COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2017-18
CEMA I-Year

Paper I
Courses: CEMAT 11-IA, 11-IB, 11-OA, 11-0B Total Marks: 100
Course coordinator: DR. BIDYUT DEBNATH

CO1:Students will get the fundamental knowledge about radioactivity, atomic structure, chemical periodicity,chemical bonding and structure, acid-base reactions, stereochemistry of acyclic compounds, nucleophilic substitution and elimination reactions, aromatic electrophilic substitution reaction.

Course planner

SL	Course Topic	Teacher	Class No	Remarks
Jul-	CEMAT 11-IA Unit-I. Radioactivity and Atomic Structure Nuclear stability and nuclear binding energy.	BD	1	
	CEMAT 11-IB Unit-I. Chemical Bonding and structure Ionic bonding: Size effects, radius ratio rules and their limitations.	SM	1	
	Unit-II. Chemical periodicity I Periodic table, group trends and periodic trends in physical properties.	SG	1	
	CEMAT 11-OA Unit I Nomenclature (trivial and IUPAC).	SK	1	
Aug	CEMAT 11-IA Unit-I. Radioactivity and Atomic Structure Nuclear forces: meson exchange theory. Nuclear models (elementary idea): Concept of nuclear quantum number, magic numbers. Nuclear Reactions: Artificial radioactivity, transmutation of elements, fission, fusion and spallation. Nuclear energy and power generation. Separation and uses of isotopes in tracer techniques. Radio chemical methods: principles of determination of age of rocks and minerals, age of earth, radio carbon dating, hazards of radiation and safety measures.	BD	7	
	CEMAT 11-IB Unit-I. Chemical Bonding and structure Packing of ions in crystals, lattice energy, Born-lande equation, Born-Mayer equation, Kapustinskii equation (no derivation) and applications, Born-Haber cycle and its applications.	SM	3	
	Unit-II. Chemical periodicity I Classification of elements on the basis of electronic configuration. Modern IUPAC Periodic table. General characteristic of s, p, d and f block elements. Position of hydrogen and noble gases in the periodic table.	SG	7	
	CEMAT 11-OA Unit I DBE, hybridization (sp^n, n = 1,2,3) of C, N, O, halogens, bond distance, bond angles, VSEPR, shapes of molecules. Inductive and field effects.	SK	7	
Sept	CEMAT 11-IA Unit-I. Radioactivity and Atomic Structure Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Sommerfeld's theory (no derivation). Quantum numbers. Introduction to the concept of atomic orbitals; shapes, radial and angular probability diagrams of s, p and d orbitals (qualitative idea). Many electron atoms and ions:	BD	7	
	CEMAT 11-IB Unit-I. Chemical Bonding and structure Solvation energy, polarizing power and polarizability, ionic potential, Fajan's rules.	SM	3	

	Defects in solids (elementary idea).			
	Unit-II. Chemical periodicity I Effective nuclear charges, screening effects, Slater's rules, atomic radii, ionic radii (Pauling's univalent), covalent radii. Ionization potential, electron affinity and electronegativity (Pauling's and Allred-Rochow's scales)	SG	7	
	CEMAT 11-OA Unit I Bond energy, bond polarity and polarisability, dipole moment, resonance, resonance energy, steric inhibition of resonance, hyperconjugation, π M.O diagrams of ethylene, butadiene, 1,3,5- hexatriene, allylcation, allyl anion, allyl radical.	SK	7	
Oct	CEMAT 11-IA Unit-I. Radioactivity and Atomic Structure Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation.	BD	1	
	CEMAT 11-IB Unit-I. Chemical Bonding and structure Covalent bonding: Lewis structures, formal charge.	SM	1	
	Unit-II. Chemical periodicity I Factors influencing Ionization potential, electron affinity and electronegativity properties.	SG	1	
	CEMAT 11-OA Unit I HOMO and LUMO in ground and excited states, orbital pictures of allene, carbene(singlet and triplet), vinyl cyanide.	SK	1	
Nov	CEMAT 11-IA Unit-I. Radioactivity and Atomic Structure Electronic energy level diagram and electronic configurations of hydrogen-like and polyelectronic atoms and ions. Term symbols of atoms and ions for atomic numbers < 30.	BD	7	
	CEMAT 11-IB Unit-I. Chemical Bonding and structure Valence Bond Theory, directional character of covalent bonds, hybridizations, equivalent and non-equivalent hybrid orbitals, Bent's rule,	SM	3	
	Unit-II. Chemical periodicity I/5 Inert pair effect. Group trends and periodic trends in these properties in respect of s-, p- and d-block elements. Catenation property and its controlling factors.	SG	7	
	CEMAT 11-OA Unit I Huckel's rule for aromaticity and antiaromaticity (neutral systems 4,6,8,10 annulene, charged systems 3,4,5,7 rings, homoaromaticity, Frost-diagram, melting point, boiling point, heat of hydrogenation, heat of combustion, hydrogen bonding (intra- and inter-molecular), crown-ether, concepts of acidity, basicity and nucleophilicity.	SK	7	
Dec	CEMAT 11-OB Unit II Aromatic electrophilic substitution: π-complex, σ-complex, ipso-substition, activating and deactivating groups.	BD	7	
	CEMAT 11-IB Unit-I. Chemical Bonding and structure VSEPR theory.	SM	2	
	CEMAT 11-IB Unit-II. Acid-Base reactions Acid-Base concept: Arrhenius concept, theory of solvent system (in H_2O, NH_3, $SO_2$and HF).	SG	6	
	CEMAT 11-OA Unit II Stereochemistry of acyclic compounds: representation of molecules in Fischer, flying-wedge, Sawhorse and Newman formula and their translations, chirality, elements of symmetry, simple axis (Cn), plane of symmetry(σ), centre of symmetry(i), alternating axis of symmetry(Sn), asymmetry and dissymmetry, optical activity, specific rotation, molar rotation, specific rotation of mixture, Biot's law.	SK	7	
Jan	CEMAT 11-OB	BD	7	

	Unit II Orienting influence of groups, activated aromatic nucleophilic substitution, cine-substitution.			
	CEMAT 11-IB Unit-I. Chemical Bonding and structure Failure of VSEPR theory-to explain [e.g., $TeCl_6^{2-}$, $TeBr_6^{2-}$ and $SbBr_6^{3-}$ in $(NH_4)_4(SbBr_6)_2$] shapes of molecules and ions containing lone pairs and bond pairs (examples from main groups chemistry),	SM	3	
	CEMAT 11-IB Unit-II. Acid-Base reactions Bronsted-Lowry's concept, relative strength of acids, Pauling rules. Amphoterism. Lux-Flood concept, Lewis concept. Superacids.	SG	7	
	CEMAT 11-OA Unit II Stereoisomerism: enantiomerism, diastereoisomerism, stereogeniccentre, systems with chiral centres, stereogeniccentres involving C=C, C=N, D/L, R/S, E/Z, syn/anti, cis/trans, meso/dl, threo/erythro nomenclature. Conformation: conformational nomenclature; eclipsed, staggered, gauche and anti, dihedral angle, torsional angle, Klyne-Prelog terminology, energy barrier of rotation, relative stability of conformers on the basis of steric effect, dipole-dipole interaction, hydrogen bonding, conformational analysis of ethane, propane, n-butane, 1,2-dihaloethane, 2-methylbutane, 1.2-glycols, invertomerism of trialkyl amines.	SK	7	
Feb	CEMAT 11-OB Unit II Alkanes: synthesis and reactivity, reactivity of radicals, carbene, nitrene: generation and stability, definition and examples of ylide and zwitterions.	BD	7	
	CEMAT 11-IB Unit-I. Chemical Bonding and structure Importance of π-bonding particularly in the '2p' sublevel- and its effect on – structure (dimerization, polymerization etc.), bonding and reactivity e.g. acid base and redox properties (application to different groups.).	SM	3	
	CEMAT 11-IB Unit-II. Acid-Base reactions HSAB principle. Acid-baseequilibria in aqueous solution and pH. Acid-base neutralisation curves; indicator, choice of indicators. Buffer solution, composition, buffer capacity.	SG	6	
	CEMAT 11-OA Unit II Stereochemistry of carbocation, carbanion, radical, thermodynamic requirements of reaction, ΔH, ΔG, ΔS, dependence of ΔH on bond energy, equilibrium controlled changes, relative ease of intermolecular versus intramolecular reactions. Reaction kinetic; rate equations, transition-state theory and ΔG‡, free energy profile for one step and two steps reactions, Hammond postulate, kinetically and thermodynamically controlled reactions, kinetic studies, studies of intermediates, cross-over experiments, stereochemical proof, isotope labeling (kinetic and non-kinetic), primary kinetic isotope effect (K_H/K_D only).	SK	7	
Mar	CEMAT 11-OB Unit I 23 Addition to C=C and C≡C bonds, halogenation, oxidation, epoxidation, hydroxylation, ozonolysis, carbene addition, oxymercuration-demercuration, peroxide effect, conjugated dienes, 1,2- vs 1,4- addition, Birch reduction of alkadienes and alkynes, regio and stereo selectivity.	BD	7	
	CEMAT 11-IB Unit-I. Chemical Bonding and structure Partial ionic Character of covalent bonds, bond moment, dipole moment and electronegativity differences. Concept of resonance, resonance energy, resonance structures.	SM	3	
	CEMAT 11-OB Unit I Nucleophilic substitution and elimination reactions: SN_1, SN_2, SN_i, NGP, E_1, E_2, E_1CB mechanism, elimination vs substitution, Sayetzeff and Hoffman rules, 1,1-elimination.	SG	7	

	CEMAT 11-OB Unit I Nucleophilic substitution and elimination reactions: SN_1, SN_2, SN_i, NGP, E_1, E_2, E_1CB mechanism, elimination vs substitution, Sayetzeff and Hoffman rules, 1,1-elimination.	SK	7	
Apr-	CEMAT 11-IB Unit-I. Chemical Bonding and structure Effect of $3d^{10}$ configuration on the chemistry of non metals e.g. As, Se, and Br particularly on the acidic and redox properties of compounds.	SM	1	
	CEMAT 11-OB Unit I Alcohol and ethers: synthesis and reactivity including pinacol-pinacolone rearrangement.	SK	1	
	Total Class:		176	

Resources:

1. Books:

1. Mortimer, R. G. *Physical Chemistry*, Elsevier
2. Laidler, K. J. *Chemical Kinetics*, Pearson
2. Glasstone, S. & Lewis, G.N. *Elements of Physical Chemistry*
4. Rakshit, P.C., *Physical Chemistry* Sarat Book House
5. Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
6. Atkin, P. *Shriver & Atkins' Inorganic Chemistry,* 5th Ed., Oxford University Press (2010).
7. Cotton, F.A., Wilkinson, G. and Gaus, P.L., *Basic Inorganic Chemistry 3rdEd.;*Wiley India.
8. Sharpe, A.G., *Inorganic Chemistry*, 4th Indian Reprint (Pearson Education) 2005.
9. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. *Inorganic Chemistry, Principles ofStructure and Reactivity 4th Ed.*, Harper Collins 1993, Pearson,2006.
10. Atkins, P.W. & Paula, J. *Physical Chemistry*, Oxford Press, 2006.
11. Nasipuri, D. *Stereochemistry of Organic Compounds*, Wiley Eastern Limited.
12. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
13. Finar, I. L. *Organic Chemistry (Volume 1)* Pearson Education.
14. Graham Solomons, T.W., Fryhle, C. B. *Organic Chemistry*, John Wiley & Sons, Inc.
15. James, J., Peach, J. M. *Stereochemistry at a Glance*, Blackwell Publishing, 2003.
16. Robinson, M. J. T., *Stereochemistry*, Oxford Chemistry Primer, Oxford University Press, 2005.

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).

COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2017-18
CEMA I-Year

Paper II (Theory)

Courses: CEMAT 12-PA, 12-PB Total Marks: 50

Course coordinator: DR. BIDYUT DEBNATH

CO1: Students will get the fundamental knowledge about Kinetic Theory of Gas, Real gas and Liquid State, Thermodynamics, Chemical Kinetics.

Course planner

SL	Course Topic	Teacher	Class No	Remarks
Jul-	**CEMAT 12-PA** **Unit -I : Kinetic Theory of Gas** Concept of pressure and temperature./1	BD	1	
	CEMAT 12-PA **Unit-II : Real gas and Liquid State** Deviation of gases from ideal behavior.1	SM	1	
	CEMAT 12-PB **Unit-I : Thermodynamics-I** Definition of thermodynamic terms: intensive and extensive variables, isolated, open and closed systems.1	SG	1	
	CEMAT 12-PB **Unit-II: Chemical Kinetics** Introduction of reaction rate in terms of extent of reaction (degree of advancement).	SK	1	
Aug	**CEMAT 12-PA** **Unit -I : Kinetic Theory of Gas** Nature of the distribution of velocities in one dimension (with derivation).3	BD	3	
	CEMAT 12-PA **Unit-II : Real gas and Liquid State** Compressibility factor; Andrew's and Amagot's plots; van der Waals equation and its characteristic features. Existence of critical state. 3	SM	3	
	CEMAT 12-PB **Unit-I : Thermodynamics-I** Concept of heat and work, thermodynamic processes : cyclic, reversible, irreversible, isothermal, adiabatic processes.3	SG	3	
	CEMAT 12-PB **Unit-II: Chemical Kinetics** Rate constants, order and molecularity of reactions. Reactions of zero order, first order, second order and fractional order.	SK	3	
Sept	**CEMAT 12-PA** **Unit -I : Kinetic Theory of Gas** Extension to two and three dimensions (without derivation, expression by induction). Maxwell's distribution of speeds. 4	BD	4	
	CEMAT 12-PA **Unit-II : Real gas and Liquid State** Critical constants in terms of van der Waals constants. Law of corresponding state and significance of second virial coefficient. Boyle temperature. Intermolecular forces; Lennard-Jones potential.4	SM	4	
	CEMAT 12-PB **Unit-I : Thermodynamics-I** Thermodynamic functions and their differentials, zeroth law of thermodynamics; first law of thermodynamics, internal energy (U), Joule's	SG	4	

	experiment and its consequences.4			
	CEMAT 12-PB **Unit-II: Chemical Kinetics** Pseudo first order reactions (example using acid catalyzed hydrolysis of methyl acetate). Determination of the order of a reaction by half-life and differential method, integrated rate equation and isolation method.	SK	4	
Oct	**CEMAT 12-PA** **Unit -I : Kinetic Theory of Gas** Kinetic energy distribution in one dimension 1	BD	1	
	CEMAT 12-PA **Unit-II : Real gas and Liquid State** Nature of the liquid state (short range order and long range disorder). Vapor pressure. 1	SM	1	
	CEMAT 12-PB **Unit-I : Thermodynamics-I** Joule-Thomson experiment and its consequences.1	SG	1	
	CEMAT 12-PB **Unit-II: Chemical Kinetics** Rate-determining and steady-state approximation – explanation with suitable examples.	SK	1	
Nov	**CEMAT 12-PA** **Unit -I : Kinetic Theory of Gas** Kinetic energy distribution in two and three dimensions,3	BD	3	
	CEMAT 12-PA **Unit-II : Real gas and Liquid State** Surface tension, surface energy, excess pressure, capillary rise and measurement of surface tension (relative and absolute methods). 3	SM	3	
	CEMAT 12-PB **Unit-I : Thermodynamics-I** Enthalpy (H), relation between Cp and Cv, calculation of work (w), quantity of heat (q), ΔU and ΔH for expansion of ideal and van der Waals gases.3	SG	3	
	CEMAT 12-PB **Unit-II: Chemical Kinetics** Opposing reactions, consecutive reactions and parallel reactions (with explanation of kinetic and thermodynamic control of products; all steps first order).	SK	3	
Dec	**CEMAT 12-PA** **Unit -I : Kinetic Theory of Gas** Calculations of average, root mean square and most probable values in each case ; calculation of the number of molecules having energy $\geq \varepsilon$. 3	BD	3	
	CEMAT 12-PA **Unit-II : Real gas and Liquid State** Work of cohesion and adhesion, spreading of a liquid over other surface. Vapour pressure over curved surface. Temperature dependence of surface tension. 3	SM	3	
	CEMAT 12-PB **Unit-I : Thermodynamics-I** Gas under isothermal and adiabatic conditions for reversible and irreversible processes including free expansion. Heat changes during various physico-chemical processes at constant pressure / constant volume.3	SG	3	
	CEMAT 12-PB **Unit-II: Chemical Kinetics** Temperature dependence of rate constant: Arrhenius equation, energy of activation.	SK	3	
Jan	**CEMAT 12-PA** **Unit -I : Kinetic Theory of Gas** Principle of the equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases. 3	BD	3	
	CEMAT 12-PA **Unit-II : Real gas and Liquid State**	SM	3	

	General features of fluid flow (streamline flow and turbulent flow). Reynold number, nature of viscous drag for streamline motion. 3			
	CEMAT 12-PB **<u>Unit-I : Thermodynamics-I</u>** Hess's law, Kirchoff's relation, concept of standard state, bond dissociation energy, Born-Haber cycle for calculation of lattice energy.3	SG	3	
	CEMAT 12-PB **<u>Unit-II: Chemical Kinetics</u>** Collision theory (detailed treatment); outline of Transition State theory.	SK	3	
Feb	**CEMAT 12-PA** **<u>Unit -I : Kinetic Theory of Gas</u>** Collision of gas molecules; collision diameter; collision number and mean free path; 3	BD	3	
	CEMAT 12-PA **<u>Unit-II : Real gas and Liquid State</u>** Newton' equation, viscosity coefficient. Poiseuille's equation (with derivation). 3	SM	3	
	CEMAT 12-PB **<u>Unit-I : Thermodynamics-I</u>** Spontaneous process, heat engine, Carnot cycle and its efficiency, statements of second law, refrigeration cycle, thermodynamic scale of temperature.3	SG	3	
	CEMAT 12-PB **<u>Unit-II: Chemical Kinetics</u>** Primary kinetic salt effect. Lindemann theory of unimolecular reaction.	SK	3	
Mar	**CEMAT 12-PA** **<u>Unit -I : Kinetic Theory of Gas</u>** Frequency of binary collisions (similar and different molecules); wall collision and rate of effusion. 3	BD	3	
	CEMAT 12-PA **<u>Unit-II : Real gas and Liquid State</u>** Temperature dependence of viscosity of liquid and its difference from gas, principle of determination of viscosity coefficient of liquids by the falling sphere method. 3	SM	3	
	CEMAT 12-PB **<u>Unit-I : Thermodynamics-I</u>** Entropy as a state function, Clausius inequality, calculation of entropy changes in different processes, molecular interpretation of entropy.3	SG	3	
	CEMAT 12-PB **<u>Unit-II: Chemical Kinetics</u>** Lindemann theory of unimolecular reaction. Homogeneous catalysis with reference to acid-base catalysis.	SK	3	
Apr-	**CEMAT 12-PA** **<u>Unit -I : Kinetic Theory of Gas</u>** Viscosity of gases from kinetic theory of gas. 1	BD	1	
		SM	1	
	CEMAT 12-PB **<u>Unit-I : Thermodynamics-I</u>** Maxwell relations.1	SG	1	
	CEMAT 12-PB **<u>Unit-II: Chemical Kinetics</u>** Homogeneous catalysis with reference to acid-base catalysis.	SK	1	
	Total Class:		**100**	

Resources:

3. Books:

1. Mortimer, R. G. *Physical Chemistry*, Elsevier
2. Laidler, K. J. *Chemical Kinetics*, Pearson
2. Glasstone, S. & Lewis, G.N. *Elements of Physical Chemistry*
4. Rakshit, P.C., *Physical Chemistry* Sarat Book House
5. Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
6. Atkin, P. *Shriver & Atkins' Inorganic Chemistry,* 5th Ed., Oxford University Press (2010).
7. Cotton, F.A., Wilkinson, G. and Gaus, P.L., *Basic Inorganic Chemistry 3rdEd.;*Wiley India.
8. Sharpe, A.G., *Inorganic Chemistry*, 4th Indian Reprint (Pearson Education) 2005.
9. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. *Inorganic Chemistry, Principles ofStructure and Reactivity 4th Ed.*, Harper Collins 1993, Pearson,2006.
10. Atkins, P.W. & Paula, J. *Physical Chemistry*, Oxford Press, 2006.
11. Nasipuri, D. *Stereochemistry of Organic Compounds*, Wiley Eastern Limited.
12. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
13. Finar, I. L. *Organic Chemistry (Volume 1)* Pearson Education.
14. Graham Solomons, T.W., Fryhle, C. B. *Organic Chemistry*, John Wiley & Sons, Inc.
15. James, J., Peach, J. M. *Stereochemistry at a Glance*, Blackwell Publishing, 2003.
16. Robinson, M. J. T., *Stereochemistry*, Oxford Chemistry Primer, Oxford University Press, 2005.

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).

Paper II (Practical)

Courses: CEMAP 12-PrA, 12-PrB **Total Marks: 50**

CO1: In their practical classes, they will learn how to carry out an experiment properly. During various experimentationsthey will be trained to analyze organic compounds, inorganic cations and anions.

Course coordinator: DR. BIDYUT DEBNATH

Course planner

SL	**Course Topic**	Teacher	Class No	Remarks
Aug	Melting point determination, Detection of special elements (N, Cl, Br, I, S) by Lassigne's test	SK+SG	9	
	Determination of hardness of water (by EDTA).	SM+BD	9	
Sept	Detection of special elements (N, Cl, Br, I, S) by Lassigne's test.	SK+SG	9	
	Estimation of vitamin-C (Iodometry).	SM+BD	9	
Nov	Solubility and classification. (Solvents: water, 5% HCl, 5% $NaHCO_3$, 5% NaOH)	SK+SG	9	
	Determination of strength of H_2O_2 (Permanganometry).	SM+BD	9	
Dec	Detection of the following functional groups: Aromatic amino(NH_2), anilido, amido, aromatic nitro.	SK+SG	9	
	Estimation of i) NH_4^+ ii) H_3BO_3 (any one).	SM+BD	9	
Jan	Detection of the following functional groups: C=C, phenolic OH, ester	SK+SG	9	
	Estimation of available oxygen in pyrolusite.	SM+BD	9	

Feb	Detection of the following functional groups: carboxylic acid, carbonyl(aldehyde and ketone distinction)	SK+SG	9	
	Estimation of Cu(II) – iodometric.	SM+BD	9	
Mar	Preparation of suitable derivative.	SK+SG	9	
	Estimation of Fe(III) – after reduction (Dichromatometry).	SM+BD	9	
Apr-	Melting point determination of derivative	SK+SG	6	
	Any test as per students need.	SM+BD	6	
	Total Class:		**138**	

Books:

1. Bhattacharyya, R. C, *A Manual of PracticalChemistry.*
2. Vogel, A. I. *Elementary Practical Organic Chemistry*, Part 2: *Qualitative Organic Analysis,* CBS Publishers andDistributors.
3. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry,* Pearson Education(2009).
4. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. *Practical Organic Chemistry,5th Ed.,* Pearson(2012).
5. Dutta, S, *B. Sc. Honours Practical Chemistry*, Bharati BookStall.
6. Advanced Practical Chemistry, S.C.Das,

COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2017-18
CEMA II-Year

Paper III/ Paper Code: **CEMAT 23-IA, 23-IB, 23-OA, 23-OB**/ Total Marks: 100

Course coordinator: **DR. SUMAN MANDAL**
CO1: Students will get the fundamental knowledge about Chemical periodicity
CO2: They will learn also NMR, IR spectroscopy.
CO3: They will learn about redox reaction.
Course planner

SL	Course Topic	Teacher	Class No	Remarks
Jul	**CEMAT 23-IA** **Unit I. Chemical Periodicity II** • General trends of variation of electronic configuration, elemental forms, metallic nature, magnetic properties (if any), catenation and catalytic properties (if any), oxidation states.	BD	3	
		SG	2	
	CEMAT 23-OA **Unit-I** ➢ **UV:** Electronic transitions (σ- σ*, n- σ*, π- π*, n- π*).	SK	2	
Aug	**CEMAT 23-IA** **Unit I. Chemical Periodicity II** • Inert pair effect (if any), aqueous and redox chemistry in common oxidation states, properties and reactions of important compounds such hydrides, halides, oxides, oxy-acids (if any), complex chemistry (if any) in respect of the following elements: (i) s-block elements: Li-Na-K, Be-Mg-Ca-Sr-Ba.	SM	6	

Sept	**CEMAT 23-IA** **Unit I. Chemical Periodicity II** • (ii) p-block elements: B-Al-Ga-In-Tl, C-Si-Ge-Sn-Pb, N-P-As-Sb-Bi, O-S-Se-Te,F-Cl-Br-I, He-Ne-Ar-Kr-Xe.	BD	5	
	CEMAT 23-OA **Unit-I** ➢ **IR:** Modes of molecular vibration, application of Hook's law, force constant, factor influencing stretching frequency (H-bonding, mass, electronic factors, bond multiplicity, ring size, solvent effect, bond coupling), Fermi resonance, characteristic and diagnostic stretching frequencies of O-H, N-H, C-H, C-D, C=C, C=N, C=O, C≡C, C≡N functions.	SG	5	
	CEMAT 23-OA **Unit-I** ➢ Factor influencing the relative position of λmax (conjugative effect, steric effect, solvent effect, conformational effect, effect of pH), relative intensity of absorption of allowed transition, transition moment, effective chromophor concentration, red shift (bathochromic shift), blue shift (hypsochromic shift), hyperchromic shift, hypochromic shift (typical examples).	SK	5	
	CEMAT 23-IA **Unit II. Other Types of Bonding** • Molecular orbital concept of bonding (elementary pictorial approach) :sigma and pi-bonds, multiple bonding, MO diagrams of H_2, F_2, O_2, C_2, B_2, CO, NO, CN^-, HF, and HF_2^- ion, BeH_2, CO_2, magnetic properties, bond orders, bond lengths. Coordinate bonding: Lewis acid-base adducts (examples), double salts and complex salts, Werner theory of coordination compounds.	BD	8	
	CEMAT 23-OA **Unit-I** ➢ **^{1}H-NMR:** Nuclear spin, NMR active nuclei, principle of proton magnetic resonance, equivalent and non-equivalent protons, chemical shift(δ) , shielding and deshielding of protons, upfield and downfield shift, NMR peak area, spin-spin coupling(simple type), ^{1}H-NMR spectra of toluene, nitrobenzene, benzaldehyde, o-,m-,p-dichlorobenzene, dinitrobenzene, CH_3CH_2Br, CH_3CHBr_2, CH_2BrCH_2Br, $CHBr_2CH_2Br$, CH_3CH_2OH (ordinary and pure), *E*- and *Z*- 2-butene, ethylene and acetylene, *E*- and *Z*-1-Bromo-2-chloroethene. ➢ Mass: Basic principle of mass spectroscopy	SK SG	6 6	
	CEMAT 23-IB **Unit I** • IUPAC nomenclature of coordination compounds (up to two metal centers). Coordination numbers, constitutional isomerism. Stereoisomerism in square planar and octahedral complexes. Hydrogen bonding and its effects on the physical properties and chemical properties of compounds of the main group elements.	SM	6	
Oct				
	CEMAT 23-IB **Unit I** • Metallic bonding: qualitative idea of band theory, conducting, semi conducting and insulating properties with examples from main group elements.	BD	6	

Nov	**CEMAT 23-OA** **<u>Unit II</u>** ➢ Phenol, ambident nucleophile: C- substitution versus O-substitution, reaction of phenols: Reimer-Tiemann reaction, Kolbe's reaction, Manasse reaction, alkylation, acetylation, Fries rearrangement, Claisen rearrangement, nitration, sulphonation, halogenation, oxidation (aerial), oxidative coupling by Fe^{3+}, Dakin reaction, Cumene-phenol rearrangement.	SK	4	
		SG	4	
	CEMAT 23-IB **<u>Unit I</u>** • Ambidentate and polydentate ligands, chelate complexes, inermetalliccomplexes(formation as a function of pH and effect of entropy and ring size). • IUPAC nomenclature of coordination compounds (up to two metal centers). Coordination numbers, constitutional isomerism. Stereoisomerism in square planar and octahedral complexes.	SM	6	
Dec	**CEMAT 23-IB** **<u>Unit I</u>** • Hydrogen bonding and its effects on the physical properties and chemical properties of compounds of the main group elements. • Metallic bonding: qualitative idea of band theory, conducting, semi conducting and insulating properties with examples from main group elements.	SM	3	
		BD	4	
	CEMAT 23-OA **<u>Unit II</u>** ➢ Organometallic compounds: Preparation and synthetic applications of organomagnesium, organolithium, organozinc, organocopper, use of TMSCl, TMSI, TMSCN. ➢ Stereochemistry: cumulene with odd and even number of C=C, axial chirality (allene, spiro compound, alkylidene cycloalkanes, biphenyls (atropisomerism)), and R/S nomenclature.	SK	3	
		SG	3	
Jan	**CEMAT 23-OA** **<u>Unit II</u>** ➢ Resolution of racemic acids, bases, and alcohols, optical purity/enantiomeric excess, topicity(topic attribute-chirotopic, achirotopic,; topic relationship-homotopic, enantitopic, diastereotopic), prochirality, Pro-r, Pro-s and re/si descriptor.	SG	6	
	CEMAT 23-IB **<u>Unit I</u>** • Noble gases: oxides, fluorides and oxofluorides of xenon; chemical and photochemical reactions of ozone.	BD	4	
	CEMAT 23-OB **<u>Unit I</u>** ➢ Electrophilic substitution at α position of carbonyl compounds (D-exchange, nitrosation, halogenation, haloform reaction, SeO_2 oxidation), Baeyer-Villiger oxidation, concept of umpulong.	SK	6	
	CEMAT 23-IB **<u>Unit II. Precipitation and Redox Reactions</u>** • Elementary idea on standard redox potentials with sign conventions, Nernst equation. Influence of complex formation, precipitation and change of pH and ionic strength on redox potentials; formal potential.	SM	5	

Feb	**CEMAT 23-OB** **Unit I** ➢ Carboxylic acids and their derivatives: Nucleophilic substitution at the acyl carbon of acyl halide, anhydride, ester, carboxylic acid, amide, esterification of carboxylic acids and hydrolysis of ester-AAc^2, AAc^1, AAl^1, BAc^2, BAc^1,BAl^1 mechanisms, HVZ reaction, Claisen ester condensation, Bouveault Blanc reduction, decarboxylation reaction, Hunsdiecker reaction, action of heat on hydroxy acid.	SG	5	
		SK	3	
Mar	**CEMAT 23-IB** **Unit II. Precipitation and Redox Reactions** • Feasibility of a redox titration, redox potential at theequivalence point, redox indicators. Redox potential diagram (Latimer, Frost, Ellingham diagrams) of common elements and their applications. Disproportionation and comproportionation reactions (typical examples), Choice of redox indicators.	SM	4	
		BD	4	
Apr	**CEMAT 23-OB** **Unit II** ➢ Organonitrogen compounds: synthesis and reactions of nitroalkanes, alkylnitrites, alkyl cyanides and isocyanides, aliphatic amines, aromatic nitro, amines and diazo compounds, distinction and separation of 1^0,2^0,3^0 amines, diazomethane, diazoacetic ester-preparation and synthetic applications.	SG	4	
		SK	2	
		SM	3	
		Total :	133	

Resources:

Books:

1. J.D Lee Concise Inorganic Chemistry
2. Huheey, J. E et, al Inorganic Chemistry

3.I.LFinar Organic Chemistry (Volume-I)

4. J. March Advanced Organic Chemistry

Other resources : Class notes and e materials

*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: 2017-18
CEMA II-Year

Paper IV/ Paper Code: CEMAT 24-PA, 24-PB, CEMAP 24-PrA, 24-PrB (Each 25 marks : Total 100 marks)

Course coordinator: **DR. SUMAN MANDAL**

CO1: Students will learn preliminary ideas about quantum chemistry.
CO2: They will also learn Thermodynamics, Chemical equilibrium.
CO3: This course also provides practical ideas about different ions and their analysis.

Course planner

SL	Course Topic	Teacher	Class No	Remarks
Jul	**CEMAT 24-PA** **Unit-I : Quantum Chemistry I** • Black body radiation: Rayleigh-Jeans and Planck's energy distribution law, Planck's theory, Wave-particle duality, light as particles: photoelectric and Compton effects; electrons as waves (electron diffraction experiment) and the de Broglie hypothesis.	SM	4	
	CEMAT 24-PB **Unit-I : Thermodynamics(II) and Chemical Equilibrium** ➢ Gibbs function (G) and Helmholtz function (A), criteria of thermodynamic equilibria and spontaneity, Maxwell's relations, variation of G and A with P, V and T, Thermodynamic equation of state.	BD	3	
Aug	**CEMAT 24-PA** **Unit-I : Quantum Chemistry I** • Elementary concepts of operators, eigenfunctions and eigenvalues. Linear operators. Commutation of operators, fundamental commutator and uncertainty relation (without proof). Expectation value. Hermitian operator. Schrödinger time-dependent and time-independent equation: nature of the equation, acceptability conditions imposed on the wave functions and probability interpretations of wave function, postulates of quantum mechanics.	SG	4	
		SM	4	
	CEMAT 24-PB **Unit-I : Thermodynamics(II) and Chemical Equilibrium** ➢ Clausius-Clapeyron equation, equilibrium between different phases, system of variable composition, partial molar	BD	5	

	quantities, chemical potential of a component in an ideal mixture, thermodynamic functions of mixing of ideal gases, Gibbs-Duhem equation, variation of chemical potential with T, P and mole fraction, thermodynamics of real gases – fugacity and activity determination.	SK	2	
Sept	**CEMAP 24-PrA** **Experiments:** ❖ 1. Determination of surface tension of a given solution by the drop weight method using a stalagmometer, considering aqueous solutions of NaCl, acetic acid, ethanol etc, as systems. ❖ Determination of viscosity coefficient of a given solution with Ostwald's viscometer considering aqueous solutions of cane-sugar, glycerol, ethanol, etc. ❖ Determination of solubility of sparingly soluble salts in water and various Electrolyte medium by titrimetric method. KHTa as sparingly soluble salt in water, KCl, $NaNO_3$ may be used.	BD+SM	8	
	CEMAT 24-PA **<u>Unit-I : Quantum Chemistry I</u>** • Particle in a box: setting up of Schrodinger equation for one-dimensional box and its solution. Comparison with free particle eigenfunctions and eigenvalues. Properties of PB wave functions (normalisation, orthogonality, probability distribution). Expectation values of x, x^2, p_x and p_x^2 and their significance in relation to the uncertainty principle. Extension of the particle in a one-dimensional problem to two and three dimensions and the concept of degenerate energy levels.	SG	3	
		SM	3	
	CEMAT 24-PB **<u>Unit-I : Thermodynamics(II) and Chemical Equilibrium</u>** ➢ Equilibrium constant and standard Gibbs free energy change. Definitions of KP, KC and Kx; 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. Le Chatelier's principle and degree of advancement.	BD	4	
	CEMAP 24-PrA **Experiments:** ❖ 4. Determination of partition coefficient of Iodine or Acetic acid in water and an immiscible organic solvent. ❖ Determination of the rate constant for the first order acid catalyzed hydrolysis of an ester (V_0 and V_∞ to be supplied) ❖ Determination of rate constant of decomposition of H_2O_2 by acidified KI solution using clock reactions.	SK+SG	10	
Oct				
	CEMAT 24-PA **<u>Unit-I : Quantum Chemistry I</u>** • Simple Harmonic Oscillator: setting up of the Schrodinger equation, energy expression (without derivation), expression of wave function for n = 0 and n = 1 (without derivation) and their characteristic features.	SG	4	

Nov	**CEMAT 24-PB** **<u>Unit -II : Electrochemistry(Conductance, EMF and Ionic Equilibrium)</u>** ➢ Conductance and measurement of 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, ion conductance and ionic mobility. Equivalent and molar conductance at infinite dilution and their determination for strong and weak electrolytes. Ostwald's dilution law.	SM	6	
		BD	4	
	CEMAP 24-PrA **Experiments:** ❖ Determination of the equilibrium constant of the reaction KI + I_2 = KI_3 by partition method (partition coefficient to be supplied). ❖ Determination of pH of an unknown buffer solution by colour matching.	SM+BD	8	
Dec	**CEMAT 24-PA** **<u>Unit-II : Quantum Chemistry II and Photochemistry</u>** • Stationary Schrodinger equation for the H-atom in polar coordinates, separation of radial and angular (θ, φ) parts. Solution of φ-part and emergence of quantum number 'm'; energy expression (without derivation), degeneracy. Hydrogenic wave functions up to n = 2 (expression only); real wave function. Concept of orbitals and shapes of s and p orbitals.	SG	4	
		SM	2	
	CEMAT 24-PB **<u>Unit -II : Electrochemistry(Conductance, EMF and Ionic Equilibrium)</u>** ➢ Debye-Huckel model (physical idea only). Application of conductance measurement (determination of solubility product and ionic product of water). Conductometric titrations. Determination of transport number by moving boundary method.	BD	4	
	CEMAP 24-PrB 25 marks(37L) **<u>Qualitative inorganic analysis of mixtures containing not more than 4 radicals from the following:</u>** ❖ **Cation Radicals**: Na^{+}, K^{+}, NH_4^{+}, Ca^{+2}, Sr^{+2}, Ba^{+2}, Al^{+3}, Mg^{+2}, Cr^{+3}, Mn^{+2}, Fe^{+2}, Fe^{+3}, Sn^{2+}, Co^{+2}, Ni^{+2}, Cu^{+2}, Zn^{+2}, Sb^{+3}.	BD+SM	8	
Jan	**CEMAT 24-PA** **<u>Unit-II : Quantum Chemistry II and Photochemistry</u>** • Potential energy curves (diatomic molecules), Qualitative idea of Born Oppenheimer approximation and Franck-Condon principle, vibrational structure of electronic spectra. Bond dissociation and principle of determination of dissociation energy (ground state). Decay of excited states by radiative and non-radiative processes. Fluorescence and phosphorescence, Jablonsky diagram.	SG	5	
	CEMAT 24-PB **<u>Unit -II : Electrochemistry(Conductance, EMF and Ionic Equilibrium)</u>**			

	➢ Types of electrochemical cells and examples, cell reactions, emf and change in free energy, ΔH and ΔS of cell reactions from emf measurements. Thermodynamic derivation of Nernst equation. Standard cells. Half-cells/electrodes, different types of electrodes (with examples).	SM	6	
	<u>Qualitative inorganic analysis of mixtures containing not more than 4 radicals from the following:</u> ❖ **Anion Radicals**: F^-, Cl^-, Br^-, BrO_3^-, I^-, SCN^-, S^{2-},SO_3^{2-} , SO_4^{2-} $S_2O_3^{2-}$, NO_3^-, NO_2^-, PO_4^{3-}, BO_3^{3-} CrO_4^{2-}/ $Cr_2O_7^{2-}$, $Fe(CN)_6^{4-}$, $Fe(CN)_6^{3-}$. IO_3^-	SG+SK	8	
Feb	**CEMAT 24-PA** **<u>Unit-II : Quantum Chemistry II and Photochemistry</u>** • Laws of photochemistry: Grotthus-Draper law, Stark-Einstein law of photochemical equivalence and Lambert-Beer's law; quantum yield and its measurement for a photochemical process, actinometry. Photostationary state. Photosensitized reactions. Kinetics of HI decomposition, H_2-Br_2 reaction, dimerisation of anthracene.	SM	4	
	CEMAT 24-PB **<u>Unit -II : Electrochemistry(Conductance, EMF and Ionic Equilibrium)</u>** ➢ Standard electrode potential (IUPAC convention) and principles of its determination. Types of concentration cells. Liquid junction potential and its minimization. Glass electrode and determination of pH of a solution. Potentiometric titrations: acid-base and redox.	BD	6	
	<u>Qualitative inorganic analysis of mixtures containing not more than 4 radicals from the following:</u> ❖ **Insoluble Materials**: Al_2O_3, Fe_2O_3, Cr_2O_3, SnO_2, $SrSO_4$, $BaSO_4$, CaF_2.	BD+SM	4	
Mar	**CEMAT 24-PB** **<u>Unit -II : Electrochemistry(Conductance, EMF and Ionic Equilibrium)</u>** ➢ Activity and activity coefficients of electrolyte/ion in solution. Debye-Huckel limiting law (statement and applications only). Solubility equilibrium and influence of common ions and indifferent ions thereon. pH, buffer solution, buffer capacity, salt hydrolysis (detailed treatment).	SK	4	
		SG	2	
	<u>Qualitative inorganic analysis of mixtures containing not more than 4 radicals from the following:</u> ❖ Detection of toxic metal ions and radicals (*<u>under special supervision</u>*): As^{3+}, AsO_4^{3-}, Bi^{3+}, Pb^{2+}, Hg_2^{2+}, Hg^{2+}, Cd^{2+}	BD+SM	6	
Apr-	Problem Solve	SG+SK+SM	4	
	<u>Qualitative inorganic analysis of mixtures containing not more than 4 radicals from the following:</u> ❖ Detection of radicals from unknown salts	SM+BD	4	
		Total:	143	

Resources:
Books:

1. P. W Atkins et. al Physical Chemistry
2. I. N Levine Physical Chemistry
3. S. Glasstone An Introduction to Electrochemistry
4. K. S dey and S. R Palit Practical Physical chemistry

Other resources: Class notes and e-materials

*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: 2017-18
CEMA III-Year (1+1+1 Systems)

Paper V/ Paper Code: CEMAT 35-IA, 35-IB, 35-AA, 35-AB/ Total Marks: 100
Course coordinator: DR. SAHELI GANGULI
CO1: Student will learn about Coordination chemistry and its applications.
CO2: The course provides ideas about the d, f block elements and bioinorganic chemistry.
CO3: Students will learn about different organo metallic chemistry.
Course planner

SL	Course Topic	Teacher	Class No	Remarks
Jul-	**CEMAT 35-IA** **Unit I. Chemistry of coordination compounds** Isomerism, reactivity and stability: Determination of configuration of cis- and trans- isomers by chemical methods. Labile and inert complexes (application of CFAE), substitution reaction on square planer complexes.	SM	2	
	CEMAT 35-IA **Unit II. Chemistry of d- and f- block elements** General comparison of 3d, 4d and 5d elements in term of electronic configuration, elemental forms, metallic nature, atomization energy.	BD	2	
	CEMAT 35-IB **Unit I. Organometallic Compounds** 18-electron rule and its applications to carbonyls (including carbonyl hydrides and carbonylates).	SG	2	
	CEMAT 35-IB **Unit II: Gravimetric and tritimetric methods of analysis** Requirements of gravimetry: properties of precipitates and precipitating regents, particle size and filterability of precipitates.	SG	1	
	CEMAT 35-AA **Unit I. Bioinorganic Chemistry** Elements of life: essential major, trace and ultratrace elements.	SK	1	
Aug	**CEMAT 35-IA** **Unit I. Chemistry of coordination compounds** Trans effect (example and applications). Stability constants of coordination compounds and their importance in inorganic analysis.	SM	4	

	Structure and bonding: EAN rule, VB description and its limitations. Elementary Crystal Field Theory: splitting of d^n configurations in octahedral, square planar and tetrahedral fields, crystal field stabilization energy in weak and strong fields.			
	CEMAT 35-IA **Unit II. Chemistry of d- and f- block elements** General comparison of 3d, 4d and 5d elements in term of oxidation states, redox properties, coordination chemistry, spectral and magnetic properties.	BD	4	
	CEMAT 35-IB **Unit I. Organometallic Compounds** nitrosyls, cyanides, and nature of bonding involved therein. Simple examples of metal-metal bonded compounds and metal clusters.	SG	4	
	CEMAT 35-IB **Unit II: Gravimetric and tritimetric methods of analysis** Colloidal and crystalline precipitates coprecipitation and post-precipitation drying and ignition of precipitates, principles of gravimetric estimation of chloride, phosphate, zinc, iron, aluminum and magnesium singly.	SG	4	
	CEMAT 35-AA **Unit I. Bioinorganic Chemistry** Basic chemical reactions in the biological systems and the role of metal ions (specially Na^+, K^+, Mg^{2+}, Ca^{2+}, $Fe^{3+/2+}$, $Cu^{2+/+}$, and Zn^{2+}).	SK	4	
Sept	**CEMAT 35-IA** **Unit I. Chemistry of coordination compounds** Pairing energy, evidence and application of crystal field (lattice energy, ionic radius, hydration energy, redox pot, spinel), Jahn-Teller distortion(static and dynamic),evidence from stability constant and vis-spectra. Metal-ligand bonding (MO concept, elementary idea), sigma- and pi-bonding in octahedral complexes (qualitative pictorial approach) and their effects on the oxidation states of transitional metals (examples).	SM	4	
	CEMAT 35-IA **Unit II. Chemistry of d- and f- block elements** f-block elements: electronic configuration, ionization energies, oxidation states, variation in atomic and ionic (3+) radii, magnetic and spectral properties of lanthanides,	BD	4	
	CEMAT 35-IB **Unit I. Organometallic Compounds** Metal-olefin complexes: zeises salt (preparation, structure and bonding), Ferrocene (preparation, structure and reactions). Hapticity(n) of organometallic ligands,	SG	4	
	CEMAT 35-IB **Unit II: Gravimetric and tritimetric methods of analysis** Primary and secondary standard substances in acid-base, redox, complexometric (EDTA) and argentometric titrations. Principle and application of redox tritimetric estimation based on the use of the following reagents: $KMnO_4$, $K_2Cr_2O_7$, I_2, $Na_2S_2O_3.5H_2O$, $KH(IO_3)_2$and $KBrO_3$. Principle of argentimetric estimation of chloride using adsorption indicators.	SG	4	
	CEMAT 35-AA **Unit I. Bioinorganic Chemistry** Metal ion transport across biological membrane Na^+-ion pump, ionophores. Biological functions of hemoglobin and myoglobin,	SK	2	
Nov	**CEMAT 35-IA** **Unit I. Chemistry of coordination compounds** Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of d^n ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic	SM	4	

	moment: super exchange and antiferromagnetic interactions (elementary idea with examples only); d-d transitions.			
	CEMAT 35-IA **<u>Unit II. Chemistry of d- and f- block elements</u>** comparison between lanthanide and actinides, separation of lanthanides (by ion-exchange method).Chemistry of some representative compounds: $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$,	BD	4	
	CEMAT 35-IB **<u>Unit I. Organometallic Compounds</u>** Examples of mono tri and penta-haptocyclopentadienyl complexes. Simple examples of fluxional molecules. Coordinative unsaturation: oxidative addition and insertion reactions.	SG	4	
	CEMAT 35-IB **<u>Unit II: Gravimetric and tritimetric methods of analysis</u>** Principle of complexometric EDTA titration, metal ion indicators (examples), masking and demasking reactions, estimation of Cu-Zn, Fe-Al and Ca-Mg mixture by EDTA titration methods.	SG	4	
	CEMAT 35-AA **<u>Unit I. Bioinorganic Chemistry</u>** Cytochromes and ferredoxins, carbonate bicarbonate buffering system and carbonicanhydrase. Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II.	SK	4	
Dec	**CEMAT 35-IA** **<u>Unit I. Chemistry of coordination compounds</u>** L-S coupling, Hole formalism principle; qualitative Orgel diagrams for $3d^1$-$3d^9$ ions and their spectroscopic ground states; selection rules for electronic spectral transitions; spectrochemical series of ligands; Nephelauxetic parameter charge transfer spectra, different types (elementary idea with examples).	SM	4	
	CEMAT 35-IA **<u>Unit II. Chemistry of d- and f- block elements</u>** Chemistry of some representative compounds:$K_2[Ni(CN)_4]$, H_2PtCl_6, $Na_2[Fe(CN)_5NO]$. **CEMAT 35-AA** **<u>Unit II. Material Chemistry</u>** Silicate minerals (Quartz)Zeolite: structure, accommodation of 'guest ions'.	BD	2+2	
	CEMAT 35-IB **<u>Unit I. Organometallic Compounds</u>** Homogeneous catalysis by organometallic compounds: hydrogenation, hydroformylation and polymerization of alkenes (Ziegler-Natta catalysis).	SG	4	
	CEMAT 35-IB **<u>Unit II: Gravimetric and tritimetric methods of analysis</u>** Dissolution, scheme of analysis and principles of estimation of the constituents of the following materials: dolomite, pyrolusite, chalchopyrites, Portland cement, basic slag, brass, steel and type metal. **CEMAT 35-AB** **<u>Unit I : Bioorganic Chemistry</u>** Secondary, tertiary and quaternary structure of proteins,	SG	2+2	
	CEMAT 35-AA **<u>Unit I. Bioinorganic Chemistry</u>** Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases.	SK	4	
Jan	**CEMAT 35-AA** **<u>Unit II. Material Chemistry</u>** Nanomaterials: (Definition and properties).Carbon nano particles	BD	4	

	(BuckmisterFullerence C_{60}), Gold nano particles			
	CEMAT 35-AB **<u>Unit I : Bioorganic Chemistry</u>** Classification of enzymes and co-enzymes (simple examples), nucleic acids: structure of nucleosides and nucleotides, DNA, RNA, complementary base pairings, elementary idea of double helical structure of DNA [Watson-Crick model, Houg-Steen model (for adenine only)], naturation and denaturation of protein.	SK SG SM	16	
Feb	**CEMAT 35-AA** **<u>Unit II. Material Chemistry</u>** Metal clusture structure i) carbonyl ii) oxide, Metal surface catalysis (NH_3 products, Haber process).	BD	4	
	CEMAT 35-AA **<u>Unit II. Material Chemistry</u>** Polymer: definition, classification, different types of molecular weight.	SM	4	
	CEMAT 35-AB **<u>Unit-II : Biophysical Chemistry</u>** Colloids and their stability, elementary idea of electrical double layer and its protective role in the stability of colloids, isoelectric point, Autocatalysis, Enzyme catalysis, Michaelis-Menten equation, Lineweaver-Burk plot, turnover number and catalytic efficiency of enzymes, Mechanisms of enzyme inhibition, pH-dependence of enzyme activity, Electrophoresis, elementary idea of gel electrophoresis,	SK SG	12	
Mar	**CEMAT 35-AA** **<u>Unit II. Material Chemistry/2</u>** Molecular weight determination (viscosity average and weight average method).	SM	4	
	CEMAT 35-AB **<u>Unit-II : Biophysical Chemistry</u>** polyacrylamide gel electrophoresis (PAGE) and SDS-PAGE, Isoelectric focusing.	BD SG SK	4	
Apr-				
	Total:		134	

Resources:

5. Books:

1. March, J. *Advanced Organic Chemistry*, Fourth edition,Wiley.
2. Jenkins, P. R., *Organometallic Reagents in Synthesis*, Oxford
3. Chemistry Primer, Oxford UniversityPress.
4. Moore, W. J. *Physical Chemistry*, OrientLongman
5. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. *Inorganic Chemistry, Principles ofStructure and Reactivity 4th Ed.,* Harper Collins 1993,Pearson,2006.
6. Cotton, F.A., Wilkinson, G., Murrillo, C. A., Bochmann, M., *Advanced Inorganic Chemistry 6th Ed. 1999.*,Wiley
7. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, NewDelhi.
8. J. A. Kent: Riegel‟s*Handbook of Industrial Chemistry*, CBS Publishers, NewDelhi.

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)

COURSE PLANER
Department of Chemistry
Basirhat College
Session: 2017-18
CEMA III-Year

Paper VI/ Paper Code: CEMAT 36-OA, 36-OB, 36-PA, 36-PB/ Total Marks: 100

Course coordinator: Dr. Bidyut Debnath

CO1: This course is about organic synthesis.

CO2: Students can enrich their knowledge about solution and it's different properties.

CO:3 Molecular spectra can be learnt from this course.

Course planner

SL	Course Topic	Teacher	Class hour	Remarks
Jul-	**CEMAT 36-OA** **UNIT I** Organic synthesis : Disconnection approach towards synthesis of bifunctional molecules (both cyclic and acyclic) :	SK	1	
	CEMAT 36-OA **UNIT II** Heterocyclic compounds: Synthesis (including retrosynthetic approach).	SK	1	
	CEMAT 36PB **Unit-II : Phase equilibria and colligative properties** Phase equilibrium and colligative properties.	BD	1	
	CEMAT 36-PA 17 **Unit-I: Statistical Thermodynamics and Third Law** Macrostates and microstates, thermodynamic probability.	SG	1	
	CEMAT 36PB 17 **Unit-I : Properties of Solid, interface and dielectrics** Crystal, crystal planes, law of rational indices.	SM	1	
Aug	**CEMAT 36-OA** **UNIT I** Concept of synthons, synthetic equivalents (ethyl acetoacetate, ethyl cyanoacetate and diethyl malonate as examples), functional group interconversion (FGI), protection and deprotection of common functional groups (-OH, -carbonyl, -NH_2, -COOH) in synthetic route.	SK	4	
	CEMAT 36-OA **UNIT II** reactivity, orientation and important reactions of furan, pyrrole, thiophene, pyridine, indole, quinoline and isoquinoline,	SK	5	
	CEMAT 36PB **Unit-II : Phase equilibria and colligative properties** Definitions of phase, component and degrees of freedom. Phase rule and its derivations. Definition of phase diagram. Phase equilibria for one component system – water, CO2. First order phase transition and Clapeyron equation; Use of Clausius-Clapeyron equation.	BD	5	
	CEMAT 36-PA **Unit-I: Statistical Thermodynamics and Third Law** Entropy and probability, Boltzmann distribution formula (with derivation). Applications to barometric distribution.	SG	4	
	CEMAT 36PB 17 **Unit-I : Properties of Solid, interface and dielectrics** Calculation of fraction occupied for simple cubic, bcc, and fcc. Miller indices. Bragg's law and its applications for the	SM	4	

	determination of crystal structure for cubic system single crystal. Crystal structures of NaCl and KCl. Brief idea about liquid crystals.			
Sept	**CEMAT 36-OA** **UNIT I** Activation of synthetic equivalents, umpulong, illogical electrophiles and nucleophiles, disconnection and synthesis of 1,3-, 1,4, 1,5 and 1,6-dioxygenated compounds, Robinson ring annulation, Favorskii rearrangement, large ring compound synthesis (High dilution principle)	SK	4	
	CEMAT 36-OA **UNIT II** Knorr pyrrole synthesis, Hantzsch pyridine synthesis, Fischer indole synthesis and Bischler-Napieralsky synthesis.	SK	5	
	CEMAT 36PB **Unit-II : Phase equilibria and colligative properties** Liquid vapour equilibrium for two component systems. Ideal solution at fixed temperature and pressure. Principle of fractional distillation. Duhem-Margules equation. Henry's law. Konowaloff's rule. Positive and negative deviations from ideal behaviour. Azeotropic solution. Liquid-liquid phase diagram using phenol-water system. Solid- liquid phase diagram. Eutectic mixture. Nernst distribution law. Solvent extraction.	BD	5	
	CEMAT 36-PA **Unit-I: Statistical Thermodynamics and Third Law** Partition function. Derivation of expression of thermodynamic functions using partition function.	SG	4	
	CEMAT 36PB 17 **Unit-I : Properties of Solid, interface and dielectrics** Special features of interfaces compared to bulk. Surface dynamics: Physical and chemical adsorption. Freundlich and Langmuir adsorption isotherms; multilayer adsorption and BET isotherm (no derivation required). Gibbs adsorption isotherm and surface excess. Heterogeneous catalysis (single reactant).	SM	4	
Nov	**CEMAT 36-OA** **UNIT I** Stereoselective synthesis (Cram's rule, Prelog's rule). Pericyclic reactions : Definition and classification, Electrocyclic reactions : FMO approach, examples of electrocyclic reactions (thermal and photochemical) involving 4- and 6π- electrons and corresponding cycloreversion reactions,	SK	2+2	
	CEMAT 36-OA **UNIT II** Pharmaceuticals: Preparation and uses of sulphadiazine, chloroquine, metronidazole, chlorpromazine, indomethacin, ranitidine.	SK	5	
	CEMAT 36PB **Unit-II : Phase equilibria and colligative properties** ΔG, ΔS, ΔH and ΔV of mixing for binary solutions. Vapour pressure of solution. Ideal solutions, ideally diluted solutions and colligative properties. Raoult's law. Thermodynamic derivation of colligative properties of solution (using chemical potential) and their inter-relationships. Abnormal colligative properties.	BD	5	
	CEMAT 36-PA **Unit-I: Statistical Thermodynamics and Third Law** Dulong-Petit's law and Einstein's theory of heat capacity of solids. Limitation of Einstein's theory and Debye's modification (qualitative).	SG	4	
	CEMAT 36PB 17 **Unit-I : Properties of Solid, interface and dielectrics** Electrical properties of molecules: Polarizability of atoms and	SM	4	

	molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules.			
Dec	**CEMAT 36-OA** **<u>UNIT I</u>** Cycloaddition reactions : FMO approach, Diels-Alder Reaction, photochemical [2+2] reactions, Sigmatropic shifts and their order, [1,3] and [1,5] H shifts, [3,3] shifts with references to Claisen and Cope rearrangements, ene reaction (simple treatment) Polynuclear hydrocarbons: Nomenclature, synthesis and important reactions of naphthalene, anthracene and phenanthrene.	SK	4	
	CEMAT 36-OB **<u>UNIT II</u>** Amino acids, peptides and proteins: synthesis of α - amino acids [Gabriel, Strecker, azlactone, hydantoin, acetamidomalonic ester methodologies], isoelectric point, ninhydrin reaction.	SK	5	
	CEMAT 36-PA **<u>Unit-II : Molecular Spectroscopy</u>** Rotational spectroscopy of diatomic molecules: rigid rotor model, selection rules, spectrum, characteristic features of spectral lines (spacing and intensity). Determination of bond length, effect of isotopic substitution.	BD	5	
	CEMAT 36-PA **<u>Unit-I: Statistical Thermodynamics and Third Law</u>** Nernst heat theorem. Approach towards zero kelvin, adiabatic demagnetisation. Planck's formulation of third law and absolute entropies.	SG	4	
	CEMAT 36PB 17 **<u>Unit-I : Properties of Solid, interface and dielectrics</u>** Clausius-Mosotti equation and Debye equation (both without derivation) and their application. Determination of dipole moments.	SM	4	
Jan	**CEMAT 36-OB** **<u>UNIT I</u>** Streochemistry of cyclohexanes, mono- and disubstituted, Baeyer strain theory, Concept of I-strain, conformational analysis of cyclohexanes, energy profile of ring inversion of cyclohexane, symmetry properties of chair, boat and skew boat conformations. Conformational analysis of mono and di-substituted cyclohexanes, Dynamic stereochemistry: E_2, SN_2 and NGP, lactonisation reactions of cyclohexane systems.	SK	4	
	CEMAT 36-OB **<u>UNIT II</u>** Peptides: geometry of peptide linkage, peptide synthesis including Merrifield ptotocol, C - terminal and N- terminal determination, determination of amino acid sequence, proteins: classification , structure (primary only).	SK	5	
	CEMAT 36-PA **<u>Unit-II : Molecular Spectroscopy</u>** Vibrational spectroscopy of diatomic molecules: SHO model, selection rules, spectra; anharmonicity and its consequences on energy levels, overtones, hot bands.	BD	5	
	CEMAT 36-OB **<u>UNIT I</u>** Oxidation of cyclohexanols with chromic acid, pinacol-pinacolone rearrangements, esterification, saponification of ester, steric assistance and steric hindrance there in, cyclohexene and cylohexanone: stereochemistry, bromine addition and epoxydation of cyclohexene, nucleophilic addition to cyclohexanone.	SG	4	
	CEMAT 36-OB **<u>UNIT I</u>**	SM	4	

	Carbohydrates: monosaccharides: classification of monosaccharides, osazone formation, stepping up and stepping down of aldoses, interconversion of aldose and ketose, epimerization.			
Feb	**CEMAT 36-OB** **UNIT I** Constitution and configuration of D- glucose and D- fructose, ring structure and conformational aspects of D- glucose and its derivatives, anomeric effect, mutarotation of D- glucose, Disaccharides : Structure of sucrose only.	SK	4	
	CEMAT 36-OB **UNIT II** Natural products: Terpenoids : Classification, isoprene rule, structure and synthesis of citral, geraniol and nerol. Alkaloids: Structure and synthesis of ephedrine and nicotine.	SK	5	
	CEMAT 36-PA **Unit-II : Molecular Spectroscopy** Raman Effect. Characteristic features and conditions of Raman activity with suitable illustrations. Rotational and vibrational Raman spectra. Rule of mutual exclusion with examples.	BD	5	
		TOTAL	129	

Resources:

Books:

1. Ball, D. W. *Physical Chemistry*, ThomsonPress
2. Mortimer, R. G. *Physical Chemistry*,Elsevier
3. Laidler, K. J. *Chemical Kinetics*,Pearson
4. Glasstone, S. & Lewis, G.N. *Elements of PhysicalChemistry*
5. Rakshit, P.C., *Physical Chemistry* Sarat BookHouse
6. Eliel, E. L. &Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London,1994.
7. Nasipuri, D. *Stereochemistry of Organic Compounds*,Wiley EasternLimited.
8. Kemp, W. *Organic Spectroscopy*,Palgrave.
9. Pavia, D. L. *et al. Introduction to Spectroscopy,* 5th Ed. Cengage Learning India Ed.(2015).
10. Dyer, J. *Application of Absorption Spectroscopy of Organic Compounds*, PHI Private Limited

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: 2017-18
CEMA III-Year

Paper VII/ Paper Code: CEMAP 37-Pr/ Total Marks: 75(PRACTICAL)+25(LNB+VIVA)

Course coordinator: Dr. Bidyut Debnath

CO1: Students can get fundamental ideas about various experiments like TLC, redox titration, conductometric titration etc.

CO2: Those experiments which are very essential for future research.

Course planner

SL	Course Topic	Teacher	Class hour	Remarks
Jul-	Identification of amino acids by TLC/paper.	SK	3	
	To study the kinetics of inversion of sucrose using polarimeter.	BD	3	
	Determination of ionization constant of a weak acid by conductometric method.	SG	3	
Aug	Identification of amino acids by TLC/paper. Binary mixture separation (neutral + acid or base) and identification by TLC/Paper.	SK	9	
	To study the kinetics of inversion of sucrose using polarimeter. To study the phase diagram of a binary system (Phenol + water) and the effect of impurities (e.g. NaCl).	BD	9	
	Determination of ionization constant of a weak acid by conductometric method. To study the kinetics of saponification of ester by conductometric method.	SG	9	
Sept	Binary mixture separation (neutral + acid or base) and identification by TLC/Paper.	SK	9	
	Determination of formal potential of Fe^{+3}/Fe^{+2} couple in the hydrogen scale by potentiometric titration of ferrous ammonium sulfate solution using $KMnO_4$, or, $K_2Cr_2O_7$ as standard.	BD	9	
	Conductometric titration of HClvsNaOH, AcOHvsNaOH.	SG	9	
Nov	Determination of pK values of weak monobasic, dibasic and polybasic acid by pH-metric method (e.g. using, acetic acid, succinic acid, oxalic acid, phosphoric acid, etc.).	BD	9	
	Determination of concentration of (i) $AgNO_3$ solution and (ii) solubility product of AgCl by potentiometic titration of standard KCl solution against $AgNO_3$ solution.	SG	9	
Dec	Study of the kinetics of the reaction $I^- + S_2O_8^{-2}$ by colorimetric method. Determination of $\wedge o$ of a strong electrolyte (KCl) conductometrically.	BD	9	
	Repeat as per students	SG	6	
Jan	Determination of specific rotation of an optically active substance. Determination of indicator constant by colourimetric method.	BD	9	
	Repeat as per students	SG	6	
Feb	Repeat as per students	SK	6	
	Verification of Lambert Beer's Law. Conductometric titration of mixed acid.	BD	9	
	Repeat as per students	SG	6	
		TOTAL	132	

Resources:

Books:

1. Mendham, J., A. I. Vogel"s Quantitative Chemical Analysis 6th Ed.,Pearson
2. Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman(2007)

3. Palit, S.R., De, S. K. *Practical Physical Chemistry* Science BookAgency
4. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University ofCalcutta

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
Session: 2017-18
CEMA III-Year

Paper VIII/ Paper Code: CEMAP 38-Pr/ Total Marks: 75(PRACTICAL)+25(LNB+VIVA)
Course coordinator: Dr. SumanMandal

Course planner

SL	Course Topic	Teacher	Class hour	Remarks
Jul	**Inorganic Chemistry** Complexometric estimation: (Ca^{2+} + Mg^{2+}) in solution.	SM	3	
Aug	Complexometric estimation: i) (Ca^{2+} + Mg^{2+}) in solution. ii)(Fe^{3+} + Al^{3+}) in solution.	SM	9	
Sept	Dichromatometry and iodometry estimation: ii) Fe^{3+} + Cu^{2+} iii) Fe^{3+} + Mn^{2+}.	SM	9	
Nov	**Organic Preparation** Preparation of an organic compound, purification and determination of its M.P.	SK	9	
	Permanganometry estimation: Fe^{3+} + Ca^{2+}. Analysis of Fe^{3+} in cement.	SM	9	
Dec	**Organic Preparation** Nitration (cold, hot), Condensation, Hydrolysis,	SK	9	
	Gravimetry: i) Ni^{2+} as glyoximato complex. ii) Cu^{2+} as CuSCN.	SM	9	
	Determination of temporary and permanent hardness in supplied water.	SG	3	
Jan	**Organic Preparation** Oxidation, Halogenation (Green method), acetylation.	SK	9	
	Repeat as per students	SG	6	
	Analysis of Fe^{3+} in cement. Gravimetry: i) Ni^{2+} as glyoximato complex.	SM	9	
Feb	Repeat as per students	SM	9	
		TOTAL	93	

Resources:

8. Books:

1. Arthur, I. V. *Quantitative Organic Analysis,*Pearson
2. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University ofCalcutta

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).