Semester: I
Department of Chemistry
Basirhat College

Lesson Plan for Course: CHEMISTRY (G) Code: CEMGCOR01T Credit: 4

- Course coordinator : **Dr. Bidyut Debnath**
- Course Outcome
- CO1: In section A of the curriculum some fundamental topics of Inorganic Chemistry-I like atomic structure, Chemical Periodicity, Acids and bases and Redox reactions are discussed.
- CO2: In Section B: Some Fundamentals of Organic Chemistry about *Electronic displacement like* inductive effect, resonance and hyperconjugation etc. are discussed.
- CO3: Some topics of Stereochemistry like isomerism, chirality, optical activity, elements of symmetry,nomenclature etc. are discussed.
- CO4: Nucleophilic Substitution and Elimination Reactions are discussed.
- CO5: Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures: alkanes, alkenes and alkynes.

Course planner

Sl	Course Topic	Teacher	Class-hour	Remarks *
Oct	Atomic Structure: Bohr's theory for hydrogen atom (simple mathematical treatment), atomic spectra of hydrogen and Bohr's model	B.D.	1hr	Class starts from 01.10.2021
	Acids and bases: Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept,	S.M.	2hrs	
	Fundamentals of Organic Chemistry: *Electronic displacements*: inductive effect, resonance and hyperconjugation	M.S.	1 hrs	
	Stereochemistry: Different types of isomerism; geometrical and optical isomerism;	S.K.	-	
Nov	Atomic Structure: Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle, Hund's rule, electronic configuration of many-electron atoms, *Aufbau*principle and its limitations	BD	5hrs	
	classification of Lewis acids and bases, Lux-Flood concept	SM	2hrs	
	Fundamentals of Organic Chemistry: cleavage of bonds: homolytic and heterolytic; structure of organic molecules on the basis of VBT; nucleophiles electrophiles; reactive intermediates: carbocations, carbanions and free radicals.	MS	3 hrs	
	Stereochemistry: concept of chirality and optical activity (up to two carbon atoms); asymmetric carbon atom; elements of symmetry (plane and centre); interconversion of Fischer and Newman representations; enantiomerism and diastereomerism, *meso*compounds; *threo*and *erythro*, D and L, *cis*and *trans* nomenclature;	SK	5 hrs	
Dec	Chemical Periodicity: Classification of elements on the basis of electronic configuration: general characteristics of s-, p-, d- and f-block elements. Positions of hydrogen and noble gases and electronegativity; periodic and group-wise variation of above properties in respect of s- and p- block elements.	BD	4hrs	
	Chemical Periodicity: solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.	SM	3 hrs	

	Alkanes:(up to 5 Carbons). *Preparation:* catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions:* mechanism forfree radical substitution: halogenation.	MS	2hrs	
	Stereochemistry: CIP Rules: *R/S* (upto 2 chiral carbon atoms) and *E/Z* nomenclature.	SK	1hrs	
	Assessment: Mid-term Test			
		BD	-	
	Redox reactions: Balancing of equations by oxidation number	SM	1 hrs	
	Alkenes:Preparation: elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides; *cis*alkenes (partial catalytic hydrogenation) and *trans* alkenes (Birch reduction).	MS	1 hrs	
Dec/Jan	Atomic and ionic radii, ionization potential, electron affinity	BD	1hrs	
	• Redox reactions: Balancing of equations by ion-electron method oxidimetry and reductimetry. • *Nucleophilic substitutions*: SN1 and SN2 reactions	SM	2 hrs	
	Alkenes, Reactions: cis-addition (alkaline KMnO4) and *trans*-addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and antiMarkownikoff's addition], hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction.	MS	1 hrs	
	Alkynes: (up to 5 Carbons). *Preparation:* acetylene from CaC2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides. *Reactions:* formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alkaline KMnO4.	SK	1hrs	
Jan	• eliminations: E1 and E2 reactions (elementary mechanistic aspects); Saytzeff and Hofmann eliminations;elimination*vs*substitution	SM	2hrs	
	Assessment: End-term Test		Total:60Hrs	

Resources :

1. Books:

- B.Sc. (general course) by Dr. S. Misra, Dr. G.C. Giri, Dr. S.K.Roy and Dr. G. Chanda (Santra Publication)
- Parmar, V. S. *A Text Book of Organic Chemistry*, S. Chand & Sons.
- Madan, R. L. *Organic Chemistry*, S. Chand & Sons.

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: I
Department of Chemistry
Basirhat College

Lesson Plan for Course: CHEMISTRY (G) Code: CEMGCOR01P Credit: 2

- Course coordinator: **Dr. Monojit Sarkar**
- Course Outcome
- CO1: In Section A: Some simple experiments of Inorganic Chemistry by titrimetric method are to be done.
- CO2: In Section B: Organic Chemistry parts some tests of organic functional group and elemental analysis are to be done.

Course planner

Sl	Course Topic	Teacher	Class-hour	Remarks*
	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture	B.D.	2hr	Class starts from 01.10.2021
	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture	S.M.	2hrs	
	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture	M.S.	2hrs	
	Detection of special elements (N, Cl, and S) in organic compounds	S.K.	2 hrs	
Nov	Estimation of oxalic acid by titrating it with KMnO4.	BD	4hrs	
	Estimation of oxalic acid by titrating it with KMnO4. Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.	SM	4hrs	
	Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.	MS	4hrs	
	Detection of special elements (N, Cl, and S) in organic compoundsSolubility and Classification (solvents: H2O, dil. HCl, dil. NaOH)	SK	6hrs	
Dec	Estimation of Cu (II) ions iodometrically using Na2S2O3.	BD	4hrs	
	Estimation of Cu (II) ions iodometrically using Na2S2O3.	SM	2 hrs	
	Estimation of water of crystallization in Mohr's salt by titrating with KMnO4.	MS	4hrs	
	Solubility and Classification (solvents: H2O, dil. HCl, dil. NaOH)	SK	2hrs	
	Solubility and Classification (solvents: H2O, dil. HCl, dil. NaOH)	SM	2 hrs	
	Detection of functional groups: Aromatic-NO2, Aromatic -NH2	MS	2 hrs	
	Detection of functional groups: -COOH, Carbonyl	SM	2 hrs	
	Detection of functional groups: Aromatic-OH, carbonyl	BD	2 Hrs	
Dec/Jan	Detection of functional groups: Aromatic-OH, carbonyl	BD	2 hrs	
	Detection of special elements (N, Cl, and S) in organic unknown compounds	SM	2 hrs	
	Detection of special elements (N, Cl, and S) in organic unknown compounds	MS	2 hrs	
	Detection of functional groups of organic unknown compounds	SM	4 hrs	
Jan	Solubility and Classification of organic unknown compounds	PD	2 hrs	
	Detection of functional groups of organic unknown compounds	MS	2 hrs	
	Assessment: End-term Test		Total: 60 Hrs	

Resources :

Books:

- Advanced Practical Chemistry: By S.C. Das.

- Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.

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).

COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2021-22
CEMG/ SEM-II (JAN-JUNE 2022)

Paper II

Credits: Theory-04 Theory: 60 Lectures Courses: CEMHGEC02T& CEMGCOR02T

Course coordinator: **Dr. Bidyut Debnath**

CO1: In Section A: Physical Chemistry-I part Kinetic Theory of gases, ideal gas, deviation from ideality,Real gases, Maxwell's distribution of speed and kinetic energy, viscosity etc. are discussed.
CO2: Chemistry of liquids and solids are discussed keeping in mind the following points: surface tension, viscosity, crystal systems, unit cells, Bravais lattice types, Symmetry elements; Laws of Crystallography, Defects in crystals; Glasses and liquid crystals.
CO3: Some points are focused of Chemical Kinetics e.g., Order and molecularity, rate, determination of order of a reaction, temperature dependence of rate constant, Arrhenius equation etc.
CO4: In Section B: Inorganic Chemistry-II includes Chemical Bonding and Molecular Structure. Here different aspects of ionic and covalent bonding with their fundamental approach are studied.
CO5: Comparative study of p-block elements highlighting the following points: Electronic configuration, common oxidation states, inert pair effect, etc.

Course planner

SL	Course Topic	Teacher	Class Hrs	Remarks
	Section A: Physical Chemistry-I **Kinetic Theory of Gases and Real gases (10 Lectures)** Concept of pressure and temperature; Collision of gas molecules; Collision diameter; Collision number and mean free path; Frequency of binary collisions (similar and different molecules)	SM	2	
	Section A: Physical Chemistry-I **Liquids (06 Lectures)** Definition of Surface tension, its dimension and principle of its determination using stalagmometer.	MS	2	
	Section A: Physical Chemistry-I **Chemical Kinetics (08 Lectures)**	BD	2	

	Introduction of rate law, Order and molecularity; Extent of reaction; rate constants; Rates of First, second and nth order reactions and their Differential and integrated forms (with derivation);			
Jan	***Section B: Inorganic Chemistry-II*** **(30 Lectures) Marks: 25** **Chemical Bonding and Molecular Structure (16 Lectures)** *Ionic Bonding:* General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds.	SK	2	
Feb	***Section A: Physical Chemistry-I*** **Kinetic Theory of Gases and Real gases (10 Lectures)** Rate of effusion, Nature of distribution of velocities, Maxwell's distribution of speed and kinetic energy; Average velocity, root mean square velocity and most probable velocity; Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases	SM	4	
	Section A: Physical Chemistry-I **Liquids (06 Lectures)** Viscosity of a liquid and principle of determination of coefficient of viscosity using Ostwald viscometer; Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only)	MS	4	
	Section A: Physical Chemistry-I **Chemical Kinetics (08 Lectures)** Rates of First, second and nth order reactions and their Differential and integrated forms (with derivation); Pseudo first order reactions; Determination of order of a reaction by half-life and differential method; Opposing reactions, consecutive reactions and parallel reactions Temperature dependence of rate constant; Arrhenius equation, energy of activation;	BD	4	
	Section B: Inorganic Chemistry-II **Chemical Bonding and Molecular Structure (16 Lectures)** Statement of Born-Landé equation for calculation of lattice energy, BornHaber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.	SK	4	
	Kinetic Theory of Gases and Real gases (10 Lectures) Deviation of gases from ideal behavior; compressibility factor; Boyle temperature; Andrew‟s and Amagat‟s plots; van der Waals equation and its features; its derivation and application in explaining real gas behaviour; Existence of critical state, Critical constants in terms of van der Waals constants; Law of corresponding states Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only)	SM	4	
	Section A: Physical Chemistry-I **Solids (06 Lectures)** Forms of solids, crystal systems, unit cells, Bravais lattice types,	MS	4	

	Symmetry elements; Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices; Miller indices of different planes and interplanar distance, Bragg‟s law; Structures of NaCl, KCl and CsCl (qualitative treatment only); Defects in crystals; Glasses and liquid crystals.			
	Section A: Physical Chemistry-I **Chemical Kinetics (08 Lectures)** Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment) ***Section B: Inorganic Chemistry-II*** **Comparative study of p-block elements: (14 Lectures)** Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important	BD	2+2	
Mar	***Section B: Inorganic Chemistry-II*** **Chemical Bonding and Molecular Structure (16 Lectures)** *Covalent bonding:* VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds.	SK	4	
	Section B: Inorganic Chemistry-II **Comparative study of p-block elements: (14 Lectures)** Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements: i)B-Al-Ga-In-Tl	SM	2	
	Section A: Physical Chemistry-I **Solids (06 Lectures)** Bragg's law; Structures of NaCl, KCl and CsCl (qualitative treatment only); Defects in crystals; Glasses and liquid crystals.	MS	2	
	Section B: Inorganic Chemistry-II **Comparative study of p-block elements: (14 Lectures)** Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements: ii)C-Si-Ge-Sn-Pb	BD	4	
Apr	***Section B: Inorganic Chemistry-II*** **(30 Lectures) Marks: 25** **Chemical Bonding and Molecular Structure (16 Lectures)** MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s*-*s*, *s*-*p* and *p*-*p*combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (including idea of *s*- *p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO+. Comparison of VB and MO approaches.	SK	4	

	Section B: Inorganic Chemistry-II **Comparative study of p-block elements: (14 Lectures)** Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements: iii)N-P-As-Sb-Bi	SM	2	
	Section B: Inorganic Chemistry-II **Comparative study of p-block elements: (14 Lectures)** Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements: iv)O-S-Se-Te	MS	2	
	Section B: Inorganic Chemistry-II **Comparative study of p-block elements: (14 Lectures)** Group trends in electronic configuration, modification of pure elements, common oxidation states, inert pair effect, and their important compounds in respect of the following groups of elements: v)F-Cl-Br-I	BD	2	
May	***Section B: Inorganic Chemistry-II*** **Chemical Bonding and Molecular Structure (16 Lectures)** MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (Including idea of *s- p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO+. Comparison of VB and MO approaches.	SK	2	
			60	

Resources:
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).

COURSE PLANER
Department of Chemistry
Basirhat College
CEMG/ SEM-II (JAN-JUNE 2022)
Paper II

CEMHGEC01P: STATES OF MATTER & CHEMICAL KINETICS, CHEMICAL BONDING & MOLECULAR STRUCTUR, p-BLOCK ELEMENTS LAB

Courses: CEMHGEC02P& CEMGCOR02P Credit: 2

Course coordinator: **Dr. Bidyut Debnath**

CO1: In Section A: Physical Chemistry, experiments of surface tension, viscosity, study the kinetics of some reactions are to be done.

CO2: In Section B: Inorganic Chemistry, Qualitative semimicro analysis of mixtures containing radicals are to be done. Emphasis should be given to the understanding of the chemistry of different reactions.

Course planner

SL	Course Topic	Teacher	Class Hrs	Remarks
Jan	***Section A: Physical Chemistry-LAB*** (I) Surface tension measurement (use of organic solvents excluded) a) Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer b) Study of the variation of surface tension of a detergent solution with concentration	SK+ PD	4	
	Section A: Physical Chemistry-LAB (I) Surface tension measurement (use of organic solvents excluded) a) Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer b) Study of the variation of surface tension of a detergent solution with concentration	MS+ SM	4	
	Section A: Physical Chemistry-LAB (I) Surface tension measurement (use of organic solvents excluded) a) Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer b) Study of the variation of surface tension of a detergent solution with concentration	BD+ MS	4	
	Section A: Physical Chemistry-LAB (I) Surface tension measurement (use of organic solvents excluded) a) Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer b) Study of the variation of surface tension of a detergent solution with concentration	SM+ PD	4	
	Section A: Physical Chemistry-LAB (II) Viscosity measurement (use of organic solvents excluded) a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald‟s viscometer b) Study of the variation of viscosity of an aqueous solution with concentration of solute (III) Study the kinetics of the following reactions a) Initial rate method: Iodide-persulphate reaction b) Integrated rate method: (i) Acid hydrolysis of methyl acetate with hydrochloric acid (ii) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate	SK+ PD	8	

	Section A: Physical Chemistry-LAB (II) Viscosity measurement (use of organic solvents excluded) a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald‟s viscometer b) Study of the variation of viscosity of an aqueous solution with concentration of solute (III) Study the kinetics of the following reactions a) Initial rate method: Iodide-persulphate reaction b) Integrated rate method: (i) Acid hydrolysis of methyl acetate with hydrochloric acid (ii) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate	MS+ SM	8	
	Section A: Physical Chemistry-LAB (II) Viscosity measurement (use of organic solvents excluded) a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald‟s viscometer b) Study of the variation of viscosity of an aqueous solution with concentration of solute (III) Study the kinetics of the following reactions a) Initial rate method: Iodide-persulphate reaction b) Integrated rate method: (i) Acid hydrolysis of methyl acetate with hydrochloric acid (ii) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate	BD+ MS	8	
Feb	***Section A: Physical Chemistry-LAB*** (II) Viscosity measurement (use of organic solvents excluded) a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald‟s viscometer b) Study of the variation of viscosity of an aqueous solution with concentration of solute (III) Study the kinetics of the following reactions a) Initial rate method: Iodide-persulphate reaction b) Integrated rate method: (i) Acid hydrolysis of methyl acetate with hydrochloric acid (ii) Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate	SM+ PD	8	
	Section B: Inorganic Chemistry-LAB **Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.** Acid Radicals: Cl^-, Br^-, I^-, NO_2^-, NO_3^-, S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	SK+ PD	8	

Mar	***Section B: Inorganic Chemistry-LAB*** **Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.** Acid Radicals: Cl-, Br-, I-, NO_2^-, NO_3^-,S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	MS+ SM	8	
	Section B: Inorganic Chemistry-LAB **Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.** Acid Radicals: Cl-, Br-, I-, NO_2^-, NO_3^-,S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	BD+ MS	8	
	Section B: Inorganic Chemistry-LAB **Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.** Acid Radicals: Cl-, Br-, I-, NO_2^-, NO_3^-,S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	SM+ PD	8	
Apr	***Section B: Inorganic Chemistry-LAB*** **Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.** Acid Radicals: Cl-, Br-, I-, NO_2^-, NO_3^-,S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	SK+ PD	8	
	Section B: Inorganic Chemistry-LAB **Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.** Acid Radicals: Cl-, Br-, I-, NO_2^-, NO_3^-,S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	MS+ SM	8	
	Section B: Inorganic Chemistry-LAB **Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.** Acid Radicals: Cl-, Br-, I-, NO_2^-, NO_3^-,S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	BD+ MS	8	
	Section B: Inorganic Chemistry-LAB **Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.** Acid Radicals: Cl-, Br-, I-, NO_2^-, NO_3^-,S^{2-}, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}, H_3BO_3. Basic Radicals: Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}, Cr^{3+}, Mn^{2+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, NH_4^+.	SM+ PD	8	

May	***Section A: Physical Chemistry-LAB &*** ***Section B: Inorganic Chemistry-LAB*** Revision	SK+ PD	2	
	Section A: Physical Chemistry-LAB & ***Section B: Inorganic Chemistry-LAB*** Revision	MS+ SM	2	
	Section A: Physical Chemistry-LAB & ***Section B: Inorganic Chemistry-LAB*** Revision	BD+ MS	2	
	Section A: Physical Chemistry-LAB & ***Section B: Inorganic Chemistry-LAB*** Revision	SM+ PD	2	
	TOTAL		128	

Resources:

Reference Books:

1. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta, 2003.
2. Palit, S.R., *Practical Physical Chemistry* Science Book Agency
3. Mukherjee, N.G., *Selected Experiments in Physical Chemistry* J. N. Ghose & Sons
4. Dutta, S.K., *Physical Chemistry Experiments* Bharati Book Stall
5. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
6. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011)

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: II
Department of Chemistry
Basirhat College

Lesson Plan for Course: ***Section A: Physical Chemistry & Section B: Inorganic Chemistry*** Code: **CEMGCOR02P**

Credit: 2

- Course coordinator: Dr. Swastik Karmakar
- Course Outcome

CO1:In Section A: Physical Chemistry, experiments of surface tension, viscosity,

study the kinetics of some reactions are to be done.

CO2: In Section B: Inorganic Chemistry, Qualitative semimicro analysis of mixtures containing radicals are to be done. Emphasis should be given to the understanding of the chemistry of different reactions.

Course planner

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jan	➢ ***Section A: Physical Chemistry*** a) Determination of the surface tension of a liquid or a dilute solution using a Stalagmometer. b) Study of the variation of surface tension of a detergent solution with concentration.	BD+SM	12hrs	Class started from 05.03.21
Feb	c) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer. d) Study of the variation of viscosity of an aqueous solution with concentration of solute.	MS+SK	12hrs	
	d) Acid hydrolysis of methyl acetate with hydrochloric acid	MS+PD	6hrs	
Mar	➢ ***Section B: Inorganic Chemistry*** Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions: Acid Radicals: Cl-, Br-, I-, NO2-, NO3-,S2-, SO42-, PO43-, BO33-, H3BO3.	PD+SM	10hrs	
Apr	Basic Radicals: Na+, K+, Ca2+, Sr2+, Ba2+, Cr3+, Mn2+, Fe3+, Ni2+, Cu2+, NH4+.	SK+BD	10hrs	
May	Mixtures Analysis	MS+SM	10hrs	
Jun	Assessment: End-term Test			
		Total:60Hrs		

Resources :

Books:

➢ ***Section A: Physical Chemistry***

1. *University Hand Book of Undergraduate Chemistry Experiments,* edited by Mukherjee, G. N., University of Calcutta, 2003.
2. Palit, S.R., *Practical Physical Chemistry* Science Book Agency
3. Mukherjee, N.G., *Selected Experiments in Physical Chemistry* J. N. Ghose& Sons
4. Dutta, S.K., *Physical Chemistry Experiments* Bharati Book Stall

➢ **Section B: Inorganic Chemistry**

1. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.
2. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).

4. 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: 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
Sep	Chemical Energetics: Intensive and extensive variables; state and path functions; isolated, closed and open systems.	B.D.	2hr	Class starts from 01.09.2021
	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	
Oct	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	
	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 :

5. 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.

6. 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
Sep	Determination of heat capacity of calorimeter for different volumes	B.D.	2hr	Class starts from 01.09.2021
	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.

7. 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).

COURSE PLANER
Department of Chemistry
Basirhat College
CEMG/ SEM-IV (JANU-JUNE 2022)

Paper IV

CEMHGEC04T:, 60 Lectures **Courses:** CEMHGEC04T& CEMGCOR04T Credits: 04

Course coordinator: **Dr. Bidyut Debnath**

CO1: In Section A: Physical Chemistry-III part, chemistry of Ideal solutions and Raoult's law and related aspects are discussed.
CO2: In this section phase rule and phase diagram of one and two components systems are to be studied.
CO3: Theories of Conductance, electromotive force, electrochemical cells, qualitative discussion of potentiometric titrations etc. are discussed.
CO4: In Section B: Analytical and Environmental Chemistry part, some basic principles of gravimetric analysis, volumetric analysis, chromatography and few estimation with these process are to be done.
CO5: In this section a study of environmental chemistry about hydrosphere and lithosphere, problems and probable solutions are dealt with.

Course planner

SL	Course Topic	Teacher	Class Hrs	Remarks
	Section A: Physical Chemistry-III **Solutions** Ideal solutions and Raoult‟s law, deviations from Raoult‟s law – non-ideal solutions; Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions; Distillation of solutions; Lever rule; Azeotropes. Critical solution temperature; effect of impurity on partial miscibility of liquids; Immiscibility of liquids- Principle of steam distillation; Nernst distribution law and its applications, solvent extraction.	SM	6	

Jan	***Section B: Analytical and Environmental Chemistry*** **Environmental Chemistry** *The Atmosphere*: composition and structure of the atmosphere; troposphere, stratosphere, mesosphere and thermosphere; ozone layer and its role; major air pollutants: CO, SO_2, NO_x and particulate matters – their origin and harmful effects; problem of ozone layer depletion; green house effect; acid rain and photochemical smog; air pollution episodes: air quality standard; air pollution control measures: cyclone collector, electrostatic precipitator, catalytic converter.	BD	3	
	Section B: Analytical and Environmental Chemistry **Chemical Analysis** *Gravimetric analysis*: solubility product and common ion effect; requirements of gravimetry; gravimetric estimation of chloride, sulphate, lead, barium, nickel, copper and zinc.	MS	3	
Feb	***Section A: Physical Chemistry-III*** **Phase Equilibria** Phases, components and degrees of freedom of a system, criteria of phase equilibrium; Gibbs‟ Phase Rule and its thermodynamic derivation; Derivation of Clausius – Clapeyron equation and its importance in phase equilibria; Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (leadsilver, $FeCl_3$-H_2O and Na-K only).	SM	8	
	Section B: Analytical and Environmental Chemistry **Environmental Chemistry** *The Atmosphere*: composition and structure of the atmosphere; troposphere, stratosphere, mesosphere and thermosphere; ozone layer and its role; major air pollutants: CO, SO_2, NO_x and particulate matters – their origin and harmful effects; problem of ozone layer depletion; green house effect; acid rain and photochemical smog; air pollution episodes: air quality standard; air pollution control measures: cyclone collector, electrostatic precipitator, catalytic converter.	BD	4	
	Section B: Analytical and Environmental Chemistry **Chemical Analysis** *Gravimetric analysis*: solubility product and common ion effect; requirements of gravimetry; gravimetric estimation of chloride, sulphate, lead, barium, nickel, copper and zinc.	MS	4	
	Section A: Physical Chemistry-III **Conductance** Conductance, cell constant, specific conductance and molar conductance; Variation of specific and equivalent conductance with dilution for strong and weak electrolytes; Kohlrausch‟s law of independent migration of ions; Equivalent and molar conductance at infinite dilution and their determination for strong and weak electrolytes; Ostwald‟s dilution law; Application of conductance measurement (determination of solubility product and ionic product of water); Conductometric titrations (acid-base) Transport Number and principles of Hittorf's and Moving-boundary method.	SM	8	
	Section B: Analytical and Environmental Chemistry **Environmental Chemistry** *The Hydrosphere*: environmental role of water, natural water sources, water treatment for industrial, domestic and laboratory uses; water pollutants; action of soaps and detergents, phosphates, industrial effluents, agricultural runoff, domestic wastes; thermal pollution, radioactive pollution and their effects on animal and plant life; water pollution episodes: water pollution control measures : waste water	BD	4	

Mar	treatment; chemical treatment and microbial treatment; water quality standards: DO, BOD, COD, TDS and hardness parameters; desalination of sea water : reverse osmosis, electro dialysis.			
	Section B: Analytical and Environmental Chemistry **Chemical Analysis** *Volumetric analysis*: primary and secondary standard substances; principles of acid-base, oxidation –reduction and complexometric titrations; indicators: acid-base, redox and metal ion; principles of estimation of mixtures: $NaHCO_3$ and Na_2CO_3 (by acidimetry); iron, copper, manganese and chromium (by redox titration); zinc, aluminum, calcium and magnesium (by complexometric EDTA titration).	MS	3	
Apr	***Section A: Physical Chemistry-III*** **Electromotive force** Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry; Chemical cells, reversible and irreversible cells with examples; Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential; Electrochemical series; Thermodynamics of a reversible cell, calculation of thermodynamic properties: *G, H* and *S* from EMF data Concentration cells with and without transference, liquid junction potential;	SM	6	
	Section B: Analytical and Environmental Chemistry **Environmental Chemistry** *The Hydrosphere*: environmental role of water, natural water sources, water treatment for industrial, domestic and laboratory uses; water pollutants; action of soaps and detergents, phosphates, industrial effluents, agricultural runoff, domestic wastes; thermal pollution, radioactive pollution and their effects on animal and plant life; water pollution episodes: water pollution control measures : waste water treatment; chemical treatment and microbial treatment; water quality standards: DO, BOD, COD, TDS and hardness parameters; desalination of sea water : reverse osmosis, electrodialysis.	BD	3	
	Section B: Analytical and Environmental Chemistry **Chemical Analysis** *Volumetric analysis*: primary and secondary standard substances; principles of acid-base, oxidation –reduction and complexometric titrations; indicators: acid-base, redox and metal ion; principles of estimation of mixtures: $NaHCO_3$ and Na_2CO_3 (by acidimetry); iron, copper, manganese and chromium (by redox titration); zinc, aluminum, calcium and magnesium (by complexometric EDTA titration).	MS	4	
May	***Section A: Physical Chemistry-III*** **Electromotive force** pH determination using hydrogen electrode and quinhydrone; Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation)	SM	2	
	Section B: Analytical and Environmental Chemistry **Environmental Chemistry** *The Lithosphere*: water and air in soil, waste matters and pollutants in soil, waste classification, treatment and disposal; soil pollution and control measures.	BD	2	
	Section B: Analytical and Environmental Chemistry **Chemical Analysis** *Chromatography*: chromatographic methods of analysis: column chromatography and thin layer chromatography.	MS	2	

			60	

Resources:

Reference Books:

1. Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
2. Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
3. Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
4. Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
5. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
6. Chugh, K.L., Agnish, S.L. *A Text Book of Physical Chemistry* Kalyani Publishers7.Bahl, B.S., Bahl, A., Tuli, G.D., *Essentials of Physical Chemistry* S. Chand & Co. ltd.
8. Palit, S. R., *Elementary Physical Chemistry* Book Syndicate Pvt. Ltd.
9. Pahari, S., *Physical Chemistry* New Central Book Agency
10. Pahari, S., Pahari, D., *Problems in Physical Chemistry* New Central Book Agency
11. Banerjee, S. P. *A Text Book of Analytical Chemistry*, The New Book Stall.
12. Gangopadhyay, P. K. *Application Oriented Chemistry*, Book Syndicate.
13. Mondal, A. K & Mondal, S. *Degree Applied Chemistry*, Sreedhar Publications.
14. Banerjee, S. P. *A Text Book of Analytical Chemistry*, The New Book Stall.

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).

COURSE PLANER
Department of Chemistry
Basirhat College
Paper IV

CEMHGEC04P: SOLUTIONS, PHASE EQUILIBRIA, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL ORGANIC CHEMISTRY-II LAB

(60 Lectures/Contact Hours)

Courses: CEMHGEC04P & CEMGCOR04P Credit: 2

Course coordinator: **Dr. Bidyut Debnath**

CO1: In Section A: Physical Chemistry-LAB part, some experiments of distribution Law, phase diagram,
conductometric and potentiometric titrations are to be done.

CO2: In Section B: Analytic and Environmental Chemistry-LAB part, experiments of total hardness of water, PH of an unknown solution, determination of the rate constant for the acid catalysed hydrolysis of an ester, strength of the H2O2 sample and solubility of a sparingly soluble salt are discussed.

Course planner

SL	Course Topic	Teacher	Class Hrs	Remarks
Jan	***Section B: Analytic and Environmental Chemistry-LAB*** 1. To find the total hardness of water by EDTA titration. 2. To find the PH of an unknown solution by comparing color of a series of HCl solutions + 1 drop of methyl orange, and a similar series of NaOH solutions + 1 drop of phenolphthalein.	MS+ SK	8	
	Section B: Analytic and Environmental Chemistry-LAB 1. To find the total hardness of water by EDTA titration. 2. To find the PH of an unknown solution by comparing color of a series of HCl solutions + 1 drop of methyl orange, and a similar series of NaOH solutions + 1 drop of phenolphthalein.	MS+ PD	4	
	Section B: Analytic and Environmental Chemistry-LAB 1. To find the total hardness of water by EDTA titration. 2. To find the PH of an unknown solution by comparing color of a series of HCl solutions + 1 drop of methyl orange, and a similar series of NaOH solutions + 1 drop of phenolphthalein.	MS+ BD	4	
Feb	***Section B: Analytic and Environmental Chemistry-LAB*** 3. To determine the rate constant for the acid catalysed hydrolysis of an ester. 4. Determination of the strength of the H_2O_2 sample. 5. To determine the solubility of a sparingly soluble salt, e.g. KHTa (one bottle)	MS+ SK	16	
	Section B: Analytic and Environmental Chemistry-LAB 3. To determine the rate constant for the acid catalysed hydrolysis of an ester. 4. Determination of the strength of the H_2O_2 sample. 5. To determine the solubility of a sparingly soluble salt, e.g. KHTa (one bottle)	MS+ PD	8	
	Section B: Analytic and Environmental Chemistry-LAB 3. To determine the rate constant for the acid catalysed hydrolysis of an ester. 4. Determination of the strength of the H_2O_2 sample. 5. To determine the solubility of a sparingly soluble salt, e.g. KHTa (one bottle)	MS+ BD	8	
	Section A: Physical Chemistry-LAB (Minimum **six** experiments to complete) (I) Distribution Law (Any **one**) Study of the equilibrium of **one of the following reactions** by the distribution method: $I_2(aq) + I^-(aq) = I_3^-(aq)$ $Cu^{2+}(aq) + xNH_2(aq) = [Cu(NH_3)_x]^{2+}$ (II) Phase equilibria (Any **one**) a) Construction of the phase diagram of a binary system (simple eutectic) using cooling curves b) Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it	MS+ SK	16	

	Section A: Physical Chemistry-LAB (Minimum **six** experiments to complete) (I) Distribution Law (Any **one**) Study of the equilibrium of **one of the following reactions** by the distribution method: $I_2(aq) + I^-(aq) = I_3^-(aq)$ $Cu^{2+}(aq) + xNH_2(aq) = [Cu(NH_3)_x]^{2+}$ (II) Phase equilibria (Any **one**) a) Construction of the phase diagram of a binary system (simple eutectic) using cooling curves b) Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it	MS+ PD	8	
Mar	***Section A: Physical Chemistry-LAB*** (Minimum **six** experiments to complete) (I) Distribution Law (Any **one**) Study of the equilibrium of **one of the following reactions** by the distribution method: $I_2(aq) + I^-(aq) = I_3^-(aq)$ $Cu^{2+}(aq) + xNH_2(aq) = [Cu(NH_3)_x]^{2+}$ (II) Phase equilibria (Any **one**) a) Construction of the phase diagram of a binary system (simple eutectic) using cooling curves b) Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it	MS+ BD	8	
	Section A: Physical Chemistry-LAB (Minimum **six** experiments to complete) (III) Conductance a) Determination of dissociation constant of a weak acid (cell constant, equivalent conductance are also determined) b) Perform the following conductometric titrations: (Any **one**) (i) Strong acid vs. strong base (ii) Weak acid vs. strong base (IV) Potentiometry Perform the following potentiometric titrations: (i) Weak acid vs. strong base (ii) Potassium dichromate vs. Mohr's salt	MS+ SK	16	
	Section A: Physical Chemistry-LAB (Minimum **six** experiments to complete) (III) Conductance a) Determination of dissociation constant of a weak acid (cell constant, equivalent conductance are also determined) b) Perform the following conductometric titrations: (Any **one**) (i) Strong acid vs. strong base (ii) Weak acid vs. strong base (IV) Potentiometry Perform the following potentiometric titrations: (i) Weak acid vs. strong base (ii) Potassium dichromate vs. Mohr's salt	MS+ PD	8	

Apr	***Section A: Physical Chemistry-LAB*** (Minimum **six** experiments to complete) (III) Conductance a) Determination of dissociation constant of a weak acid (cell constant, equivalent conductance are also determined) b) Perform the following conductometric titrations: (Any **one**) (i) Strong acid vs. strong base (ii) Weak acid vs. strong base (IV) Potentiometry Perform the following potentiometric titrations: (i) Weak acid vs. strong base (ii) Potassium dichromate vs. Mohr's salt	MS+ BD	8	
May	***Section A: Physical Chemistry-LAB &*** ***Section B: Analytic and Environmental Chemistry-LAB*** Revision	MS+ SK	4	
	Section A: Physical Chemistry-LAB & ***Section B: Analytic and Environmental Chemistry-LAB*** Revision	MS+ PD	2	
	Section A: Physical Chemistry-LAB & ***Section B: Analytic and Environmental Chemistry-LAB*** Revision	MS+ BD	2	
	TOTAL		120	

Resources:

Reference Books:

1. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta, 2003.
2. Palit, S.R., *Practical Physical Chemistry* Science Book Agency
3. Mukherjee, N.G., *Selected Experiments in Physical Chemistry* J. N. Ghose & Sons
4. Dutta, S.K., *Physical Chemistry Experiments* Bharati Book Stall
5. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
6. Ghosal, Mahapatra & Nad, *An Advanced Course in Practical Chemistry,* New Central Book Agency.
7. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N. University of Calcutta, 2003.
8. Das, S. C., Chakraborty, S. B., *Practical Chemistry.*

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
Jul Aug				Class starts from 01.09.2022
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	
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 energy change of mixing of polymers solutions, Flory-Huggins theory, Lower and Upper critical solution temperatures.	PD	4hrs	
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	BD	10hrs	

	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.			
Jan	Assessment: End-term Test		Total:60 Hrs	

Resources :

8. 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.

9. 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 Aug				Class starts from 01.09.2021
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	

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).

10. 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: 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 18.02.2022
	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,	BD	8 hrs	

	Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.			
	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:

11.
12. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
13. • R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
14. • W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
15. • J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
16. • P. C. Jain & M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
17. • R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
18. • B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
19.

Other resources :

*Remarks will specify

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- Methodology of teaching (whether using ICT, engaging students in group discussion, quiz etc. etc.)
- 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: 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

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	from 18.02.2022
April	1. Determination of composition of dolomite (by complexometrictitration). 2. Analysis of (Cu, Ni); (Cu, Zn) in alloy or syntheticsamples. 3. Analysis ofCement. 4. Preparation of pigment (zincoxide).	SM	12hrs 12 hrs	
May		BD	6 hrs	
		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