1st SEMESTER TEACHING PLAN

Department of Chemistry

SBMS College, Sualkuchi

Session: 2022-2023

Subject	Chemistry	**Semester**	**I**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-1014: Inorganic Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Atomic Structure:** Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s, p, d* and *f* orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.	Dr. Bhabesh Chandra Deka	14	**August**	02-08-2022 to 20-08-2022
2	**Periodicity of Elements:** *s, p, d, f* block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to *s* & *p*-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.	Dr. Bhabesh Chandra Deka	**16**	**August/September**	**21-08-2022 to 15-09-2022**

	(f) Electron gain enthalpy, trends of electron gain enthalpy. (g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.				
3	**Chemical Bonding:** (i) *Ionic bond:* General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy. (ii) *Covalent bond:* Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl,BeF_2, CO_2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference. (iii) *Metallic Bond:* Qualitative idea of	**Dr. Bhabesh Chandra Deka**	**26**	**September/ October**	**16-09-2022 to 20-09-2022**

	valence bond and band theories. Semiconductors and insulators, defects in solids. (iv) *Weak Chemical Forces:* van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions.Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.				
4	**Oxidation-Reduction:** Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.	Dr. Bhabesh Chandra Deka	**4**	**October**	**21-09-2022 to 30-09-2022**
LAB	**(A) Titrimetric Analysis** (i) Calibration and use of common laboratory apparatus (ii) Preparation of solutions of different Molarity/Normality of titrants **(B) Acid-Base Titrations** (i) Estimation of carbonate and hydroxide present together in mixture. (ii) Estimation of carbonate and bicarbonate present together in a mixture. (iii) Estimation of free alkali present in different soaps/detergents **(C) Oxidation-Reduction Titrimetry** (i) Estimation of Fe(II) and oxalic acid using standardized $KMnO_4$ solution. (ii) Estimation of oxalic acid and sodium oxalate in a given mixture. (ii) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.	Dr. Bhabesh Chandra Deka	**10** **10** **10**	**August** **Septembe r** **October**	

1st SEMESTER TEACHING PLAN

Department of Chemistry

SBMS College, Sualkuchi

Session: 2022-2023

Subject	Chemistry	**Semester**	**I**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-1026: Physical Chemistry
Credit	6 (Theory) +2 (Practical	**Marks**	60 (Theory)+20 (Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1 Gaseous state	Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root meansquare and most probable) and average kinetic energy. Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, *Z*, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour,mention of other equations of state (Berthelot, Dietrici); virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.	Mr. Kangkan K. Barua	18	August	02-08-22 to 25-08-2022
2	**Liquid state:** Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their	Mr. Kangkan K. Barua	**6**	**August**	26-08-2022 to 02-09-2022

	determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water.				
3	**Molecular and Crystal Symmetry** Elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices.	Mr. Kangkan K. Barua	**6**	**September**	03-09-2022 to 09-09-2022
4	**Solid state:** Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices,; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Liquid crystals (Introductory idea)	Mr. Kangkan K. Barua	**10**		**10-09 to 23-09-2022**
5	**Ionic equilibria:** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases,pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment). Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity,buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages).	Mr. Kangkan K. Barua	**20**		**24-09-2022 to 31-10-2022**

	Theory of acid–base indicators; selection of indicators and their limitations. Multistage equilibria in polyelectrolyte systems; hydrolysis and hydrolysis constants.				
LAB	1. Surface tension measurements. a. Determine the surface tension by (i) drop number (ii) drop weight method. b. Study the variation of surface tension of detergent solutions with concentration.	Mr. Kangkan K. Barua	**10**	**August**	
	2. **Viscosity measurement using Ostwald's viscometer**. a. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature. b. Study the variation of viscosity of sucrose solution with the concentration of solute.	Mr. Kangkan K. Barua	**10**	**September**	
	3. Indexing of a given powder diffraction pattern of a cubic crystalline system. **4. pH metry** a. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures. b. Preparation of buffer solutions of different pH i. Sodium acetate-acetic acid ii. Ammonium chloride-ammonium hydroxide c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base. d. Determination of dissociation constant of a weak acid.	Mr. Kangkan K. Barua	**10**	**October**	

1st SEMESTER TEACHING PLAN

Department of Chemistry

SBMS College, Sualkuchi

Session : 2022-2023

Subject	Chemistry	**Semester**	**I**
Course	B.Sc (Hons,) /Regular	**Paper Code/Name**	CHE-HG/RC-1026: Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s. Shapes of *s*, *p* and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number (m_s). Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations. **(14 Lectures)**	Dr. Bhabesh Chandra Deka	**16**	**August/ September**	**02-08-2022 to 24-09-022**
2	**Chemical Bonding and Molecular Structure** *Ionic Bonding:* General characteristics	Mr. Kangkan K. Barua	**16**		**02-08-2022 to 24-09-022**

	of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character. *Covalent bonding:* VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of *s-p* mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approaches. **(16 Lectures)**				
3	***Section B: Organic Chemistry-1*** **(30 Periods)** **Fundamentals of Organic Chemistry** Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of	**Dr. Bhabesh Chandra Deka**	**8**	**September/October**	**26-09-2022 to 20-10-2022**

	organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.				
4	**Stereochemistry** Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; *cis – trans* nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).	**Dr. Pulin Ch, Sarma**	**10**	**August**	**02-08-2022 to 31-08-2022**
5	**Aliphatic Hydrocarbons** Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. **Alkanes:** (Upto 5 Carbons). *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. *Reactions:* Free radical Substitution: Halogenation. **Alkenes:** (Upto 5 Carbons) *Preparation:* Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). *Reactions:* cis-addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's	**Dr. Pulin Ch. Sarma**	**20**	**October/ November**	**01/09/2022 to 05/11/2022**

	addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation. **Alkynes**: (Upto 5 Carbons) *Preparation:* Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. *Reactions:* formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$. .				
LAB	***Section A: Inorganic Chemistry - Volumetric Analysis*** 1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture. 2. Estimation of oxalic acid by titrating it with $KMnO_4$. 3. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$. 4. Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator. 5. Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.	**Dr Bhabesh Ch Deka**	**15**	**Aug/September/October**	

	Section B: Organic Chemistry 1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements) 2. Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given) (a) Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography (b) Identify and separate the sugars present in the given mixture by paper chromatography.	**Dr. Pulin Ch. Sarma**	**15**	**August/September/ October**	

2nd SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**II**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-2016: Organic Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	Course Content	Allotted to	Hours	Month	Date
1	**Basics of Organic Chemistry** *Organic Compounds:* Classification, and Nomenclature, Hybridization, Shapes of molecules,Influence of hybridization on bond properties. *Electronic Displacements:* Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges;Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.	**Dr. Pulin Ch. Sarma**	**8**	**January**	**18-01-2023 to 31-01-2023**
2	**Stereochemistry:** Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. *Optical Isomerism:* Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S	**Dr. Bhabesh Chandra Deka**	**16**	**January/ February**	**18/01/ 2023 to 28/02/2023**

	designations.				
3	**Chemistry of Aliphatic Hydrocarbons** 13 **A. Carbon-Carbon sigma bonds** Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity. **B. Carbon-Carbon pi bonds:** Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations. *Reactions of alkenes:* Electrophilic additions and their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation,ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene. *Reactions of alkynes:* Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes. **C. Cycloalkanes and Conformational Analysis** Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.	**Dr. Pulin Ch. Sarma**	**24**	**February / March**	**01-02-2023 to 19-03-2023**
4	**Aromatic Hydrocarbons** *Aromaticity:* Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and	**Dr. Bhabesh Chandra Deka**	**12**	**March**	**01/03/2023 to 19/03/2023**

	heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups. **(12 Lectures)**				
LAB	1. Checking the calibration of the thermometer 2. Purification of organic compounds by crystallization using the following solvents: a. Water b. Alcohol c. Alcohol-Water 3. Determination of the melting points of above compounds and unknown organic Compounds. 4. Effect of impurities on the melting point – mixed melting point of two unknown organic Compounds. 5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and use of thiele tube method) 6. Chromatography a. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography b. Separation of a mixture of two sugars by ascending paper chromatography c. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)	**Dr. Pulin Ch. Sarma** **Dr. Bhabesh Chandra Deka**	**20** **10**		**18/01/2023 to 19/03/2023** **18/01/2023 to 19/03/2023**

2nd SEMESTER TEACHING PLAN

Department of Chemistry

SBMS College, Sualkuchi

Session : 2022-2023

Subject	Chemistry	**Semester**	**II**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-2026: Physical Chemistry
Credit	6 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Chemical Thermodynamics:** Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. *First law:* Concept of heat, *q*, work, *w*, internal energy, *U*, 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. Law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. *Thermochemistry:* Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature. *Second Law:* Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes. *Third Law:* Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules. *Free Energy Functions:* Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; spontaneous process-	**Mr. Kangkan K Barua**	**36**	**January /**	**18/01/2023 to 18/02/2023**

	enthalpy change, entropy change and free energy change considerations. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state. **(36 Lectures)**				
2	**Systems of Variable Composition:** Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.		**8**		**19/02/2023 to 28-02-2023**
3	**Chemical Equilibrium:** Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants K_p, K_c and K_x. Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.		**8**		**01-03-2023 to 11-03-2023**
4	**Solutions and Colligative Properties:** Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions. 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. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.		**8**		**12-03-2023 to 22-03-2023**
5	**Thermochemistry**				**18-01-2023**

LAB	(a) Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization). 17 (b) Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide. (c) Calculation of the enthalpy of ionization of ethanoic acid. (d) Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts. (e) Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step. (f) Determination of enthalpy of hydration of copper sulphate. (g) Study of the solubility of benzoic acid in water and determination of ΔH. *Any other experiment carried out in the class.*		**30**		**to 22-03-2023**

2nd SEMESTER TEACHING PLAN

Department of Chemistry

SBMS College, Sualkuchi

Session : 2022-2023

Subject	Chemistry	**Semester**	**II**
Course	B.Sc (Hons) /Regular	**Paper Code/Name**	CHE-HG/RC-2016: *S*- And *P*-Block Elements, Transition Elements, Coordination Chemistry States Of Matter & Chemical Kinetics
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	*s*- and *p*-Block Elements Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred-Rochow scales). Allotropy in C, S, and P. Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group.	Dr. Pulin Ch. Sarma	10	January/ February	18/01/2023 to 22/02/2023
2	Transition Elements (3d series) General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.	Dr. Bhabesh Ch. Deka	6	Jan/Feb	18/01/2023 to 12/02/2023
3	Coordination Chemistry Coordination compounds, types of ligands, Werner's theory, IUPAC nomenclature and isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Drawbacks of VBT. Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral		14		13/02/2023 to 20/03/2023

	symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for *Oh* and *Td* complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.				
4	***Section B: Physical Chemistry-3*** **(30 Lectures)** **Kinetic Theory of Gases** Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. Van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO_2. Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).	**Dr. Pulin Ch. Sarma**	**8**	**February/ March**	**23/02/2023 to 20/02/2023**
5	**Liquids** Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).	**Mr. Kangkan K Barua**	**6**		**18/01 to 11/02/2023**

6	**Solids** Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals.	**Mr. Kangkan K Barua**	**8**		**12-02-2023 to 28/02/2023**
7	**Chemical Kinetics** The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). **(8 Lectures)**	**Mr. Kangkan K Barua**	**8**		**01/03/2023 to 20/03/2023**
LAB	***Section A: Inorganic Chemistry*** Semi-micro qualitative analysis using H_2S of mixtures - not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following: CO_3^{2-}, NO_2^-, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-},	**Dr. Bhabesh Ch. Deka**	**15**		**18/01/2023 to 20/03/2023**

	NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+},, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+} *(Spot tests should be carried out wherever feasible)* 1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically. 12 2. Draw calibration curve (absorbance at λmax vs. concentration) for various concentrations of a given coloured compound ($KMnO_4$/ $CuSO_4$) and estimate the concentration of the same in a given solution. 3. Determine the composition of the Fe^{3+}-salicylic acid complex solution by Job's method. 4. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA. 5. Estimation of total hardness of a given sample of water by complexometric titration. 6. Determination of concentration of Na^+ and K^+ using Flame Photometry. ***Section B: Physical Chemistry*** (I) Surface tension measurement (use of organic solvents excluded). a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer. b) Study of the variation of surface tension of a detergent solution with concentration. (II) Viscosity measurement (use of organic solvents excluded). a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer. b) Study of the variation of viscosity of an aqueous solution with concentration of solute. (III) Chemical Kinetics	**Mr. Kangkan K Barua**	**15**		**18/01/2023 to 20/03/2023**

	Study the kinetics of the following reactions. 1. Initial rate method: Iodide-persulphate reaction 2. Integrated rate method: a. Acid hydrolysis of methyl acetate with hydrochloric acid. b. Saponification of ethyl acetate. c. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate				

3rd SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**III**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-3016: Inorganic Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	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. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining.	Dr. Bhabesh Chandra Deka	06	August	02/08/22 to 08/08/22
2	Acids and Bases Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids,types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle. (8 Lectures)	Dr. Bhabesh Chandra Deka	08	August	09/08/22 to 20/08/22
3	Noble Gases: Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF2, XeF4 and XeF6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF2). Molecular shapes of noble gas compounds (VSEPR theory).	Dr. Bhabesh Chandra Deka	08	August	22/08/22 to 30/08/22
4	Inorganic Polymers: Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Silicates – clays and	Dr. Bhabesh Chandra Deka	8	September	01/09/22 to 09/09/22

	zeolites, polyphosphazenes, metal-organic framework compounds (MOFs).				
5	**Chemistry of *s* and *p* Block Elements:** Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of *s* and *p* block elements. Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Boric acid and borates, boron nitrogen compounds, boranes, carboranes and graphitic compounds, silanes, oxides and oxoacids of nitrogen, phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.	Dr. Bhabesh Chandra Deka	30	September/ October	12/09/22 to 20/10/22
LAB	(A) Iodo / Iodimetric Titrations (i) Estimation of Cu(II) and K2Cr2O7 using sodium thiosulphate solution (Iodimetrically). (ii) Estimation of (i) arsenite and (ii) antimony in tartar-emetic iodimetrically (iii) Estimation of available chlorine in bleaching powder iodometrically. (B) Inorganic preparations (i) Cuprous Chloride, CuCl (ii) Preparation of manganese(III) phosphate, MnPO4.H2O (iii) Preparation of aluminium potassium sulphate KAl(SO4)2.12H2O (Potash alum) or Chrome alum.	Dr. Bhabesh Chandra Deka	30	Aug-October	02/08/22 to 20/10/22

3rd SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**III**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-3026: Organic Chemistry
Credit	6 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Chemistry of Halogenated Hydrocarbons:** *Alkyl halides:* Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination. *Aryl halides:* Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. Organometallic compounds of Mg and Li – Use in synthesis of organic compounds. **(16 Lectures)**	Dr. Pulin Ch. Sarma	16	August	02/08/2022 to 23/08/2022
2	**Alcohols, Phenols, Ethers and Epoxides:** *Alcohols:* preparation,properties and relative reactivity of 1°,2°,3°alcohols, Bouveault-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement; *Phenols:* Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism; *Ethers and Epoxides:* Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH4 (16 Lectures)	Dr. Pulin Ch. Sarma	16	Aug-Sept	24/08/2022 to 12/09/2022

3	**Carbonyl Compounds:** Preparation, properties, structure and reactivity; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α- substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH4,NaBH4, MPV, PDC and PGC); Addition reactions of unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate. (14 Lectures).	Dr. Pulin Ch. Sarma	14	Sept	13/09/2022 To 30/09/2022
4	**Sulphur containing compounds:** Preparation and reactions of thiols, thioethers and sulphonic acids. **(4 Lectures)** Defects in crystals. Liquid crystals (Introductory idea)	Dr. Pulin Ch. Sarma	10	Oct	01/10/22 to 20/10/2022
5	**LAB** 1. Test of functional groups like alcohols, phenols, carbonyl and carboxylic acid group. 2. Organic preparations: i. Acetylation of one of the following compounds: amines (aniline, *o*-, *m*-, *p*toluidines *o*-, *m*-, *p*-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method: a. Using conventional method. b. Using green approach ii. Benzolyation of one of the following amines (aniline, *o*-, *m*-, *p*-toluidines and *o*-, *m*-, *p*-anisidine) and one of the following phenols (β-naphthol, resorcinol, pcresol) by	Dr. Pulin Ch. Sarma	30	Aug-Oct	02/08/2022 to 20/10/2022

	Schotten-Baumann reaction. iii. Oxidation of ethanol/ isopropanol (Iodoform reaction). iv. Bromination of any one of the following: a. Acetanilide by conventional methods b. Acetanilide using green approach (Bromate-bromide method) v. Nitration of any one of the following: a. Acetanilide/nitrobenzene by conventional method b. Salicylic acid by green approach (using ceric ammonium nitrate). 22 vi. Selective reduction of *meta* dinitrobenzene to *m*-nitroaniline. vii. Reduction of *p*-nitrobenzaldehyde by sodium borohydride. viii. Hydrolysis of amides and esters. ix. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde. x. *S*-Benzylisothiouronium salt of one each of water soluble and water insoluble acids(benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid). xi. Aldol condensation using either conventional or green method. xii. Benzil-Benzilic acid rearrangement. The above preparations should be done using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.		30		

3rd SEMESTER TEACHING PLAN

Subject	Chemistry	**Semester**	**III**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-3036: Physical Chemistry
Credit	6 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Phase Equilibria:** Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solidliquid,liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications. Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions. *Binary solutions:* Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation. Nernst distribution law: its derivation and applications.	Mr. Kangkan K Barua	28	August-Sept	02/08/2022 to 07/09/2022
2	**Chemical Kinetics** Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (iv) chain reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates. Reaction mechanism- steady-state approximation and rate determining step approximation methods.	Mr. Kangkan K Barua	18	Sept	08/09/2022 to 30/09/2022
3	**Catalysis:**	Mr. Kangkan	8	Sept	01/10/2022

	Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.	K Barua			To 14/10/2022
4	**Surface chemistry:** Physical adsorption, chemisorption, adsorption isotherms, nature of adsorbed state.	Mr. Kangkan K Barua	6	Oct	15/10/22 to 20/10/2022
5	**LAB** I. Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it. II. Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method: a. simple eutectic and b. congruently melting systems. III. Distribution of acetic/ benzoic acid between water and cyclohexane. IV. Study the equilibrium of at least one of the following reactions by the distribution method: (i) $I_2(aq) + I \rightarrow I_3(aq)^{2+}$ (ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$ V. Study the kinetics of the following reactions. 1. Initial rate method: Iodide-persulphate reaction 2. Integrated rate method: a. Acid hydrolysis of methyl acetate with hydrochloric acid. b. Saponification of ethyl acetate. 3. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate. **VI. Adsorption** I. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.	Mr. Kangkan K Barua	30	Aug-Oct	02/08/2022 to 20/10/2022

3rd SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	III
Course	B.Sc (Hons,) /Regular	**Paper Code/Name**	CHE-HG/RC-3016: Chemical Energetics, Equilibria & Functional Organic Chemistry
Credit	6 (Theory) +2 (Practical	**Marks : 60**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Chemical Energetics** Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.	Mr. K. K. Barua	10	August	02/08/2022 to 13/08/2022
2	**Chemical Equilibrium:** Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG_o, Le Chatelier's principle. Relationships between K_p, K_c and K_x for reactions involving ideal gases.	Mr. K. K. Barua	8	Aug	16/08/2022 to 25/08/2022
3	**Ionic Equilibria:** Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of	Mr. K. K. Barua	12	Aug /Sept	26/08/2022 to 09/09/2022

	hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.				
4	***Section B: Organic Chemistry*** **Aromatic hydrocarbons** *Preparation* (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. *Reactions*: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).	Dr. Pulin Ch. Sarma	8		10/09/2022 to 21/09/2022
5	**Alkyl Halides** (Upto 5 Carbons) Types of Nucleophilic Substitution (S_N1, S_N2 and S_Ni) reactions. *Preparation:* from alkenes *and* alcohols. *Reactions:* hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution. **Aryl Halides** *Preparation:* (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. *Reactions (Chlorobenzene):* Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.	Dr. Pulin Ch. Sarma	8		22/09/2022 to 30/09/2022
6	**Alcohols:** *Preparation:* Preparation of 1^o, 2^o and 3^o alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. *Reactions:* With sodium, HX (Lucas test), esterification, oxidation (with	Dr. Pulin Ch. Sarma	14	October	01/10/2022 to 20/10/2022

	PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation *Diols:* (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement. **Phenols:** (Phenol case) *Preparation:* Cumene hydroperoxide method, from diazonium salts. *Reactions:* Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer- Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction. **Ethers (aliphatic and aromatic):** Cleavage of ethers with HI. **Aldehydes and ketones (aliphatic and aromatic):** (Formaldehye, acetaldehyde, acetone and benzaldehyde) *Preparation:* from acid chlorides and from nitriles. *Reactions* – Reaction with HCN, ROH, $NaHSO_3$, NH_2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.				
LAB	***Section A: Physical Chemistry*** **Thermochemistry** 1. Determination of heat capacity of calorimeter for different volumes. 2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide. 3. Determination of enthalpy of ionization of acetic acid. 4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl). 5. Determination of enthalpy of hydration of copper sulphate. 6. Study of the solubility of benzoic acid in water and determination of ΔH. **Ionic equilibria** pH measurements	Mr. Kangkan K Barua			

	a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter. b) Preparation of buffer solutions: (i) Sodium acetate-acetic acid (ii) Ammonium chloride-ammonium hydroxide Measurement of the pH of buffer solutions and comparison of the values with theoretical values. ***Section B: Organic Chemistry*** 1. Purification of organic compounds by crystallization (from water and alcohol) and distillation. 2. Criteria of Purity: Determination of melting and boiling points. 3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done. (a) Bromination of Phenol/Aniline (b) Benzoylation of amines/phenols (c) Oxime and 2,4 dinitrophenylhydrazone of aldehyde/ketone	Dr. Bhabesh Ch. Deka			

4th SEMESTER TEACHING PLAN

Department of Chemistry

SBMS College, Sualkuchi

Session : 2022-2023

Subject	Chemistry	**Semester**	**IV**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-4016: Inorganic Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Coordination Chemistry:** Coordination compounds, types of ligands, Werner's theory, IUPAC nomenclature and isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of 10 Dq (Δo), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt).Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspects of ligand field and MO Theory. Chelate effect, polynuclear complexes, labile and inert complexes.	Dr.Bhabesh Ch. Deka	26	Jan /Feb	18/01/23 to 27/02/23
2	**Transition Elements:** General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer & Frost diagrams). Difference between the first, second and third transition series. Chemistry of Ti, V, Cr Mn, Fe and Co (Chemistry of first -row transition elements) in various oxidation states as halides, oxides, hydroxides.	Dr.Bhabesh Ch. Deka	18	Feb/Mar	28/02/23 to 24/03/23
3	**Lanthanoids and Actinoids:** **E**lectronic configuration, oxidation states, colour, spectral and magnetic	Dr.Bhabesh Ch. Deka	6	Mar	25/03/23 to 31/03/23

	properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).				
4	**Bioinorganic Chemistry:** Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine. Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.	Dr.Bhabesh Ch. Deka	10	Apr	01/04/23 to 12/04/23
LAB	**Gravimetric Analysis:** i. Estimation of nickel(II) using dimethylglyoxime (DMG). ii. Estimation of copper as CuSCN iii. Estimation of iron as Fe2O3 by precipitating iron as Fe(OH)3. iv. Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)3 (aluminium oxinate). **Inorganic Preparations:** i. Tetraamminecopper(II) sulphate, [Cu(NH3)4]SO4.H2O ii. *Cis* and *trans* K[Cr(C2O4)2.(H2O)2] Potassium dioxalatodiaquachromate (III) iii. Tetraamminecarbonatocobalt (III) ion iv. Potassium tris(oxalato)ferrate(III) **Chromatography of metal ions** Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions: i. Ni(II) and Co(II) ii. Fe(III) and Al(III)	Dr.Bhabesh Ch. Deka	30		18/01/23 to 12/04/23

4th SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**IV**
Course	B.Sc (Hons)	**Paper Code/Name**	CHE-HC-4026: Organic Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	Course Content	Allotted to	Hours	Month	Date
1	**Nitrogen Containing Functional Groups** Preparation and important reactions of nitro and compounds, nitriles and isonitriles Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2°and 3° amines with Hinsberg reagent and nitrous acid. Diazonium Salts: Preparation and their synthetic applications.	Dr. Pulin Ch. Sarma	18	Jan/Feb	18/01/2023 to 17/02/23
2	**Polynuclear Hydrocarbons** Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.	Dr. Pulin Ch. Sarma	8	Feb	18/02/2023 to 28/02/23
3	**Heterocyclic Compounds** Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis),Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine. Indole: Fischer indole synthesis and Madelung synthesis). Quinoline and isoquinoline: Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski	Dr. Pulin Ch. Sarma	22	March	01/03/2023 to 27/03/23

	reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction				
4	**Alkaloids** Natural occurrence, General structural features, Isolation and their physiological action Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.	Dr. Pulin Ch. Sarma	6		28/3/23 to 04/04/23
5	**Terpenes** Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Neral and α-terpineol. **(6 Lectures)**	Dr. Pulin Ch. Sarma			05/04/23 to 12/04/23
LAB	1. Detection N, S, halogens in organic compounds. 2. Functional group test for nitro, amine and amide groups. 3. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols and carbonyl compounds)	Dr. Pulin Ch. Sarma	30		18/01/23 to 12/04/23

4th SEMESTER TEACHING PLAN

TEACHING PLAN

Department of Chemistry

SBMS College, Sualkuchi

Session : 2022-2023

Subject	Chemistry	**Semester**	**IV**
Course	B.Sc (Hons)	**Paper Code/Name**	CHE-HC-4036 : Physical Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Conductance** Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivityand their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules. Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.	Mr. Kangkan K Barua	20	Jan-Feb	18/01/2023 to 20/02/23
2	**Electrochemistry** Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials. 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-	Mr. Kangkan K Barua	28	Feb-Mar	21/02/2023 to 28/02/23

	hydroquinone, glass and SbO/Sb_2O_3 electrodes. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric 30 titrations (acid-base, redox, precipitation). Applications of electrolysis in metallurgy and industry. **(28 Lectures)**				
3	**Electrical & Magnetic Properties of Atoms and Molecules** Basic ideas of electrostatics, Electrostatics of dielectric media, Clausius-Mosotti equation, Lorenz-Laurentz equation, Dipole moment and molecular polarizabilities and their measurements. Diamagnetism, paramagnetism, magnetic susceptibility and its measurement, molecular interpretation.	Mr. Kangkan K Barua	12	Mar-Apr	29/03/2023 to 12/04/23
LAB	**LAB** **60 Lectures** **Conductometry** I. Determination of cell constant II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid. III. Perform the following conductometric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base iii. Mixture of strong acid and weak acid vs. strong base iv. Strong acid vs. weak base **Potentiometry** I Perform the following potentiometric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base iii. Dibasic acid vs. strong base iv. Potassium dichromate vs. Mohr's salt	Mr. Kangkan K Barua	30	Jan-April	18/01/23 to 12/04/23

4th SEMESTER TEACHING PLAN

Department of Chemistry

SBMS College, Sualkuchi

Session : 2022-2023

Subject	Chemistry	**Semester**	**IV**
Course	B.Sc (Hons,) /Regular	**Paper Code/Name**	CHE-HG/RC-4016 Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	***Section A: Physical Chemistry-2* (30 Lectures)** **Solutions** Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperaturecomposition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.	Mr. Kangkan K Barua	08	Jan-Feb	18/01/23 to 23/02/23
2	**Phase Equilibrium** Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H_2O and Na-K only).	Mr. Kangkan K Barua	**6**	Feb-Mar	24/02/23 to 11/03/23
3	**Conductance** Conductivity, equivalent and molar conductivity and their variation with	Mr. Kangkan K Barua	**6**	Mar	12/03/23 to 26/03/23

	dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acidbase).				
4	**Electrochemistry** Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).	Mr. Kangkan K Barua	10	Mar-Apr	26/03/23 to 12/04/23
5	**Carboxylic acids and their derivatives** Carboxylic acids (aliphatic and aromatic) *Preparation:* Acidic and Alkaline hydrolysis of esters. *Reactions:* Hell – Vohlard - Zelinsky Reaction. **Carboxylic acid derivatives (aliphatic):** (Upto 5 carbons) *Preparation:* Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. *Reactions:* Comparative study of nucleophilicity of acyl derivatives.	Dr Bhabesh Ch Deka	6	Jan-Feb	19/01/23 to 28/02/23

	Reformatsky Reaction,Perkin condensation.				
6	**Amines and Diazonium Salts** Amines (Aliphatic and Aromatic): (Upto 5 carbons) *Preparation*: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. *Reactions:* Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation. **Diazonium salts**: *Preparation:* from aromatic amines. *Reactions:* conversion to benzene, phenol, dyes.	Dr. Bhabesh Ch Deka	6	Mar-Apr	01/03/23 to 12/04/23
7	**Carbohydrates**: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.	Dr. Pulin Ch Sarma	8	**Jan-Feb**	20-01-23 to 20/02/23
8	**Amino Acids, Peptides and Proteins:** *Preparation of Amino Acids:* Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. *Reactions of Amino acids*: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (Nterminal) and C–terminal (thiohydantoin and with carboxypeptidase	Dr. Pulin Ch Sarma	10	**Mar-Apr**	21/02 to 12/04

	enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & Cactivating groups and Merrifield solid-phase synthesis.				
LAB	***Section A: Physical Chemistry*** **Distribution** Study of the equilibrium of one of the following reactions by the distribution method: $I_2(aq) + I^-(aq) \rightleftharpoons I_3^-(aq)$ 19 $Cu^{2+}(aq) + xNH_3(aq) \rightleftharpoons [Cu(NH_3)x]^{2+}$ **Phase equilibria** a) Construction of the phase diagram of a binary system (simple eutectic) using cooling curves. b) Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it. c) Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature. **Conductance** IV. Determination of cell constant V. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid. VI. Perform the following conductometric titrations: v. Strong acid vs. strong base vi. Weak acid vs. strong base **Potentiometry** Perform the following potentiometric titrations: v. Strong acid vs. strong base vi. Weak acid vs. strong base vii. Potassium dichromate vs. Mohr's salt ***Section B: Organic Chemistry*** **I** Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and	Mr. K K Barua Dr. Pulin Ch	20 20	Jan-Feb	18/01/23 to 28/02/23

	preparation of one derivative. **II** 1. Separation of amino acids by paper chromatography 2. Determination of the concentration of glycine solution by formylation method. 3. Titration curve of glycine 4. Action of salivary amylase on starch 5. Effect of temperature on the action of salivary amylase on starch. 6. Determination of the saponification value of an oil/fat. 7. Determination of the iodine value of an oil/fat 8. Differentiation between a reducing/nonreducing sugar. 9. Extraction of DNA from onion/ cauliflower	Sarma		Mar-Apr	01/03/23 to 12/04/23

5th SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**V**
Course	B.Sc (Hons)	**Paper Code/Name**	CHE-HC-5016: Organic Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	Nucleic Acids Components of nucleic acids; Nucleosides and nucleotides; Synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Polynucleotides: DNA and RNA	Dr. Pulin Ch Sarma	9	August	02/08/2022 to 16/08/2022
2	Amino Acids, Peptides and Proteins Amino acids, Peptides and their classification. α-Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, p*K*a values, isoelectric point and electrophoresis; Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups -Solid-phase synthesis (16 Lectures).	Dr. Pulin Ch Sarma	16	Aug-Sept	17/08/2022 to 06/09/2022
3	Enzymes Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes. Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive	Dr. Pulin Ch Sarma	8	Sept	07/09/2022 to15/09/2022

	inhibition including allosteric inhibition).				
4	Lipids Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenntion of fats and oils, saponification value, acid value, iodine number, rancidity.	Dr. Pulin Ch Sarma	6	Sept	16/09/2022 to24/09/2022
5	Concept of Energy in Biosystems Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism). ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD+, FAD. Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle. Overview of catabolic pathways of fat and protein. Interrelationship in the metabolic pathways of protein, fat and carbohydrate. Calorific value of food, standard calorie content of food types. (9 Lectures)	Dr. Pulin Ch Sarma	9	Sept-Oct	26/09/2022 to 08/10/2022
6	Pharmaceutical Compounds: Structure and Importance Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (turmeric), azadirachtin (neem), vitamin C and antacid (ranitidine). (12 Lectures)	Dr. Pulin Ch Sarma	12	October	10/10/2022 to 21/10/2022
LAB	1. Estimation of glycine by Sorenson's formalin method. 2. Study of the titration curve of	Dr. Pulin Ch Sarma	30	Aug-Oct	02/08/2022 to 21/10/2022

	glycine. 3. Estimation of proteins by Lowry's method. 4. Study of the action of salivary amylase on starch at optimum conditions. 5. Effect of temperature on the action of salivary amylase. 6. Saponification value of an oil or a fat. 7. Determination of Iodine number of an oil/ fat. 8. Isolation and characterization of DNA from onion/ cauliflower/peas.				

5th SEMESTER TEACHING PLAN
Department of Chemistry
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Subject	Chemistry	**Semester**	**V**
Course	B.Sc (Hons)	**Paper Code/Name**	CHE-HC-5026: Physical Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	Course Content	Allotted to	Hours	Month	Date
1	**Quantum Chemistry:** Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy Extension to two and three dimensional boxes, separation of variables, degeneracy. Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy. Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component. Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution. Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus. 34 Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box,	Dr. Bhabesh Chandra Deka	24	August	02/08/2022

	harmonic oscillator, hydrogen atom). Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+. Bonding and antibonding orbitals. Qualitative extension to H_2. Comparison of LCAO-MO and VB treatments of H_2 (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH). Localised and non-localised molecular orbitals treatment of triatomic (BeH_2, H_2O) molecules. Qualitative MO theory and its application to AH_2 type molecules.				
2	**Molecular Spectroscopy:** Interaction of electromagnetic radiation with molecules and various types of spectra; Born- Oppenheimer approximation. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution. Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches. Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion. Electronic spectroscopy: Franck-Condon principle, electronic	Dr. Bhabesh Chandra Deka	24	September	01/09/2022 to 30/09/2022

	transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model. (24 Lectures)				
3	**Photochemistry** Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence. **(12 Lectures)**.	Kangkan K Barua	12		01/10/2022 to 20/10/2022
4	**LAB** **UV/Visible spectroscopy** I. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV). II. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$. III. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds. **Colourimetry** **I.** Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration II. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.	Dr. Bhabesh Chandra Deka	30		02/08/2022 to 20/10/2022

	III. Study the kinetics of iodination of propanone in acidic medium. IV. Determine the amount of iron present in a sample using 1,10-phenathroline. V. Determine the dissociation constant of an indicator (phenolphthalein). **VI.** Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide. VII. Analysis of the given vibration-rotation spectrum of HCl(g)				

5th SEMESTER TEACHING PLAN

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Subject	Chemistry	**Semester**	**V**
Course	B.Sc (Hons) /Regular	**Paper Code/Name**	CHE-HE-5026: Analytical Methods In Chemistry
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Qualitative and quantitative aspects of analysis:** Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.	Dr. Bhabesh Chandra Deka	5	August	02/08/2022 to 06/08/2022
2	**Optical methods of analysis:** Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. *UV-Visible Spectrometry:* Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; *Basic principles of quantitative analysis:* estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of metal complex composition using Job's method of continuous variation and mole ratio method. *Infrared Spectroscopy:* Basic principles of instrumentation (choice of source, monochromator & detector) for continuous wave and Fourier transform spectrometers; sampling techniques. Structure elucidation through interpretation of data. Effect and importance of isotope substitution. *Flame Atomic Absorption and Emission Spectrometry:* Basic principles of instrumentation (choice	Dr. Bhabesh Chandra Deka	25	Aug-Sept	08/08/2022 to 10/09/2022

	of source, monochromator, and detector, choice of flame and Burner designs. Techniques of atomization and sample introduction. Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.				
3	**Thermal methods of analysis:** 44 Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture	Dr. Bhabesh Chandra Deka	5	Sept	12/09/2022 to 16/09/2022
4	**Electroanalytical methods:** Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.	Dr. Bhabesh Chandra Deka	10	Sept	19/09/2022 to 30/09/2022
5	**Separation techniques:** Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media. Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC. Stereoisomeric separation and analysis: Measurement of optical rotation, calculation of Enantiomeric	Dr. Bhabesh Chandra Deka	15	Oct	01/10/2022 to 20/10/2022

	excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC). Role of computers in instrumental methods of analysis.				
LAB	**1. Separation Techniques** I. Chromatography: (a) Separation of mixtures (i) Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}. (ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values. (b) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values. (c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC **II. Solvent Extractions:** (i) To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+}- DMG complex in chloroform, and determine its concentration by spectrophotometry. (ii) Solvent extraction of zirconium with amberliti LA-1, separation from a mixture of irons and gallium. **3.** Determine the pH of the given aerated drinks fruit juices, shampoos and soaps. 4. Determination of Na, Ca, Li in cola drinks and fruit juices using fame photometric techniques. **5. Analysis of soil:** (i) Determination of pH of soil. (ii) Total soluble salt (iii) Estimation of calcium, magnesium, phosphate, nitrate **6. Ion exchange:** (i) Determination of exchange capacity	Dr. Bhabesh Chandra Deka	30		02/08/2022 to 20/10/2022

	of cation exchange resins and anion exchange resins. 46 (ii) Separation of metal ions from their binary mixture. (iii) Separation of amino acids from organic acids by ion exchange chromatography. **7. Spectrophotometry** (i) Determination of pKa values of indicator using spectrophotometry. (ii) Structural characterization of compounds by infrared spectroscopy. (iii) Determination of dissolved oxygen in water. (iv) Determination of chemical oxygen demand (COD). (v) Determination of Biological oxygen demand (BOD). (vi) Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.				

5th SEMESTER TEACHING PLAN

Department of Chemistry

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Subject	Chemistry	**Semester**	**V**
Course	B.Sc (Hons)	**Paper Code/Name**	**CHE-HE-5056 Polymer Chemistry**
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Introduction and history of polymeric materials:** Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.	Dr.Pulin Ch Sarma	4	Aug	02/08/2022 to 06-08-2022
2	**Functionality and its importance:** Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems	Dr.Pulin Ch Sarma	8	Aug	08/08/2022 to 20-08-2022
3	**Kinetics of Polymerization:** Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.	Dr.Pulin Ch Sarma	8	Aug	22/08/2022 to 30-08-2022
4	**Determination of molecular weight of polymers** (M_n, M_w, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.	Dr.Pulin Ch Sarma	8	Septembe r	01/09/2022 to 09-08-2022
5	**Nature and structure of polymers**- Structure Property relationships.	Dr.Pulin Ch Sarma	2	Septembe r	10/09/2022 to 12-09-2022
6	**Glass transition temperature (Tg) and determination of Tg**, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).	Dr.Pulin Ch Sarma	8	Septembe r	13/09/2022 to 22-09-2022
7	**Polymer Solution** – Criteria for	Dr.Pulin Ch	8	Septembe	23/09/2022

	polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.	Sarma		r	to 30-09-2022
8	**Properties of Polymer**s (Physical, thermal, Flow & Mechanical Properties). Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].	Dr.Pulin Ch Sarma	12	October	01/10/2022 to 20-10-2022
L A B	1. **Polymer synthesis** 1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) /Methyl Acrylate (MA) / Acrylic acid (AA). a. Purification of monomer b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN) 2. Preparation of nylon 66/6 1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein a. Preparation of IPC b. Purification of IPC c. Interfacial polymerization 3. Redox polymerization of acrylamide 4. Precipitation polymerization of	Dr.Pulin Ch Sarma	30	Aug-Oct	02/08/2022 to 20-10-2022

	acrylonitrile 5. Preparation of urea-formaldehyde resin 6. Preparations of novalac resin/resold resin. 7. Microscale Emulsion Polymerization of Poly(methylacrylate). **Polymer characterization** 1. Determination of molecular weight by viscometry: (a) Polyacrylamide-aq.$NaNO_2$ solution (b) (Poly vinyl proplylidine (PVP) in water 2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer. 3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group). 4. Testing of mechanical properties of polymers. 5. Determination of hydroxyl number of a polymer using colorimetric method. **Polymer analysis** 1. Estimation of the amount of HCHO in the given solution by sodium sulphite method 2. Instrumental Techniques 3. IR studies of polymers 4. DSC analysis of polymers 5. Preparation of polyacrylamide and its electrophoresis				

5th SEMESTER TEACHING PLAN

Department of Chemistry

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Session : 2022-2023

Subject	Chemistry	**Semester**	**V**
Course	B.Sc (Regular)	**Paper Code/Name**	**CHE-RE-5056 Polymer Chemistry**
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	**Course Content**	**Allotted to**	**Hours**	**Month**	**Date**
1	**Introduction and history of polymeric materials:** Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.	Mr. Kangkan K Barua	4	Aug	02/08/2022 to 06-08-2022
2	**Functionality and its importance:** Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems	Mr. Kangkan K Barua	8	Aug	08/08/2022 to 20-08-2022
3	**Kinetics of Polymerization:** Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.	Mr. Kangkan K Barua	8	Aug	22/08/2022 to 30-08-2022
4	**Determination of molecular weight of polymers** (M_n, M_w, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.	Mr. Kangkan K Barua	8	September	01/09/2022 to 09-08-2022
5	**Nature and structure of polymers**- Structure Property relationships.	Mr. Kangkan K Barua	2	September	10/09/2022 to 12-09-2022
	Glass transition temperature (Tg) and determination of Tg, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).	Mr. Kangkan K Barua	8	September	13/09/2022 to 22-09-2022

	Polymer Solution – Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.	Mr. Kangkan K Barua	8	Septembe r	23/09/2022 to 30-09-2022
	Properties of Polymers (Physical, thermal, Flow & Mechanical Properties). Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].	Mr. Kangkan K Barua	12	October	01/10/2022 to 20-10-2022
L A B	1. **Polymer synthesis** 1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) /Methyl Acrylate (MA) / Acrylic acid (AA). a. Purification of monomer b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN) 2. Preparation of nylon 66/6 1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein a. Preparation of IPC b. Purification of IPC c. Interfacial polymerization 3. Redox polymerization of acrylamide	Mr. Kangkan K Barua	30	Aug-Oct	02/08/2022 to 20-10-2022

	4. Precipitation polymerization of acrylonitrile 5. Preparation of urea-formaldehyde resin 6. Preparations of novalac resin/resold resin. 7. Microscale Emulsion Polymerization of Poly(methylacrylate). **Polymer characterization** 1. Determination of molecular weight by viscometry: (a) Polyacrylamide-aq.$NaNO_2$ solution (b) (Poly vinyl proplylidine (PVP) in water 2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer. 3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group). 4. Testing of mechanical properties of polymers. 5. Determination of hydroxyl number of a polymer using colorimetric method. **Polymer analysis** 1. Estimation of the amount of HCHO in the given solution by sodium sulphite method 2. Instrumental Techniques 3. IR studies of polymers 4. DSC analysis of polymers 5. Preparation of polyacrylamide and its electrophoresis				

6th SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**VI**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-6019: Inorganic Chemistry
Credit	6 (Theory) +2 (Practical	**Marks**	60 (Theory) + 20(Prctical)

Unit	Course Content	Allotted to	Hours	Month	Date
1	**Mechanism of Inorganic Reactions** Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans-effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes. Electron transfer reactions.	Dr. Bhabesh Ch. Deka	18	January	18/01/23 to 17/02/23
2	**Organometallic Compounds** Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. □-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding. Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.	Dr. Bhabesh Ch. Deka	22	Feb-Mar	18/02/23 to 20/03/23

	Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds. Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium. Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.				
3	**Transition Metals in Catalysis** Study of the following industrial processes and their mechanism: 1. Alkene hydrogenation (Wilkinson's Catalyst) 2. Hydroformylation (Co catalysts) 3. Wacker Process 4. Synthetic gasoline (Fischer Tropsch reaction) 5. Synthesis gas by metal carbonyl complexes **.**	Dr. Bhabesh Ch. Deka	10		21/03/23 to 31/03/23
4	**Theoretical Principles in Qualitative Inorganic Analysis (H_2S Scheme)** Basic principles involved in analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.	Dr. Bhabesh Ch. Deka	10		01/04/23 to 12/04/23
LAB	Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested: CO_3^{2-} , NO_2^-, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO_3^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, NH_4^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+},	Dr. Bhabesh Ch. Deka	30	Jan-Apr	18/02/23 to 12/04/23

	Sb^{3+}, Fe^{3+}, Al^{3+},, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+} □ Mixtures should preferably contain one interfering anion, **or** insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) **or** combination of anions e.g. CO_3^{2-} and SO_3^{2-}, NO_2 and NO_3^-, Cl^- and Br^-, Cl^- and I^-, Br^- and I^-, NO_3^- and Br^-, NO_3^- and I^-. □ Spot tests should be done whenever possible. □ Synthesis of ammine complexes of Ni(II) and their ligand exchange reactions involving bidentate ligands like acetylacetone, dimethylglyoxime, glycine, etc. □ Preparation of acetylacetanato complexes of Cu^{2+}/Fe^{3+}. □ Controlled synthesis of two copper oxalate hydrate complexes: kinetic vs. thermodynamic factors. □ Determination of λ_{max} value from UV-visible spectra of complexes. □ Measurement of 10 Dq by spectrophotometric method, verification of spectrochemical series.				

6th SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**VI**
Course	B.Sc (Hons,)	**Paper Code/Name**	CHE-HC-6026: Organic Chemistry
Credit	6 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	Course Content	Allotted to	Hours	Month	Date
1	**Spectroscopy** Introduction to absorption and emission spectroscopy. *UV Spectroscopy:* Types of electronic transitions, λ_{max}, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward 39 Rules for calculation of λmax for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers. *IR Spectroscopy:* Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis. *NMR Spectroscopy:* Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpetation of NMR spectra of simple compounds. Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.	Dr. Bhabesh Ch. Deka	24	Jan-Feb	18/01/23 to 25/03/23

	Applications of IR, UV and NMR for identification of simple organic and inorganic molecules.				
2	**Carbohydrates** Occurrence, classification and their biological importance. Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation; Disaccharides – Structure elucidation of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch, cellulose and glycogen.	Dr. Pulin Ch Sarma	16		19/01/23 to 10/03/23
3	**Dyes** Classification, Colour and constitution; Mordant and Vat Dyes; Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes -Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes synthesis of Alizarin and Indigotin; Edible Dyes with examples.	Dr. Bhabesh Ch. Deka	8		26/03/2023 to 12/04/2023
4	**Polymers** Introduction and classification. Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index. Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene); Fabrics – natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene;	Dr. Pulin Ch Sarma	12		11/03/23 to 12/04/23

	Vulcanization; Polymer additives; Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.				
LAB	1. Extraction of caffeine from tea leaves. 2. Preparation of sodium polyacrylate. 3. Preparation of urea formaldehyde. 4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars 5. Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, for e.g. salicylic acid, cinnamic acid, nitrophenols etc. 6. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided). 7. Preparation of methyl orange.	Dr. Pulin Ch Sarma Dr. Bhabesh Ch. Deka	15 15		19/01/23 to 10/03/23

6th SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**VI**
Course	B.Sc (Hons)	**Paper Code/Name**	Che-HE-6026: Industrial Chemicals And Environment
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	Course Content	Allotted to	Hours	Month	Date
1	**Industrial Gases and Inorganic Chemicals** *Industrial Gases:* Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene. *Inorganic Chemicals:* Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.	Dr Pulin Ch Sarma	10	Jan-Feb	18/01/23 to 10/02/23
2	**Industrial Metallurgy** Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.	Dr Pulin Ch Sarma	4	Feb	11/02/23 to 18/02/23
3	**Environment and its segments** Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution.	Dr Pulin Ch Sarma	30	Mar-Apr	13/03/23 to 12/04/23

	Pollution by SO_2, CO_2, CO, NO_x, H_2S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates. *Water Pollution*: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water. **(30 Lectures)**				
4	**Energy & Environment** Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management. **(10 Lectures)**	Dr Pulin Ch Sarma	10	19/2/23 to 04/03/23	Feb-Mar
5	**Biocatalysis** Introduction to biocatalysis:	Dr Pulin Ch Sarma			05/03/23 to 12/03/23

	Importance in “Green Chemistry” and Chemical Industry. **(6 Lectures)**				
L A B	1. Determination of dissolved oxygen in water. 2. Determination of Chemical Oxygen Demand (COD) 3. Determination of Biological Oxygen Demand (BOD) 4. Percentage of available chlorine in bleaching powder. 5. Measurement of chloride, sulphate and salinity of water samples by simple titration method ($AgNO_3$ and potassium chromate). 6. Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method. 7. Measurement of dissolved CO_2. 8. Study of some of the common bio-indicators of pollution. 9. Estimation of SPM in air samples. 10. Preparation of borax/ boric acid.	Dr Pulin Ch Sarma	30		18/01/23 to 12/04/23

6th SEMESTER TEACHING PLAN
Department of Chemistry
SBMS College, Sualkuchi
Session : 2022-2023

Subject	Chemistry	**Semester**	**VI**
Course	B.Sc (Regular)	**Paper Code/Name**	Che-RE-6026: Industrial Chemicals And Environment
Credit	4 (Theory) +2 (Practical	**Marks**	60 (Theory)+20(Prctical)

Unit	Course Content	Allotted to	Hours	Month	Date
1	**Industrial Gases and Inorganic Chemicals** *Industrial Gases:* Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene. *Inorganic Chemicals:* Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.	Mr. Kangkan K Barua	10	Jan-Feb	18/01/23 to 10/02/23
2	**Industrial Metallurgy** Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.	Mr. Kangkan K Barua	4	Feb	11/02/23 to 18/02/23
3	**Environment and its segments** Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur. Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution.	Mr. Kangkan K Barua	30	Mar-Apr	13/03/23 to 12/04/23

	Pollution by SO_2, CO_2, CO, NO_x, H_2S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates. *Water Pollution*: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment). Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water. **(30 Lectures)**				
4	**Energy & Environment** Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management. **(10 Lectures)**	Mr. Kangkan K Barua	10	19/2/23 to 04/03/23	Feb-Mar
5	**Biocatalysis** Introduction to biocatalysis:	Mr. Kangkan K Barua			05/03/23 to 12/03/23

	Importance in “Green Chemistry” and Chemical Industry. **(6 Lectures)**				
L A B	1. Determination of dissolved oxygen in water. 2. Determination of Chemical Oxygen Demand (COD) 3. Determination of Biological Oxygen Demand (BOD) 4. Percentage of available chlorine in bleaching powder. 5. Measurement of chloride, sulphate and salinity of water samples by simple titration method ($AgNO_3$ and potassium chromate). 6. Estimation of total alkalinity of water samples (CO_3^{2-}, HCO_3^-) using double titration method. 7. Measurement of dissolved CO_2. 8. Study of some of the common bio-indicators of pollution. 9. Estimation of SPM in air samples. 10. Preparation of borax/ boric acid.	Mr. Kangkan K Barua	30		18/01/23 to 12/04/23