Semester: I
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2019)

Lesson Plan for Course: Organic Chemistry I Code: CEMACOR01T Credit: 4

- Course coordinator: MONOJIT SARKAR
- Course Outcome

  - ✓ CO1:CO1:To impart students a broad outline of the basic organic chemistry in general.
  - ✓ CO2: The students will learn the Bonding of organic compounds in the light of valence bond and MO theories, Hybridization of organic compound and their Physical Properties, different types of organic reactions like ionic, radical and pericyclic etc., different types of reaction like: addition, elimination and substitution reactions, electrophiles and nucleophiles.

Course planne

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jul				
Aug	*Valence Bond Theory:* concept of hybridisation, shapes of molecules, resonance (including hyperconjugation); calculation of formal charges and double bond equivalent (DBE); orbital pictures of bonding (sp3, sp2, sp: C-C, C-N & C-O systems and *s-cis*and *s-trans* geometry for suitable cases).	PD	3hrs	
	Electronic displacements: inductive effect, field effect, mesomeric effect, resonance energy; bond polarization and bond polarizability; electromeric effect; steric effect, steric inhibition of resonance.	SM	5 hrs	
	MO theory: qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about σ, σ^*, π, π^*, n – MOs; basic idea about Frontier MOs (FMO); concept of HOMO, LUMO and SOMO; interpretation of chemical reactivity in terms of FMO interactions; sketch and energy levels of π MOs of i) acyclic p orbital system (C=C, conjugated diene, triene, allyl and pentadienyl systems) ii) cyclic p orbital system (neutral systems: [4], [6]-annulenes; charged systems: 3-,4-,5-membered ring systems);	SK	7 hrs	
Sep	*Physical properties:* influence of hybridization on bond properties: bond dissociation energy (BDE) and bond energy; bond distances, bond angles; concept of bond angle strain (Baeyer‟s strain theory); melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces; polarity of molecules and dipole moments; relative stabilities of isomeric hydrocarbons in terms of heat of hydrogenation, heat of combustion and heat of formation.	PD	5 hrs	
	Mechanistic classification: ionic, radical and pericyclic (definition and example); reaction type: addition, elimination and substitution reactions (definition and example); nature of bond cleavage and bond formation: homolytic and heterolytic bond fission.	SM	5 hrs	
	Hückel‟s rules for aromaticity up to [10]-annulene (including mononuclear heterocyclic compounds up to 6-membered ring); concept of antiaromaticity and homoaromaticity; non-aromatic molecules; Frost diagram; elementary idea about α and β; measurement of delocalization energies in terms of β for buta-1,3-diene, cyclobutadiene, hexa-1,3,5-triene and benzene.	SK	5 hrs	

Oct	*Mechanistic classification:* homogenic and heterogenic bond formation; curly arrow rules in representation of mechanistic steps; reagent type: electrophiles and nucleophiles (elementary idea); electrophilicity and nucleophilicity in terms of FMO approach.	SK	2 hrs	
Nov	*Reactive intermediates:* carbocations (carbenium and carbonium ions), carbanions, carbon radicals, carbenes: generation and stability, structure using orbital picture and electrophilic/nucleophilicbehavior of reactive intermediates (elementary idea).	PD	3hrs	
	Relative and absolute configuration: D/L and *R/S* descriptors; *erythro/threo*and *meso*nomenclature of compounds; *syn/anti* nomenclatures for aldols	SM	3 hrs	
	Bonding geometries of carbon compounds and representation of molecules: tetrahedral nature of carbon and concept of asymmetry; Fischer, sawhorse, flying-wedge and Newman projection formulae and their inter translations. *Concept of chirality and symmetry:* symmetry elements and point groups (*Cαv*, *Cnh*, *Cnv*, *Cn*, *Dαh*, *Dnh*, *Dnd*, *Dn*, *Sn*(*Cs*, *Ci*); molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers; concept of epimers; concept of stereogenicity, chirotopicity and pseudoasymmetry; chiral centres and number of stereoisomerism: systems involving 1/2/3-chiral centre(s) (AA, AB, ABA and ABC types).	SK	10 hrs	
Dec	*E*/*Z* descriptors for C=C, conjugated diene, triene, C=N and N=N systems; combination of *R/S*- and *E/ Z*- isomerisms.	PD	2hrs	
	Optical activity of chiral compounds: optical rotation, specific rotation and molar rotation; racemic compounds, racemisation (through cationic, anionic, radical intermediates and through reversible formation of stable achiral intermediates); resolution of acids, bases and alcohols via diastereomeric salt formation; optical purity and enantiomeric excess; invertomerism of chiral trialkylamines.	SK	10 hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Clayden, J., Greeves, N. & Warren, S. *Organic Chemistry*, Second edition, Oxford University Press, 2012.
2. Sykes, P., *A guidebook to Mechanism in Organic Chemistry*, Pearson Education, 2003.
3. Eliel, E. L. &Wilen, S. H. *Stereochemistry of Organic Compounds*, Wiley: London, 1994.
4. Nasipuri, D. *Stereochemistry of Organic Compounds,*Wiley Eastern Limited.

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).

Semester: I
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2019)

Lesson Plan for Course: Organic Chemistry I Lab Code: CEMACOR01P Credit: 2

- Course coordinator: SWASTIK KARMAKAR
- Course Outcome

CO1: Based on solubility separation of different inorganic and organic liquid and solid compounds are discussed.

CO2: Recrystallization of the separated compounds is to be done.

Course planne

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jul				
Aug	Separation, based upon solubility, by using common laboratory reagents like water (cold, hot), dil. HCl, dil. NaOH, dil. NaHCO3, *etc*., of components of a binary solid mixture; purification of any one of the separated components by crystallization and determination of its melting point. The composition of the mixture may be of the following types: Benzoic acid/*p*-Toluidine; *p*-Nitrobenzoic acid/*p*-Aminobenzoic acid; *p*-Nitrotoluene/*p*-Anisidine; *etc*.	MS+SK	15hrs	
Sep	Determination of boiling point of common organic liquid compounds e.g., ethanol, cyclohexane, chloroform, ethyl methyl ketone, cyclohexanone, acetylacetone, anisole, crotonaldehyde, mesityl oxide, *etc*. [Boiling point of the chosen organic compounds should preferably be less than 160 °C]	BD+SM	15 hrs	
Oct				
Nov	Identification of a Pure Organic Compound *Solid compounds*: oxalic acid, tartaric acid, citric acid, succinic acid, resorcinol, urea, glucose, cane sugar, benzoic acid and salicylic acid	SK+MS	15 hrs	
Dec	Identification of a Pure Organic Compound *Liquid Compounds*: formic acid, acetic acid, methyl alcohol, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehyde, chloroform and nitrobenzene	BD+SM	15hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Bhattacharyya, R. C, *A Manual of Practical Chemistry*.
2. Vogel, A. I. *Elementary Practical Organic Chemistry*, Part 2: *Qualitative Organic Analysis*, CBS Publishers and Distributors.
3. Dutta, S, *B. Sc. Honours Practical Chemistry*, Bharati Book Stall.

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).

Semester: I
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2019)

Lesson Plan for Course: Physical Chemistry I Code: CEMACOR02T Credit: 4

- Course coordinator: BIDYUT DEBNATH
- Course Outcome

CO1:Following aspects of gas are discussed: Kinetic Theory of gases,Maxwell's distribution of speed and energy,Real gas and virial equation.

CO2: Zeroth, firstand second law of thermodynamics, laws of thermochemistry, different thermodynamic relations are discussed.

Course planne

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jul				
Aug	Chemical Thermodynamics : Zeroth and 1st law of Thermodynamics: Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics;Concept of heat, work, internal energy and statement of first law; enthalpy, *H*, relation between heat capacities, calculations of *q*, *w*, *U* and *H* for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions; Joule‟s experiment and its consequence	MS	5hrs	
	Kinetic Theory of gases: 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); Rate of collision on wall and rate of effusion.	BD	5 hrs	
	Chemical Thermodynamics:Thermochemistry:Standard states; Heats of reaction; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; Laws of thermochemistry; bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff‟s equations and effect of pressure on enthalpy of reactions; Adiabatic flame temperature; explosion temperature	SM	5 hrs	
Sep	Kinetic Theory of gases: Maxwell‟s distribution of speed and energy: Nature of distribution of velocities, Maxwell's distribution of speeds in one, two and three dimensions; Kinetic energy distribution in one, two and three dimensions, calculations of average, root mean square and most probable values in each case; Calculation of number of molecules having energy $\geq \varepsilon$, Principle of equipartition of energy and its application to calculate the classical limit of molar heat capacity of gases	BD	7 hrs	
	Kinetic Theory of gases: Real gas and virial equation: 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, other equations of state (Berthelot, Dietrici); Existence of critical state, Critical constants in terms of van der Waals constants; Law of corresponding states; virial equation of state; van der Waals equation expressed in virial form and significance of second virial coefficient; Intermolecular forces (Debye, Keesom and London interactions; LennardJones potential - elementary idea)	SM	8 hrs	
Oct				

Nov	Chemical Thermodynamics: Second Law:Need for a Second law; statement of the second law of thermodynamics; Concept of heat reservoirs and heat engines; Carnot cycle; Physical concept of Entropy; Carnot engine and refrigerator; Kelvin – Planck and Clausius statements and equivalence of the two statements with entropic formulation.	BD	5hrs	
	Chemical Thermodynamics: Carnot's theorem; Values of dQ/T and Clausius inequality; Entropy change of systems and surroundings for various processes and transformations; Entropy and unavailable work; Auxiliary state functions (G and A) and their variation with T, P and V. Criteria for spontaneity and equilibrium.	MS	5 hrs	
	Chemical Thermodynamics: Thermodynamic relations: Maxwell's relations; Gibbs- Helmholtz equation, JouleThomson experiment and its consequences; inversion temperature; Joule-Thomson coefficient for a van der Waals gas; General heat capacity relations	SM	5 hrs	
Dec	Chemical kinetics: Rate law, order and molecularity: Introduction of rate law, Extent of reaction; rate constants, order; Forms of rates of First, second and n-th order reactions; Pseudo first order reactions (example using acid catalyzed hydrolysis of methyl acetate); Determination of order of a reaction by half-life and differential method; Opposing reactions, parallel reactions and consecutive reactions (with explanation of kinetic and thermodynamic control of products; all steps first order) ; Rate equation for the fast reaction	BD	5hrs	
	Chemical kinetics: Role of T and theories of reaction rate: Temperature dependence of rate constant; Arrhenius equation, energy of activation; Rate-determining step and steady-state approximation – explanation with suitable examples; Collision theory; Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment)	MS	5 hrs	
	Chemical kinetics: Homogeneous catalysis: Homogeneous catalysis with reference to acid-base catalysis; Primary kinetic salt effect; Enzyme catalysis; Michaelis-Menten equation, LineweaverBurk plot, turn-over number. Autocatalysis; periodic reactions	SM	5 hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Rakshit, P.C., *Physical Chemistry* Sarat Book House
2. Atkins, P. W. & Paula, J. de *Atkins' Physical Chemistry*, Oxford University Press
3. Glasstone, S. & Lewis, G.N. *Elements of Physical Chemistry*
4. Atkins, P. W. & Paula, J. de *Atkins' Physical Chemistry*, Oxford University Press

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: 2019-20(JULY-DEC 2019)

Lesson Plan for Course: Physical Chemistry I Lab Code: CEMACOR02P Credit: 2

- Course coordinator: SUMAN MANDAL
- Course Outcome
  - ✓ CO1:Some experiments of pH, kinetics of acid-catalyzed hydrolysis, kinetics of decomposition of H_2O_2, heat of neutralization, heat of solution are to be performed.

Course planne

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jul				
Aug	Experiment 1: Determination of pH of unknown solution (buffer), by color matching method	MS+SK	12hrs	
	Experiment 2: Determination of heat of neutralization of a strong acid by a strong base	BD+SM	4 hrs	
Sep	Experiment 2: Determination of heat of neutralization of a strong acid by a strong base	BD+SM	8 hrs	
	Experiment 3: Study of kinetics of acid-catalyzed hydrolysis of methyl acetate	MS+SK	12 hrs	
Oct				
Nov	Experiment 4: Study of kinetics of decomposition of H2O2	BD+MS	12 hrs	
	Experiment 5: Determination of heat of solution of oxalic acid from solubility measurement	SM+SK	2 hrs	
Dec	Experiment 5: Determination of heat of solution of oxalic acid from solubility measurement	BD+SM	10hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Viswanathan, B., Raghavan, P.S. *Practical Physical Chemistry* Viva Books (2009)
2. Mendham, J., A. I. Vogel‟s Quantitative Chemical Analysis 6th Ed., Pearson
3. Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007)
4. Palit, S.R., De, S. K. *Practical Physical Chemistry* Science Book Agency
5. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta
6. Levitt, B. P. edited *Findlay's Practical Physical Chemistry* Longman Group Ltd.
7. Gurtu, J. N., Kapoor, R., *Advanced Experimental Chemistry* S. Chand & Co. Ltd

3. Other resources :

*Remarks will specify

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

Semester: II
Department of Chemistry
Basirhat College
SESSION: 2019-20(JANU-JUNE 2020)

Lesson Plan for Course: Inorganic chemistry-I. Code: **CEMACOR03T** Credit: 4

- Course coordinator: BIDYUT DEBNATH
- Course Outcome

CO1:: Bohr's theory, its limitations and atomic spectrum of hydrogen atom

CO2: Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance

CO3: Quantum numbers and their significance.

Course planne

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jan	**Extra nuclear Structure of atom:** Bohr‟s theory, its limitations and atomic spectrum of hydrogen atom; Sommerfeld‟s Theory.	SM	6hrs	
	Extra nuclear Structure of atom: Wave mechanics: de Broglie equation, Heisenberg‟s Uncertainty Principle and its significance, Schrödinger‟s wave equation, significance of ψ and $\psi 2$. Quantum numbers and their significance. Radial and angular wave functions for hydrogen atom.	BD	6hrs	
	Extra nuclear Structure of atom: Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals. Pauli‟s Exclusion Principle, Hund‟s rules and multiplicity, Exchange energy, Aufbau principle and its limitations	SK	4hrs	
	Extra nuclear Structure of atom: Ground state Term symbols of atoms and ions for atomic number upto 30.	MS	2hrs	
Feb	**Chemical periodicity:** Modern IUPAC Periodic table, Effective nuclear charge, screening effects and penetration, Slater‟s rules, atomic radii, ionic radii (Pauling‟s univalent), covalent radii.	BD	2hrs	
	Chemical periodicity: lanthanide contraction. Ionization potential, electron affinity and electronegativity (Pauling‟s, Mulliken‟s and Allred-Rochow‟s scales) and factors influencing these properties, group electronegativities. Group trends and periodic trends in these properties in respect of s-, p- and d-block elements. Secondary periodicity, Relativistic Effect, Inert pair effect.	MS	6hrs	
	Acid-Base reactions: Acid-Base concept: Arrhenius concept, theory of solvent system (H2O, NH3, SO2 and HF), Bronsted-Lowry‟s concept, relative strength of acids, Pauling‟s rules. Lux-Flood concept, Lewis concept, group characteristics of Lewis acids, solvent levelling and differentiating effects.	SM	6 hrs	
	Acid-Base reactions: Thermodynamic acidity parameters, Drago-Wayland equation. Superacids, Gas phase acidity and proton affinity.	SK	4hrs	
	Acid-Base reactions: HSAB principle. Acid-baseequilibria in aqueous solution (Proton transfer equilibria in water), pH, buffer. Acidbase neutralisation curves; indicator, choice of indicators.	BD	6hrs	

March	**Redox Reactions and precipitation reactions:** Ion-electron method of balancing equation of redox reaction. Elementary idea on standard redox potentials with sign conventions, Nernst equation (without derivation). Influence of complex formation, precipitation and change of pH on redox potentials; formal potential.	MS	6hrs	
April	**Redox Reactions and precipitation reactions:** Feasibility of a redox titration, redox potential at the equivalence point, redox indicators. Redox potential diagram (Latimer and Frost diagrams) of common elements and their applications.	SM	5hrs	
	Redox Reactions and precipitation reactions: Disproportionation and comproportionation reactions.	SK	2hrs	
May	**Redox Reactions and precipitation reactions:** Solubility product principle, common ion effect and their applications to the precipitation and separation of common metallic ions as hydroxides, sulfides, phosphates, carbonates, sulfates and halides	BD	5hrs	
Jun	Assessment: End-term Test			
		Total:60hrs		

Resources :

Books:

1. Lee, J. D. *Concise Inorganic Chemistry,*5th Ed., Wiley India Pvt. Ltd., 2008.
2. Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970.
3. Day, M.C. and Selbin, J. *Theoretical Inorganic Chemistry*, ACS Publications, 1962.
4. Atkin, P. *Shriver & Atkins' Inorganic Chemistry,* 5th Ed., Oxford University Press (2010).
5. Cotton, F.A., Wilkinson, G. and Gaus, P.L., *Basic Inorganic Chemistry 3rdEd.;*Wiley India.
6. Sharpe, A.G., *Inorganic Chemistry*, 4th Indian Reprint (Pearson Education) 2005.
7. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. *Inorganic Chemistry, Principles ofStructure and Reactivity 4th Ed.,* Harper Collins 1993, Pearson,2006.
8. Atkins, P.W. & Paula, J. *Physical Chemistry*, Oxford Press, 2006.
9. Mingos, D.M.P., *Essential trends in inorganic chemistry*. Oxford University Press (1998).
10. Winter, M. J., The Orbitron, http://winter.group.shef.ac.uk/orbitron/ (2002). An illustrated gallery of atomic and molecular orbitals.
11. Burgess, J., *Ions in solution: basic principles of chemical interactions.* Ellis Horwood (1999).

4. Other resources :

*Remarks will specify

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

Semester: II
Department of Chemistry
Basirhat College
SESSION: 2019-20(JANU-JUNE 2020)

Lesson Plan for Course: INORGANIC CHEMISTRY-I LAB. Code: **CEMACOR03P** Credit: 2

- Course coordinator: SUMAN MANDAL
- Course Outcome

  - ✓ CO1:: They will learn how simple acid base titrations are to be done.
  - ✓ CO2: Student will gather knowledge about different oxidation reduction titrations which helps them to estimate ions in a solution.

Course planne

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jan	**Acid and Base Titrations:** 1.Estimation of carbonate and hydroxide present together in mixture 2.Estimation of carbonate and bicarbonate present together in a mixture.	MS+SM	12hrs	
	3.Estimation of free alkali present in different soaps/detergents.	SM+SK	6hrs	
Feb	**Oxidation-Reduction Titrimetric:** 1. Estimation of Fe(II) using standardized KMnO4 solution	MS+SK	8hrs	
Mar	2. Estimation of oxalic acid and sodium oxalate in a given mixture	BD+SK	8hrs	
	3. Estimation of Fe(II) and Fe(III) in a given mixture using K2Cr2O7 solution.	BD+MS	8hrs	
Apr	4. Estimation of Fe(III) and Mn(II) in a mixture using standardized KMnO4 solution. 5. Estimation of Fe(III) and Cu(II) in a mixture using K2Cr2O7.	SM+BD	12hrs	
May	6. Estimation of Fe(III) and Cr(III) in a mixture using K2Cr2O7.	SK+BD	6hrs	
Jun	Assessment: End-term Test			
		Total:60Hrs		

Resources :

Books:

1.Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis* 6th Ed., Pearson, 2009.

5. Other resources :

*Remarks will specify

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

Semester: II
Department of Chemistry
Basirhat College
SESSION: 2019-20(JANU-JUNE 2020)

Lesson Plan for Course: Organic chemistry-II. Code: **CEMACOR04T** Credit: 4

- Course coordinator:SWASTIK KARMAKAR
- Course Outcome

  - ✓ CO1:Students will get a clear conception on "Chirality arising out of stereoaxis".
  - ✓ CO2: The students will learn about "Prostereoisomerism" which includes the concept of prostereogeniccentre, (pro)n-chirality, topicity of ligands and faces (elementary idea), pro-R/pro-S, pro-E/pro-Z,Re/Si descriptors, pro-r and pro-s descriptors of ligands on propseudoasymmetriccentre.

Course planne

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jan	**Stereochemistry II:** Chirality arising out of stereoaxis: stereoisomerism of substituted cumulenes with even and odd number of double bonds; chiral axis in allenes, spiro compounds, alkylidenecycloalkanes and biphenyls; related configurational descriptors (Ra/Sa and P/M); atropisomerism; racemisation of chiral biphenyls; buttressing effect.	SK	8hrs	
	Stereochemistry II: Concept of prostereoisomerism: prostereogenic centre; concept of (pro)n-chirality: topicity of ligands and faces (elementary idea); pro-R/pro-S, pro-E/pro-Z and Re/Si descriptors; pro-r and pro-s descriptors of ligands on propseudoasymmetric centre.	SM	4hrs	
	Stereochemistry II: Conformation: conformational nomenclature: eclipsed, staggered, gauche, syn and anti; dihedral angle, torsion angle; Klyne-Prelog terminology; P/M descriptors; energy barrier of rotation, concept of torsional and steric strains; relative stability of conformers on the basis of steric effect, dipole-dipole interaction and H-bonding; butane gauche interaction.	BD	4hrs	
Feb	**Stereochemistry II:** Conformational analysis of ethane, propane, *n*-butane, 2methylbutane and 2,3-dimethylbutane; haloalkane, 1,2-dihaloalkanes and 1,2-diols (up to four carbons); 1,2-halohydrin; conformation of conjugated systems (*s-cis*and *s-trans*).	MS	4hrs	
	General Treatment of Reaction Mechanism II: Reaction thermodynamics: free energy and equilibrium, enthalpy and entropy factor, calculation of enthalpy change via BDE, intermolecular &intramolecular reactions. Concept of organic acids and bases: effect of structure, substituent and solvent on acidity and basicity; proton sponge; gas-phase acidity and basicity; comparison between nucleophlicity and basicity; HSAB principle; application of thermodynamic principles in acid-baseequilibria.	SK	8hrs	
	General Treatment of Reaction Mechanism II: Tautomerism: prototropy (keto-enol, nitro - aci-nitro, nitroso-oximino, diazo-amino and enamine-imine systems); valence tautomerism and ring-chain tautomerism; composition of the equilibrium in different systems (simple carbonyl; 1,2- and 1,3dicarbonyl systems, phenols and related systems), factors affecting keto-enoltautomerism; application of thermodynamic principles in tautomericequilibria.	BD	8hrs	
March	**General Treatment of Reaction Mechanism II:** catalyzed reactions: electrophilic and nucleophilic catalysis; kinetic control and thermodynamic control of reactions; isotope effect: primary and secondary kinetic isotopic effect (*k*H /*k*D); principle of microscopic reversibility; Hammond‟s postulate.	SM	7hrs	
	Substitution and Elimination Reactions: Free-radical substitution reaction: halogentaion of alkanes, mechanism (with evidence) and stereochemical features; reactivity-selectivity principle in the light of Hammond‟s postulate.	BD	5hrs	
April	**Substitution and Elimination Reactions:** Nucleophilic substitution reactions: substitution at sp3 centre: mechanisms (with evidence), relative rates &stereochemical features: SN1, SN2, SN2', SN1' (allylic rearrangement) and SNi; effects of solvent, substrate structure, leaving group and nucleophiles (including ambident nucleophiles, cyanide & nitrite); substitutions involving NGP; role of crown ethers and phase transfer catalysts; [systems: alkyl halides, allyl halides, benzyl halides, alcohols, ethers, epoxides].	SK	7hrs	

	Substitution and Elimination Reactions: Elimination reactions: E1, E2, E1cB and Ei (pyrolyticsyn eliminations); formation of alkenes and alkynes; mechanisms (with evidence), reactivity, regioselectivity (Saytzeff/Hofmann) and stereoselectivity.	MS	4hrs	
May	**Substitution and Elimination Reactions:** comparison between substitution and elimination; importance of Bredt‟s rule relating to the formation of C=C.	BD	2hrs	
Jun	Assessment: End-term Test			
		Total 60 hrs		

Resources :

Books:

1. Clayden, J., Greeves, N., Warren, S. Organic Chemistry, Second edition, Oxford University Press 2012.
2. Sykes, P., A guidebook to Mechanism in Organic Chemistry, Pearson Education, 2003.
3. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.
4. Carey, F. A. &Guiliano, R. M. Organic Chemistry, Eighth edition, McGraw Hill Education, 2012.
5. Loudon, G. M. Organic Chemistry, Fourth edition, Oxford University Press, 2008.
6. Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994.
7. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited.
8. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Finar, I. L. Organic Chemistry (Volume 1) Pearson Education.
10. Graham Solomons, T.W., Fryhle, C. B. Organic Chemistry, John Wiley & Sons, Inc.
11. James, J., Peach, J. M. Stereochemistry at a Glance, Blackwell Publishing, 2003.

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).

Semester: II
Department of Chemistry
Basirhat College
SESSION: 2019-20(JAN-JUNE 2020)

Lesson Plan for Course: ORGANIC CHEMISTRY-II LAB. Code: **CEMACOR04P** Credit: 2

- Course coordinator: MONOJIT SARKAR
- Course Outcome
  - ✓ CO1: Some reactions and its mechanism will be performed by the students.

Course planner

Sl	Course Topic	Teacher	Class -hrs	Rem arks

Jan	**Organic Preparations:** 1. Nitration of aromatic compounds 2. Condensation reactions 3. Hydrolysis of amides/imides/esters	SK+BD	12hrs	
Feb	4. Acetylation of phenols/aromatic amines 5. Benzoylation of phenols/aromatic amines	MS+SK	8hrs	
	6. Side chain oxidation of aromatic compounds 7. Diazo coupling reactions of aromatic amines	MS+SM	8hrs	
Mar	8. Bromination of anilides using green approach (Bromate-Bromide method) 9. Redox reaction including solid-phase method	BD+SM	8hrs	
	10. Green „multi-component-coupling" reaction 11. Selective reduction of *m*-dinitrobenzene to *m*-nitroaniline	BD+MS	8hrs	
Apr	B. Purification of the crude product is to be made by crystallisation from water/alcohol, crystallization after charcoal treatment, or sublimation, whichever is applicable.	SM+SK	8hrs	
May	C. Melting point of the purified product is to be noted.	SK+MS	8hrs	
Jun	Assessment: End-term Test			
		Total:60Hrs		

Resources :

Books:

1. Vogel, A. I. *Elementary Practical Organic Chemistry,* Part 1: *Small scale Preparations,* CBS Publishers and Distributors.

2. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N. University of Calcutta, 2003.

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).

6. Other resources :

*Remarks will specify

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

Semester: III
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2020)

Lesson Plan for Course: PHYSICAL CHEMISTRY-II Code: CEMACOR05T Credit: 4

- Course coordinator: Bidyut Debnath
- Course Outcome

  - ✓ CO1:Transport properties of liquid like viscosity, conductance and transport number are discussed in detail. Application of conductance measurement, conductometric titrations is also discussed.
  - ✓ CO2: Different thermodynamic properties like partial properties and chemical potential, thermodynamic conditions for equilibrium, nernst's distribution law, thermodynamic properties of ideal substances- pure and mixtures etc. are discussed.

Course planne

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jul				
Aug	Transport processes: Fick's law: Flux, force, phenomenological coefficients & their inter-relationship (general form), different examples of transport properties. Transport processes: Viscosity: General features of fluid flow (streamline flow and turbulent flow); Newton's equation, viscosity coefficient; Poiseuille's equation; principle of determination of viscosity coefficient of liquids by falling sphere method; Temperature variation of viscosity of liquids and comparison with that of gases	BD	7 hrs	
	Transport processes: Conductance and transport number: Ion conductance; Conductance and measurement of conductance, cell constant, specific conductance, equivalent conductance and molar conductance; Variation of specific and equivalent conductance with dilution for strong and weak electrolytes; Kohlrausch's law of independent migration of ions; Equivalent and molar conductance at infinite dilution and their determination for strong and weak 16 electrolytes; Debye –Huckel theory of Ion atmosphere (qualitative)-asymmetric effect, relaxation effect and electrophoretic effect; Ostwald's dilution law; Ionic mobility; Application of conductance measurement (determination of solubility product and ionic product of water); Conductometric titrations	MS	5 hrs	
	Transport processes: Transport number, Principles of Hittorf's and Moving-boundary method; Wien effect, Debye-Falkenhagen effect, Walden's rule	SM	3 hrs	
Sep	Applications of Thermodynamics – I: Partial properties and Chemical potential: Chemical potential and activity, partial molar quantities, relation between Chemical potential and Gibbs‟ free energy and other thermodynamic state functions; variation of Chemical potential (μ) with temperature and pressure; Gibbs-Duhem equation; fugacity and fugacity coefficient; Variation of thermodynamic functions for systems with variable composition; Equations of states for these systems, Change in G, S, H and V during mixing for binary solutions.	BD	7 hrs	
	Applications of Thermodynamics – I: Chemical Equilibrium: Thermodynamic conditions for equilibrium, degree of advancement; van't Hoff's reaction isotherm (deduction from chemical potential); Variation of free energy with degree of advancement; Equilibrium constant and standard Gibbs' free energy	SM	4 hrs	

	change.			
	Applications of Thermodynamics – I: Definitions of KP, KC and KX; van't Hoff's reaction isobar and isochore from different standard states; Shifting of equilibrium due to change in external parameters e.g. temperature and pressure; variation of equilibrium constant with addition to inert gas; Le Chatelier's principle and its derivation.	MS	4 hrs	
Oct				
Nov	Nernst's distribution law; Application- (finding out Keq using Nernst dist law for KI+I2 = KI3 and dimerization of benzene) Foundation of Quantum Mechanics: Beginning of Quantum Mechanics: Black-body radiation and Planck's theory of radiation; Light as particles: photoelectric and Compton effects; electrons as waves; Wave-particle duality: de Broglie hypothesis, Uncertainty relations (without proof)	BD	5hrs	
	Chemical potential and other properties of ideal substances- pure and mixtures: a) Pure ideal gas-its Chemical potential and other thermodynamic functions and their changes during a change of Thermodynamic parameters of mixing; Chemical potential of an ideal gas in an ideal gas mixture; Concept of standard states and choice of standard states of ideal gases. Foundation of Quantum Mechanics: Wave function: Schrödinger time-independent equation; nature of the equation, acceptability conditions imposed on the wave functions and probability interpretations of wave function; Orthogonal and normal functions; Schmidt's orthogonalization	MS	7 hrs	
	b) Condensed Phase – Chemical potential of pure solid and pure liquids, Ideal solution – Definition, Raoult's law; Mixing properties of ideal solutions, chemical potential of a component in an ideal solution; Choice of standard states of solids and liquids. Foundation of Quantum Mechanics: Concept of Operators: Elementary concepts of operators, eigenfunctions and eigenvalues; Linear operators; Commutation of operators, commutator and uncertainty relation; Expectation value; Hermitian operator; Postulates of Quantum Mechanics; General structure of Schrodinger equation (S.E.) and time dependency; Stationary state	SM	6 hrs	
Dec	Foundation of Quantum Mechanics: Particle in a box: Setting up of S.E. for one-dimensional well and its solution; Comparison with free particle eigenfunctions and eigenvalues. Properties of PB wave functions (normalisation, orthogonality, probability distribution);	BD	4hrs	
	Foundation of Quantum Mechanics: Expectation values of x, x2, px and px2 and their significance in relation to the uncertainty principle; Extension of the problem to two and three dimensions and the concept of degenerate energy levels; Accidental degeneracy	MS	4 hrs	
	Foundation of Quantum Mechanics: Simple Harmonic Oscillator: setting up of the Schrodinger stationary equation, energy expression (without derivation), expression of wave function for n = 0 and n = 1 (without derivation) and their characteristic features	SM	4 hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Atkins, P. W. & Paula, J. de *Atkins', Physical Chemistry*, Oxford University Press
2. Castellan, G. W. *Physical Chemistry*, Narosa
3. McQuarrie, D. A. & Simons, J. D. *Physical Chemistry: A Molecular Approach*, Viva Press
4. Levine, I. N. *Physical Chemistry*, Tata McGraw-Hill
5. Rakshit, P.C., *Physical Chemistry*, Sarat Book House
6. Moore, W. J. *Physical Chemistry*, Orient Longman
7. Mortimer, R. G. *Physical Chemistry*, Elsevier

8. Denbigh, K. *The Principles of Chemical Equilibrium* Cambridge University Press
9. Engel, T. & Reid, P. *Physical Chemistry*, Pearson
10. Levine, I. N. *Quantum Chemistry*, PHI
11. Atkins, P. W. *Molecular Quantum Mechanics*, Oxford
12. Zemansky, M. W. &Dittman, R.H. *Heat and Thermodynamics*, Tata-McGraw-Hill
13. Rastogi, R. P. &Misra, R.R. *An Introduction to Chemical Thermodynamics*, Vikas
14. Klotz, I.M., Rosenberg, R. M. *Chemical Thermodynamics:Basic Concepts and Methods* Wiley
15. Glasstone, S. *An Introduction to Electrochemistry*, East-West Press

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).

Semester: III
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2020)

Lesson Plan for Course: PHYSICAL CHEMISTRY-II Lab Code: CEMACOR05P Credit: 2

- Course coordinator: Monojit Sarkar
- Course Outcome
  - ✓ CO1:Study of viscosity, partition coefficient, conductometric titration, verification of ostwald,s dilution law etc. are to be done.

Course planne

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jul				
Aug	Experiment 1: Study of viscosity of unknown liquid (glycerol, sugar) with respect to water	MS+SK	10hrs	
	Experiment 2: Determination of partition coefficient for the distribution of I_2 between water and CCl_4	MS+SK	5 hrs	
Sep	Experiment 2: Determination of partition coefficient for the distribution of I2 between water and CCl4	BD+SM	5 hrs	
	Experiment 3: Determination of Keq for KI + I2 = KI3, using partition coefficient between water and CCl4	BD+SM	10 hrs	
Oct				
Nov	Experiment 4: Conductometric titration of an acid (strong, weak/ monobasic, dibasic) against base strong	BD+MS	10 hrs	
	Experiment 5: Study of saponification reaction conductometrically	SM+SK	10 hrs	
Dec	Experiment 6: Verification of Ostwald‟s dilution law and determination of Ka of weak acid	BD+MS	10hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Viswanathan, B., Raghavan, P.S. *Practical Physical Chemistry* Viva Books (2009)

2. Mendham, J., A. I. Vogel‟s Quantitative Chemical Analysis 6th Ed., Pearson
3. Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007)
4. Palit, S.R., De, S. K. *Practical Physical Chemistry* Science Book Agency
5. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta
6. Levitt, B. P. edited *Findlay's Practical Physical Chemistry* Longman Group Ltd.
7. Gurtu, J. N., Kapoor, R., *Advanced Experimental Chemistry* S. Chand & Co. Ltd.

8. Other resources :

*Remarks will specify

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

Semester: III
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2020)

Lesson Plan for Course: Inorganic chemistry-II. Code: CEMACOR06T Credit: 4

- Course coordinator: SumanMandal
- Course Outcome

CO1:General characteristics of ions and ionic bonds and covalent bonds are discussed in general.
CO2: In the second part molecular orbital concepts of bonding, qualitative idea of valence bond and band theories, different weak chemical forces in molecules are discussed.
CO3: Theories of radioactivity and uses of radioactive elements are discussed

Course planne

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jul				
Aug	Chemical Bonding-I: *Ionic bond:* General characteristics, types of ions, size effects, radius ratio rule and its application and limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy.	BD	6 hrs	
	Chemical Bonding-I: Madelung constant, Born-Haber cycle and its application, Solvation energy. Defects in solids (elememtary idea). Solubility energetics of dissolution process	MS	6 hrs	
	Chemical Bonding-I: *Covalent bond:* Polarizing power and polarizability, ionic potential,Fazan's rules.	SM	3 hrs	
Sep	Chemical Bonding-I: Lewis structures, formal charge. Valence Bond Theory. The hydrogen molecule (Heitler-London approach), directional character of covalent bonds, hybridizations, equivalent and non-equivalent hybrid orbitals, Bent's rule, Dipole moments.	SM	5 hrs	
	Chemical Bonding-I: VSEPR theory, shapes of 19 molecules and ions containing lone pairs and bond pairs (examples from main groups chemistry) and multiple bonding (ζ and π bond approach).	BD	4 hrs	
	Chemical Bonding-II: Molecular orbital concept of bonding (The approximations of the theory, Linear combination of atomic orbitals (LCAO))	MS	6 hrs	

	(elementary pictorial approach): sigma and pibonds and delta interaction, multiple bonding. Orbital designations: *gerade*, *ungerade*, HOMO, LUMO. Orbital mixing.			
Oct				
Nov	Chemical Bonding-II: MO diagrams of H2, Li2, Be2, B2, C2, N2, O2, F2, and their ions wherever possible; Heteronuclear molecular orbitals: CO, NO, NO+, CN-, HF, BeH2, CO2 and H2O. Bond properties: bond orders, bond lengths.	BD	4hrs	
	Chemical Bonding-II: *Metallic Bond:* Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.	MS	4 hrs	
	Chemical Bonding-II: *Weak Chemical Forces:* van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Intermolecular forces: Hydrogen bonding (theories of hydrogen bonding, valence bond treatment), receptor-guest interactions, Halogen bonds. Effects of chemical force, melting and boiling points.	SM	10 hrs	
Dec	Radioactivity: Nuclear stability and nuclear binding energy. Nuclear forces: meson exchange theory. Nuclear models (elementary idea):. Nuclear energy and power generation.	BD	4hrs	
	Radioactivity: Concept of nuclear quantum number, magic numbers. Nuclear Reactions: Artificial radioactivity, transmutation of elements, fission, fusion and spallation.	MS	4 hrs	
	Radioactivity: . Separation and uses of isotopes. Radio chemical methods: principles of determination of age of rocks and minerals, radio carbon dating, hazards of radiation and safety measures.	SM	4 hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Lee, J. D. *Concise Inorganic Chemistry, 5thEd.,*Wiley India Pvt. Ltd., 2008.
2. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. *Inorganic Chemistry, Principles ofStructure and Reactivity 4th Ed.,* Harper Collins 1993, Pearson, 2006.
3. Douglas, B.E. and McDaniel, D.H. *Concepts & Models of Inorganic Chemistry* Oxford, 1970.
4. Porterfield, H. W., *Inorganic Chemistry,* Second Edition, Academic Press, 2005.
5. Purecell, K.F. and Kotz, J.C., *An Introduction toInorganic Chemistry,* Saunders: Philadelphia, 1980.
6. Cotton, F.A., Wilkinson, G., &Gaus, P.L. *Basic Inorganic Chemistry 3rdEd.;*Wiley India.
7. Gillespie, R. J. and Hargittai, I., The VSEPR Model of Molecular Geometry, Prentice Hall (1992).
8. Albright, T., *Orbital interactions in chemistry,* John Wiley and Sons (2005).
9. Mingos, D.M.P., *Essential trends in inorganic chemistry*. Oxford University Press (1998).
10. Miessler, G. L., Fischer, P. J., Tarr, D. A., *Inorganic Chemistry,* Pearson, 5th Edition.
11. Kaplan, I., *Nuclear Physics,* Addison-Wesley Publishing Company Inc. London, 1964.
12. Friedlander, G., Kennedy, J. W., Macias, E. S. And Miller, J. M., *Nuclear and Radiochemistry*, Wiley, 1981.

9. Other resources :

*Remarks will specify

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

Semester: III
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2020)

Lesson Plan for Course: INORGANIC CHEMISTRY-II LAB. Code: CEMACOR06P Credit: 2

- Course coordinator: Bidyut Debnath
- Course Outcome
  - ✓ CO1:Iodometric titrations for estimations of metal ions, vitamin C and available chlorine in bleaching powder are to be done. Estimation of metals in brass, steel and cement are also to be done.

Course planne

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jul				
Aug	Iodimetric Titrations: Estimation of Cu(II)	MS+SK	8hrs	
	Iodimetric Titrations: Estimation of Vitamin C	MS+SK	8 hrs	
Sep	Iodimetric Titrations: Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically	BD+SM	10 hrs	
	Iodimetric Titrations: Estimation of available chlorine in bleaching powder	BD+SM	8 hrs	
Oct				
Nov	Estimation of metal content: Estimation of Cu in brass.	BD+MS	8 hrs	
	Estimation of metal content: Estimation of Cr and Mn in Steel.	SM+SK	8 hrs	
Dec	Estimation of metal content: Estimation of Fe in cement.	BD+MS	10hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1.Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis* 6th Ed., Pearson, 2009.

10. Other resources :

*Remarks will specify

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

Semester: III
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2020)

Lesson Plan for Course: ORGANIC CHEMISTRY-III Code: CEMACOR07T Credit: 4

- Course coordinator: Swastik Karmakar
- Course Outcome

CO1:Students will learn about addition reaction to alkenes and alkynes.

CO2: Electrophilic aromatic substitution and nucleophilic aromatic substitution will be discussed elaborately.

Course planne

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jul				
Aug	**Chemistry of alkenes and alkynes :***Addition to C=C:* mechanism (with evidence wherever applicable), reactivity, regioselectivity (Markownikoff and anti-Markownikoff additions) and stereoselectivity.	SK	3 hrs	
	Chemistry of alkenes and alkynes :reactions: hydrogenation, halogenations, iodolactonisation, hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation, epoxidation, *syn*and *anti*-hydroxylation, ozonolysis.	BD	3 hrs	
	Chemistry of alkenes and alkynes : Addition of singlet and triplet carbenes; electrophilic addition to diene (conjugated dienes and allene); radical addition: HBr addition; mechanism of allylic and benzylicbromination in competition with brominations across C=C; use of NBS; Birch reduction of benzenoid aromatics; interconversion of *E* - and *Z* - alkenes; contra-thermodynamic isomerization of internal alkenes.	MS	3 hrs	
	Chemistry of alkenes and alkynes : *Addition to C≡C (in comparison to C=C):* mechanism, reactivity, regioselectivity (Markownikoff and anti-Markownikoff addition) and stereoselectivity;	PD	3 hrs	
	Chemistry of alkenes and alkynes : Reactions: hydrogenation, halogenations, hydrohalogenation, hydration, oxymercurationdemercuration, hydroboration-oxidation, dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes by exploring its acidity; interconversion of terminal and non-terminal alkynes.	SM	3 hrs	
Sep	**Aromatic Substitution:** *Electrophilic aromatic substitution:* mechanisms and evidences in favour of it; orientation and reactivity;	MS	3 hrs	
	Aromatic Substitution: reactions: nitration, nitrosation, sulfonation, halogenation, Friedel-Crafts reaction; one-carbon electrophiles (reactions: chloromethylation, Gatterman-Koch, Gatterman, Houben-Hoesch, Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmidt); *Ipso* substitituion.	SK	4 hrs	
	Aromatic Substitution: *Nucleophilic aromatic substitution:* addition-elimination mechanism and evidences in favour of it; SN1 mechanism; cine substitution (benzyne mechanism), structure of benzyne.	MS	3 hrs	
	Carbonyl and Related Compounds: *Addition to C=O:* structure, reactivity and preparation of carbonyl compounds; mechanism (with evidence), reactivity, equilibrium and kinetic control; Burgi-Dunitz trajectory in nucleophilic additions;	SM	3 hrs	
	Carbonyl and Related Compounds: Formation of hydrates, cyanohydrins and bisulphite adduct; nucleophilic addition-elimination reactions with alcohols,	PD	3 hrs	

	thiols and nitrogen- based nucleophiles; reactions: benzoin condensation, Cannizzaro and Tischenko reactions, reactions with ylides: Wittig and Corey-Chaykovsky reaction; Rupe rearrangement, oxidations and reductions: Clemmensen, Wolff-Kishner, LiAlH4, NaBH4, MPV, Oppenauer, Bouveault-Blanc, acyloin condensation; oxidation of alcohols with PDC and PCC; periodic acid and lead tetraacetate oxidation of 1,2-diols.			
Oct	**Carbonyl and Related Compounds:** *Exploitation of acidity of α-H of C=O:* formation of enols and enolates; kinetic and thermodynamic enolates.	SK	3hrs	
Nov	**Carbonyl and Related Compounds:** Reactions (mechanism with evidence): halogenation of carbonyl compounds under acidic and basic conditions, Hell-Volhard-Zelinsky (H. V. Z.) reaction, nitrosation, SeO2 (Riley) oxidation; condensations (mechanism with evidence).	SK	4hrs	
	Carbonyl and Related Compounds: Aldol, Tollens‟, Knoevenagel, Claisen-Schmidt, Claisen ester including Dieckmann, Stobbe; Mannich reaction, Perkin reaction, Favorskii rearrangement; alkylation of active methylene compounds.	MS	3 hrs	
	Carbonyl and Related Compounds: Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate; specific enol equivalents (lithium enolates, enamines, aza-enolates and silylenol ethers) in connection with alkylation, acylation and aldol type reaction.	BD	3 hrs	
	Elementary ideas of Green Chemistry: Twelve (12) principles of green chemistry; planning of green synthesis; common organic reactions and their counterparts: reactions: 22 Aldol, Friedel-Crafts, Michael, Knoevenagel, Cannizzaro, benzoin condensation and Dieckmann condensation.	SM	3 hrs	
	Nucleophilic addition to α,β-unsaturated carbonyl system: general principle and mechanism (with evidence); direct and conjugate addition, addition of enolates (Michael reaction), Stetter reaction, Robinson annulation.	PD	4hrs	
Dec	*Substitution at sp2 carbon (C=O system):* mechanism (with evidence): *B*AC2, *A*AC2, *A*AC1, *A*AL1 (in connection to acid and ester); acid derivatives: amides, anhydrides & acyl halides (formation and hydrolysis including comparison).	BD	4hrs	
	Organometallics: *Grignard reagent; Organolithiums; Gilman cuprates:* preparation and reactions (mechanism with evidence); addition of Grignard and organolithium to carbonyl compounds; substitution on -COX; directed orthometalation of arenes using organolithiums, conjugate addition by Gilman cuprates; Corey-House synthesis; abnormal behavior of Grignard reagents; comparison of reactivity among Grignard,	SK	3 hrs	
	Organometallics: Organolithiums and organocopper reagents; Reformatsky reaction; Blaise reaction; concept of *umpolung*and base-nucleophile dichotomy in case of organometallic reagents.	SM	2 hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Clayden, J., Greeves, N., Warren, S. *Organic Chemistry,* Second edition, Oxford University Press 2012.
2. Sykes, P., *A guidebook to Mechanism in Organic Chemistry,* Pearson Education, 2003.
3. Smith, J. G. *Organic Chemistry*, Tata McGraw-Hill Publishing Company Limited.
4. Carey, F. A., Guiliano, R. M. *Organic Chemistry*, Eighth edition, McGraw Hill Education, 2012.
5. Loudon, G. M. *Organic Chemistry*, Fourth edition, Oxford University Press, 2008.
6. Norman, R.O. C., Coxon, J. M. *Principles of Organic Synthesis*, Third Edition, Nelson Thornes, 2003.
7. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Finar, I. L. *Organic Chemistry (Volume 1),* Pearson Education.
9. Graham Solomons, T.W., Fryhle, C. B. *Organic Chemistry,* John Wiley & Sons, Inc.

10. March, J. *Advanced Organic Chemistry*, Fourth edition, Wiley.
11. Jenkins, P. R., *Organometallic Reagents in Synthesis*, Oxford Chemistry Primer, Oxford University Press.
12. Ward, R. S., *Bifunctional Compounds*, Oxford Chemistry Primer, Oxford University Press.
13. Ahluwalia, V. K. *Strategies for Green Organic Synthesis*, ANE Books Pvt. Ltd.

11. Other resources :

*Remarks will specify

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

Semester: III
Department of Chemistry
Basirhat College
SESSION: 2019-20(JULY-DEC 2020)

Lesson Plan for Course: ORGANIC CHEMISTRY-III LAB. Code: CEMACOR07P Credit: 2

- Course coordinator: Swastik Karmakar
- Course Outcome
  - ✓ CO1:Qualitative Analysis of Single Solid Organic Compounds like elemental detection, solubility and classification, functional group, melting points and derivative preparations are to be done.

Course planne

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jul				
Aug	Detection of special elements (N, S, Cl, Br) by Lassaigne's test. Detection of the following functional groups: aromatic amino (-NH2), aromatic nitro (-NO2)	BD+SM	8hrs	
	Solubility and classification (solvents: H2O, 5% HCl, 5% NaOH and 5% NaHCO3) Detection of the following functional groups: amido (-CONH2, including imide), phenolic –OH	MS+SK	8 hrs	
Sep	Detection of the following functional groups: carboxylic acid (-COOH), carbonyl (-CHO and >C=O) Melting point of the given compound.	BD+SM	6 hrs	
	Preparation, purification and melting point determination of a crystalline derivative of the given compound. Identification of the compound through literature survey.	MS+SK	10 hrs	
Oct				
Nov	Identification of **known (at leastsix)**organic compounds. through qualitative chemical tests for all the special elements and the functional groups with relevant derivatisation	BD+MS	10 hrs	
	Identification of unknown (**at leastsix)**organic compounds. through qualitative chemical tests for all the special elements and the functional groups with relevant derivatisation	SM+SK	6 hrs	
Dec	Identification of unknown (**at leastsix)**organic compounds. through qualitative chemical tests for all the special elements and the functional groups with relevant derivatisation	BD+MS	12hrs	
	Assessment: End-term Test	Total:60 Hrs		

Resources :

Books:

1. Vogel, A. I. *Elementary Practical Organic Chemistry,* Part 2: *Qualitative Organic Analysis,* CBS Publishers and Distributors.
2. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N. University of Calcutta, 2003.
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. Clarke, H. T., *A Handbook of Organic Analysis (Qualitative and Quantitative)*, Fourth Edition, CBS Publishers and Distributors (2007).
6. *Practical Workbook Chemistry (Honours), UGBS, Chemistry*, University of Calcutta, 2015.

12. 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: IV
Department of Chemistry
Basirhat College
SESSION: 2019-20(JAN-JUN 2020)

Lesson Plan for Course: PHYSICAL CHEMISTRY-III Code: **CEMACOR08T,** Credit: 4

- Course coordinator: Monojit Sarkar
- Course Outcome

CO1:This course helps in understanding about dilute solution behavior and colligative properties and their applications for measurements different properties.

CO2: How to study phase rule and phase diagram for different component systems are discussed. This study helps in chemical engineering.

Course plane

Sl	Course Topic	Teacher	Class -hrs	Rem arks
Jan	**Application of Thermodynamics – II** Colligative properties: Vapour pressure of solution; Ideal solutions, ideally diluted solutions and colligative properties; Raoult's law; Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) Osmotic pressure] and amount of solute.	MS	4hrs	

	Electrical Properties of molecules Ionic equilibria: Chemical potential of an ion in solution; Activity and activity coefficients of ions in solution; Debye-Huckel limiting law-brief qualitative description of the postulates involved, qualitative idea of the model, the equation (without derivation) for ion-ion atmosphere interaction potential.	BD	4hrs	
Feb	**Application of Thermodynamics – II** Applications in calculating molar masses of normal, dissociated and associated solutes in solution; Abnormal colligative properties Phase rule: Definitions of phase, component and degrees of freedom; Phase rule and its derivations; Definition of phase diagram; Phase diagram for water, CO2, Sulphur First order phase transition and Clapeyron equation; Clausius-Clapeyron equation - derivation and use; Liquid vapour equilibrium for two component systems; Phenolwater system Three component systems, water-chloroform-acetic acid system, triangular plots	MS	8hrs	
	Electrical Properties of molecules Estimation of activity coefficient for electrolytes using Debye-Huckel limiting law; Derivation of mean ionic activity coefficient from the expression of ion-atmosphere interaction potential; Applications of the equation and its limitations Electromotive Force: Quantitative aspects of Faraday‟s laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry; Chemical cells, reversible and irreversible cells with examples; Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb2O3 electrodes	BD	8hrs	
Mar	**Quantum Chemistry** Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component; Properties of angular momentum operators; Eigenfunctions of *LZ* and *LZ2*; Rigid rotator model of rotation of diatomic molecule and Schrödinger equation; Transformation to spherical polar coordinates; Separation of variables; Spherical harmonics; Discussion of solution	SM	8hrs	
	Application of Thermodynamics – II Binary solutions: 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 behavior; Azeotropic solution; Liquidliquid phase diagram using phenol- water system; Solid-liquid phase diagram; Eutectic mixture	MS	8hrs	
	Electrical Properties of molecules Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers; Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation) Dipole moment and polarizability: Polarizability of atoms and molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules; Clausius-Mosotti equation and Debye equation (both without derivation) and their application; Determination of dipole moments	BD	8 hrs	
Apr	**Quantum Chemistry** Qualitative treatment of hydrogen atom and hydrogen-like ions: Setting up of S.E. in spherical polar coordinates, radial part, quantization of energy (only final energy expression); Plots of polar parts and radial distributions; Wave – function of one electron atoms; Average and most probable distances of	SM	8hrs	

	electron from nucleus; Setting up of Schrödinger equation for many-electron atoms (He, Li) LCAO and HF-SCF: Born-Oppenheimer approximation; LCAO-MO treatment of H2+;			
May	**Quantum Chemistry** Bonding and antibonding orbitals; Qualitative extension to H2; Comparison of LCAOMO and VB treatments of H2 and their limitations; Covalent bonding, valence bond and molecular orbital approaches, Hartree-Fock method development, SCF and configuration interaction (only basics)	SM	4hrs	
	Assessment: End-term Test	Total:60Hrs		

Resources :

Books:

1. Castellan, G. W. *Physical Chemistry*, Narosa
2. Atkins, P. W. & Paula, J. de *Atkins', Physical Chemistry*, Oxford University Press
3. McQuarrie, D. A. &Simons, J. D. *Physical Chemistry: A Molecular Approach*, Viva Press
4. Levine, I. N. *Physical Chemistry*, Tata McGraw-Hill
5. Moore, W. J. *Physical Chemistry*, Orient Longman
6. Mortimer, R. G. *Physical Chemistry*, Elsevier
7. Engel, T. & Reid, P. *Physical Chemistry*, Pearson
8. Levine, I. N. *Quantum Chemistry*, PHI
9. Atkins, P. W. *Molecular Quantum Mechanics*, Oxford
10. Engel, T. & Reid, P. *Physical Chemistry*, Pearson
11. Maron, S.H., Prutton, C. F., *Principles of Physical Chemistry*, McMillan
12. Klotz, I.M., Rosenberg, R. M. *Chemical Thermodynamics:Basic Concepts and Methods* Wiley
13. Rastogi, R. P. &Misra, R.R. An Introduction to Chemical Thermodynamics, Vikas
14. Glasstone, S. An Introduction to Electrochemistry, East-West Press

13. 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: IV
Department of Chemistry
Basirhat College
SESSION: 2019-20(JAN-JUN 2020)

Lesson Plan for Course: PHYSICAL CHEMISTRY-III Lab, Code: CEMACOR08P, Credit: 2

- Course coordinator: SumanMandal
- Course Outcome
  - ✓ CO1:Some experiments with potentiometer, phase diagram, determination of solubility of sparingly soluble salt in water, effect of ionic strength on rate and pH-metric titrations are to be done.

Course plane

Sl	Course Topic	Teacher	Class-hrs	Remarks

Jan	Experiment 1: Determination of solubility of sparingly soluble salt in water, in electrolyte with common ions and in neutral electrolyte (using common indicator)	MS+BD	10hrs	
Feb	Experiment 2: Potentiometric titration of Mohr‟s salt solution against standard K2Cr2O7 solution	MS+BD	10hrs	
Mar	Experiment 3: Determination of Ksp for AgCl by potentiometric titration of AgNO3 solution against standard KCl solution	BD+MS	10hrs	
	Experiment 4: Effect of ionic strength on the rate of Persulphate – Iodide reaction	BD+MS	10hrs	
Apr	Experiment 6: pH-metric titration of acid (mono- and di-basic) against strong base	BD+MS	10 hrs	
May	Experiment 5: Study of phenol-water phase diagram	BD+MS	10hrs	
Jun				
	Assessment: End-term Test	Total:60Hrs		

Resources:

Books:

1. Viswanathan, B., Raghavan, P.S. *Practical Physical Chemistry* Viva Books (2009)
2. Mendham, J., A. I. Vogel‟s Quantitative Chemical Analysis 6th Ed., Pearson
3. Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007)
4. Palit, S.R., De, S. K. *Practical Physical Chemistry* Science Book Agency
5. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta
6. Levitt, B. P. edited *Findlay's Practical Physical Chemistry* Longman Group Ltd.
7. Gurtu, J. N., Kapoor, R., *Advanced Experimental Chemistry* S. Chand & Co. Ltd.

14. 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: IV
Department of Chemistry
Basirhat College
SESSION: 2019-20(JAN-JUNE 2020)

Lesson Plan for Course: INORGANIC CHEMISTRY-III Code: CEMACOR09T Credit: 4

- Course coordinator: SumanMandal
- Course Outcome

CO1: General Principles of Metallurgy is discussed.

CO2: Chemistry of *s* and *p* Block Elements, noble gases are to be known.

CO3: Types of inorganic polymers, synthesis, properties and comparison with organic polymers are given here.

CO4: A brief idea of coordination chemistry is discussed.

Course plane

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jan	**General Principles of Metallurgy** Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy.	SM	4 hrs	
Feb	**General Principles of Metallurgy** Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond‟s process, Zone refining.	SM	2hrs	
	Chemistry of *s* and *p* Block Elements Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Beryllium hydrides and halides.	SM	8hrs	
Mar	**Chemistry of *s* and *p* Block Elements** Boric acid and borates, boron nitrides, borohydrides (diborane) and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, phosphorus, sulphur and chlorine. Peroxo acids of sulphur, sulphur-nitrogen compounds, interhalogen compounds, polyhalide ions, pseudohalogens, fluorocarbons and basic properties of halogens.	SM	8hrs	
	Inorganic Polymers: Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes.	BD	4hrs	
	Coordination Chemistry-I Coordinate bonding: double and complex salts. Werner‟s theory of coordination complexes,	MS	6 hrs	
Apr	**Noble Gases:** Occurrence and uses, rationalization of inertness of noble gases, peculiar behaviour of liquid helium, Clathrates; preparation and properties of XeF2, XeF4 and XeF6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF2 and XeF4).	BD	6 hrs	
	Coordination Chemistry-I Classification of ligands, Ambidentate ligands, chelates, Coordination numbers, IUPAC nomenclature of coordination complexes (up to two metal centers),	MS	10 hrs	
May	**Noble Gases:** Xenon-oxygen compounds. Molecular shapes of noble gas compounds (VSEPR theory).	BD	4hrs	
	Coordination Chemistry-I Isomerism in coordination compounds, constitutional and stereo isomerism, Geometrical and optical isomerism in square planar and octahedral complexes.	MS	8 hrs	
Jun				
	Assessment: End-term Test		Total: 60Hrs	

Resources :

Books:

1. Huheey, J. E.; Keiter, E.A. &Keiter, R.L. *Inorganic Chemistry, Principles ofStructure and Reactivity 4th Ed.*, Harper Collins 1993, Pearson,2006.
2. Greenwood, N.N. &Earnshaw A. *Chemistry of the Elements*, ButterworthHeinemann, 1997.
3. Cotton, F.A., Wilkinson, G., Murrillo, C. A., Bochmann, M., *Advanced Inorganic Chemistry 6th Ed. 1999.*,Wiley.
4. Miessler, G. L. & Donald, A. Tarr. *Inorganic Chemistry* 4th Ed., Pearson, 2010.
5. Purecell, K.F. and Kotz, J.C., *An Introduction toInorganic Chemistry*, Saunders: Philadelphia, 1980.
6. Mingos, D.M.P., *Essential trends in inorganic chemistry*. Oxford University Press (1998).

15. 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: IV
Department of Chemistry
Basirhat College
SESSION: 2019-20(JAN-JUNE 2020)

Lesson Plan for Course: INORGANIC CHEMISTRY-III Lab, Code: CEMACOR09P, Credit: 2

- Course coordinator: Bidyut Debnath
- Course Outcome
  - ✓ CO1:Complexometric titration of few metal ions in solution and preparation of few inorganic complex compounds are to be performed.

Course plane

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jan	**Complexometric titration** 1. Zn(II) 2. Zn(II) in a Zn(II) and Cu(II) mixture.	SM+BD	10hrs	
Feb	**Complexometric titration** 3. Ca(II) and Mg(II) in a mixture. 4. Hardness of water.	SM+MS	14hrs	
Mar	**Inorganic preparations** 1. $[Cu(CH_3CN)_4]PF_6/ClO_4$ 2. *Cis*and *trans* $K[Cr(C_2O_4)_2(H_2O)_2]$ 3. Tetraamminecarbonatocobalt (III) ion	SM+BD	18hrs	
Apr	4. Potassium tris(oxalato)ferrate(III) 5.Tris-(ethylenediamine) nickel(II) chloride.	SM+MS	12 hrs	
May	6.[Mn(acac)3] and Fe(acac)3] (acac= acetylacetonate)	SM+BD	6 hrs	
Jun				
	Assessment: End-term Test	Total:60Hrs		

Resources:

Books:

1. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis* 6th Ed., Pearson, 2009.

2. *Inorganic Synthesis*, Vol. 1-10.
3. *University Hand Book of Undergraduate Chemistry Experiments*, edited by Mukherjee, G. N., University of Calcutta

16. 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: IV
Department of Chemistry
Basirhat College
SESSION: 2019-20(JAN-JUNE 2020)

Lesson Plan for Course: ORGANIC CHEMISTRY-III Code: CEMACOR10T Credit: 4

- Course coordinator: Swastik Karmakar
- Course Outcome

CO1:Preparations and reactions of amines, nitro compounds, alkylnitrile and isonitrile, diazonium salts and their related compoundsare to be studied.
CO2: Different organic rearrangement reactions should be known with mechanism**.**

Course plane

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jan	**Nitrogen compounds** *Amines: Aliphatic & Aromatic:* preparation, separation (Hinsberg's method) and identification of primary, secondary and tertiary amines; reaction (with mechanism): Eschweiler–Clarke methylation,diazo coupling reaction, Mannich reaction; formation and reactions of phenylenediamines, diazomethane and diazoacetic ester.	PD	4 hrs	
	The Logic of Organic Synthesis *Retrosynthetic analysis:* disconnections; synthons, donor and acceptor synthons; natural reactivity and *umpolung*; latent polarity in bifunctional compounds: consonant and dissonant polarity; illogical electrophiles and nucleophiles; synthetic equivalents; functional group interconversion and addition (FGI and FGA); C-C disconnections and synthesis: one-group and two-group (1,2- to 1,5-dioxygenated compounds)	SK	4 hrs	
Feb	**Nitrogen compounds** *Nitro compounds (aliphatic and aromatic):* preparation and reaction (with mechanism): reduction under different conditions; Nef carbonyl synthesis, Henry reaction and conjugate addition of nitroalkane anion. *Alkylnitrile and isonitrile*: preparation and reaction (with mechanism): Thorpe nitrile condensation, von Richter reaction. *Diazonium salts and their related compounds*: reactions (with mechanism) involving replacement of diazo group; reactions: Gomberg, Meerwein, Japp-Klingermann.	PD	8hrs	

	The Logic of Organic Synthesis Reconnection (1,6-dicarbonyl);protection-deprotection strategy (alcohol, amine, carbonyl, acid). *Strategy of ring synthesis:* thermodynamic and kinetic factors; synthesis of large rings, application of high dilution technique. *Asymmetric synthesis*: stereoselective and stereospecific reactions; diastereoselectivity and enantioselectivity (only definition); enantioselectivity: kinetically controlled MPV reduction; diastereoselectivity: addition of nucleophiles to C=O adjacent to a stereogenic centre: Felkin-Anh and Zimmermann-Traxler models.	SK	10hrs	
Mar	**Rearrangements** *Mechanism with evidence and stereochemical features for the following* *Rearrangement to electron-deficient carbon:* Wagner-Meerwein rearrangement, pinacol rearrangement, dienone-phenol; Wolff rearrangement in Arndt-Eistert synthesis, benzilbenzilic acid rearrangement, Demjanov rearrangement, Tiffeneau–Demjanov rearrangement.	PD	6 hrs	
	Organic Spectroscopy **(20 Lectures) Marks: 20** *UV Spectroscopy:* introduction;types of electronic transitions, end absorption; transition dipole moment and allowed/forbidden transitions; chromophores and auxochromes; Bathochromic and Hypsochromic shifts; intensity of absorptions (Hyper/Hypochromic effects); application of Woodward"s Rules for calculation of λmax for the following systems: conjugated diene, *α,β*-unsaturated aldehydes and ketones (alicyclic, homoannular and heteroannular); extended conjugated systems (dienes, aldehydes and ketones); relative positions of λmax considering conjugative effect, steric effect, solvent effect, effect of pH; effective chromophore concentration: keto-enolsystems; benzenoid transitions.	SK	8hrs	
Apr	**Rearrangements** *Rearrangement to electron-deficient nitrogen:* rearrangements: Hofmann, Curtius, Lossen, Schmidt and Beckmann. *Rearrangement to electron-deficient oxygen:* Baeyer-Villiger oxidation, cumenehydroperoxide-phenol rearrangement and Dakin reaction. *Aromatic rearrangements: Migration from oxygen to ring carbon*: Fries rearrangement and Claisen rearrangement. *Migration from nitrogen to ring carbon*: Hofmann-Martius rearrangement**,** FischerHepp rearrangement, *N*-azo to *C*-azo rearrangement, Bamberger rearrangement, Orton rearrangement and benzidine rearrangement.	PD	6 hrs	
	Organic Spectroscopy *IR Spectroscopy:* introduction;modes of molecular vibrations(fundamental and nonfundamental); IR active molecules; application of Hooke"s law, force constant; *fingerprint region* and its significance; effect of deuteration; overtone bands; vibrational coupling in IR; characteristic and diagnostic stretching frequencies of C-H, N-H, O-H, C-O, C-N, C-X, C=C (including skeletal vibrations of aromatic compounds), C=O, C=N, N=O, C≡C, C≡N; characteristic/diagnostic bending vibrations are included; factors affecting stretching frequencies: effect of conjugation, electronic effects, mass effect, bond multiplicity, ring-size, solvent effect, H-bonding on IR absorptions; application in functional group analysis. *NMR Spectroscopy:* introduction;nuclearspin;NMR active molecules;basic principles of Proton Magnetic Resonance; equivalent and non-equivalent protons; chemical shift and factors influencing it; ring current effect; significance of the terms: up-/downfield, shielded and deshielded protons; spin coupling and coupling constant (1st order spectra); relative intensities of *first-order* multiplets: Pascal"s triangle; chemical and magnetic equivalence in NMR ;	SK	8 hrs	
May	**Rearrangements** *Rearrangement reactions by green approach*: Fries rearrangement,	PD	2 hrs	

	Claisenrearrangement, Beckmann rearrangement, Baeyer-Villiger oxidation.			
	Organic Spectroscopy elementary idea about *non-first-order* splitting; anisotropic effects in alkene, alkyne, aldehydes and aromatics; NMR peak area, integration; relative peak positions with coupling patterns of common organic compounds (both aliphatic and benzenoid-aromatic); rapid proton exchange; interpretation of NMR spectra of simple compounds. Applications of IR, UV and NMR spectroscopy for identification of simple organic molecules.	SK	4 hrs	
Jun				
	Assessment: End-term Test	Total:60Hrs		

Resources :

Books:

1. Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. Finar, I. L. *Organic Chemistry* (*Volume 2: Stereochemistry and the Chemistry of Natural Products*), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).

3. Norman, R.O. C., Coxon, J. M. *Principles of Organic Synthesis*, Third Edition, Nelson Thornes, 2003.

4. Clayden, J., Greeves, N., Warren, S., *Organic Chemistry*, Second edition, Oxford University Press 2012.

5. Silverstein, R. M., Bassler, G. C., Morrill, T. C. *Spectrometric Identification of Organic Compounds*, John Wiley and Sons, INC, Fifth edition.

6. Kemp, W. *Organic Spectroscopy*, Palgrave.

7. Pavia, D. L. *et al. Introduction to Spectroscopy*, 5th Ed. Cengage Learning India Ed. (2015).

8. Dyer, J. *Application of Absorption Spectroscopy of Organic Compounds*, PHI Private Limited

9. March, J. *Advanced Organic Chemistry*, Fourth edition, Wiley.

10. Harwood, L. M., *Polar Rearrangements*, Oxford Chemistry Primer, Oxford University Press.

11. Bailey, Morgan, Organonitrogen Chemistry, Oxford Chemistry Primer, Oxford University Press.

12. Ahluwalia, V. K. *Strategies for Green Organic Synthesis*, ANE Books Pvt. Ltd. 13. Warren, S. *Organic Synthesis the Disconnection Approach*, John Wiley and Sons.

14. Warren, S., *Designing Organic Synthesis*, Wiley India, 2009.

15. Carruthers, W. *Modern methods of Organic Synthesis*, Cambridge University Press.

16. Willis, C. A., Wills, M., *Organic Synthesis*, Oxford Chemistry Primer, Oxford University Press.

17. 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: IV
Department of Chemistry
Basirhat College
SESSION: 2019-20(JAN-JUNE 2020)

Lesson Plan for Course: ORGANIC CHEMISTRY-III Lab, Code: CEMACOR10P, Credit: 2

- Course coordinator: Monojit Sarkar
- Course Outcome
  - ✓ CO1:Students will get ideas about saponification values of different types of ester, fats & oil.

Course planne

Sl	Course Topic	Teacher	Class-hrs	Remarks
Jan	**Quantitative Estimations:** 1. Estimation of glycine by Sörensen‟sformol method 2. Estimation of glucose by titration using Fehling‟s solution	SK+PD	10hrs	
Feb	3. Estimation of sucrose by titration using Fehling‟s solution 4. Estimation of vitamin-C (reduced)	SK+PD	14hrs	
Mar	5. Estimation of aromatic amine (aniline) by bromination (Bromate-Bromide) method 6. Estimation of phenol by bromination (Bromate-Bromide) method 7. Estimation of formaldehyde (Formalin)	SK+PD	18hrs	
Apr	8. Estimation of acetic acid in commercial vinegar 9. Estimation of urea (hypobromite method)	SK+PD	12 hrs	
May	10. Estimation of saponification value of oil/fat/ester	SK+PD	6 hrs	
Jun				
	Assessment: End-term Test	Total:60Hrs		

Resources :

Books:

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

18. 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)

LESSON PLAN FOR PART III CEMA IN 1+1+1 SYSTEM

Department of Chemistry

Basirhat College

Session: 2019-20

CEMA III-Year

Paper V/ Paper Code: CEMAT 35-IA, 35-IB, 35-AA, 35-AB/ Total Marks: 100

Course coordinator: MONOJIT SARKAR

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 hour	Remarks
Jul-	**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. **Chemistry of coordination compounds:** trans effect (example and applications). Stability constants of coordination compounds and their importance in inorganic analysis. Structure and bonding: EAN rule, VB description and its limitations. **Chemistry of coordination compounds:** 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; pairing energy, evidence andapplication of crystal field (lattice energy, ionic radius, hydration energy, redox pot, spinel). **Chemistry of coordination compounds:** 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	12	
Aug	**Chemistry of coordination compounds:** Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of d^nions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment: super exchange and antiferromagnetic interactions (elementary idea with examples only); **Chemistry of coordination compounds:** d-d transitions; 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 withexamples).	SM	8	

	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, oxidation states, redox properties, coordination chemistry, spectral and magnetic properties. **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, comparison between lanthanide and actinides, separation of lanthanides (by ion-exchange method).	MS	8	
Sept	**Chemistry of d- and f- block elements:** Chemistry of some representative compounds: K2Cr2O7, KMnO4, K4[Fe(CN)6], K2[Ni(CN)4], H2PtCl6, Na2[Fe(CN)5NO].	MS	4	
	Organometallic Compounds: 18-electron rule and its applications to carbonyls (including carbonyl hydrides and carbonylates), nitrosyls, cyanides, and nature of bonding involved therein **Organometallic Compounds:** Simple examples of metal-metal bonded compounds and metal clusters. Metal-olefin complexes: zeises salt (preparation, structure and bonding), Ferrocene (preparation, structure and reactions). Hapticity(n) of organometallic ligands, examples of mono tri and penta-haptocyclopentadienyl complexes. Simple examples of fluxional molecules. **Organometallic Compounds:** Coordinative unsaturation: oxidative addition and insertion reactions. Homogeneous catalysis by organometallic compounds: hydrogenation, hydroformylation and polymerization of alkenes (Ziegler-Natta catalysis).	BD	6	
Nov	**Gravimetric and tritimetric methods of analysis:** Requirements of gravimetry: properties of precipitates and precipitating regents, particle size and filterability of precipitates, 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. **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: KMnO4, $K_2Cr_2O_7$, I_2, $Na_2S_2O_3.5H_2O$, $KH(IO_3)_2$ and $KBrO_3$. Principle of argentimetric estimation of chloride using adsorption indicators. **Gravimetric and tritimetric methods of analysis:** 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. **Gravimetric and tritimetric methods of analysis:** 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.	SM	14	

Dec	**Bioinorganic Chemistry:** Elements of life: essential major, trace and ultratrace elements. 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+}). **Bioinorganic Chemistry:** Metal ion transport across biological membrane Na^+-ion pump, ionophores. Biological functions of hemoglobin and myoglobin, cytochromes and ferredoxins. **Bioinorganic Chemistry:** Carbonate bicarbonate buffering system and carbonicanhydrase. Biological nitrogen fixation, Photosynthesis: Photosystem-I and Photosystem-II. **Bioinorganic Chemistry:** Toxic metal ions and their effects, chelation therapy (examples only), Pt and Au complexes as drugs (examples only), metal dependent diseases.	MS	12	
Jan	**Material Chemistry:** Silicate minerals (Quartz) Zeolite: structure, accommodation of 'guest ions'. **Material Chemistry:** Nanomaterials: (Definition and properties). Carbon nano particles (Buckmister FullerenceC60), Gold nano particles **Material Chemistry:** Metal clusture structure i) carbonyl ii) oxide, Metal surface catalysis (NH3 products, Haber process). **Material Chemistry:** Polymer: definition, classification, different types of molecular weight and their determination (viscosity average and weight average method).	BD	12	
Feb	**Bioorganic Chemistry:** Secondary, tertiary and quaternary structure of proteins, classification of enzymes and coenzymes (simple examples), **Bioorganic Chemistry:** nucleic acids: structure of nucleosides and nucleotides, DNA, RNA, **Bioorganic Chemistry:** 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	12	
	Biophysical Chemistry: Colloids and their stability, elementary idea of electrical double layer and its protective role in the stability of colloids.	SM	4	
Mar	**Biophysical Chemistry:** isoelectric point, Autocatalysis, Enzyme catalysis, Michaelis-Menten equation, Lineweaver-Burk plot **Biophysical Chemistry:** isoelectric point, Autocatalysis, Enzyme catalysis, Michaelis- Menten equation, Lineweaver-Burk plot **Biophysical Chemistry:** pH-dependence of enzyme activity, Electrophoresis, elementary idea of gel electrophoresis, **Biophysical Chemistry:** polyacrylamide gel electrophoresis (PAGE) and SDS-PAGE, Isoelectric focusing.	SM	12	
Apr-				
		Total:	104	

Resources:

1. Books:

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: 2019-20

CEMA III-Year

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

Course coordinator: 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) : 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, -NH2, - COOH) in synthetic route, 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), stereoselective synthesis (Cram's rule, Prelog's rule).	SK	7	
	CEMAT 36-PA, UNIT I: Statistical Thermodynamics and Third Law: Macrostates and microstates, thermodynamic probability, entropy and probability, Boltzmann distribution formula (with derivation). Applications to barometric distribution. Partition function. Derivation of expression of thermodynamic functions using partition function.	SM	6	

Aug	**CEMAT 36-OA: UNIT I:** 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, 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	12	
	CEMAT 36-PA, UNIT I: Statistical Thermodynamics and Third Law: Dulong-Petit's law and Einstein's theory of heat capacity of solids.	SM	3	
Sept	**CEMAT 36-OA:UNIT II:** Heterocyclic compounds: Synthesis (including retrosynthetic approach), reactivity, orientation and important reactions of furan, pyrrole, thiophene, pyridine, Synthesis (including retrosynthetic approach), reactivity, orientation and important reactions of indole, quinolone and isoquinoline, Knorr pyrrole synthesis. Synthesis (including retrosynthetic approach), reactivity, orientation and important reactions of Hantzsch pyridine synthesis, Fischer indole synthesis and Bischler-Napieralsky synthesis. Pharmaceuticals: Preparation and uses of sulphadiazine, chloroquine, metronidazole,chlorpromazine, indomethacin, ranitidine.	SM	12	
	CEMAT 36-PA, UNIT I: Limitation of Einstein's theory and Debye's modification (qualitative). Nernst heat theorem. Approach towards zero kelvin, adiabatic demagnetisation. Planck's formulation of third law and absolute entropies.	SM	4	
Nov	**CEMAT 36-OB, UNIT I:** 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,		3	
	CEMAT 36-PA, UNIT II: Molecular Spectroscopy: 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 Vibrational spectroscopy of diatomic molecules: SHO model, selection rules, spectra; anharmonicity and its consequences on energy levels, overtones, hot bands. Raman Effect. Characteristic features and conditions of Raman activity with suitable illustrations. Rotational and vibrational Raman spectra. Rule of mutual exclusion with examples	SM	12	

Dec	**CEMAT 36-OB, UNIT I:** conformational analysis of mono and di-substituted cyclohexanes, Dynamic stereochemistry: E2, SN2 and NGP, lactonisation reactions of cyclohexane systems, 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.	SK	6	
	CEMAT 36PB,UNIT I: Crystal, crystal planes, law of rational indices, Calculation of fraction occupied for simple cubic, bcc, and fcc. Miller indices. Bragg's law and its applications for the determination of crystal structure for cubic system single crystal. Crystal structures of NaCl and KCl. Brief idea about liquid crystals. 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).	BD	8	
Jan	**CEMAT 36-OB, UNIT I:** Carbohydrates: monosaccharides: classification of monosaccharides, osazone formation, stepping up and stepping down of aldoses, interconversion of aldose and ketose. Epimerization, 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.	PD	4	
	CEMAT 36PB, UNIT I: Electrical properties of molecules: Polarizability of atoms and molecules, dielectric constant and polarisation, molar polarisation for polar and non-polar molecules. Clausius-Mosotti equation and Debye equation (both without derivation) and their application. Determination of dipole moments.	BD	5	
	CEMAT 36PB, UNIT II: Phase equilibrium and colligative properties. Definitions of phase, component and degrees of freedom. Phase rule and its derivations. Definition of phase diagram.	MS	4	
Feb	**CEMAT 36-OB, UNIT II:** Amino acids, peptides and proteins: synthesis of α - amino acids [Gabriel, Strecker, azlactone, hydantoin, acetamidomalonic ester methodologies], isoelectric point, ninhydrin reaction,, 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	8	
	CEMAT 36PB, UNIT II: Phase equilibria for one component system – water, CO2. First order phase transition and Clapeyron equation; Use of Clausius-Clapeyron equation.	MS	4	
Mar	**CEMAT 36PB, UNIT II:** Liquid vapour equilibrium for two component systems. Ideal solution at fixed temperature and pressure. Principle of fractional distillation.	MS	8	

	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. 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.			
	CEMAT 36-OB, UNIT II: Natural products: Terpenoids : Classification, isoprene rule, structure and synthesis of citral, geraniol and nerol.	SK	4	
Apr-	**CEMAT 36-OB, UNIT II:** Alkaloids: Structure and synthesis of ephedrine and nicotine.	SK	4	
	CEMAT 36PB, UNIT II: Thermodynamic derivation of colligative properties of solution (using chemical potential) and their inter relationships. Abnormal colligative properties.	MS	4	
		TOTAL CLASS :110		

Resources:

3. Books:

1 Atkins, P. W. & Paula, J. de *Atkins' Physical Chemistry*, Oxford University Press
2. Castellan, G. W. *Physical Chemistry*, Narosa
3. Maron, S. &Prutton*Physical Chemistry*
4. Ball, D. W. *Physical Chemistry*, Thomson Press
5. Mortimer, R. G. *Physical Chemistry*, Elsevier
6. Laidler, K. J. *Chemical Kinetics*, Pearson
7. Glasstone, S. & Lewis, G.N. *Elements of Physical Chemistry*
8. Rakshit, P.C., *Physical Chemistry* Sarat Book House
9 Zemansky, M. W. &Dittman, R.H. *Heat and Thermodynamics*, Tata-McGraw- Hill
10. Rastogi, R. P. &Misra, R.R. *An Introduction to Chemical Thermodynamics*,
11.Finar, I. L. *Organic Chemistry (Volume 1),* Pearson Education.
12. March, J. *Advanced Organic Chemistry*, Fourth edition, Wiley.
13. Silverstein, R. M., Bassler, G. C., Morrill, T. C. *Spectrometric Identification of Organic Compounds*, John Wiley and Sons, INC, Fifth edition.
14. Kemp, W. *Organic Spectroscopy*, Palgrave.
15. Pavia, D. L. *et al. Introduction to Spectroscopy,* 5th Ed. Cengage Learning India Ed. (2015).
16. Dyer, J. *Application of Absorption Spectroscopy of Organic Compounds*, PHI Private Limited

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).

COURSE PLANER

Department of Chemistry

Basirhat College

Session: 2019-20

CEMA III-Year

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

Course coordinator: 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-	To study the kinetics of inversion of sucrose using polarimeter.	MS+BD	4	
	To study the phase diagram of a binary system (Phenol + water) and the effect of impurities (e.g. NaCl).	SK+SM	4	
Aug	Determination of ionization constant of a weak acid by conductometric method.	MS+BD	6	
	To study the kinetics of saponification of ester by conductometric method.	SK+SM	6	
Sept	Conductometric titration of HClvsNaOH, AcOHvsNaOH.	MS+BD	6	
	Determination of formal potential of Fe+3/Fe+2 couple in the hydrogen scale by potentiometric titration of ferrous ammonium sulfate solution using KMnO4, or, K2Cr2O7 as standard.	SK+SM	6	
Nov	Determination of concentration of (i) AgNO3 solution and (ii) solubility product of AgCl by potentiometic titration of standard KCl solution against AgNO3 solution.	MS+BD	6	
	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.).	SK+SM	10	
Dec	Study of the kinetics of the reaction I^- + $S_2O_8^{-2}$by colorimetric method.	MS+BD	6	
	Determination of $\wedge o$ of a strong electrolyte (KCl) conductometrically.	SK+SM	6	
Jan	Identification of amino acids by TLC/paper.	MS+BD	4	
	Binary mixture separation (neutral + acid or base) and identification by TLC/Paper.	SK+SM	6	
Feb	Determination of specific rotation of an optically active substance.	MS+BD	4	

	Determination of indicator constant by colourimetric method.	SK+SM	4	
Mar	Verification of Lambert Beer's Law.	MS+BD	6	
	Conductometric titration of mixed acid.	SK+SM	6	
Apr-				
		TOTAL HOUR: 90		

Resources:

5. Books:
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: 2019-20

CEMA III-Year

Paper VIII/ Paper Code: CEMAP 38-Pr/ Total Marks: 75(PRACTICAL)+25(LNB+VIVA)

Course coordinator: Bidyut Debnath

Course planner

SL	Course Topic	Teacher	No of Class	Remarks
Jul-	Complexometric estimation: $Ca^{2+} + Mg^{2+}$ in solution.	MS+BD	9	
	Complexometric estimation: (Fe^{3+} + Al^{3+}) in solution.	SK+SM	9	
Aug	Dichromatometry and iodometry: $Fe^{3+} + Cr_2O_7^{2-}$	MS+BD	9	
	Dichromatometry and iodometry:Fe^{3+} + Cu^{2+}	SK+SM	9	
Sept	Dichromatometry and iodometry:Fe^{3+} + Mn^{2+}	MS+BD	9	
	Permanganometry: Fe^{3+} + Ca^{2+}	SK+SM	9	
Nov	Analysis of Fe^{3+} in cement.	MS+BD	6	
	Gravimetry: Ni^{2+} as glyoximato complex.	SK+SM	9	
Dec	Gravimetry:Cu^{2+} as CuSCN	MS+BD	9	

	Determination of temporary and permanent hardness in supplied water.	SK+SM	9	
Jan	Organic Preparation: Preparation of an organic compound, purification and determination of its M.P.by Nitration (cold, hot), Condensation, Hydrolysis.	MS,BD, SK,SM	12	
Feb	Organic Preparation: Preparation of an organic compound, purification and determination of its M.P.by Oxidation	MS,BD, SK,SM	12	
Mar	Organic Preparation: Preparation of an organic compound, purification and determination of its M.P.by Halogenation (Green method),	MS,BD, SK,SM	12	
Apr-	Organic Preparation: Preparation of an organic compound, purification and determination of its M.P.byacetylation.	MS,BD, SK,SM	12	
		TOTAL CLASS: 135		

Resources:

7. Books:
8. 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).