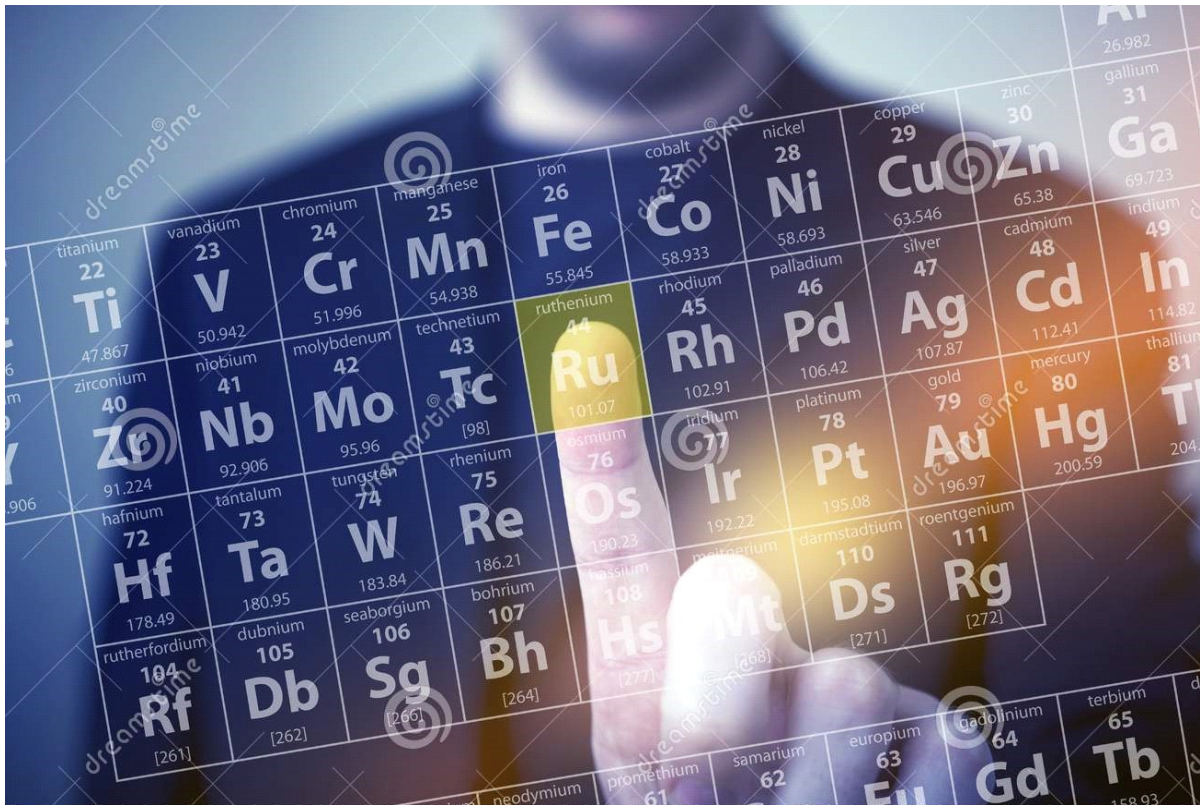




## DEPARTMENT OF CHEMISTRY



**B.Sc., CHEMISTRY**  
**LESSON PLANS: 2022-23**



**Academic-Pedagogical-Evaluation:CourseOverview**

<b>Pedagogy:</b>	P1	Lecture
	P2	Demonstration
	P3	Question & Answer
	P4	Debate
	P5	Audio & video clips
	PQ	Quiz
	PT	Test
	P10	Seminar
	P1	Invited Lecture

## SEMESTER - I

### PAPER -I: INORGANIC & PHYSICAL CHEMISTRY – I

<b>Course:</b> B.Sc.Chemistry	<b>Year/Semester:</b> 1-1	<b>Faculty Name:</b> B.Leelakumari			
<b>Subject:</b>	<b>PAPER-I: INORGANIC &amp; PHYSICAL CHEMISTRY</b>				
<b>Units:</b>	1. Chemistry of p-block elements 2. Chemistry of d-block, f-block elements and bonding in metals 3. Solid state 4. Gaseous state and Liquid state 5. Solutions, Ionic equilibrium & dilute solutions				
<b>Learning Objectives</b>	At the end of the session the student shall be able to;  1. Understand the basic concepts of p-block elements.  2. Explain the difference between solid, liquid and gases in terms of Inter molecular interactions.  3. Apply the concepts of gas equations, PH and electrolytes while studying other chemistry courses.				
<b>Units</b>	U1	U2	U3	U4	U5
<b>Total Hours: 60</b>	8	16	10	10	16
<b>Internal Evaluation</b>	5	5	5	5	5

**Resource  
Material:**

**Study Material (Handouts):**

1. <https://byjus.com/chemistry/imperfections-in-solids-point-defects/>
2. <https://www.vedantu.com/chemistry/bravais-lattice>
3. <https://www.vedantu.com/chemistry/solutions>

**Reference Books:**

1. Principles of physical chemistry by Samuel H Maron and Carl F Prutton, 4<sup>th</sup> edition, Oxford & Ibh publishing.
2. Solid State Chemistry and its applications by Anthony R. West, Wiley-India.
3. Text book of physical chemistry by K L Kapoor, Mc Hraw Hill.
4. Inorganic Chemistry by J.E. Huheey, 4<sup>th</sup> edition, Pearson.
5. Concise Inorganic Chemistry by J.D. Lee, 5<sup>th</sup> edition, Wiley India
6. Basic Inorganic Chemistry by F. Albert Cotton and G. Wilkinson and P.L Gaus, 3rd edition, Wiley India.
7. Atkin's Physical Chemistry by Peter Atkins & Julio de Paula, 10<sup>th</sup> edition, Oxford University Press.
8. LMS portal of APCCE
9. Content available through VIDYA-MITRA portal
10. Telugu Academy Text Book

**YouTube Links:**

1. <https://www.youtube.com/watch?v=ADCrzxLHiPk>
2. <https://www.youtube.com/watch?v=IcmAE-vON08>
3. <https://www.youtube.com/watch?v=6VCyqtiTI-A>
4. <https://www.youtube.com/watch?v=8zJrjEV9n8o>

**Power Point Presentations:**

<https://www.slideshare.net/tintojohnsvazhupadickal/d-and-f-block-elements>

## Unit-Wise Plan

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<p><b>Chemistry of p-block elements</b></p> <p><b>Group 13:</b> Preparation &amp; structure of Diborane, Borazine</p> <p><b>Group 14:</b> Preparation, classification and uses of silicones</p> <p><b>Group 15:</b> Preparation &amp; structures of Phosphonitrilic halides <math>(\text{PNCl}_2)_n</math> where <math>n=3, 4</math></p> <p><b>Group 16:</b> Oxides and Oxoacids of Sulphur (structures only)</p> <p><b>Group 17:</b> Pseudohalogens, Structures of Interhalogen compounds.</p>	P1, P3, P5, P7, PX	P10,PT
II	<p>1. Chemistry of d-block elements: Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.</p> <p>2. Chemistry of f-block elements: Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.</p> <p>3. Theories of bonding in metals: Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.</p>	P1, P3, P5, P6, P10	PQ,PT
III	<p><b>Solidstate</b></p> <p>Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.</p>	P1,P3,P6,P10,PX.	P10,PT
IV	<p><b>1. Gaseous state</b></p> <p>vander Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Law of corresponding</p>	P1,P3,P5,P6,P10	PT,PQ

	<p>states. Joule- Thomson effect. Inversion temperature.</p> <p><b>2. Liquid state</b>  Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.</p>		
V	<p><b>Solutions, Ionic equilibrium &amp; dilute solutions</b></p> <p><b>1. Solutions 6h</b>  Azeotropes-HCl-H<sub>2</sub>O system and ethanol-water system. Partially miscible liquids-phenol-water system. Critical solution temperature (CST), Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.</p> <p><b>2. Ionic equilibrium 3h</b>  Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.</p> <p><b>3. Dilute solutions 7h</b>  Colligative properties- RLVP, Osmotic pressure, Elevation in boiling point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile solute using osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.</p>	P1, P3,P5,P6,P7	<b>PQ,PT</b>



## SEMESTER - II

### PAPER -II: ORGANIC & GENERAL CHEMISTRY

<b>Course:</b> B.Sc. Chemistry	<b>Year/Semester:</b> 1-2	<b>Faculty Name:</b> B. LEELA KUMARI			
<b>Subject:</b>	<b>PAPER-II: ORGANIC &amp; GENERAL CHEMISTRY</b>				
<b>Units:</b>	1. Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes) 2. Carbon-Carbon pi Bonds (Alkenes and Alkynes) 3. Benzene and its reactivity 4. Surface Chemistry and Chemical bonding 5. Stereochemistry of carbon compounds				
<b>Learning Objectives</b>	At the end of the session the student shall be able to; 1. Understand the basic concepts of alkanes, alkenes and alkynes. 2. Explain the surface chemistry and chemical bonding. 3. Understand the concept of conformations, configurations. In stereochemistry.				
<b>Units</b>	U1	U2	U3	U4	U5
<b>Total Hours: 60</b>	12	14	13	11	10
<b>Internal Evaluation</b>	5	5	5	5	5

#### **Resource Material:**

#### **Study material/ Handouts:**

1. <https://byjus.com/chemistry/imperfections-in-solids-point-defects/>
2. <https://www.vedantu.com/chemistry/bravais-lattice>
3. <https://www.vedantu.com/chemistry/solutions>

#### **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.

- . 6. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
- . 7. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).
- . 8. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
- .

**YouTube Links:**

1. <https://www.youtube.com/watch?v=ADCrzLHiPk>
2. <https://www.youtube.com/watch?v=IcmAE-yON08>
3. <https://www.youtube.com/watch?v=6VCvgtiTI-A>
4. <https://www.youtube.com/watch?v=8zJrjEV9n8>

**Power Point Presentations:**

<https://www.slideshare.net/tintojohnsvazhupadickal/d-and-f-block-elements>



## Unit-Wise Plan

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<p><b>Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes)</b></p> <p>General methods of preparation of alkanes- Wurtz and WurtzFittig reaction, CoreyHouse synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane).General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.</p>	P1,P3,P4,P5,P10	P10,PT
II	<p><b>Carbon-Carbon pi Bonds (Alkenes and Alkynes)</b> 2h</p> <p>General methods of preparation, physical and chemical properties, mechanism of E1,E2,E1cb reactions, Saytzeff and Hoffmann eliminations, Electrophilic Additions, mechanism (Markownikoff/anti-markownikoff addition) with suitable examples, <i>syn</i> and <i>anti</i>-addition; addition of H<sub>2</sub>,X<sub>2</sub>,HX. Oxymercuration demercuration, hydroboration, oxidation, ozonolysis, hydroxylation, Diels Alder reaction,1,2-and1,4-addition reactions in conjugated dienes.</p> <p>Reactions of alkynes: acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes</p>	P1,P3,P4,P5,P10	PQ,PT
III	<p><b>Benzene and its reactivity</b></p> <p>Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropyliumcation) Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromaticsubstitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO<sub>2</sub> and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens (Explanation by taking minimum of one example from each type)</p>	P1,P3,P4,P5,P10	P10,PT

IV	<p><b>1. Surface chemistry</b></p> <p>Definition of colloids. Solids in liquids(sols), preparation, purification, properties - kinetic,optical, electrical. Stability of colloids, Hardy-Schulze law, protective colloid. Liquids in liquids (emulsions) preparation, properties, uses. Liquids in solids (gels) preparation, uses.Adsorption: Physical adsorption, chemisorption. Freundlich, Langmuir adsorption isotherms. Applications of adsorption</p> <p><b>2.Chemical Bonding</b></p> <p>Valence bond theory, hybridization, VB theory as applied toClF3, Ni(CO)4, Molecular orbital theory - LCAO method, construction of M.O. diagrams for homonuclear and hetero-nuclear diatomic molecules (N2, O2, CO and NO).</p> <p><b>HSAB</b></p> <p>Pearson's concept, HSAB principle &amp; its importance, bonding in Hard-Hard and Soft-Soft combinations</p>	P1,P3,P4,P5, P10	PT,PQ
V	<p><b>Stereochemistry of carbon compounds</b></p> <p>Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae. Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria(Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane. D,L and R,S configuration methods and E,Z-configuration with examples.</p> <p>Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)</p>	P1,P3,P4,P5, P10	PQ,PT

## SEMESTER - III

### PAPER -III: ORGANIC CHEMISTRY & SPECTROSCOPY

<b>Course:</b> B.Sc.Chemistry	<b>Year/Semester:</b> 2-1	<b>Faculty Name:</b> M. RAMI NAIDU CH.MALLIKA			
<b>Subject:</b>	<b>PAPER-III: ORGANIC CHEMISTRY &amp; SPECTROSCOPY</b>				
<b>Units:</b>	<ol style="list-style-type: none"><li>1. Chemistry of halogenated hydrocarbons, Alcohols and Phenols</li><li>2. Carbonyl Compounds</li><li>3. Carboxylic acids and their derivatives</li><li>4. Spectroscopy</li><li>5. Application of spectroscopy to simple organic molecules</li></ol>				
<b>Learning Objectives</b>	<ul style="list-style-type: none"><li>• Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups.</li><li>• Understand synthetic chemistry learnt in this course to do functional group transformations.</li><li>• To propose possible mechanisms for any relevant reaction.</li></ul>				
<b>Units</b>	U1	U2	U3	U4	U5
<b>Total Hours: 60</b>	12	12	12	12	12
<b>Internal Evaluation</b>	5	5	5	5	5

**ResourceMaterial:**

**StudyMaterial(Handouts):**

Organic Chemistry Notes | NMR Spectroscopy

<https://chemistrynotes.com>

**ReferenceBooks:**

1. A text book of organic chemistry by Bahl and Arunbhai
2. Organic Chemistry by Bruice,Clayden
3. Spectroscopy by William Kemp,Pavia,J.RDyre.

**YouTube Links:**

<https://www.youtube.com/channel/UCUumszlie8-D0LXi9AbvYCg>

**Power Point Presentation:**

introduction to spectroscopy - SlideShare

<https://www.slideshare.net>

## UNIT-WISE PLAN

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<p><b>Chemistry of Halogenated Hydrocarbons:</b>  <b>Alkyl halides:</b> Methods of preparation and properties, nucleophilic substitution reactions–SN1, SN2 and SNi mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution v/s elimination, Williamson’s synthesis. Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.</p> <p><b>Alcohols &amp; Phenols</b>  <b>Alcohols:</b> preparation, properties and relative reactivity of 1°,2°,3° alcohols, Bouvaelt Blanc Reduction; Oxidation of diols by periodic acid and lead tetra acetate, Pinacol-Pinacolone rearrangement;  <b>Phenols:</b> Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer– Tiemann and Kolbe’s–Schmidt Reactions, Fries and Claisen rearrangements with mechanism;</p>	P1,P3,P4,P5,P10	P10,PT
II	<p><b>Carbonyl Compounds</b>            Structure, reactivity, preparation and properties;            Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives Mechanisms of Aldol and Benzoin condensation, Claisan Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann haloform reaction and Baeyer Villiger oxidation, <math>\alpha</math>-substitution reactions, oxidations and reductions (Clemmensen, wolf–kishner, with LiAlH<sub>4</sub> &amp; NaBH<sub>4</sub>). Addition reactions of <math>\alpha,\beta</math>-unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-Enol tautomerism. Preparation and synthetic applications of diethylmalonate and ethylacetoacetate.</p>	P1,P3,P4,P5,P10	PQ,PT
III	<p><b>Carboxylic Acids and their Derivatives</b>            General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of</p>	P1,P3,P4,P5,P10	P10,PT

Substituents on acidic strength. Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic substitution at acyl group-Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Reformatsky reactions and Curtius rearrangement Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Hunsdiecker reaction, decarboxylation by Schimdt reaction, Arndt-Eistert synthesis, halogenation by Hell-Volhard-Zelinsky reaction.

### **Molecular Spectroscopy:**

Interaction of electromagnetic radiation with molecules and various types of spectra;

**Rotation spectroscopy:** Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear tri atomic molecules, isotopic substitution.

**Vibrational spectroscopy:** Classical equation of vibration, computation of force constant, Harmonic and anharmonic oscillator, Morse potential curve, vibrational degrees of freedom for poly atomic molecules, modes of vibration. Selection rules for vibrational transitions, Fundamental frequencies, overtones and hot bands.

**Electronic spectroscopy:** Energy levels of molecular orbitals ( $\sigma$ ,  $\pi$ ,  $n$ ). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation, Concept of chromophore, bathochromic and hypsochromic shifts. Beer-Lambert's law and its limitations.

**Nuclear Magnetic Resonance (NMR) spectroscopy:** Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals -spin-spin coupling, coupling constants. Applications of NMR with suitable examples-ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethylacetate, toluene and acetophenone

**P1,P3,P4,P5,P10**

**PT,PQ**

**IV**

**Application of Spectroscopy to Simple Organic Molecules**  
**8h**

**P1,P3,P4,P5,P10**

**P10,PT**

**Application of visible, ultraviolet and Infrared spectroscopy in organic molecules.**

Application of electronic spectroscopy and Woodward rules for calculating  $\lambda_{\text{max}}$  of conjugated dienes and  $\alpha$ ,  $\beta$ -unsaturated compounds.

V

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intra molecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on  $>\text{C}=\text{O}$  stretching absorptions).



## SEMESTER - IV

### PAPER -IV: INORGANIC, ORGANIC & PHYSICAL CHEMISTRY

<b>Course:</b> B.Sc.Chemistry	<b>Year/Semester:</b> 2-2	<b>Faculty Name:</b> B.LEELA KUMARI CH.MALLIKA			
<b>Subject:</b>	<b>PAPER-IV : INORGANIC, ORGANIC &amp; PHYSICAL CHEMISTRY</b>				
<b>Units:</b>	<ol style="list-style-type: none"><li>1. Organo mettalic compounds</li><li>2. CarbohydratesAmino acids and proteins</li><li>3. Hetrocyclic compounds</li><li>4. Nitrogen containing functional groups</li><li>5. Photochemistry and Thermodynamics</li></ol>				
<b>Learning Objectives</b>	<ul style="list-style-type: none"><li>• Understand about laws of absorption of light energy by molecules and subsequent photochemical reactions.</li><li>• To understand the concepts of quantum efficiency and mechanisms of photochemical reaction.</li></ul>				
<b>Units</b>	U1	U2	U3	U4	U5
<b>Total Hours: 60</b>	12	11	13	12	12
<b>Internal Evaluation</b>	5	5	5	5	5

**ResourceMaterial:**

**Study Material (Handouts):**

**Inorg. Ch 5 Organometallic Chemistry-compressed.pdf - Notes**  
<https://www.teachmint.com> ›

**Reference Books:**

- Coordination chemistry by Gopalan Ramalingam
- Physical chemistry by S Glasstone
- Organic chemistry by G.Mareloudan
- Inorganic chemistry by J.D Lee

**YouTube Links: Biomolecules | CBSE Class 11 Biology  
Chapter 9 | NEET 2020 | NEET Biology | NCERT  
Biology | By Garima Goel**

**Power Point Presentations:**

**Amino acids - SlideShare**  
<https://www.slideshare.net>

## Unit-Wise Plan

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<p><b>Organometallic Compounds</b></p> <p>Definition and classification of organometallic Compounds on the basis of bond type, Concept of hapticity of organic ligands. Metalcarbonyls:18 electron rule, electron count of mono nuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and bi nuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VBapproach)-(MOdiagramof CO can be referred to for synergic effect to IR frequencies).</p>	P1,P3,P4, P5,P10	P10,PT
II	<p><b>Carbohydrates</b></p> <p>Occurrence, classification and their biological importance, Mono saccharides: Constitution and absolute configuration of glucose and fructose,epimers and anomers, mutarotation, determination of ringsizeofglucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides–Elementary treatment of maltose, lactose and sucrose. Polysaccharides– Elementary treatment of starch.</p>	P1,P3,P4,P5,P10	P10,PT
III	<p><b>Amino acids and proteins</b></p> <p>Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids-definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples -Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b)Gabriel Phthalimide synthesis c) strecker's synthesis.</p> <p><b>Physical properties:</b> Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of iso electric point.</p>	P1,P3,P4,P5,P10	P10,PT

	<p>Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond(amide linkage).Structure and nomenclature of peptides and proteins.</p> <p><b>Heterocyclic Compounds</b></p> <p>Introduction and definition: Simple five membered ring compounds with one hetero atom Ex.Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis.</p> <p>Properties:Acidic character of pyrrole-electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties-Reactivity towards Nucleophilic substitution reaction.</p>		
IV	<p><b>Nitrogen Containing Functional Groups</b></p> <p>Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.</p> <p><b>1. Nitrohydrocarbons</b></p> <p>Nomenclature and classification-nitro hydrocarbons, structure - Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Michael addition and reduction</p> <p><b>2. Amines</b></p> <p>Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.</p> <p>Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary, secondary and tertiary amines using Hinsberg's method and nitrous acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann Bromamide reaction, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction and Cope elimination</p> <p><b>3. Diazonium Salts</b></p> <p>Preparation and Synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, cyano and nitro</p>	P1,P3,P4,P5,P10	PT,PQ

	compounds. Coupling reactions of diazonium salts (preparation of azodyes).		
V	<p><b>Photochemistry 5h</b></p> <p>Difference between thermal and photochemical processes, Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photo chemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen-chlorine and hydrogen-bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).</p> <p><b>Thermodynamics</b></p> <p>The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff's equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non-spontaneous processes, Helmholtz and Gibbs energies- Criteria for spontaneity.</p>	<b>P1,P3,P4,P5,P10</b>	<b>P10, PT</b>

## SEMESTER - IV

### PAPER -V: INORGANIC & PHYSICAL CHEMISTRY

<b>Course: B.Sc.Chemistry</b>	<b>Year/Semester:2-2</b>	<b>Faculty Name: M.RAMI NAIDU R.ANURADHA</b>			
<b>Subject:</b>	<b>PAPER-V: INORGANIC &amp; PHYSICAL CHEMISTRY</b>				
<b>Units:</b>	<ol style="list-style-type: none"><li>1. Coordination chemistry</li><li>2. Inorganic reaction mechanism ,stability of metal complexes and bioinorganic chemistry</li><li>3. Phase rule</li><li>4. Electrochemistry</li><li>5. Chemical kinetics</li></ol>				
<b>Learning Objectives</b>	<ul style="list-style-type: none"><li>• Understand concepts of boundary conditions and quantization, probability distribution most probable values, uncertainty and expectation values.</li><li>• Understand application of quantization to spectroscopy</li><li>• Understand various types of spectra and their use in structure determination.</li></ul>				
<b>Units</b>	U1	U2	U3	U4	U5
<b>Total Hours: 60</b>	11	13	12	12	12
<b>Internal Evaluation</b>	5	5	5	5	5

**ResourceMaterial:**

**Study Material (Handouts):**

<https://www.tutorialspoint.com>

**Reference Books:**

1. . Text book of physical chemistry by S Glasstone
2. Concise Inorganic Chemistry by J.D.Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marro

**YouTube Link:Bsc 2nd year Inorganic chemistry - Coordination Compound**

<https://youtu.be/4svPlfcUs7s>

**Power Point Presentations:**

**Phase Rule CHAPTER-6 PHASE RULE - CCS University**

<https://ccsuniversity.ac.in › bridge-library › pdf>

**PDF**

**Phase rule - SlideShare**

<https://www.slideshare.net › RakeshSingh125 › phaserule>



## Unit-Wise Plan

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<p><b>Coordination Chemistry</b></p> <p>IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.</p>	P1,P3,P4, P5,P10	P10,PT
II	<p><b>1. Inorganic Reaction Mechanism</b></p> <p>Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions -SN<sup>1</sup> and SN<sup>2</sup>, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications.</p> <p><b>2. Stability of metal complexes</b></p> <p>Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method</p> <p><b>3. Bio inorganic Chemistry</b></p> <p>Metal ions present in biological systems, classification of elements according to their action in biological system. Geo chemical effect on the distribution of metals, Sodium/ K-pump, carbonic anhydrase and</p> <p>Carboxy peptidase.</p> <p>Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cis platin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin. Storage and transfer of iron.</p>	P1,P3,P4,P5,P10	PQ,PT
III	<p><b>Phase rule</b></p> <p>Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.</p>	P1,P3,P4,P5,P10	P10,PT

<b>IV</b>	<p><b>Electro chemistry</b></p> <p>Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel- Onsagar's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conductometric titrations. Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metalmetal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuel cells- Basic concepts, examples and applications.</p>	<b>P1,P3,P4,P5,P10</b>	<b>PT,PQ</b>
<b>V</b>	<p><b>Chemical Kinetics</b></p> <p>The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).Enzyme catalysis- Specificity, 27 factors affecting enzyme catalysis, Inhibitors and Lock &amp; key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.</p>	<b>P1,P3,P4,P5,P10</b>	<b>PQ,PT</b>

## SEMESTER - V

### PAPER –VI-A: SYNTHETIC ORGANIC CHEMISTRY

<b>Course: B.Sc. Chemistry</b>	<b>Year/Semester:3-1</b>	<b>Faculty Name: M. RAMI NAIDU R.ANURADHA</b>			
<b>Subject:</b>	<b>PAPER-VI-A : SYNTHETIC ORGANIC CHEMISTRY</b>				
<b>Units:</b>	<ol style="list-style-type: none"><li>1. Pericyclic reactions</li><li>2. Organic photochemistry</li><li>3. Retro synthesis</li><li>4. Synthetic Reactions</li><li>5. Reagents in Organic Chemistry</li></ol>				
<b>Learning Objectives</b>	<ul style="list-style-type: none"><li>• Students will Identify the importance of reagents used in the synthesis of organic compounds.</li><li>• Acquire knowledge on basic concepts in different types of pericyclic reactions.</li><li>• Understand the importance of retro synthesis in organic chemistry.</li></ul> Comprehend the applications of different reactions in synthetic organic chemistry				
<b>Units</b>	<b>U1</b>	<b>U2</b>	<b>U3</b>	<b>U4</b>	<b>U5</b>
<b>Total Hours: 50</b>	10	10	10	10	10
<b>Internal Evaluation</b>	5	5	5	5	5

**ResourceMaterial:**

**StudyMaterial(Handouts):**

**Inorg. Ch 5 Organometallic Chemistry-compressed.pdf - Notes**  
<https://www.teachmint.com> ›

**Reference Books:**

1. Peri cyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Peri cyclic Reactions-A Text book: Reactions, Applications and Theory by S.Sankararaman, WILEY-VCH.
3. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P.Singh, Revised edition, Trinity Press.
4. Pericyclic reactions-A Mechanistic study by S.M. Mukherji, Macmillan India.
5. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley & Sons.
6. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford university press.
7. Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors.

**YouTube Links: Biomolecules | CBSE Class 11 Biology  
Chapter 9 | NEET 2020 | NEET Biology | NCERT  
Biology | By Garima Goel**

**Power Point Presentations:**

**Amino acids - SlideShare**  
<https://www.slideshare.net>

## Unit-Wise Plan

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<p><b>Pericyclic reactions</b></p> <p>1. A brief introduction to synthetic organic chemistry</p> <p>2. Features and classification of pericyclic reactions: Phases, nodes and symmetry properties of molecular orbital's in ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene, alkylation and ally radical. Thermal and photochemical reactions.</p> <p>3. <b>Electrocyclic reactions:</b> Definition and examples, definitions of con and dis rotation, Woodward- Hoffmann selection rules. (Correlation diagrams are not required)</p> <p>4. <b>Cyclo addition reactions:</b> Definition and examples, definitions of supra facial and an tar facial addition, Woodward- Hoffmann selection rules. (Correlation diagrams are not required)</p>	P1,P3,P4,P5,P10	P10,PT
II	<p><b>Organic photochemistry</b></p> <p>1. Jablonski diagram-singlet and triplet states</p> <p>2. Photochemistry of Carbonyl compounds <math>n-\pi</math> and <math>\pi-\pi^*</math> transitions, Norrish type-1 and type-2 reactions</p> <p>3. Paterno – Buchi reaction.</p>	P1,P3,P4,P5,P10	PQ,PT
III	<p><b>Retro synthesis</b></p> <p>1. Important terms in Retro synthesis with examples- Disconnection, Target molecule, FGI, Synthons, Retro synthetic analysis, chemo selectivity, region selectivity</p> <p>2. Importance of Order of events in organic synthesis</p> <p>3. Retro synthetic analysis of the compounds: a. cyclohexene, b. 4-Nitro toluene, c. Paracetamol.</p>	P1,P3,P4,P5,P10	P10,PQ
IV	<p><b>Synthetic Reactions</b></p> <p>Shapiro reaction, Stork - enamine reaction (only alkylation), Wittig reaction, Robinson annulation, Bailys-Hillman reaction, Heck reaction, Suzuki coupling. Synthesis of aldehydes and ketones using 1, 3-Dithiane.</p>	P1,P3,P4,P5,P10	PT,PQ
V	<p><b>Reagents in Organic Chemistry</b></p> <p><b>Oxidizing agents:</b> PCC, PDC, SeO<sub>2</sub> (Riley oxidation), NBS.</p> <p><b>Reducing agents:</b> LiAlH<sub>4</sub> (with mechanism), LTBA, Metal-solvent reduction (Birch reduction), Catalytic reduction.</p>	P1,P3,P4,P5,P10	PQ,PT

## SEMESTER - V

### PAPER –VII-A: ANALYSIS OF ORGANIC COMPOUNDS

<b>Course:</b> B.Sc. Chemistry	<b>Year/Semester:</b> 3-1	<b>Faculty Name:</b> M. RAMI NAIDU B.LEELA KUMARI			
<b>Subject:</b>	<b>PAPER-VII- A: ANALYSIS OF ORGANIC COMPOUNDS</b>				
<b>Units:</b>	<ol style="list-style-type: none"><li>1. Mass spectrometry</li><li>2. Structural elucidation of organic compounds using IR, NMR, Mass Spectral data</li><li>3. Structural elucidation of organic compounds using IR, NMR, Mass Spectral data</li><li>4. Separation techniques-1</li><li>5. Separation techniques-2</li></ol>				
<b>Learning Objectives</b>	<ol style="list-style-type: none"><li>1. Identify the importance of mass spectrometry in the structural elucidation of organic compounds.</li><li>2. Acquire the knowledge on structural elucidation of organic compounds.</li><li>3. Understand various chromatography methods in the separation and identification of organic compounds.</li><li>4. Demonstrate the knowledge gained in solvent extraction for the separate the organic compounds.</li></ol>				
<b>Units</b>	U1	U2	U3	U4	U5
<b>Total Hours: 50</b>	10	10	10	10	10
<b>Internal Evaluation</b>	5	5	5	5	5

**ResourceMaterial:**

**Study Material (Handouts):**

**Inorg. Ch 5 Organometallic Chemistry-compressed.pdf - Notes**

<https://www.teachmint.com> ›

**Reference Books:**

- Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
- introduction to Spectroscopy by Pavia, Lamp man, Kriza nd Vyvyan, Fifth edition, Cen gage.
- Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
- . Spector's copy of Organic Compounds by P.S.Kalsi, Seventh edition, New Age International.
- Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
- . Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald
- M.Westand Douglas A.Skoog, Ninth edition, Cen gage.
- Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
- . Quantitative analysis by R.A.Day Jr. and A.L.Underwood, Sixth edition, Pearson.
- Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

**YouTube Links: Biomolecules | CBSE Class 11 Biology**

**Chapter 9 | NEET 2020 | NEET Biology | NCERT**

**Biology | By Garima Goel**

**Power Point Presentations:**

**Amino acids - SlideShare**

<https://www.slideshare.net>



## Unit-Wise Plan

UNIT	DESCRIPTION	PEDAGOGY	INTERNAL EVALUATION
I	<p><b>Mass Spectrometry</b> A brief introduction to analysis of organic compounds Basic principles, Instrumentation - Mass spectrometer, electron Ionization (Electron Impact ionization, EI), Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, But aldehyde, Propionic acid.</p>	P1,P3,P4,P5, P10	P10,PT
II	<p><b>Structural elucidation of organic compounds using IR, NMR, mass spectral data</b> 2, 2, 3, 3-Tetra methyl butane, Butane-2, 3-dione, Propionic acid and methyl propionate.</p>	P1,P3,P4,P5,P10	PQ,PT
III	<p><b>Structural elucidation of organic compounds using IR, NMR, Mass spectral data</b> Phenyl acetylene, ace to phenomenon amici acid and p-nitro aniline</p>	P1,P3,P4,P5,P10	P10
IV	<p><b>Separation techniques-1</b> 1. Solvent extraction-Principle and theory, Batch extraction technique, application of batch extraction in the separation of organic compounds from mixture- acid &amp; neutral, base &amp;neutral. 2. Chromatography- Principle and theory, classification, types of adsorbents, eluents, Rf values and factors affecting Rf values. 3. Thin layer chromatography-principle, experimental procedure, advantages and applications.</p>	P1,P3,P4,P5,P10	PT,PQ
V	<p><b>Separation techniques-2</b> 1. Paper chromatography- Principle, experimental procedure, ascending, descending, radial and two dimensional, applications. 2. Column chromatography-Principle, classification, experimental procedure, applications. 3. HPLC-Principle, Instrumentation-block diagram and applications.</p>	P1,P3,P4,P5,P10	PQ,PT