TEACHING PLAN

Name: Gautam Kalita **Course:** B.Sc. **Semester:** I **Department:** Chemistry
Programme: Generic Elective **Class allotted:** 1 per week

Paper/Unit	Course content	Key aspect	Class required
GE – 1 SECTION - A	**Atomic Structure**	Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and $\psi 2$, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1*s*, 2*s*, 2*p*, 3*s*, 3*p* and 3*d* 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 1*s* and 2*s* atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers *ml* and *ms*. Shapes of *s*,	14

		p and *d* atomic orbitals, nodal planes. Discovery of spin, spin quantum number (*s*) and magnetic spin quantum number (*ms*). 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.	

TEACHING PLAN

Name: Gautam Kalita **Course:** B.Sc. **Semester:** III

Department: Chemistry **Programme:** Core **Class allotted:** 1 per week

Paper/Unit	**Course content**	**Key aspect**	**Class required**
NM-301/Unit IV	**Amines**	**Amines (Aliphatic & Aromatic)** Preparation – from alkyl halides, Gabriel's phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Carbylamine test, Hinsberg test, with HNO_2, Electrophilic substitution (in case of aniline) –nitration, bromination, sulphonation.	6
NM-301/Unit IV	**Diazonium Salt**	**Diazonium Salts** – Preparation from aromatic amines. Synthetic uses of benzene diazonium chloride including preparation of dyes.	3

TEACHING PLAN

Name: Gautam Kalita **Course:** B.Sc. **Semester:** I

Department: Chemistry **Programme:** CORE **Class allotted:** 1per week

Paper/Unit	**Course content**	**Key aspect**	**Class required**
C – II: Physical Chemistry - I	**Solid State**	Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; 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. Glasses and liquid crystals.	16

TEACHING PLAN

Name: Gautam Kalita **Course:** B.Sc. **Semester:** V

Department: Chemistry **Programme:** Major **Class allotted:** 2 per week

Paper/Unit	**Course content**	**Key aspect**	**Class required**
Paper: MM 501 Physical Chemistry II Unit II	Solution and Colligative Properties	Dilute solutions, lowering of vapour pressure, Roult's and Henry's Laws and their applications, distribution of solutes between two immiscible liquids, Nernst's Distribution law, and solvent extraction. Thermodynamic derivation using chemical potential to derive relation 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, application in calculating molar masses of normal, associated and dissociated solutes in solution.	10

Paper: MM 501 Physical Chemistry II Unit III	System of Variable Composition and Chemical Equilibrium	Partial molar quantities- chemical potential, Gibb's-Duhem equation, effect of temperature and pressure on chemical potential, Duhem-Margules equation, concept of activity and activity coefficient, fugacity, derivation of expression of equilibrium constant, temperature pressure and concentration dependence of equilibrium constant-Van't Hoff equation, Le-chetelier principle	10
Paper: MM 507 Symmetry and Quantum Chemistry Unit – I	Symmetry and Group theory:	Symmetry elements and symmetry operations. Definition of group, symmetry group, point group and space group. Perspective sketch and point group of some common molecules (H_2, HF, CO_2, C_2H_2, C_2H_4,$CHCl_3$, PCl_5, NH_3, BF_3, $[PtCl_4]^{2-}$,BrF_5), symmetry and mathematical tools, matrix algebra, reducible and irreducible representation, great orthogonality theorem (deduction not necessary), Character table for C2v and C3v point groups, Determination of Γ I for C_{2v} and C_{3v} point groups.	18

TEACHING PLAN

Name: Akhtara H. Kalita **Course:** B.Sc. **Semester:** I

Department: Chemistry **Programme:** Generic Elective **Class allotted:** 1 per week

Paper/Unit	Course content	Key aspect	Class required
G E – 1 Section B	Fundamentals of Organic Chemistry	**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 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.	8
G E – 1 Section B	Aliphatic Hydrocarbon	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	8

		(alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.	

TEACHING PLAN

Name: Akhtara H. Kalita **Course:** B.Sc. **Semester:** III

Department: Chemistry **Programme:** Core **Class allotted:** 1 per week

Paper/Unit	Course content	Key aspect	Class required
NM-301/Unit I	Alkynes	Alkynes (up - to 5 carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes: by dehydrohalogenation of tetra halides, dehydrohalogenation of vicinal-dihalides. Reactions- Formation of metal acetylides, addition of bromine and alkaline $KMnO_4$, ozonolysis and oxidation with hot alk. $KMnO_4$.	4
NM-301/Unit III	Alkyl and Aryl halides	Alkyl halides - Nucleophilic Substitution Reactions (SN_2, SN_1, & SN_i) Preparation: from alkenes and alcohols Reactions; Hydrolysis, nitrite and nitro formation, nitrile and isonitrile formation. Williamson's Synthesis: elimination vs Substitution Aryl halides Preparation (chloro, bromo, iodo benzene only): From phenol, Sandmeyer & Gattermann reaction. Reactions (chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH) and effect of nitro substituent. Reactivity and relative strength of carbon-halogen bond in alkyl, allyl, benzyl and vinyl and Aryl halide.	

TEACHING PLAN

Name: Akhtara H. Kalita **Course**: B.Sc. **Semester:** III

Department: Chemistry **Programme:** Major **Class allotted:** 2 per week

Paper/Unit	Course content	Key aspect	Teaching methods	Class required
MM 303/Unit II	Chemistry of C-O Bond Alcohols	Alcohols : Preparation, properties and relative reactivity of 1°, 2°, 3° alcohols. Bouvealt Blance Reduction and Baeyer-Villiger Oxidation Preparation and properties of Glycol: Oxidation by OsO_4 , alkaline $KMnO_4$, periodic acid and lead tetracetate. Pinacol Pinacolone rearrangement with mechanism. Trihydric alcohol : Glycerol: preparation & properties. Phenols : Preparation and properties: -acidity-comparison with alcohol. Substitution reaction, Reimer-Tiemann and Kolbe - Schmidt reaction, Fries rearrangement with mechanism. Other aromatic Hydroxy compounds : Cresol, nitrophenols, picric acid, benzyl alcohol, dihydric phenols. Ethers and Epoxides : Preparation and reactions with acids.		12
MM 303/Unit III	Carboxylic acid and their derivatives	Structure, Preparation and Reactions, Relative reactivity of aldehydes, ketones. Nucleophilic addition reactions.		5

	(aliphatic and aromatic)	Mechanism of Aldol, Benzoin, Stobbe, Darzen glycidic ester condensation, Perkin, Cannizzaro reaction. Beckmann and Benzil-Benzilic acid rearrangement, substitution, oxidation and reduction (Clemmensen, Wolf -Kishner and M P V reduction) Addition reactions of unsaturated carbonyl Compound: Michal addition. Unsaturated aldehydes (Acrolein, Crotonaldehyde, Cinnamaldehyde) Unsaturated ketone (MVK).		

TEACHING PLAN

Name: Akhtara H. Kalita **Course:** B.Sc. **Semester:** V

Department: Chemistry **Programme:** Major **Class allotted:** 3 per week

Paper/Unit	Course content	Key aspect	Class required
MM 505/Unit II	Bio-molecules	Carbohydrates- Occurrence, classification and biological importance, General properties of glucose and fructose (open and cyclic structure). Monosaccharides: Constitution and absolute configuration of glucose and fructose, Epimerization, Mutarotation, Determination of ring size of glucose. Haworth projections and conformational structures. Ascending and descending in monosaccharides, Interconversions of Aldoses and Ketoses.	10
MM 505/Unit IV	Pharmaceutical compounds: Structure and Importance	Introduction to natural and synthetic medicinal compounds: Azadirachtin (neem), Curcumin (haldi), Vitamin C- their medicinal values, Drug action. Classification, structure, preparation and therapeutic uses of Antipyretics: Paracetamol, Analgesic: Aspirin, Ibuprofens (with green synthesis) Antimalerials: Chloroquine. Antacids: Ranitidine, Antibacterial: povidone –Iodine solutions, Sulphanilamide and other sulphadrugs. An elementary treatment of Antibiotics and detailed study of chloramphenicol.	12

MM 505/Unit V	Terpenes	Occurrence, classification Isoprene Rule. Elucidations of structure and synthesis of Citral, Neral and α-Terpineol	8