# Teaching Plan

# Department of Chemistry

# Session 2023-24

# Odd Semester

Teaching Plan – 2023-24 (Odd semester)

# Dr. Gagan Chandra Mandal

Department of Chemistry

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| **Semester III** | | |
| **Syllabus Allotted** | CC-6: Inorganic Chemistry II **Chemical Bonding-II**<br>CC 6 P: INORGANIC CHEMISTRY-II Quantitative Estimations (Prac) | |
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| **CC-6T** | **Lecture No** | **Topics to be covered** |
| | **01** | Course outcome and Introduction of given topic |
| | **02** | *Ionic bond:* General characteristics, types of ions and size effects |
| | **03** | Radius ratio rule and its application and limitations |
| | **04** | Packing of ions in crystals |
| | **05** | Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy |
| | **06** | Madelung constant, Born-Haber cycle and its application |
| | **07** | Discussion about solvation energy |
| | **08** | Defects in solids |
| | **09** | Solubility energetics of dissolution process |
| | **10** | *Covalent bond:* Polarizing power and polarizability |
| | **11** | Ionic potential, Fazan's rules. And it's application |
| | **12** | Lewis structures, formal charge. Valence Bond Theory |
| | **13** | The hydrogen molecule (Heitler-London approach) |
| | **14** | Directional character of covalent bonds, hybridizations, equivalent and nonequivalent hybrid orbitals |
| | **15** | Bent's rule, Dipole moments |
| | **16** | VSEPR theory, shapes of molecules and ions containing lone pairs and bond pairs |
| | **17** | Assignments and problem discussion |
| | **11** | Assignments and problem discussion |
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| **Semester V** | | |
| **Syllabus Allotted** | CC-11: Inorganic Chemistry - IV<br>C11P: Chromatography and Spectrophotometry | |
| **C11T** | **01** | Course outcome |
| | **02** | General discussion about transition elements |
| | **03** | General comparison of 3d, 4d and 5d elements |
| | **04** | Discussion about electronic configuration and oxidation states |
| | **05** | Redox properties of transition elements |
| | **06** | Coordination chemistry |
| | **07** | Coordination chemistry of about transition elements |
| | **08** | Problem solving |
| | **09** | Problem solving |

Teaching Plan - 2023-24 (Odd semester)

**Prasanna Kumar Duley**

Department of chemistry

| **Semester III** | | |
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| **Syllabus allotted** | **C5T:** Physical Chemistry-II<br>**C5P:** Physical Chemistry-II | |
| | **Lecture No** | **Topics to be covered** |
| | **1** | Fick's law: Flux, force, phenomenological coefficients & their inter-relationship (general form), different examples of transport properties |
| | **2** | Viscosity: General features of fluid flow (streamline flow and turbulent flow); Newton's equation, |
| | **3** | viscosity coefficient; Poiseuille's equation; principle of determination of viscosity coefficient of liquids by falling sphere method |
| | **4** | Temperature variation of viscosity of liquids and comparison with that of gases |
| | **5** | Chemical potential and activity, partial molar quantities, relation between Chemical potential and Gibb's free energy and other thermodynamic state functions, |
| | **6** | variation of Chemical potential ($\mu$) with temperature and pressure; Gibbs-Duhem equation; |
| | **7** | fugacity and fugacity coefficient; Variation of thermodynamic functions for systems with variable composition; Equations of states for these systems, Change in G, S H and V during mixing for binary solutions |
| | **8** | Chemical Equilibrium: Thermodynamic conditions for equilibrium, degree of advancement, van't Hoff's reaction isotherm (deduction from chemical potential); |
| | **9** | Variation of free energy with degree of advancement; Equilibrium constant and standard Gibbs free energy change, Definitions of $K_P$, $K_C$ and $K_X$; van't Hoff's reaction isobar and isochore from different standard states; |
| | **10** | Shifting of equilibrium due to change in external parameters e.g. temperature and pressure; variation of equilibrium constant with addition to inert gas; Le Chatelier's principle and its derivation |
| | **11** | Nernst's distribution law; Application- (finding out $K_{eq}$ using Nernst dist law for $KI+I_2 = KI_3$ and dimerization of benzene |
| | **12** | Pure ideal gas-its Chemical potential and other thermodynamic functions and their changes during a change of; |
| | **13** | Thermodynamic parameters of mixing; Chemical potential of an ideal gas in an ideal gas mixture, Concept of standard states and choice of standard states of ideal gases |
| | **14** | Chemical potential of pure solid and pure liquids, Ideal solution – Definition, Raoult's law; |

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| | **15** | Mixing properties of ideal solutions, chemical potential of a component in an ideal solution, Choice of standard states of solids and liquids |
| | **16** | Wave-particle duality, light as particles, photoelectric and Compton effects; |
| | **17** | electrons as waves and the de Broglie hypothesis; Uncertainty relations (without proof) |
| | **18** | Schrodinger time-independent equation; |
| | **19** | nature of the equation, acceptability conditions imposed on the wave functions and probability interpretations of wave function |
| | **20** | Elementary concepts of operators, eigenfunctions and eigenvalues, Linear operators; Commutation of operators |
| | **21** | commutator and uncertainty relation; Expectation value; Hermitian operator; Postulates of Quantum Mechanics |
| | **22** | Particle in a box: Setting up of Schrodinger equation for one-dimensional box and its solution, Comparison with free particle eigenfunctions and eigenvalues. |
| | **23** | Properties of PB wave functions (normalisation, orthogonality, probability distribution) |
| | **24** | Expectation values of x, $x^2$, $p_x$ and $p_x^2$ and their significance in relation to the uncertainty principle |
| | **25** | Extension of the problem to two and three dimensions and the concept of degenerate energy levels |
| | **26** | Simple Harmonic Oscillator: setting up of the Schrodinger stationary equation |
| | **27** | energy expression (without derivation), expression of wave function for n = 0 and n = 1 (without derivation) and their characteristic features |
| | **28** | |
| **Semester III** | | |
| **Syllabus allotted** | **GE-3:** Physical Chemistry-II<br>**GE-3:** Physical Chemistry-II | |
| | **Lecture No** | **Topics to be covered** |
| | **1** | Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics |
| | **2** | Concept of heat, work, internal energy and statement of first law; enthalpy, H; relation between heat capacities |
| | **3** | calculations of q, w, U and H for reversible, irreversible and free expansion of gases Standard states |
| | **4** | Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications |
| | **5** | Laws of thermochemistry; bond energy, bond dissociation energy and resonance energy from thermochemical data |

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| | **6** | Kirchhoff's equations and effect of pressure on enthalpy of reactions, Adiabatic flame temperature; explosion temperature Statement of the second law of thermodynamics |
| | **7** | Concept of heat reservoirs and heat engines; Carnot cycle, Physical concept of Entropy, Carnot engine, refrigerator and efficiency |
| | **8** | Entropy changes of systems and surroundings for various processes and transformations, Auxiliary state functions (G and A) and Criteria for spontaneity and equilibrium. |
| | **9** | Chemical Equilibrium- introduction, Thermodynamic conditions for equilibrium, degree of advancement |
| | **10** | Equilibrium constant and standard Gibbs free energy change |
| | **11** | Definitions of KP, KC and KX and relation among them |
| | **12** | van't Hoff's reaction isotherm, isobar and isochore from different standard states; |
| | **13** | Shifting of equilibrium due to change in external parameters e.g., temperature and pressure |
| | **14** | variation of equilibrium constant with addition to inert gas; Le Chatelier's principle |
| **Semester V** | | |
| **Syllabus allotted** | **DSE1T:** Advanced Physical Chemistry | |
| | **Lecture No** | **Topics to be covered** |
| | **1** | Crystal Structure – Introduction, Bravais Lattice and Laws of Crystallography, Types of solid, Bragg's law of diffraction |
| | **2** | Laws of crystallography (Haüy's law and Steno's law); Permissible symmetry axes in crystals |
| | **3** | Lattice, space lattice, unit cell, crystal planes, Bravais lattice, Packing of uniform hard sphere, close packed arrangements (fcc and hcp); |
| | **4** | Tetrahedral and octahedral voids. Void space in p-type, F-type and I-type cubic systems |
| | **5** | Distance between consecutive planes [ cubic, tetragonal and orthorhombic lattices]; |
| | **6** | Indexing of planes, Miller indices; calculation of $d_{hkl,}$ Relation between molar mass and unit cell dimension for cubic system |
| | **7** | Bragg's law (derivation), application |
| | **8** | Determination of crystal structure: Powder method |
| | **9** | Structure of NaCl and KCl crystals |
| | **10** | Statistical Thermodynamics – Introduction, Configuration: Macrostates, microstates and configuration |
| | **11** | calculation with harmonic oscillator, variation of W with E; equilibrium configuration |
| | **12** | Boltzmann distribution: Thermodynamic probability, entropy and probability |
| | **13** | Boltzmann distribution formula (with derivation) |
| | **14** | Applications to barometric distribution; Partition function |

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| | **15** | concept of ensemble - canonical ensemble and grand canonical ensembles |
| | **16** | Partition function: molecular partition function and thermodynamic properties |
| | **17** | Maxwell's speed distribution; Gibbs' paradox |
| | **18** | Specific heat of solid: Coefficient of thermal expansion, thermal compressibility of solids |
| | **19** | Dulong –Petit's law; Perfect Crystal model |
| | **20** | Einstein's theory – derivation from partition function, limitations; |
| | **21** | Debye's T3 law – analysis at the two extremes |
| | **22** | 3rd law: Absolute entropy, Plank's law, Calculation of entropy, |
| | **23** | Adiabatic demagnetization: Approach to zero Kelvin |
| | **24** | adiabatic cooling, demagnetization, adiabatic demagnetization – involved curves |
| | **25** | Polymers: Classification of polymers, nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers |
| | **26** | Criteria for synthetic polymer formation; Relationships between functionality, extent of reaction and degree of polymerization |
| | **27** | Mechanism and kinetics of step growth polymerization |
| | **28** | Mechanism and kinetics of copolymerization; Conducting polymers |

| **Semester V** | | |
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| **Syllabus allotted** | **DSE-1T: Polymer Chemistry** | |
| | **Lecture No** | **Topics to be covered** |
| | **1** | Nature and structure of polymers – Structure Property relationships. |
| | **2** | Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) |
| | **3** | coordination polymerizations |
| | **4** | Mechanism and kinetics of copolymerization |
| | **5** | polymerization techniques. |
| | **6** | Recap and discussion. |
| | **7** | Questions and answer discussion. |
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Teaching Plan - 2023-24 (Odd semester)

**DR. INDRANIL CHAKRABORTY**

Department of Chemistry

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| **Semester-I** | | |
| **Syllabus allotted** | **MJ-1(Organic chemistry)** | |
| **MJ-1** | **Lecture No** | **Topics to be covered** |
| | **01** | Introduction to organic chemistry |
| | **02** | Course outcome of Stereochemistry |
| | **03** | Basics of hybridization and drawing of orbital picture |
| | **04** | Concepts and requirement of different projection formula |
| | **05** | Concept of Isomerism |
| | **06** | Optical activity of chiral compounds |
| | **07** | Optical rotation, specific rotation and molar rotation; racemic compounds. |
| | **08** | Concepts of racemisation. Process of racemisation through cationic and anionic intermediate. |
| | **09** | Racemisation through radical intermediates and through reversible formation of stable achiral intermediates. |
| | | Concepts of Resolution of racemic modifications |
| | **10** | Procedure of resolution of optically active acids & bases. |
| | **11** | Resolution of alcohols via diastereomeric salt formation. |
| | **12** | Different examples on resolution and racemisation of optically active compounds. |
| | **13** | Definition and examples of optical purity and enantiomeric excess. |
| | **14** | Invertomerism of chiral trialkylamines |
| | **15** | Problem discussion |
| | **16** | Problem discussion |
| | **17** | Problem discussion |
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| **SEC-1: COSMETICS CHEMISTRY** | | |
| SEC 1 | **PR1** | Introduction to Lab safety and use of instruments |
| | **PR2** | Preparation of Talcum Powder |
| | **PR3** | Preparation of Shampoo (Eggless) |
| | **PR4** | Preparation of Shampoo (with egg) |
| | **PR5** | Preparation of nail polish |
| | **PR6** | Preparation of nail polish remover |
| | **PR7** | Preparation of hair remover |
| | **PR8** | Preparation of lip stick |
| | **PR9** | Practice |
| | **PR10** | Practice |
| | **PR11** | Practice |
| | **PR12** | Practice |
| | **PR13** | Practice |
| | **PR14** | Practice |
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| **SEMESTER V** | | |
| **Syllabus Allotted** | DSE 2T ANALYTICAL METHODS IN CHEMISTRY | |

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| **DSE 2 T** | **01** | Chromatography: Classification, principle and efficiency of the technique. |
| | **02** | Mechanism of separation: adsorption, partition & ion exchange. |
| | **03** | Development of chromatograms: frontal, elution and displacement methods; Qualitative and quantitative aspects of chromatographic methods of analysis. |
| | **04** | Concepts, procedure and use of IC. |
| | **05** | Concepts, procedure and use of GLC. |
| | **06** | Concepts, procedure and use of GPC. |
| | **07** | Concepts, procedure and use of TLC. |
| | **08** | Concepts, procedure and use of HPLC. |
| | **09** | Stereoisomeric separation and analysis: Measurement of optical rotation, |
| | **10** | Enantiomeric excess (ee) /diastereomeric excess (de) |
| | **11** | Ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. |
| | **12** | Chiral chromatographic techniques using chiral columns (GC and HPLC). |
| | **13** | Problem discussion |
| | **14** | Problem discussion |
| | **15** | Problem discussion |
| **Semester V**<br>B.Sc General | | |
| **Syllabus Allotted** | POLYMER CHEMISTRY<br>**DSE1 T** | |
| | **Lecture** | **Topics to be covered** |
| | **01** | Course outcome |
| | **02** | Molecular weight distribution and its significance. Different types of molecular weight of polymers, *Mn*, *Mw*, etc |
| | **03** | Determination of molecular weight of polymers (*Mn*, *Mw*, etc) by end group analysis & viscometry |
| | **04** | Determination of molecular weight of polymers, light scattering and osmotic pressure methods. |
| | **05** | Polydispersity index., Glass transition temperature (Tg) and determination of Tg |
| | **06** | Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg). |
| | **07** | Polymer Solution, polymer solubility, Solubility parameter, |
| | **08** | Thermodynamics of polymer solutions,entropy, enthalpy, and free energy change of mixing of polymers solutions, |
| | **09** | Flory- Huggins theory. |
| | **10** | Lower and Upper critical solution temperatures. |
| | **11** | Problem discussion |
| | **12** | Problem discussion |

Teaching Plan-2023-2024 (Odd Semester)


## Kuheli Pramanik

Department of chemistry


| Semester I | |
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| **Syllabus allotted** | **CEMHMJ101(Theory):** Physical Properties, Aromaticity<br>**CEMHMJ101(Practical):** Separation, Determination of Boiling point, Identification of Pure Organic Compounds |
| **No of Classes (Hour) per week** | **CEMHMJ101(Theory):** 01<br>**CEMHMJ101(Practical):** 03 |
| **Teaching Plan** | **Lecture 1:** Course outcome and introduction on Physical Properties of compounds.<br>**Lecture 2:** influence of hybridization on bond properties: bond dissociation energy (BDE) and bond energy.<br>**Lecture 3:** bond distances, bond angles<br>**Lecture 4:** concept of bond angle strain (Baeyer's strain theory).<br>**Lecture 5:** melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces.<br>**Lecture 6:** polarity of molecules and dipole moments<br>**Lecture 7:** relative stabilities of isomeric hydrocarbons in terms of heat of hydrogenation, heat of combustion and heat of formation.<br>**Lecture 8:** Hückel's rules for aromaticity up to [10]-annulene (including mononuclear heterocyclic compounds up to 6-membered ring).<br>**Lecture 9:** concept of antiaromaticity and homoaromaticity, non-aromatic molecules.<br>**Lecture10:** Frost diagram.<br>**Lecture 11:** elementary idea about $\alpha$ and $\beta$; measurement of delocalization energies in terms of $\beta$ for buta-1,3-diene, cyclobutadiene, hexa-1,3,5-triene and benzene.<br>**Lecture 12:** Discussion of questions on Physical Properties of organic compounds.<br>**Lecture 13:** Discussion of questions on Aromaticity.<br>**Lecture 14:** Tutorial (Discussion on VU previous year questions)<br>**Lecture 15:** Tutorial (Discussion on VU previous year questions) |
| **Semester III** | |
| **Syllabus allotted** | **C7T:** Aromatic Substitution<br>**C7P**: Qualitative Analysis of Single Solid Organic Compounds |
| **No of Classes (Hour) per week** | **C7T: 1**<br>**C7P: 3** |
| **Teaching Plan** | **Lecture 1:** Course outcome and introduction on related topics<br>**Lecture 2***:* What is Electrophilic Aromatic Substitution, Its mechanisms and evidence in favour of it.<br>**Lecture 3:** orientation and reactivity of reactions.<br>**Lecture 4:** nitration, nitrosation reaction.<br>**Lecture 5:** sulfonation, halogenation. |

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| | **Lecture 6:** Friedel-Crafts reaction.<br>**Lecture 7:** one-carbon electrophiles reactions: chloromethylation, Gatterman-Koch.<br>**Lecture 8:** Gatterman, Houben-Hoesch, Vilsmeier-Haack<br>**Lecture 9:** Reimer-Tiemann, Kolbe-Schmidt<br>**Lecture 10:** Ipso substitituion.<br>**Lecture 11:** Nucleophilic aromatic substitution*:* addition-elimination mechanism and evidence in favour of it.<br>**Lecture 12:** $S_N1$ mechanism; cine substitution (benzyne mechanism), structure of benzyne.<br>**Lecture 13:** Questions answer discussion.<br>**Lecture 14:** Discussion on VU previous year questions |
| **Semester V** | |
| **Syllabus allotted** | **C12T:** Pericyclic reactions<br>**C12P:** A. Chromatographic Separations, B. Spectroscopic Analysis of Organic Compounds<br>**DSE2P:** Analytical Methods in Chemistry (lab) |
| **No of Classes (Hour) per week** | **C12T: 1**<br>**C12P: 3**<br>**DSE2P: 3** |
| **Teaching Plan** | **Lecture 1:** Course outcome and introduction of the given topics.<br>**Lecture 2:** What is Pericyclic reaction, different examples, classification of pericyclic reaction.MO orbital symmetry.<br>**Lecture 3:** Electrocyclic reactions: Ring opening and Ring closing, its mechanism, Stereochemistry.<br>**Lecture 4:** Regioselectivity of electrocyclic reaction *by* FMO approach involving 4π- and 6π-electrons (thermal and photochemical) and corresponding cycloreversion reactions.<br>**Lecture 5:** Cycloaddition reactions: its mechanism, stereochemistry explanation through FMO approach.<br>**Lecture 6:** Diels-Alder reaction, Retro-Diels Alder Reaction, photochemical [2+2] cycloadditions.<br>**Lecture 7:** Sigmatropic reactions*:* FMO approach. sigmatropic shifts and their order.<br>**Lecture 8:** [1,3]- and [1,5]-H shifts and [3,3]-shifts with reference to Claisen and Cope rearrangements.<br>**Lecture 9:** Questions answer discussion.<br>**Lecture 10:** Discussion on VU previous year questions<br>**Lecture 11:** Discussion on VU previous year questions |

| **Semester V(General)** | |
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| **Syllabus allotted** | **DSE-1T: Properties of Polymer**s (Physical, thermal, Flow & Mechanical Properties). |
| **No of Classes** | **DSE-1T:** 01 |

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| **(Hour) per week** | |
| **Teaching Plan** | **Lecture 1:** Course outcome and introduction of the given topics.<br>**Lecture 2:** Brief introduction to preparation, structure, properties, and application of the following polymers: polyolefins,<br>**Lecture 3:** Brief introduction to preparation, structure, properties, and application of the following polymers: polystyrene and styrene copolymers,<br><br>**Lecture 4:** Brief introduction to preparation, structure, properties, and application of the following polymers: poly (vinyl chloride) and related polymers,<br>**Lecture 5:** poly (vinyl acetate) and related polymers, acrylic polymers<br><br>**Lecture 6:** Brief introduction to preparation, structure, properties, and application of the following polymers: fluoro polymers, polyamides, and related polymers.<br>**Lecture 7:** Brief introduction to preparation, structure, properties, and application of the following polymers: Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes<br>**Lecture 8:** Brief introduction to preparation, structure, properties, and application of the following polymers: silicone polymers, polydienes, Polycarbonates<br>**Lecture 9:** Brief introduction to preparation, structure, properties, and application of the following polymers: Conducting Polymers, [polyacetylene, polyaniline, poly (p-phenylene sulphide polypyrrole, polythiophene)]<br>**Lecture 10:** Questions answer discussion.<br>**Lecture 11:** Discussion on VU previous year questions |

Teaching Plan – 2023-24 (Odd semester)

**DR. FORID SAIKH**

Department of Chemistry

| **Semester I** | | |
|---|---|---|
| **Syllabus allotted** | MJ-1(Organic chemistry) | |
| **MJ-1** | **Lecture No** | **Topics to be covered** |
| | **01** | Bonding geometries of carbon compounds |
| | **02** | 3D representation of molecules |
| | **03** | tetrahedral nature of carbon and concept of asymmetry |
| | **04** | Fischer, sawhorse, flying-wedge and Newman projection formulae and their inter translations |
| | **05** | symmetry elements and point groups ($C_{\alpha v}$, $C_{nh}$, $C_{nv}$, $C_n$, $D_{\alpha h}$, $D_{nh}$, $D_{nd}$, $D_n$, $S_n$ ($C_s$, $C_i$) |
| | **06** | symmetry elements and point groups ($C_{\alpha v}$, $C_{nh}$, $C_{nv}$, $C_n$, $D_{\alpha h}$, $D_{nh}$, $D_{nd}$, $D_n$, $S_n$ ($C_s$, $C_i$) |
| | **07** | molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers |
| | **08** | concept of epimers; concept of stereogenicity, chirotopicity and pseudoasymmetry |
| | **09** | chiral centres and number of stereoisomerism: systems involving 1/2/3-chiral centre |
| | **10** | Problem discussion |
| SEC-1: COSMETICS PREPARATION | | |
| **Semester III** | | |
| **Syllabus Allotted** | CC-7T : ORGANIC CHEMISTRY-IV *Addition to C=O*<br>CC 6 P :INORGANIC CHEMISTRY-IV Quantitative Estimations (Prac)<br>SEC 2T : BASIC ANALYTICAL CHEMISTRY (Theory) | |
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| **CC-7 T** | **Lecture No** | **Topics to be covered** |
| | **01** | *Addition to C=O:* structure, reactivity and preparation of carbonyl compounds |
| | **02** | Mechanism (with evidence), reactivity, equilibrium and kinetic control; |
| | **03** | Burgi-Dunitz trajectory in nucleophilic additions |
| | **04** | formation of hydrates, cyano hydrins and bisulphite adduct; nucleophilic addition-elimination reactions with alcohols, thiols and nitrogen- based nucleophiles |
| | **05** | benzoin condensation, Cannizzaro and Tischenko reactions |
| | **06** | Reactions with ylides: Wittig and Corey-Chaykovsky reaction |
| | **07** | Rupe rearrangement, oxidations |
| | **08** | reductions: Clemmensen, Wolff-Kishner, |
| | **09** | $LiAlH_4$, $NaBH_4$, MPV |
| | **10** | Oppenauer, Bouveault-Blanc, acyloin condensation |

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| | **11** | oxidation of alcohols with PDC and PCC; periodic acid and lead tetraacetate oxidation of 1,2-diols |
| | **12** | Assignments and problem discussion |
| | **13** | Assignments and problem discussion |
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| **SEC 1 T** | **01** | Aerobic and anaerobic fermentation |
| | **02** | Production of Ethyl alcohol and citric acid, |
| | **03** | Production of Penicillin, Cephalosporin |
| | **04** | Production of Chloromycetin and Streptomycin |
| | **05** | Production of Lysine, Glutamic acid |
| | **06** | Production of Vitamin B2, Vitamin C |
| | **07** | Production of Vitamin B12 |
| | **14** | Problem solving |
| | **15** | Problem solving |
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## Semester V

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| **Syllabus Allotted** | CC 12 T : Carbocycles & Heterocycles(Theory)<br>CC12P: TLC & 1H NMR (Practical) | |
| **CC 12T** | **Lecture** | **Topics to be covered** |
| | **01** | Course outcome |
| | **02** | synthetic methods include Haworth, Bardhan-Sengupta, Bogert-Cook |
| | **03** | other useful syntheses |
| | **04** | fixation of double bonds and Fries rule |
| | **05** | reactions (with mechanism) of naphthalene |
| | **06** | reactions (with mechanism) of anthracene |
| | **07** | reactions (with mechanism) of phenanthrene and their derivatives |
| | **08** | *Heterocyclic compounds:* 5- and 6-membered rings with one heteroatom; reactivity, orientation |
| | **09** | *Heterocyclic compounds:* 5- and 6-membered rings with one heteroatom important reactions (with mechanism) of furan |
| | **10** | *Heterocyclic compounds:* 5- and 6-membered rings with one heteroatom important reactions (with mechanism) of thiophene |
| | **11** | *Heterocyclic compounds:* 5- and 6-membered rings with one heteroatom important reactions (with mechanism) of pyrrole |
| | **12** | *Heterocyclic compounds:* 5- and 6-membered rings with one heteroatom important reactions (with mechanism) of pyridine |
| | **13** | *Heterocyclic compounds:* 5- and 6-membered rings with one heteroatom important reactions (with mechanism) of Quinoline |
| | **14** | *Heterocyclic compounds:* 5- and 6-membered rings with one heteroatom important reactions (with mechanism) of indole |
| | **15** | Problem answer |

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| | **15** | Problem & solution |
| | **SEMESTER _III(General)**<br>**Theory:Organic Chemistry**<br>**Practical: Organic Qualitative estimation, Quantative eastimation,** | |
| **DSC 1T** | **01** | Course outcome |
| | **02** | Chemistry of carboxylic acid and their derivatives |
| | **03** | Chemistry of carboxylic acid and their derivatives aliphatic |
| | **04** | Chemistry of amines and diazonium salt |
| | **05** | Chemistry of amino acids |
| | **06** | Chemistry of amino acids |
| | **07** | Chemistry of amino acids |
| | **08** | Chemistry of carbohydrates |
| | **09** | Chemistry of carbohydrates |
| | **10** | Chemistry of carbohydrates |
| | **11** | Problem solving |
| | **12** | Problem solving |
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Teaching Plan - 2022-23 (Even semester)

**DR. SUBHRA MISHRA**

Department of Chemistry

<table>
<tr><th colspan="3">Semester I</th></tr>
<tr><td>Syllabus allotted</td><td colspan="2">CEMHMJ 101: ORGANIC CHEMISTRY-(Theory) General Treatment of Reaction Mechanism I</td></tr>
<tr><td>No. of classes (Hour) per week</td><td colspan="2">CEMHMJ 101: 01</td></tr>
<tr><td rowspan="15">CC4T</td><td>Lecture No</td><td>Topics to be covered</td></tr>
<tr><td>01</td><td>Course outcome of the topic</td></tr>
<tr><td>02</td><td>Mechanistic classification: ionic, radical and pericyclic (definition with example)</td></tr>
<tr><td>03</td><td>Type of reactions: addition, elimination and substitution reactions (definition with example)</td></tr>
<tr><td>04</td><td>Introduction to Homolytic and heterolytic bond fission, homogenic and heterogenic bond formation</td></tr>
<tr><td>05</td><td>Elementary ideas about electrophiles and nucleophiles with examples</td></tr>
<tr><td>06</td><td>Discussion on electrophilicity and nucleophilicity in terms of FMO approach</td></tr>
<tr><td>07</td><td>General introduction of reaction kinetics (Order, Molecularity,Transition state, Intermediate etc)</td></tr>
<tr><td>08</td><td>Discussion on generation, stability, structure of carbocations (using orbital picture)</td></tr>
<tr><td>09</td><td>Discussion on generation, stability, structure of carbanions (using orbital picture)</td></tr>
<tr><td>10</td><td>Generation, stability, structure of carbon radicals (using orbital picture)</td></tr>
<tr><td>11</td><td>Generation, stability, structure of carbenes (using orbital picture)</td></tr>
<tr><td>12</td><td>Elementary idea on electrophilic/nucleophilic behavior of reactive intermediates</td></tr>
<tr><td>13</td><td>Problems discussion</td></tr>
<tr><td>14</td><td>University questions discussion</td></tr>
<tr><th colspan="3">Semester III</th></tr>
<tr><td>Syllabus allotted</td><td colspan="2">C7T: Organic Chemistry-III<br>C7P: Qualitative functional group analysis<br>SEC1P:Pharmaceutical Chemistry<br>GE3P:Organic Chemistry-LAB</td></tr>
<tr><td>No. of classes (Hour) per week</td><td colspan="2">C7T: 1<br>C7P: 3<br>SEC1P: 3<br>GE3 P: 2</td></tr>
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|---|---|---|
| **C7T** | **Lecture No** | **Topics to be covered** |
| | **01** | Course outcome of the syllabus |
| | **02** | Elementary ideas of Green Chemistry |
| | **03** | Discussion about the Twelve (12) principles of green chemistry |
| | **04** | Discussion about the Twelve (12) principles of green chemistry |
| | **05** | Planning of green synthesis; common organic reactions and their counterparts: reactions: Aldol condensation and Friedel-Crafts reactions |
| | **06** | Planning of green synthesis; common organic reactions and their counterparts: reactions: Michael and Knoevenagel condensation. |
| | **07** | Planning of green synthesis; common organic reactions and their counterparts: reactions: Cannizzaro, benzoin condensation and Dieckmann reaction |
| | **08** | Substitution at $sp^2$ carbon (C=O system): mechanism (with evidence): $B_{AC}2$, $A_{AC}2$, (in connection to acid and ester); acid derivatives: amides, anhydrides & acyl halides (formation and hydrolysis including comparison). |
| | **09** | Mechanism (with evidence): $A_{AC}1$, $A_{AL}1$ (in connection to acid and ester); acid derivatives: amides, anhydrides & acyl halides (formation and hydrolysis including comparison). |
| | **10** | Grignard reagent; preparation and reactions (mechanism with evidence) |
| | **11** | Organolithiums; Gilman Cuprates preparation and reactions (mechanism with evidence) |
| | **12** | Substitution on -COX; directed ortho metalation of arenes using organolithiums, conjugate addition by Gilman cuprates; Corey-House synthesis |
| | **13** | Abnormal behavior of Grignard reagents; comparison of reactivity among Grignard, organolithiums and organocopper reagents |
| | **14** | Reformatsky reaction; Blaise reaction; concept of *umpolung* and base-nucleophile dichotomy in case of organometallic reagents |
| | **15** | Problem discussion |
| | **16** | University questions discussion |
| | | |

## Semester V

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|---|---|---|
| **Syllabus Allotted** | **C12 T: Organic Chemistry – V**<br>**DSE1 T: Polymer Chemistry** | |
| | | |
| | **Lecture** | **Topics to be covered** |

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|---|---|---|
| **CC12 T** | **01** | Course outcome and application of Bioorganic chemistry |
| | **02** | Bio-molecules –Introduction |
| | **03** | Classification structure of Amino acids |
| | **04** | Synthesis with mechanistic details: Strecker, Gabriel, acetamido malonic ester, azlactone |
| | **05** | Synthesis with mechanistic details Bücherer hydantoin synthesis, synthesis involving diketopiperazine. |
| | **06** | Iso-electric point, zwitterions; electrophoresis, reaction (with mechanism): ninhydrin reaction, Dakin-West reaction. resolution of racemic amino acids |
| | **07** | *Peptides:* peptide linkage and its geometry; syntheses (with mechanistic details) of peptides using *N*-protection & C-protection, solid-phase (Merrifield) synthesis |
| | **08** | Peptide sequence: *C*-terminal and *N*-terminal unit determination (Edman, Sanger & 'dansyl' methods) |
| | **09** | Partial hydrolysis; specific cleavage of peptides: use of CNBr, Overlapping technique |
| | **10** | Pyrimidine and purine bases (only structure & nomenclature); nucleosides and nucleotides corresponding to DNA and RNA |
| | **11** | Mechanism for acid catalysed hydrolysis of nucleosides (both pyrimidine and purine types); comparison of alkaline hydrolysis of DNA and RNA |
| | **12** | Elementary idea of double helical structure of DNA (Watson-Crick model); complimentary base–pairing in DNA |
| | **16** | Assignment and problem discussion |
| | **17** | University questions discussion |
| **Syllabus Allotted** | **DSE1 T: Polymer Chemistry** | |
| **No. of classes (Hour) per week** | **DSE1 T: 1** | |
| **DSE1 T** | **01** | Course outcome |
| | **02** | Introduction to the polymer Chemistry |
| | **03** | Classification and Characterisation of Polymer |
| | **04** | Structure of polymer |
| | **05** | Functionality and its importance: Criteria for synthetic polymer formation.Classification of polymerization processes |
| | **06** | Structure –Function relationship |
| | **07** | Problem solving |
| | **08** | Problem solving |

Teaching Plan – 2023-24 (Odd semester)


## Dr. Sumit Kumar Ray

Department of Chemistry


| Semester I | | |
|---|---|---|
| **Syllabus allotted** | MJ-1(Organic chemistry)<br>MJ1P: Organic Chemistry Lab-1 | |
| **MJ-1** | **Lecture No** | **Topics to be covered** |
| | **01** | Course outcome and Introduction of given topic |
| | **02** | Valence Bond Theory*:* concept of 18ybridization, shapes of molecules, resonance (including hyperconjugation) |
| | **03** | Calculation of formal charges and double bond equivalent (DBE). Prediction the structure of molecules from DBE. |
| | **04** | Orbital pictures of bonding ($sp^3$, $sp^2$, sp: C-C, C-N & C-O systems and *s-cis* and *s-trans* geometry for suitable cases). |
| | **05** | Electronic displacements: inductive effect, field effect, mesomeric effect and their applications in organic chemistry. |
| | **06** | Resonance: it's application in organic chemistry. Resonance energy calculation for various molecules. |
| | **07** | Bond polarization and bond polarizability: Application of dipole moment. |
| | **08** | Discuss the concept of electromeric effect; steric effect and steric inhibition of resonance. Their applications in organic chemistry. |
| | **09** | MO theory: qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about $\sigma$, $\sigma^*$, $\pi$, $\pi^*$, $n$ – Mos |
| | **10** | Basic idea about Frontier Mos (FMO); concept of HOMO, LUMO and<br>SOMO; interpretation of chemical reactivity in terms of FMO interactions |
| | **11** | Sketch and energy levels of $\pi$ Mos of i) acyclic p orbital system (C=C, conjugated diene, triene, allyl and pentadienyl systems) |
| | **12** | Sketch and energy levels of $\pi$ Mos of i) cyclic p orbital system (neutral systems: [4], [6]-annulenes; charged systems: 3-,4-,5-membered<br>ring systems) etc |
| | **13** | Problem discussion |
| | **14** | Class test |
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| **Semester III** | | |
| **Syllabus Allotted** | CC-6T : Inorganic Chemistry II **Chemical Bonding-II**<br>CC 6 P : INORGANIC CHEMISTRY-II Quantitative Estimations (Prac)<br>CC-7T : Organic Chemistry III : Chemistry of Alkenes and Alkynes.<br>SEC1T: Pharmaceutical Chemistry | |
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| | **Lecture No** | **Topics to be covered** |
| | **01** | Course outcome and Introduction of given topic |

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| **CC-6T** | **02** | Discussion about concept of molecular orbital bonding (The approximations of the theory, Linear combination of atomic orbitals (LCAO)) (elementary pictorial approach) |
| | **03** | Formation of sigma and pi bonds and delta interaction, multiple bonding. Orbital designations: *gerade*, *ungerade*, HOMO, LUMO. Orbital mixing, |
| | **04** | MO diagrams of $H_2$, $Li_2$, $Be_2$, $B_2$ and their bond energies, bond lengths and magnetic moments |
| | **05** | MO diagrams of $C_2$, $N_2$, $O_2$, $F_2$ and their ions wherever possible |
| | **06** | Heteronuclear molecular orbitals of CO, NO, $NO^+$, $CN^-$, HF |
| | **07** | Sketch and energy levels of Mos of $BeH_2$, $CO_2$ and $H_2O$ |
| | **08** | Internal class test |
| | **09** | Discussion about bond properties: bond orders, bond lengths |
| | **10** | Assignments and problem discussion |
| | **11** | Assignments and problem discussion |
| | | |
| **SEC1T** | **Lecture No** | **Topics to be covered** |
| | **01** | Course outcome and Introduction of given topic |
| | **02** | Drug discovery, design and development |
| | **03** | Basic Retrosynthetic approach for design of drugs. |
| | **04** | Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents |
| | **05** | Synthesis of antiinflammatoryagents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim) |
| | **06** | Discussion about antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), |
| | **07** | Discussion about HIV-AIDS related drugs (AZT- Zidovudine). |
| | **08** | Problem discussion |
| | **09** | Class test |
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| | **01** | Course outcome and Introduction of given topic |
| | **02** | Heat of hydrogenation, Stability and reactivity of alkenes and alkynes. |
| | **03** | Addition to C=C: mechanism (with evidence wherever applicable), reactivity and regioselectivity (Markownikoff and anti-Markownikoff additions) |
| | **04** | Stereoselective reactions: hydrogenation, halogenations, iodolactonisation, hydrohalogenation, hydration, oxymercuration-demercuration |
| | **05** | Hydroboration-oxidation and application in organic synthesis |
| | **06** | Epoxidation reactions and epoxide ring opening and its application in organic synthesis. |

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| **CC-7T** | **07** | *syn* and *anti* hydroxylation and ozonolysis reaction |
| | **08** | Addition of singlet and triplet carbenes, Simmon Smith reactions |
| | **09** | Electrophilic addition to diene (conjugated dienes and allene) and addition reactions via radical mechanism |
| | **10** | HBr addition; mechanism of allylic and benzylic bromination in competition with brominations across C=C; and use of NBS |
| | **11** | Birch reduction of benzenoid aromatics |
| | **12** | Interconversion of *E* - and *Z* - alkenes; contra-thermodynamic isomerization of internal alkenes. |
| | **13** | Addition to C≡C (in comparison to C=C): mechanism, reactivity, regioselectivity (Markownikoff and anti Markownikoff addition) and stereoselectivity |
| | **14** | Hydrogenation, halogenations, hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation reactions of alkyne |
| | **15** | Dissolving metal reduction of alkynes (Birch reduction) |
| | **16** | Reactions of terminal alkynes by exploring its acidity and interconversion of terminal and non-terminal alkynes. |
| | **17** | Problem solving |
| | **18** | Problem solving |
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| **Semester V** | | |
| **Syllabus Allotted** | CC-12T: Organic Chemistry - V<br>CC12P: TLC & 1H NMR (Practical)<br>CC-11: Inorganic Chemistry - IV<br>DSE-1: Advanced Physical Chemistry | |
| **CC 12T** | **Lecture** | **Topics to be covered** |
| | **01** | Course outcome |
| | **02** | General concept about carbohydrates chemistry |
| | **03** | Monosaccharides: Aldoses up to 6 carbons; structure of D-glucose & D-fructose (configuration & conformation) |
| | **04** | Ring structure of monosaccharides (furanose and pyranose forms) |
| | **05** | Haworth representations and non-planar conformations; anomeric effect (including stereoelectronic explanation) |
| | **06** | Mutarotation and epimerization reactions (mechanisms in relevant cases) |
| | **07** | Fischer glycosidation, osazone formation, bromine water oxidation, HNO3 oxidation of D-glucose & D-fructose. |
| | **08** | Selective oxidation of terminal –CH2OH of aldoses and reduction to alditols |
| | **09** | Lobry de Bruyn-van Ekenstein rearrangement |
| | **10** | Stepping–up (Kiliani-Fischer method) and stepping–down (Ruff's & Wohl's methods) of aldoses |

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| | **11** | End-group-interchange of aldoses; acetonide (isopropylidene) and benzylidene protections; ring-size determination |
| | **12** | Fischer's proof of configuration of (+)-glucose |
| | **13** | Disaccharides: Glycosidic linkages, concept of glycosidic bond formation by glycosyl donor-acceptor; structure of sucrose, inversion of cane sugar. heteroatom important reactions (with mechanism) of Quinoline |
| | **14** | Polysaccharides: starch (structure and its use as an indicator in titrimetric analysis). |
| | **15** | Problem answer |
| | **15** | Problem & solution |
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| **C11T** | **01** | Course outcome |
| | **02** | Valence Bond Theory and it's application |
| | **03** | Limitation of VBT |
| | **04** | Elementary Crystal Field Theory: splitting of $d^n$ configurations in octahedral, square planar and tetrahedral fields |
| | **05** | Crystal field stabilization energy (CFSE) in weak and strong fields; pairing energy |
| | **06** | Spectrochemical series. Jahn- Teller distortion |
| | **07** | Discussion about Octahedral site stabilization energy (OSSE) |
| | **08** | Application of CFT |
| | **09** | Metal ligand bonding (MO concept, elementary idea), sigma- and pi-bonding in octahedral complexes |
| | **10** | Qualitative pictorial approach for Metal ligand bonding and their effects on the oxidation states of transitional metals |
| | **12** | Problem solving |
| | **13** | Problem solving |

Teaching Plan-2023-24 (Odd semester)

**Kalyan Sur**
Department of Chemistry

| Semester-V(5H) | | |
|---|---|---|
| **Syllabus allotted** | **LANTHANOIDS AND ACTINOIDS** | |
| **INORGANIC CHEMISTRY** | **Lecture No** | **Topics to be covered** |
| | **01** | General Comparison on Electronic Configuration. |
| | **02** | Oxidation states, Colour. |
| | **03** | Spectral and magnetic properties. |
| | **04** | Lanthanide contraction. |
| | **05** | Separation of lanthanides (ion-exchange methods only). |
| | **06** | Previous Year Question (VU, CU). |
| | **07** | Frequently asked questions, IIT-JAM. |
| | **08** | Multiple choice question. |
| **Semester-V(5G)** | | |
| **Syllabus allotted** | **Lecture No** | **DSE-1 POLYMER CHEMISTRY** |
| **CRYSTALLISATION AND CRYSTALLINITY** | **01** | Determination of Crystalline. |
| | **02** | Melting point and degree of crystallinity. |
| | **03** | Morphology of crystallinity polymer. |
| | **04** | Factors affecting crystalline melting point. |
| | **05** | Most probable question answers. |
| | **06** | Question & Answer Discussion. |
| **SEMESTER-III(GENERIC)** | | |
| **Syllabus Allotted** | **Lecture No** | **GE3T EQUILIBRIA, CARBONYL COMPOUNDS** |
| **IONIC EQUILIBRIUM** | **01** | Strong, moderate and weak electrolytes, factor affecting degree of ionization. |
| | **02** | Ionization constant and ionic product of water. |
| | **03** | Ionization of weak acids and bases, pH scale, common ion effect. |
| | **04** | Salt hydrolysis-calculation of hydrolysis constant. |
| | **05** | Degree of hydrolysis and pH for different salts; Buffer solution. |
| | **06** | Solubility and solubility product of sparingly soluble salts-applications of solubility product principle. |

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| **CARBONYL COMPOUNDS** | **07** | Aldehydes and Ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde). |
| | **08** | Preparation: from acid chlorides, from nitriles and from Grignard reagents: general properties of aldehydes and ketones. |
| | **09** | Reactions: with HCN, ROH, NaHSO3, NH2-G derivatives and with Tollens' and Fehling's reagents; iodoform test; aldol condensation (with mechanism). |
| | **10** | Cannizzaro reaction (with mechanism), Wittig reaction, benzoin condensation; Clemmensen reduction. |
| | **11** | Wolff- Kishner reduction and Meerwein- Pondorff-Verley (MPV) reduction. |
| | **12** | Question & Answer discussion |
| | **13** | PYQ'S, MCQ'S, FAQ'S |
| **SEMESTER-III**<br>B.Sc General | | |
| **Syllabus Allotted** | **DSC-3T ELECTROCHEMISTRY, PHASE EQILIBRIUM** | |
| | **Lecture** | **Topics to be covered** |
| **PHASE EQUILIBRIUM & ELECTROCHEMISTRY** | **01** | Phases, components and degrees of freedom of a system. |
| | **02** | Criteria Of Phase Equilibrium. Gibbs Phase Rule and Its Thermodynamic Derivation. |
| | **03** | Derivation of Clausius - Clapeyron equation and its importance in phase equilibria. |
| | **04** | Phase diagrams of one-component systems (water and Sulphur) and two component systems involving eutectics. |
| | **05** | congruent and incongruent melting points (lead-silver, FeCl3-H2O and Na-K only). |
| | **06** | Reversible and irreversible cells. Concept of EMF of a cell. |
| | **07** | Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Electrochemical series. |
| | **08** | Thermodynamics of a reversible cell, calculation of thermodynamic properties: AG, AH and AS from EMF data. |
| | **09** | Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. |
| | **10** | Previous year question solved. |
| | **11** | MCQ'S & PYQ'S |
| | **12** | FAQ'S |

# SEMESTER -III (CC-06)

| **Syllabus Allotted** | **C6T WEAK CHEMICAL FORCES, METALLIC BON** | |
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| | **Lecture** | **Topics to be covered** |
| | **01** | Qualitative idea of valence bond and band theories. |
| **METALIC BOND & WEAK CLASSICAL FORCES** | | Semiconductors and insulators, defect in solids. |
| | **02** | van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Intermolecular forces. |
| | **03** | Hydrogen bonding (theories of hydrogen bonding, valence bond treatment), receptor-guest interactions, Halogen bonds. |
| | **04** | Frequently asked questions discussion. |
| | **05** | PYQ'S question discussion. |

Teaching Plan - 2023-24(Odd semester)

Name of the Teacher -**Sanjoy Kumar Bera**

Department of chemistry

| **Semester III** | | |
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| **Syllabus Allotted** | DSC3T: Conductance, Solutions.<br>GE3T: Aromatic Hydrocarbons, Organometallic Compounds,Aryl Halides, Alcohols, Phenols and Ethers.<br>GE3P: Physical Chemistry-LAB + Organic Chemistry-LAB. | |
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| DSC-3 | **Lecture No** | **Topics to be covered** |
| | **01** | Definition of conductance, cell constant, specific and equivalent Conductance and their relationship. |
| | **02** | Variation of specific and equivalent Conductance with dilution, kohlrausch's law, numerical problem. |
| | **03** | Ostwald's dilution law, application of conductance measurement( Determination of solubility and ionic product of water) |
| | **04** | Definition of transport number, abnormal transport number,How transport number change with temperature and concentration. |
| | **05** | Principles of Hittorf's equation and moving boundary method for determining transport number. |
| | **06** | Numerical problem solution. |
| | **07** | Previous year question ans discussion. |
| | **08** | Tutorial classes. |
| | **09** | Definition of Ideal , non Ideal solutions,and Raoult's law, devia of Raoult's law - non ideal solution. |
| | **10** | Vapour pressure composition and temperature - composition curves for Ideal and non ideal solutions. |
| | **11** | Distillation of Solutions Lever rule Azeotropes critical solution temperature. |
| | **12** | Effect of impurities of partial miscibility of liquids. |
| | **13** | Principles of steam distillation and it's applications. |
| | **14** | Nernst distribution law and it's applications. |
| | **15** | Solvent extraction and it's applications. |
| | **16** | Question answer discussion. |
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| | **01** | Course outcome and introduction on related topics. |
| | **02** | Benzene: Preparation: from phenol, by decarboxylation, from acetylene, from Benzene. sulphonic acid. Reactions: electrophilic substitution (general mechanism); nitration (with mechanism), halogenations (chlorination and bromination), sulphonatio |
| | **03** | Friedel-Craft's reaction (alkylation and acylation) (up to 4 carbons on benzene); side chain oxidation of alkyl benzenes (up to 4 carbons on benzen. |

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| GE3T | **04** | Introduction; Grignard reagents: Preparations (from alkyl and aryl halide); concept of umpolung; Reformatsky reaction. |
| | **05** | nucleophilic aromatic substitution (replacement by –OH group)and effect of nitro substituent (activated nucleophilic substitution). |
| | **06** | Preparation: 1°-, 2°- and 3°- alcohols: using Grignard reagent, reduction of aldehydes, ketones, carboxylic acid and esters. |
| | **07** | Reactions: With sodium, HX (Lucas test), oxidation (alkaline KMnO4, acidic dichromate, concentrated HNO3); Oppenauer oxidation . |
| | **08** | pinacol- pinacolone rearrangement (with mechanism) (with symmetrical diols only). Reimer -Tiemann reaction. |
| | **09** | Houben–Hoesch condensation, Schotten –Baumann reaction, |
| | **10** | Fries rearrangement and Claisen rearrangement. |
| | **11** | Williamson's ether synthesis; Reaction: cleavage of ethers with HI. |
| | **12** | Questions answers discussion. |
| | **13** | Previous years questions answers discussion. |
| | **14** | Unit questions answers discussion. |
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| **Semester V** | | |
| **Syllabus Allotted** | DSE-1: Polymer Chemistry. ( Kinetics of Polymerization).<br>DSE1P: Polymer Chemistry (Lab). | |
| **DSE 1T** | **Lecture** | **Topics to be covered** |
| | **01** | Introduction of polymer chemistry and its aims and objectives. |
| | **02** | Introduction, Addition polymerisation. Free radical polymerisation . |
| | **03** | Mechanism and kinetics of free radical polymerisation,cationic polymerisation. condensation polymerisation. |
| | **04** | Co-ordination polymerisation. Co- polymerisation. |
| | **05** | Mechanism and kinetics of co- polymerisation. |
| | **06** | Polymerisation Techniques, solution polymerisation.y |
| | **07** | Bulk polymerisation, suspension polymerisation, Emulsion polymerisation. |
| | **08** | Tutorial class |
| | **09** | Questions answers discussion. |
| | **10** | Problem solving. |
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| **DSE1P** | **1** | Preparation of urea-formaldehyde res |
| | **2** | Determination of molecular weight by end group analysis: Polyethylene glycol (PEG)(OH group). |
| | **3** | Preparation of urea-formaldehyde resin |
| | **4** | Polystyrene synthesis. |
| | **5** | Revision classes. |
| | **6.** | Viva questions discussion. |
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Teaching Plan - 2023-24(Odd semester)

Name of the Teacher -**Laboni Giri**

Department of chemistry

| **Semester III** | | |
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| **Syllabus Allotted** | **DSC1CT:** Carboxylic acids and their derivatives, Amines and Diazonium Salts<br>**CC6T: Radioactivity**<br>**C5P:** Physical Chemistry-II Lab<br>**DSC1CP:** Physical Chemistry-LAB + Organic Chemistry-Lab. | |
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| **DSC-1CT** | **Lecture No** | **Topics to be covered** |
| | **01** | Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelin |
| | **02** | Carboxylic acid derivatives (aliphatic): (Upto 5 carbons)<br><br>Preparation: Acid chlorides, Anhydrides from acids and their inter-conversion. |
| | **03** | Preparation: Esters and Amides from acids and their inter-conversion. |
| | **04** | Comparative study of nucleophilicity of acyl derivatives. |
| | **05** | Reformatsky Reaction, Perkin condensation |
| | **06** | Numerical problem solution. |
| | **07** | Previous year question answer discussion. |
| | **08** | Tutorial classes. |
| | **09** | Amines and Diazonium Salts<br><br>Amines (Aliphatic and Aromatic): (Upto 5 carbons)<br><br>Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. |
| | **10** | Reaction:Hoffmann vs. Saytzeff elimination, Carbylamine test |
| | **11** | Hinsberg test, with HNO2, Schotten – Baumann Reaction. |
| | **12** | Electrophilic substitution (case aniline): nitration, bromination, Sul phonation. |
| | **13** | Diazonium salts: Preparation: from aromatic amines. |
| | **14** | Diazonium salts:Reactions: conversion to benzene, phenol, dyes. |
| | **15** | Previous year question answer discussion. |
| | **16** | Class test |
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| | **01** | Nuclear stability and nuclear binding energy. |
| | **02** | Nuclear forces: meson exchange theory. |

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| **CC-6T** | **03** | Nuclear models (elementary idea): Concept of nuclear quantum number, magic numbers. |
| | **04** | Nuclear Reactions: Artificial radioactivity |
| | **05** | Transmutation of elements,nuclear fission |
| | **06** | Discuss on Nuclear fusion and spallation. |
| | **07** | Nuclear energy and power generation. |
| | **08** | Separation and uses of isotopes |
| | **09** | Tutorial class |
| | **10** | Previous years questions answers discussion. |
| | **11** | Questions answers discussion. |
| | **12** | Unit questions answers discussion. |
| | **13** | Class test |
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| **Semester V** | | |
| **Syllabus Allotted** | **CC11T:** Coordination Chemistry-II<br><br>**DSE1T**: Polymer solution | |
| **CC11T** | **Lecture** | **Topics to be covered** |
| | **01** | VB description and its limitations. |
| | **02** | Elementary Crystal Field Theory: splitting of dn configurations in octahedral fields. |
| | **03** | Elementary Crystal Field Theory: splitting of dn configurations in square planar and tetrahedral fields |
| | **04** | crystal field stabilization energy (CFSE) in weak and strong fields |
| | **05** | Discuss on Pairing energy |
| | **06** | Spectrochemical series. Jahn- Teller distortion. |
| | **07** | Tutorial classes |
| | **08** | Previous years questions answers discussion |
| | **09** | Problem solving. |
| | **10** | Class test |
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| | **1** | Criteria for polymer solubility, Solubility parameter |
| | **2** | Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions |

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| **DSE1T** | **3** | Flory-Huggins theory, |
| | **4** | Lower and Upper critical solution temperatures. |
| | **5** | Previous years questions answers discussion |
| | **6.** | Unit questions answers discussion. |
| | **7.** | Class test |
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