality control, consulting	**15L**
	Total	**45L**

PRACTICALS		
	Chemistry Practical **SEM – II Paper I** 1) Hydrolysis of methyl acetate (HCl/H_2SO_4) 2) $K_2S_2O_8$ + KI (with equal initial concentration) 3) $K_2S_2O_8$ + KI (with unequal initial concentration) 4) Titrimetric Analysis Double indicators Commercial analysis of HCl, acetic acid and NaOH Redox titrations 5) Recrystallization of organic compounds [2 with water + 1 with alcohol]	

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science				**Semester : II**	
Course : Chemistry II				**Course Code: USMACH202**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - 25)**	**Term End Examinations (TEE) (Marks- 75 in Question Paper)**
3	3	-	2 + 1	10 + 15 = 25	75

Pre-requisite/Preamble:

The well-organized curriculum including basic as well as advanced concepts in chemistry from first year to third year shall inspire the students for pursuing higher studies in chemistry and for becoming an entrepreneur and also enable students to get employed in the Research Institutes, Industries, Educational Institutes and in the various concerning departments of State and Central Government based on subject chemistry.

Objectives:

Introduce students to basics of chemical kinetics, photochemistry, environmental chemistry, aliphatic hydrocarbons and polymer chemistry.

Course Outcomes:

After completion of the course, students would be able to:

CO1: Determine the rate and order of reactions.

CO2: Understand basics of photochemistry.

CO3: Explain sources and effects of organic and inorganic pollutants.

CO4: Comprehend the basic concepts of polymer chemistry and nanotechnology.

Detailed Syllabus: (per session plan)

module	**Description**	**Duration**
1	**1.1 Chemical Kinetics (10L)** Rate of reaction, definition and units of rate constant, measurement of reaction rates. Order and molecularity of reaction. Integrated rate equations for zero, first and second order reactions (with equal and unequal concentrations) with examples. Kinetic characteristics of first and second order reactions. Pseudo-unimolecular reactions with examples. Methods of determining order of reaction by Integration method Graphical method Equi-fractional time method Differential method Ostwald's isolation method	**15L**

	1.2 Photochemistry (5L) Laws of photochemistry, photon yield (quantum yield) and its determination, primary and secondary photochemical reactions, reasons for high quantum yield, study of photochemical reactions: Reaction between hydrogen and chlorine Dissociation of hydrogen iodide Photosensitizers and photosensitized reactions, photochemical smog, concept of flash photolysis	
2	**2.1 Basic bio-inorganic chemistry (3L)** Introduction Essential and non-essential elements in biological systems Role of metal ions such as Na, K, Fe and Cu in biological systems **2.2 Environmental chemistry (4L)** Study of various gaseous pollutants such as oxides of Carbon, Nitrogen and Sulphur with respect to, (i) sources of emissions (ii) fate (iii) health hazard (iv) control measures Greenhouse effect, Ozone layer depletion and its consequences **2.3 Comparative chemistry of group 14 elements (8L)** Trends in metallic character, oxidation states, melting and boiling points Inert pair effect Catenation and allotropy with special reference to carbon Chemistry of Silicon with special reference to methods of purification zone, refining and single crystal method Introduction to silicones with reference to methods of preparations and their uses	**15L**
3	**3.1 Chemistry of aliphatic hydrocarbons (10L)** Reactions of olefins: Electrophilic additions their mechanisms (Markownikoff/AntiMarkownikoff addition), Oxymercuration-demercuration, hydroboration-oxidation,syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylicbrominationusing N-bromosuccinimide (NBS) (mechanism) Reactions of alkynes**:** Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes **3.2 Polymer Chemistry (3L)** Classification, Types of polymerization process with structures, properties and uses Examples: polyethylene, polystyrene, polypropylene, nylons and plastics **3.3 Nanotechnology (2L)** Introduction, Principles and practices, Milestones, methods of synthesis, methods of analysis, properties and applications.	**15L**

	Total	**45L**
PRACTICALS		
	SEM – II Paper II 1) Determine the strength in g/dm^3 of the following: Solution containing (i) Na_2CO_3 + $NaHCO_3$ (ii) $H_2C_2O_4$ + $K_2C_2O_4$ 2) Determine the volume strength of supplied H_2O_2 solution. 3) Inorganic Preparations $BaCrO_4$ $Na_2S_2O_3$ 4) Organic Compound Characterization [with C,H,(O),N; C,H,(O),N,S and C,H,(O),X elements, minimum 6 compounds]	

Text Books:

Reference Books:

Physical Chemistry:

1. Atkins P.W. and Paula J.de, Atkin's Physical Chemistry, 10th Ed., Oxford University 12 Press (2014).
2. Ball D.W., Physical Chemistry, Thomson Press, India (2007).
3. Castellan G.W., Physical Chemistry, 4th Ed., Narosa (2004).
4. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
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6. Peter A. and Paula J. de., Physical Chemistry, 10th Ed., Oxford University Press (2014).
7. McQuarrie D.A. and Simon J.D., Molecular Thermodynamics, Viva Books Pvt. Ltd.,New Delhi (2004).
8. Levine I.N., Physical Chemistry, 6th Ed., Tata McGraw Hill (2010).
9. Metz C.R., 2000 Solved Problems in Chemistry, Schaum Series (2006).
10. Mortimer R.G., Physical Chemistry, 3rd Ed., Elsevier: NOIDA, UP (2009).
11. Banwell C.N., Fundamentals of Molecular Spectroscopy, 4th Ed., Tata McGraw Hill (1994).
12. K.L. Kapoor, A Textbook of Physical Chemistry, Macmillan (2000).
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14. Garland C. W., Nibler J.W. and Shoemaker D.P., Experiments in Physical Chemistry, 8th Ed., McGraw-Hill, New York (2003).
15. Halpern A.M. and McBane G.C., Experimental Physical Chemistry, 3rd Ed., W.H. Freeman and Co., New York (2003).

16. Athawale V.D. and Mathur P., Experimental Physical Chemistry, New Age International, New Delhi (2001).

Inorganic Chemistry

1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Douglas, B.E. and McDaniel, D.H. Concepts & Models of Inorganic Chemistry Oxford, 1970
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