

COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2018-19
CEMG - III-Year

Paper IV/ Paper Code: CEMGT 34A, 34B, 34C/ Total Marks: 75

Course coordinator: Dr. Swastik Karmakar

CO1: This course is about the theory on analysis like Error, Volumetric analysis.

CO2: It's a application based chemistry provides industrial application and environmental applications also.

Course planner

SL	Course Topic	Teacher	Class No	Remarks
Jul-	CEMGT 34A Unit I. Chemical analysis Gravimetric Analysis: Solubility product and common ion effect.	SK	1	
	CEMGT 34A Unit I. Chemical analysis Error analysis and computer applications Accuracy and precision of quantitative analysis.	SM	1	
	CEMGT 34A Unit II: Volumetric Analysis Primary and secondary standard substances.	PD	1	
	CEMGT 34B Unit I. Industrial chemistry I a) Fuels: Classification of fuel, heating values.	BD	1	
Aug	CEMGT 34A Unit I. Chemical analysis Requirements of gravimetry. Gravimetric estimation of chloride, sulphate, lead, barium and nickel.	SK	3	
	CEMGT 34A Unit I. Chemical analysis Error analysis and computer applications Determinate-, indeterminate-, systematic- and random-errors. Methods of least squares and standard deviations.	SM	4	
	CEMGT 34A Unit II: Volumetric Analysis Principles of acid-base, oxidation –reduction, and complexometric titrations.	PD	4	
	CEMGT 34B Unit I. Industrial chemistry I Origin of coal, carbonization of coal, coal gas, producer gas, water gas, coal based chemicals. Origin and composition of petroleum, petroleum refining.	BD	3	
Sept	CEMGT 34A Unit I. Chemical analysis Error analysis and computer applications General introduction to computers, different components of a computer, hardware and software, input and output devices.	SM	4	
	CEMGT 34A Unit II: Volumetric Analysis	PD	3	

	Acid-base, redox and metal-ion indicators. Principles of estimation of mixtures of NaHCO_3 and Na_2CO_3 (by acidimetry).			
	CEMGT 34B Unit I. Industrial chemistry I Cracking, knocking, octane number, anti-knock compounds, Kerosene, liquefied petroleum gas (LPG), liquefied natural gas (LNG), petrochemicals (C1 to C3 compounds and their uses).	BD	3	
	CEMGT 34C Unit I. 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 and particulate matters –their origins and harmful effects.	SK	4	
Nov	CEMGT 34A Unit I. Chemical analysis Error analysis and computer applications binary numbers and arithmetic. Introduction to computer languages, programming and operating systems.	SM	4	
	CEMGT 34A Unit II: Volumetric Analysis Principles of estimation of iron, copper, manganese, chromium (by redox titration).	PD	4	
	CEMGT 34B Unit I. Industrial chemistry I b) Fertilizers: Manufacture of ammonia and ammonium salts, urea, superphosphate, biofertilizers.	BD	4	
	CEMGT 34C Unit I. Environmental chemistry Problems 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.	SK	4	
Dec	CEMGT 34A Unit II: Volumetric Analysis Principles of estimation of zinc, calcium, magnesium (by complexometric EDTA titration).	PD	4	
	CEMGT 34B Unit I. Industrial chemistry I c) Glass and Ceramics: Definition and manufacture of glasses, optical glass and coloured glass. Clay and feldspar, glazing and vitrification, glazed porcelain, enamel. Portland cement: composition and setting of cement, white cement.	BD	4	
	CEMGT 34C Unit I. 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 run off, domestic wastes.	SK	4	
	CEMGT 34C Unit II. Industrial Chemistry III Fats-Oils-Detergents : Fats and oils, natural fat, edible and inedible oil of vegetable origin. Common fatty acids, glycerides.	SM	4	

Jan	CEMGT 34A Unit II: Volumetric Analysis Chromatographic methods of analysis: column chromatography and thin layer chromatography	PD	4	
	CEMGT 34C Unit I. Environmental chemistry 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, electro dialysis.	SK	4	
	CEMGT 34C Unit II. Industrial Chemistry III Hydrogenation of unsaturated oil, production of vanaspati and margarine. Production of toilet and washing soaps, Enzyme based detergents, detergent powder, liquid soaps.	SM	4	
	CEMGT 34C Unit II. Industrial Chemistry III Pesticides: Common pesticides : Production, applications and residual toxicity of gammaxane, aldrin, parathion, malathion, DDT, paraquat, decamethrin.	BD	4	
Feb	CEMGT 34C Unit I. 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.	SK	4	
	CEMGT 34C Unit II. Industrial Chemistry III Food Additives: Food flavour, food colour, food preservatives, artificial sweeteners, acidulants, alkalies, edible emulsifiers and edible foaming agents, sequesterants – uses and abuses of these substances in food beverages.	BD	4	
	CEMGT 34C Unit II. Industrial Chemistry III Food Additives: Food flavour, food colour, food preservatives, artificial sweeteners, acidulants, alkalies,	SM	4	
	TOTAL CLASS	90		

Resources:

1. Books:

- 1) 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) B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

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).

Paper IV/ Paper Code: CEMGP 34D/ Total Marks: 25

Course coordinator: Dr. Manojit Sarkar

CO1: Students will learn about all the experiments regarding various volumetric titrations and its application.

CO2: different estimations can be performed by the student wel.

Course planner

SL	Course Topic	Teacher	Class hour	Remarks
Jul-	Experiment –I. Preparation of standard (N/20) solution of oxalic acid and standardization of (a) NaOH solution (b) KMnO_4 solution (c) Mohr's salt solution (against KMnO_4).	MS+BD SK+SM	2+2	
Aug	Experiment –II. Preparation of standard (N/20) $\text{K}_2\text{Cr}_2\text{O}_7$ solution of oxalic acid and standardization of (a) Mohr's salt solution (b) KMnO_4 solution (c) sodium thiosulphate solution.	MS+BD SK+SM	2+2	
Sept	Experiment –III. Preparation of standard (M/50) Zinc acetate solution and (a) standardization of Na_2EDTA solution and (b) Estimation of unknown solution of single metal ion ($\text{Zn}^{2+}/\text{Ca}^{2+}/\text{Mg}^{2+}$).	MS+BD SK+SM	4+4	
Nov	Experiment –IV. Acidimetric estimation of NaHCO_3 , Na_2CO_3 mixture using phenolphthalein and methyl orange.	MS+BD SK+SM	2+2	
Dec	Experiment –V. Alkalimetric estimation of HCl , CH_3COOH mixture. Experiment –VI. Estimation of Fe (II) + Fe (III) mixture using standard (N/20) solution of (a) $\text{K}_2\text{Cr}_2\text{O}_7$ (b) KMnO_4 as titrants.	MS+BD SK+SM	2+2	
Jan	Experiment –VII. Estimation of total hardness of water (EDTA method). Experiment –VIII. Estimation of Vitamin C by iodometric method	MS+BD SK+SM	2+2	
Feb	Experiment –IX. Estimation of available oxygen in pyrolusite	MS+BD	2	
TOTAL CLASS HOUR			30	

Resources:

3. Books:

1. Palit, S.R., *Practical Physical Chemistry* Science BookAgency.
2. Dutta, S.K., *Physical Chemistry Experiments* Bharati BookStall

4. Other resources :

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COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2018-19
CEMG II-Year

Paper II

Courses: CEMGT 22A, 22B, 22C, 22D / Total Marks: 100

Course coordinator: Dr. Bidyut Debnath

CO1: Students will learn about Acids bases, buffer solution and PH.

CO2: The course provides ideas about kinetics and catalyst.

Course planner

SL	Course Topic	Teacher	Class No	Remarks
Jul-	CEMGT 22A Unit I. Basic physical chemistry III Thermodynamics II: (a) Spontaneous processes, heat engine, Carnot cycle and its efficiency, Second law of thermodynamics, Entropy (S) as a state function, molecular interpretation of entropy.	BD	2	
	CEMGT 22A Unit II. Basic physical chemistry IV Chemical kinetics and catalysis: Order and molecularity of reactions, rate laws and rate equations for first order and second order reactions (differential and integrated forms).	SM	2	
	CEMGT 22C Unit I. Basic organic chemistry III a) Aldehydes and ketones: the nature of carbonyl group, methods of synthesis, physical properties, Cannizzaro reaction, relative reactivities and distinction of aldehydes and ketones, Aldol condensation (with mechanism), Perkin reaction, Benzoin condensation, Claisen condensation, Oxidation and reduction reactions.	PD	4	
Aug	CEMGT 22A Unit I. Basic physical chemistry III Thermodynamics II: Entropy changes in simple transformations; including entropy change of ideal gas during expansion, Free energy: Gibbs function (G) and Helmholtz function (A), Gibbs-Helmholtz equation, criteria for thermodynamic equilibrium and spontaneity of a process.	BD	4	

	CEMGT 22A Unit II. Basic physical chemistry IV Chemical kinetics and catalysis: Zero order reactions. Determination of order of reactions. Temperature dependence of reaction rate, the Arrhenius equation; special emphasis on temperature coefficient, energy of activation.	SM	4	
	CEMGT 22C Unit I. Basic organic chemistry III b) Carboxylic acids and their derivatives: acidity of carboxylic acids and effects of substituents on acidity, chemical reactivity, mechanism of esterification of carboxylic acids and hydrolysis of esters (BAC2 and AAC2 only) c) Carbohydrates: Introduction, occurrence and classification of carbohydrates, constitution of glucose, osazone formation, reactions of glucose and fructose.	PD	8	
Sept	CEMGT 22A Unit I. Basic physical chemistry III Thermodynamics II: (b) Chemical equilibrium: chemical equilibria of homogeneous and heterogeneous systems, derivation of expression of equilibrium constants; temperature, pressure and concentration dependence of equilibrium constants (K_P , K_C , K_X); Le Chatelier's Principle of dynamic equilibrium.	BD	4	
	CEMGT 22A Unit II. Basic physical chemistry IV Catalytic reactions: homogeneous and heterogeneous catalytic reactions, autocatalytic reactions, catalyst poisons, catalyst promoters (typical examples)	SM	4	
	CEMGT 22C Unit I. Basic organic chemistry III Mutarotation, cyclic structures – pyranose and furanose forms (determination of ring-size excluded), epimerization, chain-lengthening (Kiliani –Fischer method) and chainshortening (Ruff's method) in aldoses. Unit II. Basic organic chemistry IV a) Phenols: synthesis, acidic character and chemical reactions of phenols, Kolbe reactions, Reimer-Tiemann reaction, Fries rearrangement, Claisen rearrangement. b) Organic compounds containing nitrogen: aromatic nitro compounds – reduction under different conditions. [acidic, neutral and alkaline]. Methods of synthesis of aliphatic amines.	PD	3+5	
Oct	CEMGT 22A Unit I. Basic physical chemistry III Thermodynamics II: (c) Phase equilibrium Definitions of phase, component and degrees of freedom. Phase rule. Definition of phase diagram.	BD	1	
	CEMGT 22A Unit II. Basic physical chemistry IV Photochemistry Grothus-Draper Law, Lambert-Beer's Law.	SM	1	
	CEMGT 22C Unit II. Basic organic chemistry IV b) Heinsberg's method of amine separation, Hofmann degradation, Gabriel's phthalimide synthesis. Distinction of primary, secondary and tertiary amines.	PD	2	

Nov	CEMGT 22A Unit I. Basic physical chemistry III Thermodynamics II: (c) Phase equilibrium Phase equilibria for one component system – water, CO ₂ . Heterogeneous systems: Nernst Distribution Law, miscibility and distillation of binary liquid mixtures, azeotropic mixture, Critical Solution temperature, steam distillation.	BD	4	
	CEMGT 22A Unit II. Basic physical chemistry IV Photochemistry Molar extinction coefficient, Stark- Einstein Law of photochemical equivalence and quantum yield, examples of low and high quantum yields, Luminescence: Fluorescence and phosphorescence.	SM	4	
	CEMGT 22C Unit II. Basic organic chemistry IV Methods of synthesis of aromatic amines, basicity of aliphatic and aromatic amines. Diazotization and coupling reactions and their mechanisms; synthetic applications of benzene diazonium salts. [Sandmeyer's reaction, preparation of nitro compounds, phenols, carboxylic acids and hydrocarbons thereby]. c) Amino acids, Proteins: methods of synthesis of α –amino acids (glycine and alanine using Gabriel's phthalimide synthesis and Strecker synthesis). Physical properties. Zwitterion structures, isoelectric point.	PD	8	
Dec	CEMGT 22B Unit I. Basic physical chemistry V a) Acids-bases and solvents: Modern aspects of acids and bases: Arrhenius theory, theory of solvent system, Bronsted and Lowry's concept, Lewis concept with typical examples, applications and limitations. Strengths of acids and bases (elementary idea).	SM	4	
	CEMGT 22B Unit II. Basic physical chemistry VI a) Solutions of non-electrolytes: Colligative properties of solution, Henry's Law, Raoult's Law, relative lowering of vapor pressure, osmosis and osmotic pressure; Elevation of boiling point.	BD	4	
	CEMGT 22 D: Unit I. Basic inorganic chemistry III Coordinate bonds and Coordination compounds: complex salts and double salts, Warner's theory of coordination, chelate complexes, stereochemistry of coordination numbers 4 and 6. IUPAC nomenclature of coordination complexes (mononuclear complexes only).	PD	8	
Jan	CEMGT 22B Unit I. Basic physical chemistry V Ionization of weak acids and bases in aqueous solutions, application of Ostwald's dilution law, ionization constants, ionic product of water, pH-scale, buffer solutions and calculation of pH values, buffer actions; hydrolysis of salts.	SM	4	
	CEMGT 22B Unit II. Basic physical chemistry VI a) Solutions of non-electrolytes: Depression of freezing point of solvents – (without deduction), calculation of molecular weight of solute from measurement of colligative properties of solutions.	BD	4	

	CEMGT 22 D: Unit I. Basic inorganic chemistry III Preparation and uses of the following compounds: Sodium borohydride, lithium aluminium hydride, calcium carbide, hydrazine, hydroxylamine, sodium bismuthate, sodium thiosulphate, potassium peroxydisulphate, Perchloric acid, potassium bromate, potassium ferrocyanide, Mohr's salt, potassium chromate, potassium dichromate and potassium permanganate.	PD	8	
Feb	CEMGT 22B Unit I. Basic physical chemistry V b) Solutions of electrolytes: Electrolytic conductance, specific conductance, equivalent conductance and molar conductance of electrolytic solutions. Influence of temperature and dilution on conductivity of strong and weak electrolytes, conductometric titration – acid-base, precipitation.	SM	4	
	CEMGT 22B Unit II. Basic physical chemistry VI b) Colloids: Colloids and crystalloids, classification of colloids, preparation and purification of colloids: ferric hydroxide sol and gold sol. Properties of colloids: Brownian motion, peptization, dialysis.	BD	4	
	CEMGT 22 D: Unit II: Basic inorganic chemistry IV 16 Comparative study of s-block elements: Group trends, electronic configuration, isolation of pure elements, common oxidation states, inert pair effect.	PD	6	
Mar	CEMGT 22B Unit I. Basic physical chemistry V Electrode potential: Electrode potentials, Nernst Equation, Reference electrodes, Normal Hydrogen Electrode and calomel electrodes, Emf of electrochemical cells and its measurement, electrode potential series and its applications, measurement of pH using glass calomel electrode.	SM	4	
	CEMGT 22B Unit II. Basic physical chemistry VI b) Colloids: Tyndal effect and its applications. Protecting colloids, gold number, isoelectric points, coagulation of colloids by electrolytes, Schulze-Hardy rule.	BD	3	
	CEMGT 22 D: Unit II: Basic inorganic chemistry IV chemical properties and reactions in respect of the following group elements: i) Li-Na-K ii) Be-Mg-Ca-Sr-Ba	PD	6	
Apr -	CEMGT 22 D: Unit II: Basic inorganic chemistry IV Extraction and purification of elements from natural sources: Li, Cr, Ni, Ag, Au. Electroplating, galvanizing and anodizing.	BD + PD + SM	6	
		Total: 125		

Resources:

5. Books:

6. Sethi, A. *Conceptual Organic Chemistry*; New Age International Publisher.

7. Parmar, V. S. *A Text Book of Organic Chemistry*, S. Chand & Sons.
8. Madan, R. L. *Organic Chemistry*, S. Chand & Sons.
9. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
10. Cotton, F.A., Wilkinson, G. & Gaus, P.L. *Basic Inorganic Chemistry*, 3rd ed., Wiley.
11. Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
12. Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
13. Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
14. Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
15. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985).
16. Chugh, K.L., Agnish, S.L. *A Text Book of Physical Chemistry* Kalyani Publishers. Bahl, B.S., Bahl, A., Tuli, G.D., *Essentials of Physical Chemistry* S. Chand & Co. Ltd.
17. Palit, S. R., *Elementary Physical Chemistry* Book Syndicate Pvt. Ltd.
18. Mandal, A. K. *Degree Physical and General Chemistry* Sarat Book House
19. Pahari, S., *Physical Chemistry* New Central Book Agency
20. Pahari, S., Pahari, D., *Problems in Physical Chemistry* New Central Book Agency

Other resources:

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COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2018-19
CEMG II-Year

Paper III

Courses: CEMGP 23A, 23B

Total Marks: 100

Course coordinator: Dr. Saheli Ganguly

CO1: Student will learn about the experimental ideas about functional group analysis.

CO2: This course provides about ideas about qualitative and quantitative analysis of various inorganic samples.

Course planner

SL	Course Topic	Teacher	Class No	Remarks
July	UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid) Experiment A: Test for special element (N, S, Cl, Br and I) Experiment B: Solubility tests and solubility classification.	MS +PD	2	
	UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid) Experiment C: Test for the following functional groups. Aromatic $-\text{NO}_2$, Aromatic $-\text{NH}_2$, $-\text{OH}$ (phenolic), Carbonyl (aldehyde and ketone), $-\text{COOH}$ and olefinic unsaturation.	BD +SG	2	
Aug	UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid) Experiment C: Test for the following functional groups. Aromatic $-\text{NO}_2$, Aromatic $-\text{NH}_2$, $-\text{OH}$ (phenolic), Carbonyl (aldehyde and ketone), $-\text{COOH}$ and olefinic unsaturation.	MS +PD	8	
	Experiment D: Determination of the melting point of the compound. UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid) Experiment C: Test for the following functional groups. Aromatic $-\text{NO}_2$, Aromatic $-\text{NH}_2$, $-\text{OH}$ (phenolic), Carbonyl (aldehyde and ketone), $-\text{COOH}$ and olefinic unsaturation. Experiment D: Determination of the melting point of the compound.	BD +SG	8	
Sept	UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid) Analysis of unknown organic samples	MS +PD	8	
	UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid) Analysis of unknown organic samples	BD +SG	8	
Oct	UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid) Analysis of unknown organic samples	MS +PD	2	
	UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid) Analysis of unknown organic samples	BD +SG	2	
Nov	UNIT-2 : Qualitative Analysis of Inorganic Mixture Experiments A: Preliminary Tests for Acid and Basic radicals in given samples. Acid Radicals: Cl^- , Br^- , I^- , NO_3^{1-} , S^{2-} , SO_4^{2-} , $\text{S}_2\text{O}_3^{2-}$, PO_4^{3-} , BO_3^{3-} , H_3BO_3 . Basic Radicals: Cu^{+2} , Cr^{+3} , Fe^{+3} , Ni^{+2} , Mn^{+2} , Co^{+2} , Ca^{+2} , Sr^{+2} , Ba^{+2} , Na^+ , K^+ , NH_4^+	MS +PD	8	
	UNIT-2 : Qualitative Analysis of Inorganic Mixture Experiments A: Preliminary Tests for Acid and Basic radicals in given samples.	BD +SG	8	

	Acid Radicals: Cl^- , Br^- , I^- , NO_3^{1-} , S^{2-} , SO_4^{2-} , $\text{S}_2\text{O}_3^{2-}$, PO_4^{3-} , BO_3^{3-} , H_3BO_3 . Basic Radicals: Cu^{+2} , Cr^{+3} , Fe^{+3} , Ni^{+2} , Mn^{+2} , Co^{+2} , Ca^{+2} , Sr^{+2} , Ba^{+2} , Na^{+} , K^{+} , NH_4^{+}			
Dec	UNIT-2 : Qualitative Analysis of Inorganic Mixture Experiments B: Wet tests for Acid and Basic radicals in given samples. Experiments C: Confirmatory tests. Experiments D: Insoluble Treatment Acid Radicals: Cl^- , Br^- , I^- , NO_3^{1-} , S^{2-} , SO_4^{2-} , $\text{S}_2\text{O}_3^{2-}$, PO_4^{3-} , BO_3^{3-} , H_3BO_3 . Basic Radicals: Cu^{+2} , Cr^{+3} , Fe^{+3} , Ni^{+2} , Mn^{+2} , Co^{+2} , Ca^{+2} , Sr^{+2} , Ba^{+2} , Na^{+} , K^{+} , NH_4^{+} Insoluble: BaSO_4 , SrSO_4 , Cr_2O_3 .	MS +PD	8	
	UNIT-2 : Qualitative Analysis of Inorganic Mixture Experiments B: Wet tests for Acid and Basic radicals in given samples. Experiments C: Confirmatory tests. Experiments D: Insoluble Treatment Acid Radicals: Cl^- , Br^- , I^- , NO_3^{1-} , S^{2-} , SO_4^{2-} , $\text{S}_2\text{O}_3^{2-}$, PO_4^{3-} , BO_3^{3-} , H_3BO_3 . Basic Radicals: Cu^{+2} , Cr^{+3} , Fe^{+3} , Ni^{+2} , Mn^{+2} , Co^{+2} , Ca^{+2} , Sr^{+2} , Ba^{+2} , Na^{+} , K^{+} , NH_4^{+} Insoluble: BaSO_4 , SrSO_4 , Cr_2O_3 .	BD +SG	8	
Jan	UNIT-2 : Qualitative Analysis of Inorganic Mixture Analysis of unknown Inorganic Mixture samples	MS +PD	8	
	UNIT-2 : Qualitative Analysis of Inorganic Mixture Analysis of unknown Inorganic Mixture samples	BD +SG	8	
Feb	UNIT-2 : Qualitative Analysis of Inorganic Mixture Analysis of unknown Inorganic Mixture samples	MS +PD	8	
	UNIT-2 : Qualitative Analysis of Inorganic Mixture Analysis of unknown Inorganic Mixture samples	BD +SG	8	
Mar	UNIT-2 : Qualitative Analysis of Inorganic Mixture Analysis of unknown Inorganic Mixture samples	MS +PD	8	
	UNIT-2 : Qualitative Analysis of Inorganic Mixture Analysis of unknown Inorganic Mixture samples	BD +SG	8	
Apr	Revision of UNIT 1 : Qualitative Analysis of Single Organic Compound (Solid)	MS +PD	4	
	Revision of UNIT-2 : Qualitative Analysis of Inorganic Mixture	BD +SG	4	
		Total:128		

Resources:

Other resources:

Books:

1. Dutta, S.K., *Physical Chemistry Experiments* Bharati BookStall
2. Palit, S.R., *Practical Physical Chemistry* Science BookAgency

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Semester: I
Department of Chemistry
Basirhat College

SESSION: 2018-19(JULY-DEC 2018)

Lesson Plan for Course: CHEMISTRY (G)

Code: CEMGCOR01T

Credit: 4

- Course coordinator: DR. SUMON MANDAL
- 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.

Course planner

Sl	Course Topic	Teacher	Class-hour	Remarks*
Jul	<i>Section A: Inorganic Chemistry-I</i> Atomic Structure: Bohr's theory for hydrogen atom (simple mathematical treatment).	S.M.	2	
	<i>Section B: Organic Chemistry-I</i> Fundamentals of Organic Chemistry <i>Electronic displacements:</i> inductive effect, resonance and hyperconjugation.	S.K.	1	
	<i>Section A: Inorganic Chemistry-I</i> 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.	M.S.	2	
	<i>Section A: Inorganic Chemistry-I</i> Acids and bases Brönsted–Lowry concept, conjugate acids and bases.	SG	2	
Aug	<i>Section A: Inorganic Chemistry-I</i> Atomic spectra of hydrogen and Bohr's model, Sommerfeld's model, quantum numbers and their significance, Pauli's exclusion principle,	SM	4	
	<i>Section B: Organic Chemistry-I</i> 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.	SK	4	
	<i>Section A: Inorganic Chemistry-I</i> Chemical Periodicity Atomic and ionic radii, ionization potential, electron affinity, and electronegativity; periodic and group-wise variation of above properties in respect of s- and p- block elements.	MS	3	
	<i>Section A: Inorganic Chemistry-I</i> Acids and bases Relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept.	SG	4	
	<i>Section A: Inorganic Chemistry-I</i> Hund's rule, electronic configuration of many-electron atoms, <i>Aufbau</i> principle and its limitations.	SM	4	
	<i>Section B: Organic Chemistry-I</i> Stereochemistry	SK	4	

Sep	Different types of isomerism; geometrical and optical isomerism; concept of chirality and optical activity (up to two carbon atoms); asymmetric carbon atom; elements of symmetry (plane and centre).			
	<i>Section A: Inorganic Chemistry-I</i> Redox reactions Balancing of equations by oxidation number and ion-electron method, oxidimetry and reductimetry.	MS	3	
	<i>Section A: Inorganic Chemistry-I</i> Acids and bases Classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.	SG	4	
Oct	<i>Section B: Organic Chemistry-I</i> Stereochemistry Interconversion of Fischer and Newman representations	SK	1	
	<i>Section A: Inorganic Chemistry-I</i> Redox reactions Balancing of equations by oxidation number and ion-electron method, oxidimetry and reductimetry.	MS	2	
	<i>Section B: Organic Chemistry-I</i> Nucleophilic Substitution and Elimination Reactions <i>Nucleophilic substitutions:</i> S _N 1 and S _N 2 reactions.	SG	1	
Nov	<i>Section B: Organic Chemistry-I</i> Enantiomerism and diastereomerism, <i>meso</i> compounds; <i>threo</i> and <i>erythro</i> , D and L, <i>cis</i> and <i>trans</i> nomenclature; CIP Rules: <i>R/S</i> (upto 2 chiral carbon atoms) and <i>E/Z</i> nomenclature.	SK	3	
	<i>Section B: Organic Chemistry-I</i> Nucleophilic Substitution and Elimination Reactions <i>Nucleophilic substitutions:</i> S _N 1 and S _N 2 reactions; eliminations: E1 and E2 reactions (elementary mechanistic aspects); Saytzeff and Hofmann eliminations; elimination vs substitution.	SG	4	
	<i>Section B: Organic Chemistry-I</i> Aliphatic Hydrocarbons Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structures. <i>Alkanes:</i> (up to 5 Carbons). <i>Preparation:</i> catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. <i>Reactions:</i> mechanism for free radical substitution: halogenation.	MS	4	
	<i>Section B: Organic Chemistry-I</i> <i>Alkenes:</i> (up to 5 Carbons). <i>Preparation:</i> elimination reactions: dehydration of alcohols and dehydrohalogenation of alkyl halides; <i>cis</i> alkenes (partial catalytic hydrogenation) and <i>trans</i> alkenes (Birch reduction). <i>Reactions:</i> <i>cis</i> -addition (alkaline KMnO ₄) and <i>trans</i> -addition (bromine) with mechanism, addition of HX [Markownikoff's (with mechanism) and anti-Markownikoff's addition], hydration, ozonolysis, oxymercuration-demercuration and hydroboration-oxidation reaction.	SM	4	
Dec	<i>Section B: Organic Chemistry-I</i> <i>Alkynes:</i> (up to 5 Carbons). <i>Preparation:</i> acetylene from CaC ₂ and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal dihalides.	SM	2	
	<i>Section B: Organic Chemistry-I</i> <i>Reactions:</i> formation of metal acetylides, addition of bromine and alkaline KMnO ₄ , ozonolysis and oxidation with hot alkaline KMnO ₄ .	SK	2	
	Assessment: End-term Test	Total: 60 Hrs		

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
SESSION: 2018-19(JULY-DEC 2018)

Lesson Plan for Course: CHEMISTRY (G)

Code: CEMGCOR01P

Credit: 2

- Course coordinator: DR. Swastik Karmakar
- 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*
Jul	Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture	B.D.	2hr	
	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.	2 hrs	
	Detection of special elements (N, Cl, and S) in organic compounds	S.K.	2 hrs	
Aug	Estimation of oxalic acid by titrating it with KMnO ₄ .	BD	4hrs	
	Estimation of oxalic acid by titrating it with KMnO ₄ .	SM	4hrs	
	Estimation of water of crystallization in Mohr's salt by titrating with KMnO ₄ .			
	Estimation of water of crystallization in Mohr's salt by titrating with KMnO ₄ .	MS	4 hrs	
	Detection of special elements (N, Cl, and S) in organic compounds Solubility and Classification (solvents: H ₂ O, dil. HCl, dil. NaOH)	SK	6 hrs	
Sep	Estimation of Cu (II) ions iodometrically using Na ₂ S ₂ O ₃ .	BD	4hrs	
	Estimation of Cu (II) ions iodometrically using Na ₂ S ₂ O ₃ .	SM	2 hrs	
	Estimation of water of crystallization in Mohr's salt by titrating with KMnO ₄ .	MS	4hrs	
	Solubility and Classification (solvents: H ₂ O, 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	
Oct				
Nov	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	
Dec	Solubility and Classification of organic unknown compounds	BD	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.

1. 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: 2018-19

CEMG/ SEM-II (JAN-JUNE 2019)

Paper II

CEMHGEC02T: STATES OF MATTER & CHEMICAL KINETICS, CHEMICAL BONDING & MOLECULAR STRUCTURE, p-BLOCK ELEMENTS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures Marks: 50

Courses: CEMHGEC02T & CEMGCOR02T

Total Marks: 50

Course coordinator: Dr. Monojit Sarkar

Course planner

SL	Course Topic	Teacher	Class Hrs	Remarks
	<i>Section A: Physical Chemistry-I</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	

Jan	<p><i>Section A: Physical Chemistry-I</i> Liquids (06 Lectures) Definition of Surface tension, its dimension and principle of its determination using stalagmometer.</p>	MS	2	
	<p><i>Section A: Physical Chemistry-I</i> Chemical Kinetics (08 Lectures) 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);</p>	BD	2	
	<p><i>Section B: Inorganic Chemistry-II</i> (30 Lectures) Marks: 25 Chemical Bonding and Molecular Structure (16 Lectures) <i>Ionic Bonding:</i> 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.</p>	SK	2	
Feb	<p><i>Section A: Physical Chemistry-I</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</p>	SM	4	
	<p><i>Section A: Physical Chemistry-I</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)</p>	MS	4	
	<p><i>Section A: Physical Chemistry-I</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;</p>	BD	4	
	<p><i>Section B: Inorganic Chemistry-II</i> 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.</p>	SK	4	
	<p>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)</p>	SM	4	
	<p><i>Section A: Physical Chemistry-I</i> Solids (06 Lectures) Forms of solids, crystal systems, unit cells, Bravais lattice types, 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</p>	MS	4	

	treatment only); Defects in crystals; Glasses and liquid crystals.			
Mar	<p><i>Section A: Physical Chemistry-I</i> Chemical Kinetics (08 Lectures) Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment)</p> <p><i>Section B: Inorganic Chemistry-II</i> 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</p>	BD	2+2	
	<p><i>Section B: Inorganic Chemistry-II</i> Chemical Bonding and Molecular Structure (16 Lectures) <i>Covalent bonding:</i> 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, trigonalbipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds.</p>	SK	4	
	<p><i>Section B: Inorganic Chemistry-II</i> 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</p>	SM	2	
	<p><i>Section A: Physical Chemistry-I</i> Solids (06 Lectures) Bragg's law; Structures of NaCl, KCl and CsCl (qualitative treatment only); Defects in crystals; Glasses and liquid crystals.</p>	MS	2	
Apr	<p><i>Section B: Inorganic Chemistry-II</i> 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</p>	BD	4	
	<p><i>Section B: Inorganic Chemistry-II</i> (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 <i>s-s</i>, <i>s-p</i> and <i>p-p</i> combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (including idea of <i>s-p</i> mixing) and heteronuclear diatomic molecules such as CO, NO and NO⁺. Comparison of VB and MO approaches.</p>	SK	4	
	<p><i>Section B: Inorganic Chemistry-II</i> 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</p>	SM	2	
	<p><i>Section B: Inorganic Chemistry-II</i> 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:</p>	MS	2	

May	iv)O-S-Se-Te			
	<i>Section B: Inorganic Chemistry-II</i> 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	
	<i>Section B: Inorganic Chemistry-II</i> Chemical Bonding and Molecular Structure (16 Lectures) MO treatment of homonuclear diatomic molecules of 1st and 2nd periods. (Including idea of <i>s-p</i> mixing) and heteronuclear diatomic molecules such as CO, NO and NO ⁺ . Comparison of VB and MO approaches.	SK	2	
			60	

Resources:

Other resources:

Book:

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. Ekambaram, S. *General Chemistry*, Pearson.
6. Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York(1985).
7. Chugh, K.L., Agnish, S.L. *A Text Book of Physical Chemistry* Kalyani Publishers8.Bahl, B.S., Bahl, A., Tuli, G.D., *Essentials of Physical Chemistry* S. Chand & Co.ltd.
9. Palit, S. R., *Elementary Physical Chemistry* Book Syndicate Pvt.Ltd.
10. Mandal, A. K. *Degree Physical and General Chemistry* Sarat BookHouse
11. Pahari, S., *Physical Chemistry* New Central BookAgency

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COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2018-19
CEMG/ SEM-II (JAN-JUNE 2019)

Paper II

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

Courses: CEMHGEC02P & CEMGCOR02P

Total Marks: 25

Course coordinator: Dr. Bidyut Debnath

Course planner

For pure science Teacher: SK+BD and MS+SM and for bio science Teacher: BD+SM and MS+BD
And only lesson plan for pure science are given. Same will be for bio science

SL	Course Topic	Teacher	Classes Hrs	Remarks
Jan	<i>Section A: Physical Chemistry-LAB</i> (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	SK+BD	2	
	<i>Section A: Physical Chemistry-LAB</i> (I) Surface tension measurement (use of organic solvents excluded) b) Study of the variation of surface tension of a detergent solution with concentration	MS+SM	2	
Feb	<i>Section A: Physical Chemistry-LAB</i> (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. a) b) Study of the variation of viscosity of an aqueous solution with concentration of solute.	SK+BD	8	
	<i>Section A: Physical Chemistry-LAB</i> (III) Study the kinetics of the following reactions Initial rate method: Iodide-persulphate reaction <i>Section A: Physical Chemistry-LAB</i> Integrated rate method: Acid hydrolysis of methyl acetate with hydrochloric acid.	MS+SM	8	
Mar	<i>Section A: Physical Chemistry-LAB</i> Compare the strengths of HCl and H ₂ SO ₄ by studying kinetics of hydrolysis of methyl acetate. <i>Section B: Inorganic Chemistry-LAB</i> 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 ⁻	SK+BD	8	
	<i>Section B: Inorganic Chemistry-LAB</i> Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions.	MS+SM	8	

	Basic Radicals: Na ⁺ , K ⁺ , Ca ²⁺ , Sr ²⁺			
April	<i>Section B: Inorganic Chemistry-LAB</i> Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions. Basic Radicals: Ba ²⁺ , Cr ³⁺ , Mn ²⁺ , Fe ³⁺	SK+ BD	8	
	<i>Section B: Inorganic Chemistry-LAB</i> Qualitative semimicro analysis of mixtures containing three radicals. Emphasis should be given to the understanding of the chemistry of different reactions. Basic Radicals: Ni ²⁺ , Cu ²⁺ , NH ₄ ⁺ .	MS+ SM	8	
May	<i>Section A: Physical Chemistry-LAB</i> Revision	SK+ BD	4	
	<i>Section B: Inorganic Chemistry-LAB</i> Revision	MS+ SM	4	
		TOTAL	60	

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)