Syllabus Developed By Board of Studies

S No	Name	Affiliation	Remark
1.	Prof V P Singh	BHU Varanasi	Member
2.	Prof. Anil Kumar Mishra	University of Lucknow	Member
3.	Prof. Sudha Yadav	DDU Gorakhpur University	Member
4.	Prof. Ashutosh Singh	K S Saket PG College, Ayodhya	Convener

Semester wise Titles of the papers in B. Sc. Chemsitry

Year	Sem	Course Code	Paper Title	Course type T/P	Credits
1	I	B020101T	Chemistry I	T	4
		B020102P	Chemistry Lab Course I	P	2
	II	B020201T	Chemistry II	T	4
		B020202P	Chemistry Lab Course II	P	2
2	III	B020301T	Chemistry III	T	4
		B020302P	Chemistry Lab Course III	P	2
	IV	B020401T	Chemistry IV	T	4
		B020402P	Chemistry Lab Course IV	P	2
3	V	B020501T	Chemistry V A	T	4
		B020502T	Chemistry V B	T	4
		B020503P	Chemistry Lab Course V	P	2
	VI	B020601T	Chemistry VI A	T	4
		B020602T	Chemistry VI B	T	4
		B020603P	Chemistry Lab Course VI	P	2
		B020604R	Research Project(**Optional**)	R	3

w.e.f. 2026-27

B. Sc. Semester I

B020101T CHEMISTRY I		60Hrs(4 Hrs/week)
1.	Indian Knowledge System	4 Hrs
2.	Atomic Structure	6 Hrs
3.	Periodic Properties	5 Hrs
4.	Chemical Bonding	16 Hrs
5.	Structure and Bonding in Organic Chemistry	5 Hrs
6.	Mechanism of Organic Reaction	6 Hrs
7.	Stereochemistry	8 Hrs
8.	Gaseous State	6 Hrs
9.	Liquid State	4 Hrs
B020102P CHEMISTRY Lab Course I		**60Hrs(4 Hrs/week)**
1.	**Inorganic Chemistry:** Qualitative analysis/ Estimation of Oxalic acid	
2.	**Organic Chemistry:** Preparation/ Recrystallization	
3.	**Physical Chemistry:** Viscosity/Surface Tension/ Water quality analysis	

B. Sc. Semester II

B020201T CHEMISTRY I		60Hrs(4 Hrs/week)
1.	s-Block Elements	4 Hrs
2.	p-Block Elements	12 Hrs
3.	Alkanes and Cycloalkanes	6 Hrs
4.	Alkenes, Cycloalkenes, Dienes and Alkynes	6 Hrs
5.	Arenes and Aromaticity	6 Hrs
6.	Alkyl and Aryl Halides	6 Hrs
7.	Solid State	6 Hrs
8.	Surface Chemistry	4 Hrs
9.	Chemical Kinetics and Catalysis	10 Hrs
B020102P CHEMISTRY Lab Course I		**60Hrs(4 Hrs/week)**
1.	**Inorganic Chemistry:** Qualitative analysis/ Estimation of Oxalic acid	
2.	**Organic Chemistry:** Systemic Identification	
3.	**Physical Chemistry: Chemical** kinetics	

w.e.f. 2027-28

B. Sc. Semester III

B020301T CHEMISTRY III		60Hrs(4 Hrs/week)
1.	Chemistry of d-block Elements	14 Hrs
2.	Coordination Compounds	5 Hrs
3.	Chemistry of f-block Elements	6 Hrs
4.	Alcohols	4 Hrs
5.	Phenols	4 Hrs
6.	Ethers and Epoxides	6 Hrs
7.	Aldehydes and Ketone	8 Hrs
8.	Thermodynamics	16 Hrs
B020302P CHEMISTRY Lab Course III		**60Hrs(4 Hrs/week)**
1.	**Inorganic Chemistry:** Volumetric analysis	
2.	**Organic Chemistry:** Systemic Identification	
3.	**Physical Chemistry:** Thrmochemistry	

B. Sc. Semester IV

B020401T CHEMISTRY IV		60Hrs(4 Hrs/week)
1.	Oxidation and Reduction	6 Hrs
2.	Acids and Bases	4 Hrs
3.	Non-aqueous Solvents	4 Hrs
4.	Carboxylic Acids	6 Hrs
5.	Carboxylic Acid Derivatives	2 Hrs
6.	Organic Compounds of Nitrogen	8 Hrs
7.	Chemical Equilibrium	3 Hrs
8.	Phase Equilibrium	6 Hrs
9.	Electrochemistry	20 Hrs
B020402P CHEMISTRY Lab Course IV		**60Hrs(4 Hrs/week)**
1.	**Inorganic Chemistry:** Qualitative analysis/ Estimation of Oxalic acid	
2.	**Organic Chemistry:** Systemic Identification	
3.	**Physical Chemistry: Chemical** kinetics	

w.e.f 2028-29

B. Sc. Semester V

B020501T CHEMISTRY V-A		**60Hrs(4 Hrs/week)**
1.	Metal-ligand Bonding in Transition Metal Complexes	10 Hrs
2.	Magnetic Properties of Transition Metal Complexes	3 Hrs
3.	Electronic Spectra of Transition Metal Complexes	4 Hrs
4.	Thermodynamic and Kinetic Aspects of Metal Complexes	5 Hrs
5.	Elementary Quantum Mechanics	20 Hrs
6.	Photochemistry	12 Hrs
B020502T CHEMISTRY V-B		**60Hrs(4 Hrs/week)**
1.	Rearrangements Reactions	8 Hrs
2.	Reagents	10 Hrs
3.	Organometallic Compounds	6 Hrs
4.	Synthesis via Enolates	6 Hrs
5.	Organosulphur Compounds	4 Hrs
6.	Heterocyclic Compounds	8 Hrs
7.	Carbohydrates	9 Hrs
8.	Amino Acids Peptides, Proteins	4 Hrs
9.	Nucleic acids	3 Hrs
10.	Chemistry and Diet	2Hrs
B020503P CHEMISTRY Lab Course V		**60Hrs(4 Hrs/week)**
1.	**Inorganic Chemistry: Gravimetric estimation**	
2.	**Organic Chemistry:** Separation of sugar by paper chromatography/ Synthesis of osazone.	
3.	**Physical Chemistry:** Determination of molar mass/ verification of Beer-Lambert law	

B. Sc. Semester VI

B020601T CHEMISTRY VI-A		60Hrs(4 Hrs/week)
1.	Organometallic Chemistry	10Hrs
2.	Bioinorganic Chemistry	12 Hrs
3.	Silicones and Phosphazenes	4 Hrs
4.	Spectroscopy	20 Hrs
5.	Physical Properties and Molecular Structure	5 Hrs
6.	Solutions, Dilute Solutions and Colligative Properties	9 Hrs
B020602T CHEMISTRY VI-B		**60Hrs(4 Hrs/week)**
1.	Electromagnetic Spectrum	4 Hrs
2.	Infrared (IR) absorption spectroscopy	10 Hrs
3.	Nuclear magnetic resonance (NMR	12 Hrs
4.	**Mass Spectrometry**	6 Hrs
5.	**Medicinal Chemistry**	12 Hrs
6.	Natural fats	2 Hrs
7.	Synthetic Polymers	6 Hrs
8.	Synthetic Dyes	8 Hrs
B020603P CHEMISTRY Lab Course VI		**60Hrs(4 Hrs/week)**
1.	**Inorganic Chemistry:** Inorganic Preparation	
2.	**Organic Chemistry:** Structure elucidation of simple organic compounds by organic spectra	
3.	**Physical Chemistry:** potentiometry/ conductometry.	

B.Sc. Sem I

(w.e.f. Session 2026-27; Aligned with NEP-2020)

Year: B. Sc. 1st		
Paper I	Paper Type: Core	Credit; 4, T
Course Code:B020101T	Max Marks-100	CTE:25, ETE:75
Course Title: Chemistry I		

Course Objectives: To understand basic principles of atomic structures, chemical bonding, periodic properties, organic reaction mechanism, stereochemistry and gaseous, liquid states of matter.

Unit	Topics	Hrs.
1.	**Indian Knowledge System:** Concepts of matter in ancient India early ideas of atoms compounds and material properties panchbhut (five elements theory) and its scientific interpretation natural acids from fruits and plants alkalis from plants as use of copper sulphur aluminium arsenic compounds natural die pigment perfume famous India chemist Kannada, Charak, Shushrut, Aacharya Prafull Chandra Ray, modern link to ancient chemistry	4
2.	**Atomic Structure:** Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of y and w^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, effective nuclear charge	6
3.	**Periodic Properties:** Atomic and ionic radii, ionization energy, electron affinity and electronegativity definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.	5
4.	**Chemical Bonding:** **(A) Covalent Bond Valence bond theory** and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH3, H_2 O, SF, CIF3. ICl2 and H2O. MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicentre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference **(B) Ionic Solids** : Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice dolects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond-free electron, valence bond and band theories. **(C) Weak Interactions** – Hydrogen bonding, van der Waals forces	16
5.	**Structure and Bonding:** Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer	4

	complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.	
6.	**Mechanism of Organic Reactions:** Curved arrow notation, drawing electron movements with arrows, half-headed and double hoaded arrows, homolytic and heterolytic bond breaking. Types of reagouts electrophiles and nucleophiles. Types of organic reactions. Energy consideration. Reactive intermediates carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic Methods of determination of reaction mechanism (product analysis, intermediates, isotope cflocts, kinetic and storeochemical studies).	6
7.	**Stereochemistry of Organic Compounds** **Concept of isomerism. Types of isomerism:**Optical isomerism elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. **Geometrical Isomerism:**Determination of configuration of geometric isomers. E & Z system of nornenclature, geometric isomerism in oximes and alicyclic compounds.Conformational isomerism. Conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.Difference between configuration and conformation.	8
8.	**Gaseous States:**Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state. Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state. **Molecular velocities:** Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect).	6
9.	**Liquid State**: Intermolecular forces, structure of liquids (a qualitative description).Structural differences between solids, liquids and gases **Liquid crystals**: Difference between liquid crystal, solid and liquid Classification, structure of nematic and cholestric phases.	4

	Thermography and seven segment cell.	

References:

1. Concise Inorganic Chemistry, J D Lee
2. Organic Chemistry, Vol 1, I L Finar
3. Principles of Physical Chemistry, Puri, Sharma, Pathania

Course Outcomes: After completion of this course students will able to:

CO-1. Know the basics of atomic structure, chemical bonding

CO-2. Understand about organic reaction mechanism, stereochemistry

CO-3. Know about gaseous and liquid states

CO-4. Know the Indian knowledge system

B.Sc. Sem I

(w.e.f. Session 2026-27; Aligned with NEP-2020)

Year: B. Sc. 1st		
Paper I	**Paper Type: Core**	**Credit; 4, T**
Course Code:B020102P	**Max Marks-100**	**CTE:25, ETE:75**
Course Title: Chemistry Lab Course I		

Course Objectives: To train students for qualitative inorganic analysis, organic preparation, experiments related to physical chemistry

Unit	Topics	Hrs.
1	**Inorganic Chemistry**: 1. Qualitative analysis for four radicals of inorganic mixture soluble in water or HCl acid. 2. Estimation of Oxalic acid by titrating it with $KMnO_4$	
2	**Organic Chemistry:** **1.** Prepration: acetanilide, p-bromoacetanilide, p-nitroacetanilide, dibenzalacetone, picrate, alpha-naphthalopicric acid, phenyl-azo-β-naphthol(an azo dye), aniline yellow. **2.** Recrystallization of Benzoic acid from water.	
3	**Physical Chemistry:** **Viscosity, Surface Tension** **1.** To determine viscosity of pure liquid or solution **2.** To determine the percentage composition of a given mixture (non interacting systems) by viscosity method. 3. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the excess viscosity of these solutions. 4. To determine the surface tension of pure liquid or solution 5. To determine the percentage composition of a given binary mixture by surface tension method (acotone & ethyl methyl ketone). **Water quality analysis** Determination of TDS.	

Duration: 4 Hrs

System of marking: one practical exercise from inorganic (20), organic (15), Physical (15)

B.Sc. Sem II

(w.e.f. Session 2026-27; Aligned with NEP-2020)

Year: B. Sc. 1st		
Paper I	**Paper Type: Core**	**Credit; 4, T**
Course Code:B020201T	**Max Marks-100**	**CTE:25, ETE:75**
Course Title: Chemistry -II		

Course Objectives: To understand chemistry of s-, p- block elements, hydrcarbons and about solid states, Chemical kinetics, catalysis

Unit	Topics	Hrs.
1.	**s-Block Elements:** comparative study, diagonal relationships, saliont foatures of hydridos, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.	4
2.	**p-Block Elements:** (A) Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16, hydrides of boron-diboraneand higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalidos **(B) Chemistry of Noble Gases:** Chemical properties of the noble gases, chemistry of xenon, structure and borang in xenon compounds.	12
3.	**Alkanes and Cycloalkanes:** IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (withspecial reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: oriontation, reactivity and selectivity. Cycloalkanes nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.	6
4.	**Alkenes, Cycloalkenes, Dienes and Alkynes** Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation,	6

	ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene. Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.	
5.	**Arenes and Aromaticity:** Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular fo mula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture. **Aromaticity:** the Huckel rule, aromatic ions. **Aromatic electrophilic substitution-** general pattern of the mechanism, role of - and π complexes. Mechansim of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, onentation and ortho/para ratio. Side chain reactions of benzone derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl, naphthalene and Anthracene.	6
6.	**Alkyl and Aryl Halides:**Nomenclature and classes of alkyl halides, methods of formation, chemical reactions Mechanisms of nucleophilic substitution reactions of alkyl halides, S2 and S1 reactions with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.	6
7.	**Solid State:** Definition of space lattice, unit cell. Laws of crystallography (i) Law of constancy of interfacial angles (ii) Law of rationality of Indices (iii) Law of symmetry. Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method)	6

8.	**Surface Chemistry** **Adsorption:** Physical and chemical adsorption, Freunlich and Langmuir adsorption isotherm, multilayer adsorption and BET isotherm(no derivation required), Gibbs adsorption isotherm,surface excess **Colloidal States:** Definition of colloids, classification of colloids.10 Solids in liquids (sols): lyophobic and lyophilic sol properties kinetic, optical (Tyndall effect) and clectical, origin of charge and stability of lyophobic colloids, protective action, coagulation and Hardy-Schulze law, gold number, Zeta potential and Stern double layer (qualitative idea), Electrokinetic phenomenon(quqlitative idea only), micclle formation.	4
9.	**Chemical Kinetics and Catalysis:** zero Chemical kinetics and its scope, rate of a reaction, litctors influencing the rate of a reaction concentration, temperaturc, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chernical reactions order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction - differential method, method of integration, method of half life period and isolation method. Radioactive decay as a first order phenomenon. Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer. **Theories of chemical kinetics**: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and thermodynamic aspects. Catalysis, characteristics of catalysed reactions, classification of catalysis, miscellaneous examples.	10

References:

1. Concise Inorganic Chemistry, J D Lee
2. Organic Chemistry, Vol 1, I L Finar
3. Principles of Physical Chemistry, Puri, Sharma, Pathania

Course Outcomes: After completion of this course students will able to:

CO-1. Know the chemistry of s-, p- block elements, hydrcarbons and alkyl, aryl halides

CO-2. Understand about solid state, adsorption, colloids, and chemical kinetics

B.Sc. Sem II

(w.e.f. Session 2026-27; Aligned with NEP-2020)

Year: B. Sc. 1st		
Paper I	**Paper Type: Core**	**Credit; 4, T**
Course Code:B020202P	**Max Marks-100**	**CTE:25, ETE:75**
Course Title: Chemistry Lab Course II		

Course Objectives: To train students for varities of exercises.

Unit	Topics	Hrs.
1	**Inorganic Chemistry:** Semi micro Qualitative analysis of Inorganic mixture containing Six radicals, 2+4, 4+2 or 3+3 from Group I, II, III, IV, V and VI, Anion analysis (including insoluble substances, interfering anions and combination of anions)	
2	**Organic Chemistry:** 1. Elemental analysis and identification of functional groups Detection pf additional elemenys (N, S, and halogens) and functional groups (phenolic, carboxylic acids, carbonyl, esters, carbohydrates, amines,amides,, nitro and anilide, lactones, alcohols) in simple compounds 2. Systemic Identification of organic compounds through the functional group analysis. Melting point determination and preparation of suitable derivatives	
3	**Physical Chemsitry:** 1. To styuy the kinetics dissolution of Mg in dil. HCl 2. To Study the kinetics of decomposition of $Na_2S_2O_5$ by mineral acids	

Duration: 4 Hrs

System of marking: one practical exercise from inorganic (20), organic (15), Physical (15)

B.Sc. Sem III

(w.e.f. Session 2027-28; Aligned with NEP-2020)

Year: B. Sc. 2nd		
Paper I	**Paper Type: Core**	**Credit; 4, T**
Course Code:B020301T	**Max Marks-100**	**CTE:25, ETE:75**
Course Title: Chemistry III		

Course Objectives: To understand chemistry of d and f-block elements, coordination compounds, hydroxy and carbonyl functional groups organic compounds and concepts behind thermodynamics.

Unit	Topics	Hrs.
1	**Chemistry of d-block Elements:** **Chemistry of Elements of First Transition Series:** Characteristic properties of d-block elements.Properties of the elements of the first transition series, their binary compounds and complexes iilustrating relative stability of their oxidation states, coordination number and geometry. **Chemistry of Elements of Second and Third Transition Series** General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry	14
2	**Coordination Compounds:** Werner's coordination theory and is experimental verification, effective atomic number concept, chulatus, nomoredature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexos	5
3	**Chemistry of f-block Elements** **Chemistry of Lanthanide Elements.** Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds. **Chemistry of Actinide:** General features and chemistry of actinides, chemistry of separation of Np. Pu and Am from U, similarities between the later actinides and the later lanthanides	6
4	**Alcohols:** Classification and nomenclature. Monohydric alcohols nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage ($Pb(OAc)_4$ and HIO_4) and pinacol-pinacolone rearrangement. Trihydric alcohols glycerol. nomenclature and methods of formation, chemical reactions of glycerols.	4

5	**Phenols:** Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.	4
6	**Ethers and Epoxides:** Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions-cleavage and autoxidation, Ziesel's method. Synthesis of epoxidos. Acid and baso-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides .	3
7	**Aldehydes and Ketone:** Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$, and $NaBH_4$. reductions. Halogenation of enolizable ketones. An introduction to a ß unsaturated aldehyues and ketones.	8
8	**Thermodynamics:** Definition of thermodynamic terms: system, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. First Law of Thermodynamics: statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law Joule-Thomson coefficient and inversion temperature. Calculation of w, q. dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Thermochemistry: standard state, standard enthalpy of formation- Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation. **Second law of thermodynamics:** need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.	16

	Concept of entropy, entropy as a state function, entropy as a function of V & T. entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases Third law of thermodynamics. Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.	

References:

1. Concise Inorganic Chemistry, J D Lee
2. Organic Chemistry, Vol 1, I L Finar
3. Principles of Physical Chemistry, Puri, Sharma, Pathania

Course Outcomes: After completion of this course students will able to:

CO-1. Know the Chemistry of d and f-block elements, coordination compounds and oxygen containing some class of organic compounds.

CO-2. Understand about concepts behind thermodynamics.

B.Sc. Sem III

(w.e.f. Session 2027-28; Aligned with NEP-2020)

Year: B. Sc. 2nd		
Paper I	Paper Type: Core	Credit; 4, T
Course Code:B020302P	Max Marks-100	CTE:25, ETE:75
Course Title: Chemistry Lab Course III		

Course Objectives: To train the students various experiments of Chemistry.

Unit	Topics	Hrs.
1	**Inorganic Chemsitry:** **Volumetric Exercise** 1. Estimation of Acetic acid in vinegar using NaOH 2. Titration of ferrous on with dichromate using internal and external indicator. 3. Iodometric estimation of Potassium dichromate and copper sulphate. 4. Estimation of copper using thiosulphate	
2	**Organic Chemistry:** Systemic Identification of organic compounds containing any one of the following groups aldehyde, corbohydrates, acids, phenols, lactones, ester, alcohols, amines, amides, nitro, hydrocarbons	
3	**Physical Chemistry:** Thrmochemistry 1. To determine heat of neutralization of strong acid with strong base. 2. To determine heat of neutralization of strong acid with weak base. 3. To determine heat of neutralization of weak acid with weak base.	

Duration: 4 Hrs

System of marking: one practical exercise from inorganic (20), organic (15), Physical (15)

B.Sc. Sem IV

(w.e.f. Session 2027-28; Aligned with NEP-2020)

Year: B. Sc. 2nd		
Paper I	**Paper Type: Core**	**Credit; 4, T**
Course Code:B020401T	**Max Marks-100**	**CTE:25, ETE:75**
Course Title: Chemistry IV		

Course Objectives: To understand oxidation –reduction, acid-base, nonaquous solvents and Chemistry of carboxylic acids, its derivatives, Nitrogenous Organic Compounds and concepts behind Chemical equilibrium, Phase equilibrium and electro Chemistry.

Unit	Topics	Hrs.
1	**Oxidation and Reduction:** Use of redox potential data analysis of redox cycle, redox stability in water Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.	6
2	**Acids and Bases:** Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases. **Hard and Soft Acids and Bases (HSAB):** Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.	4
3	**Non-aqueous Solvents** Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH, and liquid SO	4
4	**Carboxylic Acids:** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxy acids: malic, tartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.	6
5	**Carboxylic Acid Derivatives:** Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.	3

	Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).	
6	**Organic Compounds of Nitrogen:** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes: reactivity. Structure and nomenclature of amines, physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction.Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.	8
	Chemical Equilibrium: Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochoro Clapoyron equation and Clausaus Clapoyron equation, applications	3
	Phase Equilibrium: Statement and meaning of the terms phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system water, COand S systems Liquid liquid mixtures Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes HCl-H_2 O and ethanol-water systems. Partially miscible liquids Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nernst distribution law - thermodynamic derivation, applications.	6
	Electrochemistry: Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorl method and moving boundary method. **Applications of conductivity measurements:** determination of degree of dissociation, determination of K, of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations. Types of reversible electrodes-gas-metal ion, metal-metal ion, metal-	20

	insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes- standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cell reversible and irreversible cells, conventional representation of electrochemical cells **EMF of a cell and its measurements:** Computation of coll EMI Calculation of thermodynamic quantities of cell reactions (AG, AH and K), polarization, over potential and hydrogen overvoltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrationsDefinition of pH and pK, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Butlers-mochanism of buffer action, Henderson-Hazel equation. Hydrolysis of salts. **Corrosion**-types, theories and methods of combating it.	

References:

1. Concise Inorganic Chemistry, J D Lee
2. Organic Chemistry, Vol 1, I L Finar
3. Principles of Physical Chemistry, Puri, Sharma, Pathania

Course Outcomes: After completion of this course students will able to:

CO-1: Know the Chemistry behind oxidation –reduction, acid-base, nonaquous solvents and Chemistry of carboxylic acids, its derivatives, Nitrogenous Organic Compounds

CO-2: Understand about concepts behind Chemical equilibrium, Phase equilibrium and electro Chemistry.

B.Sc. Sem IV

(w.e.f. Session 2027-28; Aligned with NEP-2020)

Year: B. Sc. 2nd		
Paper I	**Paper Type: Core**	**Credit; 4, T**
Course Code:B020402P	**Max Marks-100**	**CTE:25, ETE:75**
Course Title: Chemistry Lab Course IV		

Course Objectives: To train for Paper Chromatographic separation of cations, Separation of two component organic mixture and phase diagram.

Unit	Topics	Hrs.
1	**Inorganic Chemistry** Paper Chromatographic separation of following i. Ni^{2+}, Co^{2+} ii. Cu^{2+}, Cd^{2+}	
2	**Organic Chemistry:** Separation of binary organic mixture (water/ $NaHCO_3$ / NaOH separable). Systematic analysis of each component leading to their final identification laying emphasis on solubility. Element detection, melting point determination, ignition test, unsaturation test, functional group test. Specific test if any and preparation of a suitable derivative.	
3	**Physical Chemistry:** 1. To construct a phase diagram for Naphthalene - Benzoic acid 2. (i) To determine critical solution temperature of Phenol - water system (ii) To observe the effect of sodium chloride or critical solution temperature of Phenol -water system. 3. To construct the phase diagram of diphenyl amine benzophenone by Thaw - melt method/Cooling curve method	

Duration: 4 Hrs

System of marking: one practical exercise from inorganic (20), organic (15), Physical (15)

B.Sc. Sem V

(w.e.f. Session 2028-29; Aligned with NEP-2020)

Year: B. Sc. 3rd		
Paper I	**Paper Type: Core**	**Credit; 4, T**
Course Code:B020501T	**Max Marks-100**	**CTE:25, ETE:75**
Course Title: Chemistry V-A		

Course Objectives: To understand bonding, magnetic and spectral properties of coordination compounds and elementary quantum mechanics.

Unit	Topics	Hrs.
1	**Metal-ligand Bonding in Transition Metal Complexes:** Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters	10
2	**Magnetic Properties of Transition Metal Complexes:** Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of us and Hon values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.	6
3	**Electronic Spectra of Transition Metal Complexes:** Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d' and d" states, discussion of the electronic spectrum of $[Ti(H_2O))^*$ complex ion.	6
4	**Thermodynamic and Kinetic Aspects of Metal Complexes:** A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.	6
5	**Elementary Quantum Mechanics:** Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrödinger wave equation and its importance, physical Interpretation of the wave function, postulatos of quantum mechanics, particle in a one dimensional box. Schrödinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers arid their importance, hydrogen like wave functions, radial wave functions, angular wave functions. Molecular orbital theory, basic ideas criteria for forming M.O from A.O. construction of M.O's by LCAO-H_2 ion,calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ', π. π" orbitals and their characteristics. Hybrid orbitals sp, sp^2, sp^3; calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H_2 , comparison of M.O. and V.B.	20

	models.	
6	**Photochemistry:** Einstein law, Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus Drapper law, Stark Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions transfer processes (simple examples). energy	12

References:

1. Concise Inorganic Chemistry, J D Lee
2. Selected topics in Inorganic Chemsitry, Malik Tuli, Madan
3. Principles of Physical Chemistry, Puri, Sharma, Pathania

Course Outcomes: After completion of this course students will able to

CO-1. Know the basic of bonding, Magnetic and electronic spectral properties of coordination compounds.

CO-2. Understanding about concepts behind quantum mechanics and photochemistry.

B.Sc. Sem V

(w.e.f. Session 2028-29; Aligned with NEP-2020)

Year: B. Sc. 3rd		
Paper I	Paper Type: Core	Credit; 4, T
Course Code:B020502T	Max Marks-100	CTE:25, ETE:75
Course Title: Chemistry V-B		

Course Objectives: To understand Chemistry of biomolecules, rearrangements, reactions and reagents and synthetic methods.

Unit	Topics	Hrs.
1.	**Rearrangements Reactions:** Pinacol-pinacolone, Demjanov, Benzil Benzilic acid, Favorskii, Hofmann, Curtius, Schmidt, Baeyer-Villiger and Fries rearrangement	8
2.	**Reagents:** Oxidation with DDQ, CAN and SeO_2, mCPBA, Jones Oxidation, PCC, PDC, PFC, Collin's reagent and ruthenium tetraoxide. Reduction with $NaBH_4$, $LiAlH_4$, Meerwein-Ponndorf-Verley (MPV) reduction, Wilkinson's catalyst, Birch reduction, DIBAL-H	10
3.	**Organometallic Compounds:** Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.	6
4.	**Synthesis via Enolates:** Acidity of hydrogens, alkylatior... diethyl malonate and othyl acetoacetate Synthesis of ethyl acetoacetate: the Claisen condensation, Keto-enol tautomerism of ethyl acejoacetate. Alkylation of 1,3-dithianes, Alkylation and acylation of enaminesChemistry	6
5.	**Organosulphur Compounds:**Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.	4
6.	**Heterocyclic Compounds** Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.	8
7.	**Carbohydrates:** Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic	9

	structure of D(+)-glucose. Mechanism of mutarotation. Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. **Artificial Sweetners:** Aspartaine, saccharin,dulcin, sucralose and sodium cyclamate	
8.	**Amino Acids Peptides, Proteins:** Classification, structure and stereochemistry of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation and reactions of a-amino acids Structure and nomenclature of peptides and proteins. Classification of proteins Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation. Ramchandran plot	4
9.	**Nucleic acids:** Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.	3
10.	**Chemistry and Diet:** Carbohydrate, Fats and oils, Proteins, Minerals, Vitamins, Calorific value of foods, Balanced Diet, BMR, BMI	2

References:

1. Organic Synthesis, Jagdamba Singh and L D S yadav.
2. Organic Chemistry, Vol 2, I L Finar

Course Outcomes: After completion of this course students will able to:

CO-1. Know the Chemistry of biomolecules,

CO-2. Understand about rearrangements, reactions, reagents and synthetic methods.

B.Sc. Sem V

(w.e.f. Session 2028-29; Aligned with NEP-2020)

Year: B. Sc. 3rd		
Paper I	Paper Type: Core	Credit; 4, T
Course Code:B020503P	Max Marks-100	CTE:25, ETE:75
Course Title: Chemistry Lab Course V		

Course Objectives: To train various types of exercises in Chemistry.

Unit	Topics	Hrs.
1	**Inorganic Chemsitry:** **Estimate the following ions Gravimetrically** 1. Barium as $BaSO_4$ in barium chloride solution 2 .Copper as CuSCN 3. Nickel as $Ni(dmg)_2$	
2	**Organic Chemsitry:** 1. Differentiate between a reducing/non-reducing sugar 2. Synthesis of osazone. **Paper Chromatography** 1. Seperastrion of a mixture of two monosaccharides(D-galactose and D-fructose) using n-butanol: acetone water (4:5:1), Spray reagent- aniline hydrogen phthalate . 2. Separation of a mixture of D,L-alanine, glycine and L- leucine using n-butanol: acetic acid:water (4:1:40, Spray reagent- ninhydrin 3. Separation of a mixture of phrnylalanine,glucine, alanine, aspartic acid, Leucine and glutamic acid,, Spray reagent- ninhydrin.	
3	**Physical Chemistry:** 1. Determination of molar mass of a non-volatile solute by Rast method 2. Preparation of buffer solution and measurement of pH by pH meter. **Spectrophotometry** 1. To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determination the concentration of the given solution of the substances from absorption measurement.	

Duration: 4 Hrs

System of marking: one practical exercise from inorganic (20), organic (15), Physical (15)

B.Sc. Sem VI

(w.e.f. Session 2028-29; Aligned with NEP-2020)

Year: B. Sc. 3rd		
Paper I	Paper Type: Core	Credit; 4, T
Course Code:B020601T	Max Marks-100	CTE:25, ETE:75
Course Title: Chemistry VI-A		

Course Objectives: To understand Organometallic Chemistry, Bioinorganic Chemistry and basics of spectroscopy.

Unit	Topics	Hrs.
1.	**Organometallic Chemistry:** Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg. Sn and Ti, a brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bondig in motal carbonyls	10
2.	**Bioinorganic Chemistry:** Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca". Nitrogen fixation.	12
3.	**Silicones and Phosphazenes:** Silicones and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.	4
4.	**Spectroscopy** Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom. **Rotational Spectrum:** Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect. **Vibrational Spectrum** **Infrared spectrum:** Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups. **Raman Spectrum:** concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules. Electronic Spectrum	20
5.	**Physical Properties and Molecular Structure:** Optical activity, polarization (Clausius – Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules. Magnetic properties-	5

	paramagnetism, diamagnetism and ferromagnetics.	
6.	**Solutions, Dilute Solutions and Colligative Properties** Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.	9

References:

1. Concise Inorganic Chemistry, J. D. Lee
2. Principles of Physical Chemistry, Puri , Sharma, Pathania
3. Inorganic Chemistry, Huheey, Keiter, Keiter

Course Outcomes: After completion of this course students will able to:

CO-1. Know about organometallics and bioinorganic Chemistry.

CO-2. Understand about concepts behind spectroscopy and dilute solution.

B.Sc. Sem VI

(w.e.f. Session 2028-29; Aligned with NEP-2020)

Year: B. Sc. 3rd		
Paper I	Paper Type: Core	Credit; 4, T
Course Code:B020602T	Max Marks-100	CTE:25, ETE:75
Course Title: Chemistry VI-B		

Course Objectives: To understand various spectroscopic tools for structure elucidation of Organic compounds and Chemistry behind useful products.

Unit	Topics	Hrs.
1.	**Electromagnetic Spectrum: Absorption Spectra:** absorption laws (Beer-Lambert law), molar Ultraviolet (UV) absorption spectroscopy absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.	4
2.	**Infrared (IR) absorption spectroscopy:** molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. Electronic Spectrum. Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, π- and n M.O., their energy levels and the respective transitions.	10
3.	**Nuclear magnetic resonance (NMR):** Proton magnetic resonance ('H NMR) spectroscopy, nuclear shielding and deshielding. Chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.	12
4.	**Mass Spectrometry:** Principles of Mass spectrometry, the mass spectrum. Molecular ion, metastable ion, fragmentation pattern, McLafferty rearrangement Structure elucidation of simple organic compounds with the help of UV, IR, ^{1}H NMR and mass spectrometry.	6
5.	**Medicinal Chemistry:** Drug discovery, design and development; Basic Retrosynthetic approach. Drug action-receptor theory. Structure - activity relationships of drug molecules, binding role of -OH group,- NH_2 group, double bond and aromatic ring. **Structure, function and Mechanism of action of the representative drugs of the following classes:** Analgesic & Antipyretics (aspirin. Paracetamol), Anti-inflammatory agents (oxypheno-butanone)., Antacids, Antibiotics (Chloramphenicol); Antiallergic (Chlorophencramine maleate) Antibacterial and Antifungal agents	12

	(Sulphonamides; Sulphanethoxazol, Sulphacetamide); Antiviral agents (Acyclovir), ,Anthelmentic (mebendazole), Antimalarials (Priazuine phosphate, Chloroquine),Anti tuberculosis, Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate),Anti-HIV (AZT-Zidovudine). Pain relieving, Antihypertencive, Antidiabetic, Stimulanats, depressants, , Narcotics, Tranquilizers, Sediatives, Hypnotics, Anaesthetic	
6.	**Natural fats:** edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.	2
7.	**Synthetic Polymers** Addition or chain-growth polymorization. Free radical vinyl polyrnoization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.	6
8.	**Synthetic Dyes:** Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo	8

References:

1. Organic Spectroscopy, J. Singh
2. Organic Spectroscopy, L.D.S. Yadav
3. Organic Spectroscopy, Y R Sharma
4. Organic Chemsitry,Vol 1 I. L Finar

Course Outcomes: After completion of this course students will able to:

CO-1. Know the various spectroscopic tools for structure elucidation of Organic compounds.

CO-2. Understand about Chemistry behind useful products.

B.Sc. Sem VI

(w.e.f. Session 2028-29; Aligned with NEP-2020)

Year: B. Sc. 3rd		
Paper I	Paper Type: Core	Credit; 4, T
Course Code:B020603P	Max Marks-100	CTE:25, ETE:75
Course Title: Chemistry Lab Course VI		

Unit	Topics	Hrs.
1	**Inorganic Preparation:** 1. $K_3[Fe(ox)_3]$ 2. $[Cu(NH_3)_4]SO_4.H_2O$ 3. Potash alum 4. $Ni(dmg)_2$	
2	**Organic Chemistry:** 1. Synthesis of aspirin by acetylation of salicylic acid. 2. To determine the saponifiation value of an oil/fat. 3. To determine the odine value of an oil/fat. **Spectroscopy:** 1. Assignment of labelled peaks in the IR spectrum of the some compounds explaining the relative frequencies of the absorption (C—H, O—H, N—H,C—O,C—N, C_C=C, C=O. C=C, C=N stretching frequencies, characteristic, bending vibrations are included. Spectra to be provided.). 2. Assignment of labelled peaks in the ^1H NMR spectra of the known organic compounds explaining the relative $\delta -$ values and aplitting pattern. 3. Structure elucidation of simple organic compounds by organic spectra (UV, IR, PMR)	
3	**Physical:** 1. To determine the solubilty of benzoic acid by titration method 2. To determine the solubilty product of $Ca(OH)_2$ 3. Estimation of acetic acid in vinegar by potentiometry. 4. Estimation of acetic acid in vinegar by condctometry	

Duration: 4 Hrs

System of marking: one practical exercise from inorganic (20), organic (15), Physical (15)