PSOs & COs of Chemistry

YEAR : 2017-18

Class: B.Sc. 1st Year (Hons.) (Semester-I)	Paper: C1T& C1P (organic Chemistry—I, Basic of organic chemistry)	Course: CO-9

Course Outcome

- **Bonding and Physical Properties**

By the end of this topic, students should be able to

1. know valence bond theory along with the concept of hybridization, the shapes of molecules, resonance, hyperconjugation, calculations of formal charge and double bond equivalent , and orbital pictures of bondings
2. understand the electronic displacement phenomena caused by inductive effect, field effect, mesomeric effect, bond polarization and bond polarizability and explain the electromeric effect, steric and steric inhibition of energy
3. understand the basic ideas of molecular orbital (MO) and frontier molecular orbital(FMO) theories , with the concepts of HOMO, LUMO and SOMO
4. interpret the reactivity in terms of FMO and sketch the energy levels of pi-MOs of different conjugated dienes and cyclic p-orbital systems
5. describe Huckel's law of aromaticity and explain the concepts of antiaromaticity and homoaromaticity
6. explain the effect of hybridization on bond properties and Baeyer's strain theory
7. explain the effects of covalent and non-bonding intermolecular properties on the properties of organic molecules

- **General treatment of reaction mechanism-I**

By the end of this topic, students should be able to

1. understand different mechanistic class , types of organic reactions, nature of bond cleavage and formation, and apply curly arrow rules in representing mechanistic steps
2. explain electrophilicity and nucleophilicity in terms of FMO approach
3. explain different organic intermediates and represent their structure in terms of orbital picture

- **Sterechemistry-I**

By the end of this topic, students should be able to

1. understand tetrahedral nature of carbon and concept of asymmetry, and draw Ficher, Sawhorse, Flying-wedge and Newman projection formulae of organic molecules
2. explain the concepts of chirality and symmetry in terms of symmetry elements, point groups, molecular chirality, centre of chirality, asymmetric and dissymmetric molecules understand enetiomers, diastereomers, concept of epimers, concept of stereogenicity, chirotopicity, psedoasymmetry, chiral centres
3. calculate the number of stereoisomers of the systems involving 1/2/3 chiral centre(s)
4. describe relative and absolute configurations in terms of D/L, R/S and E/Z descriptors
5. understand optical activity of chiral compounds in terms of optical rotation, specific and molar rotations
6. describe racemic compounds and the process of racemisation
7. Know how to carry out resolution of acids, bases and alcohols via diastereomeric salt formation
8. understand optical purity, enantiomeric excess and invertomerism of chiral trialkylamines.

- **Organic Chemistry Lab-I : C1P**

By the end of this practical, students should be able to

1. separate the components of a mixture of solid organic compounds on the basis of their solubilities by using common laboratory reagents
2. determine boiling point of a liquid organic compound
3. identify a pure organic compound by systematic analysis

Class: B.Sc. 1st Year (Hons.) (Semester-I)	Paper: C2T& C2P (Physical Chemistry—I)	Course: CO-10

Course Outcome

- **Kinetic theory and Gaseous state**

  By the end of this topic, students should be able to

1. understand the kinetic–molecular theory of gases and apply it to derive the relations of binary collision frequency, wall collision, rate of effusion and mean free path of gas molecules
2. describe the Maxwell's law of distribution of molecular speeds and energy in 1D, 2D and 3D and its apllications
3. apply principle of equipartition of energy along with the concept of degree of freedom to describe heat capacities of gases
4. understand Amagat's plot, the significance of the compressibility factor and its use in describing deviation of real gases from ideal behaviour
5. derive van der Waals equation and write down equations of state proposed by Berthelot and Dieterici
6. understand virial equation of state and know how to express van der Waals equation in virial form
7. describe the critical properties of a gas in terms of van der Waals constants and the principle of corresponding states.
8. explain intermolecular foreces of attraction and Lennard-Jones potential

- **Chemical Thermodynamics**

  By the end of this topic, students should be able to

1. understand the terminologies used in the study of thermodynamics, the concept of state functions, internal energy, enthalpy, different processes including reversible and irreversible, and thermodynamic meanings of heat and work
2. use the First Law of Thermodynamics to relate heat, work, and energy changes in a process and formulate mathematically the work done involved in a process due to change in volume of the system in reversible and irreversible processes
3. understand different enthalpy changes associated with different physical and chemical processes
4. use the Laws of thermochemistry to find the enthalpy change associated with a physical or chemical process
5. understand bond dissociation energy, bond energy and resonance energy in terms of thermochemical data
6. derive and illustrate Kirchoff's equation
7. understand the concepts of heat engines , Carnot engine and refrigerator, and their efficiencies
8. illustrate the need of the second law of thermodynamics, and its basic concepts, including directionality, and efficiency.
9. understand different statements of the 2nd law of thermodynamic , and the concept of entropy, including it predicting power of directionality of a process
10. explain Carnot's theorem and Clausius inequality, and calculate entropy changes of system and surroundings associated with different transformations

9\. understand the need of auxiliary functions (A and G) and their uses, how to derive the Maxwell relations and its applications

11\. explain Joule-Thomson experiment and its consequenses

- **Chemical Kinetics**

  By the end of this topic, students should be able to

1. understand the terms rate law, extent of reaction, order, molecularity and rate constant , and know how to express the rate equations of 1st, 2nd , nth order and pseudo first-order reactions
2. explain different methods for determining order of a reaction
3. explain opposing, consecutive and parallel reactions (all steps 1st order)
4. explain how temperature affects rates of reactions in terms the Arrhenius equation
5. understand collision theory for bimolecular reactions and the concepts underlying the Lindemann theory of unimolecular reactions, and describe the theoretical derivation of transition state theory
6. describe homogeneous catalysis with reference to acid-base catalysis, autocatalysis and primary kinetic salt effect, and the characteristics of enzyme catalysis reactions and factors affecting such reactions
7. explain the kinetics of enzyme reactions in terms of MichaelisMentenequation , and draw Lineweaver-Burk plot .

- **Physical Chemistry Lab-I : C2P**

  By the end of this practical, students should be able to

1. Carry out all experiments as stipulated in the syllabus

YEAR : 2017-18

Class: B.Sc. 1st Year (Hons.) (Semester-II)	Paper: C3T& C3P (Inorganic Chemistry—I)	Course: CO-11

Course Outcome

- **Extranulear structure of Atom**

By the end of this topic, students should be able to

1. explain Bohr theory of atomic structure together with its merits and demerits and modifications to this theory made by Somerfield
2. apply Bohr theory to hydrogen and hydrogen- like single electron speciesand explain spectrum of hydrogen atom
3. identify the relevance of Planck's hypothesis, the de Broglie's particle-wave duality and Heisenberg uncertainty principle regarding simultaneous measurements of conjugate variables
4. describe the main features of the quantum mechanical picture of the atomalong with Schrödinger wave equation and its significance
5. explain the significance of electron density diagrams and radial probability distribution plots and how to depict the electron's location within the atom
6. explain the hierarchy of quantum numbers defining energy, shape and orientation of an orbital
7. apply Hund's rule, Pauli exclusion principle and Aufbau principle in drawing electron orbital diagrams and determining the electron configuration of hydrogen like and polyelectron atoms and ions
8. represent the electronic state of an atom or ion by means of term symbol

- **Periodic Table**

By the end of this topic, students should be able to

1. understand IUPAC periodic table, effective nuclear charge, screening effects and penetration
2. apply Slater's rules and explain different periodic properties, e.g., I.P., E.A., E.N., etc.
3. understand different electronegativity scales and their applications
4. explain the group and periodic trends of different periodic properties of s-, p- and d-block elements and inert pair effect

- **Acid-Base Reactions**

By the end of this topic, students should be able to

1. explain different concepts of acids and bases, solvent levelling and differentiating effects
2. understand Drago-Wayland equation and its applications
3. explain HSAB principle and its applications
4. explain acid-baseequilibria in aqueous solution
5. understand pH and its significance
6. define buffer solutions , its type and know how to make such solutions.
7. describe acid-base neutralisations, their curves and choice of indicators

- **Redox reactions and Precipitation Reactions**

By the end of this topic, students should be able to

1. identify the various components of an oxidation-reduction reaction including reducing/oxidizing agents and half-reactions
2. define redox potential, standard redox potential and write the Nernst's equation
3. define formal potential and illustrate the influence of complex formation, precipitation and change of pH on redox potential
4. discuss the stability of electrochemically active species in terms of the electrode potentials and
5. use diagrammatic summaries in terms of Latimer diagram and Frost diagram in explaining the relative stabilities of different oxidation states in aqueous solution.
6. describe redox titrations and choose suitable redox indicator for a particular redox titration
7. write solubility product constant expressions and the relation between solubility product and molar solubility
8. explain the applications of the solubility product principle

- **Inorganic Chemistry Lab-I : C3P**

By the end of this practical, students should be able to

1. carry out acid-base titration of a mixtureof bases as stipulated in the syllabus

2. carry out redox titration of a mixtureas stipulated in the syllabus

YEAR : 2017-18

Class: B.Sc. 1st Year (Hons.) (Semester-II)	Paper: C4T& C4P (Organic Chemistry—II)	Course: CO-12

Course Outcome

- **Stereochemistry-II**

By the end of this topic, students should be able to

1. explain stereoisomerism of substituted cumulenes , chiral axis in allenes, spiro compounds, alkylidenecycloalkanes and biphenyls
2. understand related configurational descriptors (Ra/Sa and P/M)matropisomerism, racemisation of chiral biphenyls and buttressing effect
3. understand the concepts of (pro)n-chirality, topicity of ligands and faces , pro-R/pro-S, pro-E/pro-Z and Re/Si descriptors, pro-r and pro-s descriptors of ligands on propseudoasymmetric centre.
4. describe the terms eclipsed, staggered, gauche, syn and anti, dihedral angle, torsion angle
5. explain Klyne-Prelog terminology, P/M descriptors and energy barrier of rotation
6. appreciate the concept of torsional and steric strains, relative stability of conformers on the basis of steric effect, dipole-dipole interaction and H-bonding
7. explain butane gauche interaction and conformational analysis of ethane, propane, n-butane

- **General Treatment of Reaction Mechanism II**

By the end of this topic, students should be able to

1. describe reaction thermodynamics in terms of free energy, enthalpy and entropy factors
2. calculate of reaction enthalpy by making use of bond energy data
3. explain intermolecular andintramolecular reactions
4. explain the effects of structure, substituent and solvent on acidity and basicity of organic acids and bases
5. understand what proton sponge, gas-phase acidity and basicity are and compare between nucleophlicity and basicity by making use of HSAB principle
6. explain prototropy valence tautomerism and ring-chain tautomerism, and factors affecting keto-enoltautomerism
7. understand the application of thermodynamic principles in tautomericequilibria
8. understand free energy of activation and draw free energy profiles for one-step, two-step and three-step reactions, and Hammond's postulate
9. define electrophilic and nucleophilic catalysis and explain kinetic control and thermodynamic control of reactions
10. explain the primary and secondary kinetic isotopic effect (kH /kD)

- **Substitution and Elimination Reactions**

By the end of this topic, students should be able to

1. explain mechanism, stereochemical features and reactivity-selectivity principle of free-radical substitution reaction associated with halogentaion of alkanes
2. describe mechanisms, relative rates and stereochemical features of nucleophilic substitution reactions, and explain the effects of solvent, substrate structure, leaving group and nucleophiles on these reactions
3. explain substitutions involving NGP, role of crown ethers and phase transfer catalysts in case of substitution reactions of the systems alkyl halides, allylhalides, benzyl halides, alcohols, ethers, epoxides

1. explain mechanisms, reactivity, regioselectivity (Saytzeff/Hofmann) and stereoselectivity of different elimination reactions associated with the formation of alkenes and alkynes
2. recognize the features that favour elimination reaction over substitution reaction
3. understand the importance of Bredt's rule relating to the formation of C=C.

- **Organic Chemistry Lab-II : C4P**

By the end of this practical, students should be able to

1. carry out the different organic reactions as prescribed in the syllabus

YEAR : 2017-18		
Class:B.Sc. 2nd Year (Hons.)	Paper-III Group-A : Organic Chemistry Group-B : Inorganic Chemistry	Course : CO-3

Group-A : Organic Chemistry

Course Outcome

Unit-I

After studying unit-1, students should be able to

1. define what elimination reactions are and recognize their types
2. explain three important mechanism of elimination reactions along with the rules associated with these mechanisms
3. understand stereochemistry associated with different mechanism of elimination reactions
4. describe the effects that influence elimination reactions
5. recognize the features that favour elimination reaction over substitution reaction
6. explain mechanism and stereochemistry of some selective elimination reactions
7. describeaddition reactions of alkenes initiated with by an electrophile, a nucleophile or a free radical
8. describe the mechanisms of selected electrophilic addition reactions
9. convert C=C double bonds to other functional groups by electrophilic addition
10. describe the mechanisms of electrophilic addition to conjugated dienes and allene
11. appreciate stereoselective and stereospecific reactions of alkenes
12. understand the effect of substituents on rate of addition reactions
13. understand dynamic stereochemistry in connection with the conformations and reactivity in cyclohexane system
14. describe some selected rearrangement reactions

Unit-2

After studying unit-2, students should be able to

1. understand the different nucleophilic addition reactions that aldehydes and ketones undergo
2. understand the mechanisms and stereochemistry involved in nucleophilic addition reactions of aldehydes and ketones
3. describe the different kinds of mechanisms by which esterification of an acid and the hydrolysis of an ester can occur
4. understand acyloin condensation and its mechanism
5. describe stereoselective syntheses enantioselective and diastereoselective reactions
6. describe asymmetric synthesis involving achiral and chiral reagents

Unit-3

After studying unit-3, students should be able to

1. understand differnet types of aromatic electrophilic substitution reactions and their mechanisms of occurring
2. describe synthetic routes selected polynuclear hydrocarbons and their reactivities
3. understand different types of aromatic nucleophilic substitution reactions and their mechanisms of occurring
4. understand chemoselectivity in respect of different reactivity of $-NH_2$and –OH in aromatic system
5. understand chemistry of aliphatic and aromatic amines in terms of their preparation, separation and identification
6. describe different types of reactions aliphatic and aromatic amines undergo along with their mechanism

Unit-4

After studying unit-4, students should be able to

1. describe how organometallics are prepared
2. understand how organometallic can be used to make new C–C bonds from C=O groups
3. understand the conditions of molecular rearrangement and differentiate between intramolecular and intermolecular rearrangements
4. describe different types of molecular rearrangement reactions involving electron-deficient species, along with mechanisms and stereochemistry
5. describe different types of aromatic rearrangement reaction involving migration from oxygen to ring carbon

Group-B : Inorganic Chemistry

Unit-I

After students have studied the Unit-1, they should be able to

1. understand the makeup of the nucleus
2. define the terms half-life and average life and describe their relation
3. carry out calculations related to radioactive decays
4. interpret disintegration series, radioacitive equilibrium and group displacement law
5. describe the relationships between neutron–proton ratio and nuclear stability and explain nuclear binding energy, mass defect and packing fraction
6. describe nuclear fission, fusion and spallation reaction
7. Tell about different uses of radionuclides

Unit-2

After students have studied the Unit-2, they should be able to

1. identify the various components of an oxidation-reduction reaction including reducing/oxidizing agents and half-reactions
2. define redox potential, standard redox potential and write the Nernst's equation
3. define formal potential and illustrate the influence of complex formation, precipitation and change of pH on redox potential
4. discuss the stability of electrochemically active species in terms of the electrode potentials and
5. use diagrammatic summaries in terms of Latimer diagram and Frost diagram in explaining the relative stabilities of different oxidation states in aqueous solution.
6. describe redox titrations and choose suitable redox indicator for a particular redox titration

Unit-3

After students have studied the Unit-3, they should be able to

1. describe the basic concepts of molecular orbital theory and LCAO
2. relate the shapes and overlap of atomic orbitals to the shapes and energies of theresulting molecular orbitals
3. distinguish among bonding, antibonding, and nonbonding orbitals
4. construct MO diagrams for different homo- and hetero-nuclear diatomic molecules and explain bond order and bond lengths of them
5. describe the bonding in metals in terms of band theory and why some why some substances are conductors, some are insulators, and others aresemiconductors
6. explain the mode of packing of constituents in crystalline solids and different types of holes associated with them
7. describe radius-ration rule to predict the geometry of the holes associated ionic crystals
8. describe the crystal structure of some typical ionic crystal,simple silicates and alloys
9. use the terminology that describes coordination compound and apply the IUPAC rules for naming coordination compounds
10. illustrate the factors affecting the stability of complexes in solution
11. explain overall and stepwise formation constants of complexes and the determination of stability constants by Job's method
12. describe chelate complexes, flexidentatebehavior of ligand, inner-metalic complexes, their properties and applications in analytical chemistry

Unit-4

After students have studied the Unit-4, they should be able to

1. Comparative study of p-block elements (Gr-14, 15, 16, 17, 18) with respect to electronic configuration, modification of pure elements, common oxidation states, inert pair effect, catenation and catalytic properties (if any), and their important compounds

YEAR : 2017-18		
Class:B.Sc. 2nd Year (Hons.)	**Paper- V** **Practical Chemistry**	**Course : CO-5**

Group A (Organic Chemistry Practical)

Course Outcome

By the end of this practical, students should be able to

1. know how to examine the physical characteristics and test the solubility of a solid unknown organic compound
2. know how to detect elements (N,S and Cl) in a solid unknown organic compound and determine the melting point of the compound
3. carry out the reactions for detecting functional groups present in a solid unknown organic compound
4. prepare a suitable derivative of the supplied organic sample and determine the melting point of this derivative

Group B (Inorganic Chemistry Practical)

(Qualitative analysis of selected inorganic sample containing not more than four radicals)

Course Outcome

By the end of this practical, students should be able to

1. know how to examine the physical characteristics and test the solubility of a supplied unknown inorganic sample
2. carry out preliminary tests for basic and acid radicals
3. carry out wet tests for acid radicals, interfering acid radicals
4. carry out systematic group analysis of basic radicals
5. write down the Probable composition with proper justification

Group C (Physical Chemistry Practical)

Course Outcome

By the end of this practical, students should be able to

1. carry out all the experiments stipulated in the syllabus

YEAR : 2017-18		
Class:B.Sc. 3rd Year (Hons.)	**Paper-VI** **Group-A : Organic Chemistry** **Group-B : Inorganic Chemistry**	**Course : CO-6**

Course Outcome

Group-A : Organic Chemistry

Unit-I

After studying unit-I, students should be able to

1. describe the theory of electronic spectroscopy and appreciate the concept of chromophore
2. understand the solvent effects on the on the absorption band of UV spectra
3. understand Woodward rule and apply electronic spectroscopy to dienes, trienes and polyenes
4. know the application of electronic spectroscopy to benzene and its substitution derivatives
5. understand molecular vibrations ,and describe the principle of infrared spectroscopy and factors affecting the vibrational frequencies
6. understand NMR phenomenon and describe the theory NMR
7. understand chemical shift and describe factors influencing chemical shift
8. appreciate spin-spin coupling and spin-spin splitting
9. describe factors influencing the coupling constant and recognize relative peak positions of different kinds of protons of substituted benzenes

Unit-2

After studying unit-2, students should be able to

1. understand the definitions of the terms used in synthesis
2. design the route map for retrosynthesis of an organic compound
3. understand different methodologies used in ring synthesis, and describe the Robinson annulation
4. describe how to synthesize large ring using high dilution technique and carry out acyloin condensation using trimethylsilyl chloride

Unit-3

After studying unit-3, students should be able to

1. describe the classification of carbohydrates and classification of monosaccharides
2. write down the structural formulas for monosaccharides
3. explain what mutarotatIon and anomeric effect are
4. describe different reactions of aldose, including stepping-up and stepping-down of aldose
5. know how the structure of sucrose has been established
6. describe the structure and naming of amino acids
7. describe how to carry out synthesis of α-amino acids by different methods
8. understand isoelectric point and ninhydrin reaction
9. describe Merrifield method of peptide synthesis
10. describe how to determine the sequence of amino acids in a polypeptide by Edman Degradation and Sanger N-terminal analysis
11. describe the makeup of nucleosides, nucleotides
12. describe structure and naming of Purine and pyrimidine bases
13. describe the structure of DNA and RNA (Watson-Crick model) and complimentary base-pairing in DNA

Unit-4

After studying unit-3, students should be able to

1. describe the properties and synthesis of some selected heterocyclic compounds, viz,furan, pyrrole, thiophene, pyridine, indole. Quinoline, Isoquinoline
2. define and classify pericyclic reactions
3. describe thermal and photochemical electrocyclic reactions of neutral species involving 4 and 6 electrons with the help of Frontier Molecular Orbital method
4. explain cycloaddition reactions [2+2] and [4+2] and DielsAlder reaction with the help of Frontier Molecular Orbital method

Group-B : Inorganic Chemistry

Course Outcome

Unit-I

After studying unit-1, students should be able to

1. derive the thermodynamic stability constants of of complexes and compare thermodynamic and kinetic stabilities of complexes 2. understand what labile and inert complexes are and explain the reasons for labile and inert characteristics 3. explain the kinetic trans effect associated with substitution reactions in square planarcomplexes 3. explain constitutional, geometrical and optical isomerism of coordination compounds in respect of coordination numbers 4 and 6 4. explain how to determination of configuration of cis-, trans-isomers by chemical methodshow to carry out resolution of optical isomers 5. explain different bonding theories (EAN rule, Valence-Bond, Crystal Field, and LigandField Theories) forcoordination compounds and understandspectrochemical series 6. understand d-orbital splitting in octahedral, tetrahedral and square planar fields and explaincrystal field stabilization energy of high- and low-spin octahedral complexes 8. describeJahn--Teller distortions and its cosequences 9. describe selection rules of electronic absorption spectra of octahedral and tetrahedral complexes and interpret these spectra 10. understand what types of complexes exhibit charge transfer absorptions and explain the reasons of such absorption 12. appreciate Orgel diagram and draw this diagram $3d^1 - 3d^9$systems 13. describe sigma and pi-bonding in octahedral complexes with the help of Ligand Field thory

Unit-2

After studying unit-2, students should be able to

1. understand magnetic susceptibility and the spin-only formula 2. write down Curie equation and describe magnetic moment and its determination by Guoy method 3. understand LS (or Russell–Saunders) coupling, i.e. spin–orbit coupling and write down term symbols for free atoms and ions 4. explain spin and orbital contributions to the magnetic moment and), and how to apply the spin only values of magnetic moments to determinevalency and stereochemistry of coordination compounds 5. explainquenching of magnetic moment, super-exchange and anti-ferromagnetic interaction 6. compare the metals of first transition series with reference to electronic configuration, atomic and ionic radii, ionization potential oxidation states, aqueous and redox chemistry, complex chemistry, magnetic properties, metallic nature and catalytic properties 7. follow trends in physical and chemical properties in passing from 3d through 4d to 5d block elements

Unit-3

After studying unit-3, students should be able to

1. understand what organometallic compounds are and the meanings of acid ligands, hapticity(s) of ligands 2. explain the application of 18-electron rule to carbonyl, nitrosyl, cyanide and hydrido complexes 3. describe the synthesis, physical, properties and structure of carbonyl, nitrosyl and cyanide complexes, metal carbonylates, carbonyl hydrides, metal olefin, alkynes(Ziese's salt) and cyclopentadienyl complexes(Ferrocene) 4. understandmetal-metal bonded compounds and metal clusters, with simple examples 5. definefluxionality of molecules, coordinative unsaturation, oxidative addition and insertion reactions 6. illustrate the chemistry of f-block elements in terms of electronic configuration, ionization energies, oxidation states, variation in atomic and ionic (3+) radii, magnetic and spectral properties 7. make a comparative study between lanthanide and actinides

Unit-4

After studying unit-4, students should be able to

1. know the essential trace elements of life and the role of $Na^+, K^+, Mg^{2+}, Fe^{3+}, Fe^{2+}$and Zn^{2+}ions 2.describe the function of biological molecules containing metal ions, and role in the transport of ions through membranes 3. describe the bio-functions of haemoglobin and myoglobin, cytochromes and ferridoxins 4. describe photosynthesis in terms of photo systems I and II 5. explain Carbonate-bicarbonate buffering system and carbonic anhydrase 6. identify toxic metal ions and their effects 7. describe basic principles, instrumentations and simple applications of conductometry, potentiometry, polarography, UV-Visible and IR spectrophotometry 8. describe the methods of determination of BOD, COD, DO, TDS in water samples 9. describe how to detect and estimate As, Hg, Cd, Pb in water sample

YEAR : 2017-18		
Class: B.Sc. 3rd Year (Hons.)	**Paper-VII (Physical Chemistry)**	**Course: CO-7**

Group C : Physical Chemistry

Course Outcome

Unit-I

After studying unit-1, students should be able to

1. understand the application of Schrödinger equation for a particle in 1D box 2. know how to solve the Schrödinger equation for a particle in 1D box and evaluate the wavefunctions for the particle 3. evaluate the expectation values of different observables and uncertainty of conjugate variables associated with the system of the particle in 1D box 4. explain the meaning of quantum mechanical tunnelling 5. write down the Schrödinger equation for a simple harmonic oscillator and explain the first few wavefunctions and energy eigenvalues of the harmonic oscillator 6. calculate the position and momentum uncertainties for the ground state and excited states of the harmonic oscillator 7. write down the Schrödinger equation for a rigid rotor and understand the egenfuctions and allowed energies of the rotor 8. write down the Schrödinger equation in Cartesian and polar coordinates for H-like system 9. appreciate the radial and angular parts of the wavefunctions of H-like system 10. calculate the probability density of electron and describe radial distribution function of different orbitals of H-like system 11. write down the energy expression for the orbitals, calculate the degeneracy of the orbitals and describe the shapes of different orbitals

Unit-2

After studying unit-2, students should be able to

1. distinguish thermal and photochemical reactions 2. understand different laws associated with photochemistry and the meaning of quantum yield 3. describe intramolecular processesand intermolecular energy transfer with the help of Jablonsky diagram 4. derive the rate equations some typical photochemical reactions 5. explain how the photosensitised reactions occur 6. understand the terms molar polarization, dipole moment, permittivity and relative permittivity 7. write down the Clausius-Mossoti and Debye equation and explain in elucidating the structure of molecules 8. describe the applications of microwave, I.R and Raman spectra in elucidating the structure of molecules

Unit-3

After studying unit-3, students should be able to

1. describe the terms unit cell and lattice of a crystalline solid 2. describe different crystal system with their crystallographic parameters 3. describe the laws of crystallography 4. derive Bragg's equation and explain its applications towards determination of the structures of NaCl and KCl 5. use the Dulong-Petit's law in describing the specific heats of solid elements and explain its limitations 6. describe Einstein's equation for the specific heats of solid elements and explain its success and failures, and how Debye's T^3 law removes these limitations 7. conceptualize the terms the macrostates , microstates, and ensemble 8. distinguish between mathematical probability and thermodynamic probability 9. explain the entropy in terms of thermodynamic probability 10. define partition function ,write down its expression and explain its significance 11. write down the Boltzmann distribution for non-degenerate and degenerate cases and explain its applications

Unit-4

After studying unit-4, students should be able to

1. be acquainted with the terms, viz., phase equilibrium, coexisting phases, phase transition, dew point, boiling and melting points, critical point, phase boundary , slope of the phase boundary, saturated vapour pressure, triple point, and know the criteria for phase stability 2.describe Nernst's distribution law and application in solvent extraction 3. understand the terms component and degree of freedom and derive thermodynamically Gibbs phase rule 4. describe phase diagrams of one-component and two-component systems 5. explain the terms isopleths, tie-line and lever rule, and their significance 6.describe the terms congruent incongruent melting points and peritectic line and their significance

YEAR : 2017-18		
Class: B.Sc. 3rd Year (Hons.)	**Paper-VIII (Practical Chemistry)**	**Course: CO-8**

Course Outcome

Group-A

(Organic Chemistry Practical)

By the end of unit-A, students should be able to

1. prepare some organic compounds from the list of compounds stipulated in the syllabus
2. analyse some of the compounds stipulates in the syllabus by their respective ^{1}H NMR and IR spectra

Group-B

(Inorganic Chemistry Practical)

By the end of unit-B, students should be able to

1. carry out of the followingquantitative analysisby titrimetric and gravimetric methods

(a) Acid-Base titration : A mixture of Na_2CO_3 and $NaHCO_3$vsHCl and a mixture of CH_3COOH and HClvsNaOH
(b) Redox titration with potassium permanganate and potassium dichromate solutions
(c) Iodometric titration
(d) Estimation of mixtures stipulated in the syllabus
(e) Gravimetric estimation of chloride, sulphate and nickel as dimethyl glyoxime complex
(f) Determination of total hardness of water by EDTA titration
(g) Estimation of available (i) chlorine in bleaching powder (ii) oxygen in pyrolusite

2. prepare inorganic compounds as stipulated in the syllabus

Group-C

(Physical Chemistry Practical)

By the end of unit-C, students should be able to

1. carry out all the experiments stipulated in the syllabus