Academic year 2023-24
Semester: III
Department of Chemistry
Basirhat College

Lesson Plan for Course: CHEMISTRY (G) Code: CEMGCOR03T Credit: 4

- Course coordinator: **Dr. Bidyut Debnath**
- Course Outcome
- CO1: In Section A: Physical Chemistry-II, Laws of thermochemistry, Statement of the first and second law of thermodynamics, thermodynamic concepts of chemical equilibrium, ionic equilibrium and other related aspects are concerned.
- CO2: In Section-B: Organic Chemistry-II,Preparations and various reactions of aromatic hydrocarbons, organometallic compounds, aryl halides, alcohols, phenols, ethers and carbonyl compounds are discussed.
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Course planner

Sl	Course Topic	Teacher	Class-hr	Remarks
Aug + Sep	Chemical Energetics: Intensive and extensive variables; state and path functions; isolated, closed and open systems.	B.D.	2hr	Class starts from 21.09.2023
	Chemical Equilibrium: Thermodynamic conditions for equilibrium, degree of advancement; Variation of free energy with degree of advancement; Equilibrium constant and standard Gibbs' free energy change.	S.M.	2hrs	
	Aromatic Hydrocarbons: Benzene(preparation): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid	SK	2hrs	
	Alcohols, Phenols and Ethers: Diols: Preparation (with OsO4); pinacol- pinacolone rearrangement (with mechanism) (with symmetrical diolsonly). Ethers:Preparation: Williamson's ether synthesis; Reaction: cleavage of ethers with HI.	MS	2 hrs	
Sep	Chemical Energetics:zeroth law of thermodynamics; Concept of heat, work, internal energy and statement of first law, enthalpy, H; relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases	BD	5hrs	
	Chemical Equilibrium: Definitions of KP, KC and KX and relation among them; van't Hoff's reaction isotherm, isobar and isochore from different standard states; 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	SM	6hrs	
Oct	Aromatic Hydrocarbons: Reactions: electrophilic substitution (general mechanism); nitration (with mechanism), halogenations (chlorination and bromination), sulphonation and Friedel-Craft's reaction (alkylation and acylation) (up to 4 carbons on benzene); side chain oxidation of alkyl benzenes (up to 4 carbons on benzene). Organometallic Compounds: Introduction; Grignard reagents: Preparations (from alkyl and aryl halide); concept of umpolung; Reformatsky reaction	SK	6hrs	
	Alcohols, Phenols and Ethers: Phenols:Preparation: cumenehydroperoxide method, from diazonium salts; acidic nature of phenols; Reactions: electrophilic substitution: nitration and halogenations; Reimer -Tiemann reaction, Houben–Hoesch condensation, Schotten –Baumann reaction, Fries rearrangement and Claisen rearrangement.	MS	5hrs	

Nov	Chemical Energetics: Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications	BD	3hrs	
	Ionic Equilibria: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water; Ionization of weak acids and bases, pH scale, common ion effect	SM	4hrs	
	Aryl Halides:Preparation: (chloro-, bromo- and iodobenzene): from phenol, Sandmeyer reactions. Reactions (Chlorobenzene): nucleophilic aromatic substitution (replacement by –OH group) and effect of nitro substituent (activated nucleophilic substitution).	SK	3hrs	
	Carbonyl Compounds:(Formaldehye, acetaldehyde, acetone and benzaldehyde): Preparation: from acid chlorides, from nitriles and from Grignard reagents; general properties of aldehydes and ketones; Reactions: with HCN, ROH, NaHSO3, NH2-G derivatives and with Tollens' and Fehling's reagents; iodoform test;	MS	4hrs	
	Assessment: Mid-term Test			
Dec	Chemical Energetics: Laws of thermochemistry; bond energy, bond dissociation energy and resonance energy from thermochemical data	BD	1 hrs	
	Ionic Equilibria: Salt hydrolysis-calculation of hydrolysis constant	SM	1 hrs	
	Alcohols, Phenols and Ethers: Preparation of alcohols: 1°-, 2°- and 3°- alcohols: using Grignard reagent, reduction of aldehydes, ketones, carboxylic acid and esters	SK	1 hrs	
	Carbonyl Compounds:aldol condensation (with mechanism); Cannizzaro reaction (with mechanism)	MS	1 hrs	
Dec	Chemical Energetics: Kirchhoff's equations and effect of pressure on enthalpy of reactions; Adiabatic flame temperature; explosion temperature. Statement of the second law of thermodynamics; Concept of heat reservoirs and heat engines; Carnot cycle; Physical concept of Entropy; Carnot engine, refrigerator and efficiency;	BD	2hrs	
	Ionic Equilibria: degree of hydrolysis and pH for different salts; Buffer solutions; Solubility and solubility product of sparingly soluble salts	SM	2 hrs	
	Alcohols, Phenols and Ethers: Reactions: With sodium, HX (Lucas test), oxidation (alkaline KMnO4, acidic dichromate, concentrated HNO3);	SK	2hrs	
	Carbonyl Compounds:Wittig reaction, benzoin condensation; Clemmensen reduction, Wolff- Kishner reduction	MS	2hrs	
Dec /Jan	Chemical Energetics :Entropy change of systems and surroundings for various processes and transformations; Auxiliary state functions (G and A) and Criteria for spontaneity and equilibrium.	BD	1hrs	
	Ionic Equilibria: Applications of solubility product principle.	SM	1 hrs	
	Alcohols, Phenols and Ethers: Reactions Oppenauer oxidation	SK	1 hrs	
	Carbonyl Compounds:Meerwein-Pondorff- Verley (MPV) reduction.	MS	1 hrs	
Jan	Assessment: End-term Test		Total:60 Hrs	

Resources :

1. Books:

- Parmar, V. S. *A Text Book of Organic Chemistry*, S. Chand & Sons.
- Palit, S. R., *Elementary Physical Chemistry* Book Syndicate Pvt. Ltd.
- Pahari, S., *Physical Chemistry* New Central Book Agency
- Madan, R. L. *Organic Chemistry*, S. Chand & Sons.
- Bahl, A. &Bahl, B.S. *Advanced Organic Chemistry,* S. Chand, 2010.

2. Other resources :

*Remarks will specify

- The nature of the class-topic (viz. Theoretical, Practical, and Tutorial).
- Methodology of teaching (whether using ICT, engaging students in group discussion, quiz etc. etc.)
- Different modes of assessment. (Please check UGC evaluation reforms).

Semester: III
Department of Chemistry
Basirhat College

Lesson Plan for Course: CHEMISTRY (G) Code: CEMGCOR03P Credit: 2

- Course coordinator: **Dr. Monojit Sarkar**
- Course Outcome
- CO1: In Section A: Physical Chemistry-LAB, some simple experiments of Thermochemistry and pH are to be done.
- CO2: In Section B: Organic Chemistry-LAB, Identification of a pure solid and liquid organic compound is to be done.

Course planner

Sl	Course Topic	Teacher	Class-hr	Remarks
Aug Sep	Determination of heat capacity of calorimeter for different volumes	B.D.	2hr	Class starts from 21.09.2023
	Determination of heat capacity of calorimeter for different volumes	S.K	2hrs	
	Determination of heat capacity of calorimeter for different volumes.	MS	2 hrs	
Oct	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.	BD	4hrs	
	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.	SM	2hrs	
	Determination of enthalpy of ionization of acetic acid.	MS	6hrs	
	Identification of a pure organic liquid compound: aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene.	SK	4hrs	

Nov	Preparation of buffer solutions ofSodium acetate-acetic acid and find the pH of the buffer solution by colour matching method .	BD	2hrs	
	Identification of a pure organic solid compound:oxalic acid, tartaric acid, succinic acid.	SK	4hrs	
	Preparation of buffer solutions of Ammonium chloride-ammonium hydroxide and find the pH of the buffer solution by colour matching method.	MS	6hrs	
Dec	Study of the solubility of benzoic acid in water	BD	4hrs	
	Identification of a pure organic solid compound: resorcinol, urea, glucose, benzoic acid and salicylic acid. Identification of a pure organic liquid compound: aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene	SK	6hrs	
	Identification of a pure organic liquid compound: methyl alcohol, ethyl alcohol, acetone.	MS	4hrs	
Dec/ Jan	Identification of a pure organic liquid compound: aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene.	BD	2hrs	
	Identification of a pure organic liquid compound: aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene.	SK	2hrs	
	Identification of a pure organic liquid compound: aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene	MS	4hrs	
Jan	Assessment: End-term Test		Total:60 Hrs	

Resources:

Books:

- Bhattacharyya, R. C, *A Manual of Practical Chemistry*.
- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbookof Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.
- Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

3. Other resources :

*Remarks will specify

- The nature of the class-topic (viz. Theoretical, Practical, and Tutorial).
- Methodology of teaching (whether using ICT, engaging students in group discussion, quiz etc. etc.)
- Different modes of assessment. (Please check UGC evaluation reforms).

Semester: V
Department of Chemistry
Basirhat College

Lesson Plan for Course: POLYMER CHEMISTRYCode: CEMGDSE01T Credit: 4

- Course coordinator: **Dr. Bidyut Debnath**
- Course Outcome
- CO1: This course includes Introduction and history of polymeric materials, Functionality and its importance of polymer.
- CO2: Kinetics of Polymerization: Crystallization and crystallinityof polymeric materials are focused.
- CO3: This course includes nature and structure of polymers, determination of molecular weight of polymers, glass transition temperature (Tg) and determination of Tg, polymer solubility.
- CO4: Physical, thermal, Flow & Mechanical Properties of polymers are discussed. A brief idea of conducting polymers is also to be studied.

Course planner

Sl	Course Topic	Teacher	Class-hr	Remarks
	Class starts from 21.09.2023			
Aug + Sep	Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of polymers.	SM	4hrs	
	Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization.	BD	4hrs	
	Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.	PD	6hrs	
Sep + Oct	Bi-functional systems, Poly-functional systems.	BD	4hrs	
	Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.	PD	4hrs	
	Structure Property relationships.(*Mn*, *Mw*, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.	BD	6hrs	
Nov	Structure Property relationships. (*Mn*, *Mw*, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.	BD	6hrs	
	Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).	MS	2hrs	
	Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).	MS+BD	6hrs	
	Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free	PD	4hrs	

	energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.			
Dec	Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.	PD	4hrs	
	Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, etc.	BD	10hrs	
Jan	Assessment: End-term Test		Total:60 Hrs	

Resources :

4. Books:

Seymour, R.B.&Carraher, C.E. *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.

• Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.

• Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971. Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.

• Lenz, R.W. *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers, New York, 1967.

5. Other resources :

*Remarks will specify

- The nature of the class-topic (viz. Theoretical, Practical, and Tutorial).
- Methodology of teaching (whether using ICT, engaging students in group discussion, quiz etc. etc.)
- Different modes of assessment. (Please check UGC evaluation reforms).

Semester: V
Department of Chemistry
Basirhat College

Lesson Plan for Course: POLYMER CHEMISTRY Code: CEMGDSE01P Credit: 2

- Course coordinator: **Dr. Bidyut Debnath**
- Course Outcome
- CO1: Technique and principles of free radical solution polymerization, Emulsion polymerization, purification of monomer, interfacial polymerization,preparation of urea-formaldehyde resin are discussed.
- CO2: Polymer characterization and polymer analysis are also included.

Course planner

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jul				Class starts

Aug Sep	1. **Polymer synthesis** 1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid(AA). a. Purification ofmonomer b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bisisobutylonitrile (AIBN) 2. Preparation of nylon66/6	BD	24hrs	from 21.09.2023
Oct	1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) andphenolphthalein a. Preparation ofIPC b. Purification ofIPC c. Interfacialpolymerization	BD+MS	12hrs 12 hrs	
Nov	3. Redox polymerization ofacrylamide 4. Precipitation polymerization ofacrylonitrile 5. Preparation of urea-formaldehyderesin 6. Preparations of novalac resin/resoldresin. 7. Microscale Emulsion Polymerization ofPoly(methylacrylate).	BD	6 hrs	
Dec	1. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in thepolymer. **Tutorial**	BD	6hrs	
Jan	Assessment: End-term Test		Total: 60Hrs	

Resources:

Books:

- M.P. Stevens, *Polymer Chemistry: An Introduction*, 3rd Ed., Oxford University Press,1999.
- H.R. Allcock, F.W. Lampe & J.E. Mark, *Contemporary Polymer Chemistry*, 3rd ed. Prentice-Hall(2003)
- F.W. Billmeyer, *Textbook of Polymer Science*, 3rded.Wiley-Interscience(1984)
- J.R. Fried, *Polymer Science and Technology*, 2nded.Prentice-Hall(2003)
- P. Munk& T.M. Aminabhavi, *Introduction to Macromolecular Science*, 2nded.John Wiley & Sons(2002)
- L. H. Sperling, *Introduction to Physical Polymer Science*, 4thed.John Wiley & Sons (2005)

- M.P. Stevens, *Polymer Chemistry: An Introduction* 3rded.Oxford University Press (2005).
- Seymour/ Carraher's Polymer Chemistry, 9th ed.by Charles E. Carraher, Jr.(2013).

6. Other resources :

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- The nature of the class-topic (viz. Theoretical, Practical, and Tutorial).
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- Different modes of assessment. (Please check UGC evaluation reforms).

Semester: VI
Department of Chemistry
Basirhat College

Lesson Plan for Course: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE Code: CEMGDSE03T, Credit: 4

- Course coordinator: **Dr. Monojit Sarkar**
- CO1: Composition, properties, uses of different Silicate materials like glass, Ceramics, cements are discussed.
- CO2: Compositions, industrial preparation and use of different types of fertilizers are discussed.
- CO3: Chemistry about Surface Coating materials like paints, pigments dyes, additives are discussed.
- CO4: Chemistry of different cells (batteries), alloys, catalyst are discussed.
- CO5: Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

Course planer

Sl	Course Topic	Teacher	Class-hrs	Remarks
Feb + March	*Glass:*Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.	MS	8 hrs	Class starts from
	Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.	BD	5 hrs	
April	*Ceramics:*Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre. *Cements:*Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.	MS	8 hrs	
	Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.	PD	5 hrs	

May	Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.	MS	7 hrs	
	Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.	BD	8 hrs	
	n alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.	SM	8 hrs	
May	General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts. Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.	BD, SK	10hrs	
	Assessment: End-term Test		Total: 60Hrs	

Resources :

Books:

7.
8. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
9. • R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
10. • W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
11. • J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
12. • P. C. Jain & M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
13. • R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
14. • B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
15.

Other resources :

*Remarks will specify

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Semester: VI
Department of Chemistry
Basirhat College

Lesson Plan for Course: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE
Code: CEMGDSE03P Credit: 2

- Course coordinator: **Dr. Suman Mandal**
- Course Outcome
- CO1: Estimation to be done of essential components fertilizer.

- CO2: Determination of composition of dolomite, analysis of (Cu, Ni); (Cu, Zn) in alloy, analysis of Cement are to be done.

Course planner

Sl	Course Topic	Teacher	Class-hrs	Remarks
Feb				Class starts from
March	1.Determination of free acidity in ammonium sulphatefertilizer. 2.Estimation of calcium in calcium ammonium nitratefertilizer. 3. Estimation of phosphoric acid in superphosphatefertilizer. 4. Electroless metallic coatings on ceramic and plasticmaterial.	BD	24 hrs	
April	1. Determination of composition of dolomite (by complexometrictitration).	SM	12hrs 12 hrs	
May	2. Analysis of (Cu, Ni); (Cu, Zn) in alloy or syntheticsamples. 3. Analysis ofCement.	BD	6 hrs	
	4. Preparation of pigment (zincoxide).	MS	6hrs	
	Assessment: End-term Test		Total: 60Hrs	

Resources :

1. Books: E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd.UK.
2. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, NewDelhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, NewDelhi.
4. J. A. Kent: Riegel's*Handbook of Industrial Chemistry*, CBS Publishers, NewDelhi.
5. P. C. Jain, M. Jain: *Engineering Chemistry*, DhanpatRai& Sons,Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, NewDelhi.
7. Sharma, B.K. & Gaur, H. *Industrial Chemistry*, Goel Publishing House, Meerut (1996).
8. *Remarks will specify

- The nature of the class-topic (viz. Theoretical, Practical, and Tutorial).
- Methodology of teaching (whether using ICT, engaging students in group discussion, quiz etc. etc.)

- Different modes of assessment. (Please check UGC evaluation reformation