



**SHRI JAGDISHPRASAD JHABARMAL
TIBREWALA UNIVERSITY, CHUDELA**

SYLLABUS

B. Sc. (Chemistry) **(Bachelor of Science)**





SHRI JAGDISHPRASAD JHABARMAL TIBREWALA UNIVERSITY
CHUDELA (JHUNJHUNU), RAJASTHAN

INSTITUTE OF SCIENCE
DEPARTMENT OF CHEMISTRY
TEACHING AND EXAMINATION SCHEME AND DETAILED SYLLABUS FOR

BACHELOR OF SCIENCE

EFFECTIVE FROM ACADEMIC SESSION 2021 – 2022

S. No.	Subject Code	Subject Name	Hrs./Week			Exam Hrs.	Maximum & Minimum Marks		
			L	T	P		Internal/Min. Pass Marks	External/Min. Pass Marks	Total/Min. Pass Marks
Theory									
1	PCM/CMZ - 101	Chemistry-I							
2	PCM/CMZ - 102	Chemistry-II							
3	PCM/CMZ - 103	Chemistry-III							
4	Practical PCM/CMZ-110	Chemistry Lab							
Total									
Total Teaching Load									

L: Lecture

T: Tutorial

P: Practical

YEAR: I

SEMESTER: I

PCM/CMZ - 101 : Chemistry-I

Unit	Contents of Course	Hrs.
I	<p>Ionic solid :</p> <p>Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, Lattice energy and Born-Haber cycle, salvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan`s rule.</p>	
II	<p>Metallic bond : Free electron, Valence bond and Band theories.</p> <p>Weak interactions : Hydrogen bonding, Vander Waals forces.</p>	
III	<p>Covalent Bond :</p> <p>Valence bond theory and its limitations, directional characteristics of covalent bond, Various types of hybridization and shape of simple inorganic molecules and ions, VSEPR theory to NH_3, H_3O^+, SF_4, ClF_3 and H_2O.</p>	
IV	<p>MO Theory : Homonuclear and Heteronuclear (CO and NO) diatomic molecules.</p> <p>Multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.</p>	

Reference Books:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company.
3. James Huheey, Inorganic Chemistry : Pricipal of Structure and Reactivity, Pearson Education India.
4. Douglas, B.E. and Mc Daniel, D.H., Concepts and Models of Inorganic Chemistry.
5. Gary Wulfsberg, Inorganic Chemistry, University Science Book.

YEAR: I

SEMESTER: I

PCM/CMZ - 102 : Chemistry-II

Unit	Contents of Course	Hrs.
I	<p>Mechanism of Organic Reactions :</p> <p>Homolytic and Heterolytic bond cleavage. Types of reagents, Electrophiles and Nucleophiles. Reactive intermediates-Carbocations, Carbanions, Free radicals and Carbenes, arynes and nitrenes (with example). Types of organic reactions, energy considerations.</p> <p>Methods of determination of reaction mechanism (products analysis, intermediates, isotope effects, kinetic and stereochemical studies).</p>	
II	<p>Stereochemistry of Organic Compounds :</p> <p>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.</p>	
III	<p>Relative and absolute, configuration, sequence rules, D/L and R/S systems of nomenclature.</p> <p>Geometric Isomerism : Determination of configuration of geometric isomers – <i>cis/trans</i> and <i>E/Z</i> system of nomenclature. Geometric isomerism in oximes and alicyclic compounds.</p> <p>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.</p>	
IV	<p>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 (With special 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 : orientation, reactivity and selectivity.</p> <p>Cycloalkanes - Nomenclature, methods of formation, chemical reactions. Baeyer's strain theory and its limitations, ring strains in small rings (cyclopropane and cyclobutane), Theory of strainless rings, the case of cyclopropane ring : Banana bonds.</p>	

Reference Books:

- Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- 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.



PCM/CMZ 103: CHEMISTRY-III

Unit	Contents of Course	Hrs.
I	Mathematical Concepts : Logarithmic relations, curve sketching, linear graphs and calculations of slopes, differentiation of simple functions like x , e^x , x^n , $\sin x$, $\log x$; maxima and minima, partial differentiation and reciprocity relations. Integrations of some useful/relevant functions; Permutations and Combinations, Factorials. Probability.	
II	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. Thermography and seven- segment cell.	
III	Gaseous States : Postulates of kinetic theory of gases, deviation from ideal behaviour, Vander-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.	
IV	Molecular Velocities : Root mean square velocity, average and most probable velocities. Qualitative discussions of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on joule - thomson effect).	

Reference Books:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press (2006).
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).

PCM/CMZ 110: CHEMISTRY LAB

S. No.	List of Experiments	Hrs.
I	Inorganic Chemistry : Semi micro and Macro analysis , Separation and Identification of Four radicals - two acidic and two basic in a given mixture which may include any one interfering radical and/or combinations of radicals.	
II	Organic Chemistry : (I) Determination of melting point : Naphthalene 80-82 °C, Benzoic acid 121.5-133 °C, Urea 132.5-133 °C, Succinic acid 184.5-185 °C, Cinnamic acid 132.5-133 °C, Salicylic acid 157.5-158 °C, Acetanilide 113.5-114 °C, m-Dinitrobenzene 90 °C, p- Dichlorobenzene 52 °C, Aspirin 135 °C. (II) Determination of boiling point : Ethanol 78 °C, Cyclohexane 81.4 °C, toluene 110.6 °C, Benzene 80 °C. (III) Crystallization : Phthalic acid from hot water (using fluted filter paper and steamless funnel), Acetanilide from boiling water, Naphthalene from ethanol, Benzoic acid from water. (IV) Qualitative analysis : Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable Derivatives.	
III	PHYSICAL CHEMISTRY : Chemical Kinetics 1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature. 2. To study the effect of acid strength on the hydrolysis of an ester. 3. To compare the strengths of HCl and H ₂ SO ₄ by studying the kinetics of hydrolysis of ethyl acetate. 4. To study kinetically the reaction of decomposition of iodide by H ₂ O ₂ .	
IV	Viva	
V	Record	



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YEAR: I

SEMESTER: II

S. No.	Subject Code	Subject Name	Hrs./Week			Exam Hrs.	Maximum & Minimum Marks		
			L	T	P		Internal/Min. Pass Marks	External/Min. Pass Marks	Total/Min. Pass Marks
Theory									
1	PCM/CMZ - 201	Chemistry - I							
2	PCM/CMZ - 202	Chemistry - II							
3	PCM/CMZ - 203	Chemistry - III							
4	Practical PCM/CMZ-210	Chemistry Lab							
Total									
Total Teaching Load									

L: Lecture

T: Tutorial

P: Practical

PCM/CMZ 201: Chemistry - I

Unit	Contents of Course	Hrs.
I	s- Block Elements : - Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in bio-systems and introduction to alkyls and aryls.	
II	p-Block elements : - Periodicity properties of p-block elements with special reference to atomic and ionic radii, ionization energy, electron affinity, diagonal relationship, catenation. Some Important Compounds of p-block Elements : Hydrides of Boron, diborane and higher boranes, borazine, fullerenes, carbides, fluoro-carbons, silicates, tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.	
III	Chemistry of Noble Gases : Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.	
IV	Nuclear Chemistry : Fundamental Particles of nucleus (nucleons), Concept of nuclides and its representation, Isotopes, Isobars and isotones (with specific examples), Force operating between nucleons (n-n, p-p, & n-p), Qualitative idea of stability of nucleus (n/p ratio). Radiochemistry : Natural and artificial radioactivity, Radioactive disintegration series, Radioactive displacement law, Radioactivity decay rates, Half-life and average life, Nuclear binding energy, mass defect and calculation of defect and binding energy, Nuclear reaction, Spallation, Nuclear fission and fusion.	

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2. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company.
3. James Huheey, Inorganic Chemistry : Principal of Structure and Reactivity, Pearson Education India.
4. Douglas, B.E. and Mc Daniel, D.H., Concepts and Models of Inorganic Chemistry.
5. Gary Wulfsberg, Inorganic Chemistry, University Science Book.

PCM/CMZ 202: Chemistry - II

Unit	Contents of Course	Hrs.
I	<p>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- mechanism involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, dehydroxylation and oxidation with KMnO_4, Polymerization of alkenes, Substitution of the allylic and vinylic positions of alkenes. 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 reaction of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, metal ammonia reductions, oxidation and polymerizations</p>	
II	<p>Arenes and aromaticity : Nomenclature of benzene derivatives. The aryl group, aromatic nucleus and side chain. Structure of benzene : molecular formula and Kekule structure, stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram. Aromaticity : The Huckel rule, aromatic ions.</p>	
III	<p>Aromatic electrophilic substitution : General pattern of the mechanism, role of sigma (σ) and pi (π) complexes. Mechanism of nitration, halogenation sulphonation, mercuriation and Friedel- Craft's reactions, energy profile diagrams. Activating & Deactivating substituents, orientation and ortho / para ratio, side chain reactions of benzene derivatives. Birch reduction.</p>	
IV	<p>Alkyl and Aryl Halides- Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms, nucleophilic substitution reactions of alkyl halides, S_N^2 and S_N^1 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, allyl, vinyl and aryl halides. Synthesis and uses of D.D.T. and B.H.C.</p>	

Reference Books:

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.



PCM/CMZ 203: CHEMISTRY-III

Unit	Contents of Course	Hrs.
I	<p>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).</p>	
II	<p>Colloidal State : Definition of colloids, classification of colloids. Solids in liquids (sols) properties - Kinetic, optical and electrical stability of colloids, protective action, Hardy - Schultze law, gold number. Liquids in liquids (emulsions) : Type of emulsions, preparation and properties of Emulsions. Liquids in solids (gels) : Classification, preparation and properties, inhibition, general applications of colloids.</p>	
III	<p>Chemical Kinetics : Chemical kinetics and its scope, rate of reaction, factors influencing the rate of reaction, concentration, temperature, pressure, solvent, light, catalyst, concentration dependence of rates, mathematical characteristics of simple chemical reactions: zero 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.</p>	
IV	<p>Experimental methods of chemical kinetics : Conductometric, potentiometric, optical methods, polarimetric and spectrophotometric. Theories of chemical kinetics: Effect of temperature on rate of reaction, Arrhenius 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. Radioactive decay as a first order phenomenon.</p>	

Reference Books:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press (2006).
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).

YEAR: I

SEMESTER: II

PCM/CMZ 210: CHEMISTRY LAB

S. No.	List of Experiments	Hrs.
I	Inorganic Chemistry : Semi micro and Macro analysis , Separation and Identification of Four radicals - two acidic and two basic in a given mixture which may include any one interfering radical and/or combinations of radicals.	
II	Organic Chemistry : 1. Decolourisation and crystallization using charcoal. 2. Sublimation – Camphor, Napthalene, Phthalic acid and succinic acid. 3. Qualitative Analysis : Detection of extra elements (N, S and halogens) and functional groups (Phenolic, carboxylic, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.	
III	Physical Chemistry : Viscosity, Surface Tension, pH metry: 1. To determine the percentage composition of a given mixture by viscosity method. 2. To determine the percentage composition of a given binary mixture by surface tension method(acetone & ethyl methyl ketone). 3. Determine the surface tension by (i) drop number (ii) drop weight method. 4. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures. 5. Preparation of buffer solutions of different pH i. Sodium acetate-acetic acid ii. Ammonium chloride-ammonium hydroxide	
IV	Viva	
V	Record	



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YEAR: II

SEMESTER: III

S. No.	Subject Code	Subject Name	Hrs./Week			Exam Hrs.	Maximum & Minimum Marks		
			L	T	P		Internal/Min. Pass Marks	External/Min. Pass Marks	Total/Min. Pass Marks
Theory									
1	PCM/CMZ - 301	Chemistry - I							
2	PCM/CMZ - 302	Chemistry - II							
3	PCM/CMZ - 303	Chemistry - III							
4	Practical PCM/CMZ-310	Chemistry Lab							
Total									
Total Teaching Load									

L: Lecture

T: Tutorial

P: Practical

PCM/CMZ 301: Chemistry - I

Unit	Contents of Course	Hrs.
I	Chemistry of Elements of First Transition Series: Characteristic properties of d-block elements. Properties of the elements of first transition series, their binary compounds and complexes, illustrating the relative stabilities of oxidation states, coordination number and geometry.	
II	Chemistry of Elements of Second and Third Transition Series: Chemistry of elements belonging to II and III transition series comparative study of post lanthanide transition metals with the members of 4d series with special emphasis on ionic radii, oxidation states, magnetic & spectral properties. Stereochemistry of their compounds.	
III	Coordination Compounds: Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes..	
IV	Chemistry of Lanthanide Elements : Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.	

Reference Books:-

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company.
3. James Huheey, Inorganic Chemistry : Pricipal of Structure and Reactivity, Pearson Education India.
4. Douglas, B.E. and Mc Daniel, D.H., Concepts and Models of Inorganic Chemistry.
5. Gary Wulfsberg, Inorganic Chemistry, University Science Book.

PCM/CMZ 302: Chemistry - II

Unit	Contents of Course	Hrs.
I	<p>Electromagnetic Spectrum : Absorption Spectra</p> <p>Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathchromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.</p> <p>Infrared (IR) absorption spectroscopy - molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurements of IR spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.</p>	
II	<p>Alcohols : Classification and nomenclature.</p> <p>Monohydric alcohols - Nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.</p> <p>Dihydric alcohols - Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)₄ and HIO₄] and pinacol-pinacolone rearrangement.</p> <p>Trihydric alcohols - Nomenclature and methods of formation, chemical reactions of glycerol.</p>	
III	<p>Phenols:</p> <p>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.</p>	
IV	<p>Ethers and Epoxides</p> <p>Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions - cleavage and autoxidation, Ziesels method. Synthesis of epoxides, Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.</p>	

Reference Books:-

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- Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 2 : Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Elie, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
- Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

Unit	Contents of Course	Hrs.
I	<p>Thermodynamics - I :</p> <p>Definition of thermodynamics 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.</p> <p>First Law of Thermodynamics : Statement, definition and 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.</p> <p>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 thermochemical data, temperature dependence of enthalpy, Kirchhoffs equation.</p>	
II	<p>Thermodynamics – II :</p> <p>Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.</p> <p>Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.</p> <p>Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.</p>	
III	<p>Chemical Equilibrium:</p> <p>Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants K_p, K_c and K_x. Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.</p>	
IV	<p>Phase Equilibrium:</p> <p>Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO_2 and S systems. Phase equilibria of two component system, solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead.</p> <p>Solid solutions - compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H_2O), (FeCl₃-H_2O) and (CuSO₄-H_2O) system.</p>	

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press (2006).
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YEAR: II

SEMESTER: III

PCM 310: CHEMISTRY LAB

S. No.	List of Experiments	Hrs.
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I	<p>Inorganic Chemistry :</p> <p>1. Calibration & Preparation of solutions : Calibration of fractional weights, pipettes and burettes. Preparation of standard solutions. Dilution 0.1 M to 0.001 M solutions.</p> <p>2. Semi micro and Macro analysis : Separation and Identification of six radicals – three acidic and three basic in a given mixture which may include any one interfering radical and/or combinations of radicals.</p>
II	<p>Organic Chemistry :</p> <p>Chromatography : Determination of R_f values and identification of organic compounds.</p> <p>(i) Preparation and separation of 2, 4-dinitrophenylhydrozone of acetone, 2-butanone, hexan-2- and 3-one using toluene and light petroleum (40 :60). (Thin layer chromatography)</p> <p>(ii) Separation of a mixture of dyes using cyclohexane and ethyl acetate(8.5 : 1.5). (Thin layer chromatography)</p> <p>(iii) Separation of a mixture of phenylalanine and glycine, Alanine and aspartic acid, Leucine and glutamic acid, Spray reagent-ninhydrin.</p> <p>(iv) Separation of a mixture of D, L-alanine, glycine and L-Leucine using n-butanol: acetic acid : water (4:1:5), spray reagent-ninhydrin.</p> <p>(V) Separation of monosachharides - a mixture of D-galactose and D-fructose using n-butanol: acetone: water (4:5:1) spray reagent-aniline hydrogen phthalate.</p>
III	<p>Physical Chemistry :</p> <p>1. Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g. $MnCl_2 \cdot 2H_2O/SrBr_2 \cdot 2H_2O$.)</p> <p>2. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol water system.</p> <p>3. To construct the phase diagram of two component (e.g. diphenylamine-benzophenone) system by cooling curve method.</p>
IV	Viva
V	Record



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SEMESTER: IV

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			L	T	P		Internal/Min. Pass Marks	External/Min. Pass Marks	Total/Min. Pass Marks
Theory									
1	PCM/CMZ - 401	Chemistry - I							
2	PCM/CMZ - 402	Chemistry - II							
3	PCM/CMZ - 403	Chemistry- III							
4	Practical PCM/CMZ- 410	Chemistry Lab							
Total									
Total Teaching Load									

L: Lecture

T: Tutorial

P: Practical

PCM/CMZ 401: Chemistry - I

Unit	Contents of Course	Hrs.
I	Chemistry of Actinides : 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.	
II	Oxidation and reduction : Use of redox potential data-Analysis of redox cycle. Redox stability in water. Frost, Latimer and Pourbaix diagram . Principles involving in the extraction of elements.	
III	Acids and Bases : Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept.	
IV	Non-aqueous Solvents : Physical properties of a solvents, types of solvents and their general characteristics, Reactions in non –aqueous solvents with reference to liquid NH ₃ and Liquid SO ₂ .	

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PCM/CMZ 402: CHEMISTRY-II

Unit	Contents of Course	Hrs.
I	<p>Aldehydes and Ketones :</p> <p>Nomenclature and structure of 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 acid. Physical properties. Mechanism of nucleophilic addition 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 acetate 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 α, β unsaturated aldehydes and Ketones</p>	
II	<p>Carboxylic Acid :</p> <p>Nomenclature, structure and bonding, physical properties, acidity Carboxylic acids, effect 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.</p>	
III	<p>Carboxylic Acid derivatives :</p> <p>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. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and Hydrolysis,(acidic and basic).</p>	
IV	<p>Organic Compounds of Nitrogen :</p> <p>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 affecting basicity, of amines. Amines 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. Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthesis, transformation of aryl diazonium salts, azo coupling.</p>	

Reference Books:

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.



Unit	Contents of Course	Hrs.
I	<p>Solutions :</p> <p>Liquid-liquid mixtures - Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal systems- azeotropes- HCl-H₂O and ethanol-water systems. Partially miscible liquids-Phenol-water, trimethylamine, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature, Immiscible liquids, steam distillation.</p>	
II	<p>Electrochemistry-I :</p> <p>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).</p> <p>Transport number- Definition and determination by Hittorf method and moving boundary method.</p> <p>Applications of conductivity measurements : Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.</p>	
III	<p>Electrochemistry-II :</p> <p>Types of reversible electrodes - gas-metal ion, metal-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.</p>	
IV	<p>Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K) polarization, over potential and hydrogen over voltage.</p> <p>Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.</p> <p>Definition of pH and pK_a determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson-Hassel equation. Hydrolysis of salts.</p>	

Reference Books:-

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press (2006).
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).

YEAR: II

SEMESTER: IV

S. No.	List of Experiments	Hrs.
I	<p>Inorganic Chemistry : Volumetric Analysis (i) Determination of acetic acid in commercial vinegar using NaOH. (ii) Determination of alkali content-antacid tablet using HCl. (iii) Estimation of calcium content in chalk as calcium oxalate by permanganometry. (iv) Estimation, of hardness of water by EDTA. (v) Estimation of ferrous and ferric by dichromate method. (vi) Estimation of copper using thiosulphate.</p> <p>Gravimetric Analysis (i) Analysis of Cu as CuSCN. (ii) Analysis of Ni as Ni(DMG).</p>	
II	<p>Organic Chemistry : Qualitative Analysis Analysis of given organic mixture containing two solid components Using water ,NaHCO₃ or NaOH for separation and preparation of suitable derivatives.</p>	
III	<p>Physical Chemistry : Transition Temperature / Thermochemistry</p> <ol style="list-style-type: none"> 1. Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g. MnCl₂.2H₂O/SrBr₂.2H₂O.). 2. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol water system. 3. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process. 4. To determine the enthalpy of neutralisation of weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base. 5. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born Haber cycle 	
IV	Viva	
V	Record	



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CHUDELA (JHUNJHUNU), RAJASTHAN

INSTITUTE OF SCIENCE
DEPARTMENT OF CHEMISTRY
TEACHING AND EXAMINATION SCHEME AND DETAILED SYLLABUS FOR

BACHELOR OF SCIENCE

EFFECTIVE FROM ACADEMIC SESSION 2023 – 2024

YEAR: III

SEMESTER: V

S. No.	Subject Code	Subject Name	Hrs./Week			Exam Hrs.	Maximum & Minimum Marks		
			L	T	P		Internal/Min. Pass Marks	External/Min. Pass Marks	Total/Min. Pass Marks
Theory									
1	PCM/CMZ - 501	Chemistry - I							
2	PCM/CMZ - 502	Chemistry - II							
3	PCM/CMZ - 503	Chemistry - III							
4	Practical PCM/CMZ - 510	Chemistry Lab							
Total									
Total Teaching Load									

L: Lecture

T: Tutorial

P: Practical

PCM/CMZ 501: CHEMISTRY - I

Unit	Contents of Course	Hrs.
I	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.	
II	Metal-ligand Bonding in Transition Metal Complexes : Limitation 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.	
III	Magnetic Properties of Transition Metal Complexes: Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.	
IV	Electron Spectra of Transition Metal Complexes : Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series, Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ complex ion.	

Reference Books:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company.
3. James Huheey, Inorganic Chemistry : Pricipal of Structure and Reactivity, Pearson Education India.
4. Douglas, B.E. and Mc Daniel, D.H., Concepts and Models of Inorganic Chemistry.
5. Gary Wulfsberg, Inorganic Chemistry, University Science Book.

PCM/CMZ 502: CHEMISTRY - II

Unit	Contents of Course	Hrs.
I	<p>Nuclear Magnetic resonance (NMR) spectroscopy :</p> <p>Paramagnetic resonance (^1H 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 NMR spectroscopic techniques.</p>	
II	<p>Organic Synthesis Via Enolates :</p> <p>Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation, Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes, Alkylation and acylation of enamines.</p>	
III	<p>Heterocyclic Compounds :</p> <p>Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine, Methods of synthesis and chemical reaction with particular emphasis on the mechanism of electrophilic substitution, Mechanism of nucleophilic substitution reaction in pyridine derivative, Comparison of basicity of pyridine, piperidine and pyrrole.</p>	
IV	<p>Introduction to condensed five and six membered heterocycles :</p> <p>Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Nepieralski synthesis, Mechanism of electrophilic substitution reaction of indole, quinoline and isoquinoline.</p>	

Reference Books:

- Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Finar, I. L. Organic Chemistry (Volume 2 : Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- Elie, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
- Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

YEAR: III

SEMESTER: V

PCM/CMZ 503: CHEMISTRY - III

Unit	Contents of Course	Hrs.
I	<p>Elementary Quantum Mechanics :</p> <p>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, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrödinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.</p>	
II	<p>Molecular orbital theory :</p> <p>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. models.</p>	
III	<p>Spectroscopy :</p> <p>Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.</p> <p>Rotational Spectrum Diatomic molecules, Energy levels of a rigid rotator (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.</p>	
IV	<p>Vibrational spectrum :</p> <p>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 an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.</p> <p>Raman Spectrum concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.</p>	

Reference Books:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press (2006).
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).

YEAR: III

SEMESTER: V

PCM/CMZ 511: CHEMISTRY LAB

S. No.	List of Experiments	Hrs.
I	<p>Inorganic Chemistry : Synthesis & Analysis : (a) Sodium trioxalato ferrate (III), $\text{Na}_3 [\text{Fe}(\text{C}_2\text{O}_4)_3]$ (b) Ni-DMG complex, $[\text{Ni} (\text{DMG})_2]$ (c) Copper tetrammine complex $[\text{Cu}(\text{NH}_3)_4] \text{SO}_4$. (d) Cis-and trans-bisoxalato diaqua chromate (III) ion. Semi micro and Macro analysis : Separation and Identification of Six radicals - three acidic and three basic from a mixture with one interfering radicals and/or combinations of radicals. Instrumentation / Colorimetry : (a) To determine Metal- Ligand ratio of complexes by Jobs method. (b) To determine Metal- Ligand ratio of complexes by Mole Ratio method.</p>	
II	<p>Organic Chemistry : Laboratory Techniques : Steam Distillation : (a) Naphthalene from its suspension in water (b) Clove Oil form Cloves (c) Separation of <i>o</i>-and <i>p</i>-nitrophenols Column Chromatography : (a) Separation of fluorescine and methylene blue (b) Separation of leaf pigments form spinach leaves (c) Resolution of racemic mixture of (+) mandelic acid Qualitative Analysis Analysis of given organic mixture containing two solid components Using water ,NaHCO_3 or NaOH for separation and preparation of suitable derivatives.</p>	
III	<p>Physical Chemistry : Electrochemistry : 1. To determine the strength of the given acid conductometrically using standard alkali solution. 2. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically. 3. To study the saponification of ethyl acetate conductometrically. 4. To determine the ionisation constant of a weak acid conductometrically. 5. To titrate potentiometrically the given ferrous ammonium sulphate solution using $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7 / \text{CuSO}_4$ as titrant calculate the redox potential of $\text{Fe}^{++}/\text{Fe}^{+++}$ system on the hydrogen scale.</p>	
IV	Viva	
V	Record	





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BACHELOR OF SCIENCE

EFFECTIVE FROM ACADEMIC SESSION 2023 – 2024

Year: III

Semester: VI

S. No.	Subject Code	Subject Name	Hrs./Week			Exam Hrs.	Maximum & Minimum Marks		
			L	T	P		Internal/Min. Pass Marks	External/Min. Pass Marks	Total/Min. Pass Marks
Theory									
1	PCM/CMZ - 601	Chemistry –I							
2	PCM/CMZ - 602	Chemistry –II							
3	PCM/CMZ - 603	Chemistry –III							
4	Practical PCM/CMZ- 610	Chemistry Lab							
Total									
Total Teaching Load									

L: Lecture

T: Tutorial

P: Practical

PCM/CMZ 601: Chemistry -I

Unit	Contents of Course	Hrs.
I	Thermodynamic and Kinetic Aspect of Metal Complexes : A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.	
II	Organometallic Chemistry : Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and Aryls of Al, Zn, Hg and Ti a brief account of metat- ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.	
III	Bioinorganic Chemistry Essential and trace elements in biological processes, metallporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+} , nitrogen fixation.	
IV	Inorganic Polymers : Silicones and phosphazenes as examples of organic ploymers, nature of bonding in triphosphazenes.	

Reference Books:

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
2. Shriver and Atkins Inorganic Chemistry, W. H. Freeman and Company.
3. James Huheey, Inorganic Chemistry : Pricipal of Structure and Reactivity, Pearson Education India.
4. Douglas, B.E. and Mc Daniel, D.H., Concepts and Models of Inorganic Chemistry.
5. Gary Wulfsberg, Inorganic Chemistry, University Science Book.

PCM/CMZ 602: CHEMISTRY-II

Unit	Contents of Course	Hrs.
I	<p>Carbohydrates :</p> <p>Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses.</p> <p>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 structure of D(+)-glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose.</p> <p>An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides e.g. starch and cellulose (without involving structure determination).</p>	
II	<p>Amino Acids, Peptides, Proteins and Nucleic Acids :</p> <p>Classification, structure and stereochemistry of amino acids. Acid base behavior, electrophoresis. Preparation and reactions of α-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, level of protein structure. Proteins denaturation/renaturation.</p> <p>Nucleic acids: Introduction, Constitution of nucleic acids-Ribonucleosides and ribonucleotides. The double helical structure of DNA.</p>	
III	<p>Synthetic Polymers :</p> <p>Addition of chain-growth polymerization, Free radical vinyl polymerization, 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.</p> <p>Synthetic Dyes</p> <p>Color and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo.</p>	
IV	<p>Organosulphur Compounds :</p> <p>Nomenclature, structural formation, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.</p>	

Reference Books:

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.



PCM/CMZ 603: CHEMISTRY -III

Unit	Contents of Course	Hrs.
I	<p>Photochemistry :</p> <p>Interaction of radiation with matter, difference between thermal and photochemical processes, laws of photochemistry: Grothus- Drapper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, inter system crossing), quantum yield, photosensitized reactions, energy transfer processes (simple examples)</p>	
II	<p>Physical Properties and Molecular Structure :</p> <p>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 : Paramagnetism, diamagnetism and ferromagnetic, Magnetic susceptibility, its measurements and its importance.</p>	
III	<p>Solutions, Dilute Solutions and Colligative Properties</p> <p>Ideal and non-ideal solutions, method of expressing concentration 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 in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.</p>	
IV	<p>Electronic Spectrum :</p> <p>Concept of potential energy curve for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck – Condon principle. Qualitative description of σ, π, n M.O. their energy levels and the respective transition.</p>	

Reference Books:

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press (2006).
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).

PCM/CMZ - 610: CHEMISTRY LAB

S. No.	List of Experiments	Hrs.
I	Inorganic Chemistry : (a) Determination of adulteration in Food Stuffs. (b) Effluent or waste water analysis. (c) Ground Water Analysis. (d) Solvent Extraction: Separation and estimation of Mg(II) and Fe(II) ions. (e) Exchange Method: Separation and estimation Mg(II) and Zn(II) ions.	
II	Organic Chemistry : (a) Acetylation of salicylic acid, aniline, glucose and hydroquinone. (b) Benzoylation of aniline and phenol. (c) Preparation of iodoform from ethanol and acetone. (d) Preparation of m-dinitrobenzene from nitrobenzene. (e) Preparation of p-nitroacetanilide from acetanilide. (f) Preparation of p-bromoacetanilide from acetanilide. (g) Preparation of benzoic acid from toluene. (h) Preparation of aniline from nitrobenzene. (i) Preparation of m-nitroaniline from m-dinitrobenzene.	
III	Physical Chemistry : (a) To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer. (b) To determine the specific rotation of a given optically active compound. (c) Determination of molecular weight of a non-volatile solute by Rast method/Backmann freezing point method. (d) Determination of the apparent degree of dissociation of an electrolyte (e.g- NaCl) in aqueous solution at different concentrations by ebullioscopy. (e) To verify Beer-Lambert law for $\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ and determine the concentration of the given solution of the substance.	
IV	Viva	
V	Record	