LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Fundamentals of Chemistry – I (CHEM-H-CC1-1)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Extra nuclear structure of atoms** Wave-Particle duality; de Broglie hypothesis. Heisenberg's uncertainty principle. Introducing Schrödinger equation. Hydrogen and hydrogen like systems (detailed solution not required) .Concept of Atomic Orbital; shapes of s, p and d orbitals. Radial and angular distribution curves. Extension to multielectronic systems. Aufbau principle and its limitations; Pauli's exclusion principle.	1.Lee,J.D.Concise Inorganic Chemistry 2. Atkins, Overton, Rourke , Weller , Armstrong; Shriver & Atkins' Inorganic Chemistry, 5th Ed., Oxford University Press (2010). 3.Huheey,J.E.;Keiter,E.A,& Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity	8	Chalk and Talk	**(SB)**
	Periodicity Hund's rules and multiplicity. Effective nuclear charge. Shielding and penetration; Slater's rule. The general idea about modern periodic table, atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, trends of variation in periodic table and their application in explaining and predicting the chemical behavior of elements and compounds. Electronegativity scales (Pauling's, Mulliken's and Allred-Rochow's scales). Inert pair effect.		7	Chalk and Talk	**(SG)**
Module : II	**Basics of Organic Chemistry Bonding and Physical Properties** **Valence Bond Theory**: Nomenclature of Organic Compounds, Concept of hybridisation, shapes and structures of molecules, double bond equivalent (DBE), Resonance (including hyperconjugation) and Resonance energy.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003.	2	Chalk and Talk	**(PR)**
	Electronic displacement: Inductive effect, bond polarization and bond polarizability; steric effect, steric inhibition of resonance.		2	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Fundamentals of Chemistry – I (CHEM-H-CC1-1)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	MO Theory Qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about σ, σ*, π, π *, n – MOs; concept of HOMO, LUMO and SOMO; sketch and energy levels of π MOs of i) acyclic p orbital system (C=C, conjugated diene, triene, allyl and pentadienyl systems) ii) cyclic p orbital system (neutral systems: [4], [6] annulenes; charged systems: 3-,4-,5-7 membered ring systems); Hückel's rules for aromaticity up to [8] annulene; concept of antiaromaticity; non-aromatic molecules.		4	Chalk and Talk	**(PR)**
	Physical properties Melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces; polarity of molecules and dipole moments.		2	Chalk and Talk	**(PR)**
	Stereochemistry – I: Bonding geometries of carbon compounds and representation of molecules: tetrahedral nature of carbon and concept of asymmetry; Fischer, sawhorse, flying wedge and Newman projection formulae and their inter translations. Concept of chirality and symmetry: symmetry elements, molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers; concept of stereogenicity, chiral centres and number of stereoisomers: systems involving 1/2-chiral centre(s).	1. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020	5	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Fundamentals of Chemistry – I (CHEM-H-CC1-1)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Thermodynamics -I :** Concept of systems (open, closed and isolated) and surroundings. State of a system; Intensive and extensive variables. Partial derivatives. Exact and inexact differentials. Path function and State function. Concept of heat and work. Zeroth law of thermodynamics. Concept of thermodynamic reversibility. Concept of internal energy and 1st law of thermodynamics. Enthalpy and heat capacity, Relations between C_p and C_v. Isothermal and Adiabatic processes ; Calculations of ΔU, ΔH, q and w involving ideal gases in different processes. Enthalpy of reaction. Hess's law. Enthalpy of formation and combustion. Kirchhoff's equation.	1. Levine, I. N. Physical Chemistry, 6th Edition McGraw-Hill India, 2011 2. Castellan, G. W. Physical Chemistry, Narosa , 2004 3. Atkins, P. W. & Paula, J. de, Atkins' Physical Chemistry, 11th Edition, Oxford University Press, 2018	9	Chalk and Talk	**(IS)**
	Chemical Kinetics-I: Concept of order and molecularity. Rate laws for zero, 1st and 2nd order reactions and in general for any n-th order reaction. Determination of order of a reaction by half-life and differential methods. Rate determining step and steady state approximation. Opposing, Consecutive and parallel reactions (first order steps only).Temperature dependence of rate constant and Arrhenius equation.		6	Chalk and Talk	**(IS)**
		Total	45		

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Fundamentals of Chemistry – I (CHEM-H-CC1-1)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	(1) Calibration and use of apparatus. (2) Preparation of primary standard solutions (Oxalic Acid and $K_2Cr_2O_7$)	1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. 2. Practical Workbook Chemistry (Honours), UGBOS, Chemistry, University of Calcutta, 2015	6	Chalk and Talk and Hand on Demonstration	**(SB)**
	Acid-Base Titrations: (3) Standardization of NaOH standard oxalic acid solution. (4) Estimation of carbonate and bicarbonate present together in a mixture (5) Estimation of acetic acid in commercial Vinegar.		8		**(SB)**
	Oxidation-Reduction Titrimetry: (6) Standardization of $KMnO_4$ standard oxalic acid solution. (7) Estimation of Fe(II) using standardized $KMnO_4$ solution. (8) Estimation of Fe(III) using standard $K_2Cr_2O_7$ solution. (9) Estimation of Fe(II) and Fe(III) in a given mixture using standard $K_2Cr_2O_7$ solution.		12		**(SB)**
	Practice		4		**(SB)**
		Total	30		

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code:Skill Enhancement Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-SEC1-1

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I **Introduction to Quantitative analysis and its interdisciplinary nature**:	Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method -accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD). Limitations of analytical methods.	Douglas A. Skoog, D.M. West , F. james Holler , Stanely R. Crouch, Fundamentals of Analytical Chemistry , Cengage learning India Pvt Ltd. 10th Edition , 2022	5	Chalk and Talk	**(SG)**
	Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance.		4	Chalk and Talk	**(SG)**
	External standard calibration -regression equation (least squares method), correlation coefficient (R^2). Presentation of experimental data and results from the point of viewof significant figures. **Numerical problems are to be solved wherever applicable.**		6	Chalk and Talk	**(SG)**
Module : II **Titrimetric analysis**:	**Principle**, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparationand dilution of reagents/ solutions using $N_1V_1 = N_2V_2$, preparation of ppm level solutions from source materials(salts). **Numerical problems are to be solved wherever applicable.**	Daniel C. Harris , Quantitative Chemical Analysis , 10th Edition , W.H. Freeman , 2020	2	Chalk and Talk	**(SB)**
	Acid-basetitrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations. Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity. **Numerical problems are to be solved wherever applicable.**		3	Chalk and Talk	**(SB)**

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code:Skill Enhancement Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-SEC1-1

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Redox titrimetry: Theory, balancing redox equations, titration curves, theory of redox indicators and applications. **Numerical problems are to be solved wherever applicable.**		3	Chalk and Talk	**(SB)**
	Precipitation titrimetry: Theory, titration curves, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences. **Numerical problems are to be solved wherever applicable.**		2	Chalk and Talk	**(SB)**
	Complexometric titrimetry: Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators forEDTA titrations - theory of metal ion indicators. Determination of hardness of water. **Numerical problems are to be solved wherever applicable.**		3	Chalk and Talk	**(AS)**
	Gravimetric Analysis: Stages in gravimetric analysis, requisites of precipitation, theories of precipitation, factors influencing precipitation,co-precipitation and post precipitation. Structure, specificity, conditions and applications of organic reagents suchas salcylaldoxime, oxine, dimethyl glyoxime, cupron and cupferron in inorganic analysis. Advantages of organicreagents over inorganic reagents.		2	Chalk and Talk	**(SG)**

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code:Skill Enhancement Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-SEC1-1

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Water analysis:** Water availability, requirement of water. Quality of surface water and ground water. Impurities in water. Standardsof water quality for potable, domestic, industrial and agricultural purpose (color, pH, alkalinity,hardness, TDS,sulphate, fluoride, chloride etc.)	Douglas A. Skoog, D.M. West , F. james Holler , Stanely R. Crouch, Fundamentals of Analytical Chemistry , Cengage learning India Pvt Ltd. 10th Edition , 2022	5	Chalk and Talk	**(AS)**
	Water treatment technologies: House hold water treatment, municipal water treatment and industrial treatment (primary and secondary treatment ofindustrial effluent).Softening of water. Disinfection of water. Definition and determinations of DO, BOD and COD,and their significance. **Numerical problems are to be solved wherever required**		5	Chalk and Talk	**(AS)**
	Basic laboratory practices: Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling(solids andliquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory, General rule forperforming quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fireprevention and accidents, First aid. Precautions to be taken whilehandling toxic chemicals, concentrated/fuming acids and organic solvents.		5	Chalk and Talk	**(IS)**
		Total	45		

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code:Skill Enhancement Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-SEC1-1

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Tutorial:	1. Safety Practices in the Chemistry Laboratory, knowledge about common toxic chemicals and safety measures intheir handling, cleaning and drying of glass wares.	1.Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. 2. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015	3	Chalk and Talk and Demonstration	**(IS)**
	2. Calibration of glassware, pipette, burette and volumetric flask.		2	Chalk and Talk and Demonstration	**(SG)**
	3. Preparation of TLC plates and separation of amino acids		2	Chalk and Talk and Demonstration	**(SG)**
	4. Calibration of instruments like colorimeter, pH-meter, conductivity meter, spectrophotometer using referencestandards or reference materials.		3	Chalk and Talk and Demonstration	**(AS)**
	5. Conductometric titration between HCl and NaOH.		2	Chalk and Talk and Demonstration	**(IS)**
	6. Determination of alkali present in soaps/detergents.		3	Chalk and Talk and Demonstration	**(SB)**
		Total	15		

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Interdisciplinary Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-IDC1-1

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I **Introduction to Quantitative analysis and its interdisciplinary nature**:	Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method -accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD). Limitations of analytical methods.	Douglas A. Skoog, D.M. West , F. james Holler , Stanely R. Crouch, Fundamentals of Analytical Chemistry , Cengage learning India Pvt Ltd. 10th Edition , 2022	4	Chalk and Talk	**(SG)**
	Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance.		3	Chalk and Talk	**(SG)**
	External standard calibration -regression equation (least squares method), correlation coefficient (R^2). Presentation of experimental data and results from the point of view of significant figures.		3	Chalk and Talk	**(SG)**
Module : II **Titrimetric analysis**:	**Principle**, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparation and dilution of reagents/ solutions using $N_1V_1 = N_2V_2$, preparation of ppm level solutions from source materials (salts).	Daniel C. Harris , Quantitative Chemical Analysis , 10th Edition , W.H. Freeman , 2020	2	Chalk and Talk	**(SB)**
	Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations.		2	Chalk and Talk	**(SB)**
	Redox titrimetry: Theory, balancing redox equations, titration curves.		2	Chalk and Talk	**(SB)**

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Interdisciplinary Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-IDC1-1

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Precipitation titrimetry: Theory, titration curves, indicators for precipitation titrations.		2	Chalk and Talk	**(SB)**
	Complexometric titrimetry: Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators for EDTA titrations. Determination of hardness of water.		2	Chalk and Talk	**(AS)**
Module : III	**Water analysis:** Water availability, requirement of water. Quality of surface water and ground water. Impurities in water. Standards of water quality for potable, domestic, industrial and agricultural purpose (color, pH, alkalinity, hardness, TDS, sulphate, fluoride, chloride etc.)	Douglas A. Skoog, D.M. West , F. james Holler , Stanely R. Crouch, Fundamentals of Analytical Chemistry , Cengage learning India Pvt Ltd. 10th Edition , 2022	3	Chalk and Talk	**(AS)**
	Water treatment technologies: House hold water treatment, municipal water treatment and industrial treatment (primary and secondary treatment of industrial effluent).Softening of water. Disinfection of water. Definition and determinations of DO, BOD and COD, and their significance.		3	Chalk and Talk	**(AS)**
	Basic laboratory practices: Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling(solids and liquids), weighing, drying,		4	Chalk and Talk	**(IS)**

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Interdisciplinary Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-IDC1-1

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	dissolving, Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.				
		Total	30		
Tutorial:	1. Safety Practices in the Chemistry Laboratory, knowledge about common toxic chemicals and safety measures in their handling, cleaning and drying of glass wares.		3	Chalk and Talk and Demonstration	**(IS)**
	2. Calibration of glassware, pipette, burette and volumetric flask.		3	Chalk and Talk and Demonstration	**(SG)**
	3. Preparation of TLC plates and separation of amino acids		3	Chalk and Talk and Demonstration	**(SG)**
	4. Calibration of instruments like colorimeter, pH-meter, conductivity meter, spectrophotometer using reference standards or reference materials.		3	Chalk and Talk and Demonstration	**(AS)**
	5. Determination of alkali present in soaps/detergents.		3	Chalk and Talk and Demonstration	**(SB)**
		Total	15		

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I(CHEM-MD-CC3-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Aromatic Substitution:** **Electrophilic aromatic substitution** Mechanisms and evidences in favour of it including PKIE; orientation and reactivity; reactions:nitration, nitrosation, sulfonation, halogenation, Friedel-Crafts reaction; one-carbonelectrophiles(reactions: chloromethylation, Houben-Hoesch, Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmidt); *Ipso* substitution. **Nucleophilic aromatic substitution** Addition-elimination mechanism and evidences in favour of it; SN1 mechanism; *cine* substitution(benzyne mechanism), structure of benzyne. **Birch Reduction of benzenoid aromatics** Benzene, Alkylbenzene, Anisole, Benzoic acid (with mechanism). **General Treatment of Reaction Mechanism –II** **Concept of organic acids and bases** Concept of pKa and pKaH, effect of structure, substituent and solvent on acidityand basicity;proton sponge. **Tautomerism** Basic difference between tautomerism and resonance,prototropy (keto-enol, phenol-keto);composition of the equilibrium in different systems (simple carbonyl; 1,2- and 1,3-dicarbonylsystems, phenols and related systems), factors affecting keto-enol tautomerism,basic ideas about valence tautomerism and ring-chain tautomerism.	1. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 2. Morrison, R. N. & Boyd, R. N. andBhattacharjee,Organic Chemistry, 7thEdition, Pearson Education, 2010	20	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I(CHEM-MD-CC3-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : II	**Stereochemistry –III** **Conformation-I** Basic idea of conformation.ConformationalNomenclature(Newman & Sawhorse):eclipsed, staggered, gauche, syn and anti; Special reference to preferred geometry for β-elimination. Relative stability of conformers on the basis of steric effect: butane-gauche interaction. **Substitution and Elimination Reactions:** **Nucleophilic substitution reactions** Substitution at sp^3centre[systems: alkyl halides, allyl halides, benzyl halides, alcohols, ethers, epoxides, α-halocarbonyls]: mechanisms (with evidence),relative rates& stereochemical features: SN1, SN2, SN2', SN1' (allylic rearrangement) and SNi; effects of solvent, substrate structure, leaving group and nucleophiles (including ambident nucleophiles, cyanide & nitrite); substitutions involving NGP (with heteroatoms and phenyl groups). **Elimination reactions** E1, E2, E1cB and Ei (pyrolytic *syn* eliminations); formation of alkenes and alkynes; mechanisms (with evidence), reactivity, regioselectivity (Saytzeff/Hofmann)and stereoselectivity; comparison between substitution and eliminationreactions, comparison between nucleophilicity and basicity.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003. 3. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 4. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7thEdition, Pearson Education, 2010	13	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I(CHEM-MD-CC3-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Chemistry of alkenes and alkynes** **Addition to C=C** Mechanism (with evidence wherever applicable), reactivity, regioselectivity (Markownikoff and anti-Markownikoff additions) and stereoselectivity; reactions: hydrogenation, halogenation, hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation, epoxidation, *syn* and *anti*-hydroxylation, ozonolysis, addition of singlet and triplet carbenes; Simmons-Smith cyclopropanation reaction; electrophilic addition to 1,3-butadiene; concept ofkinetic and thermodynamic control of products; radical addition: HBr addition; mechanism of allylic and benzylic bromination in competition with brominations across C=C; use of NBS; interconversion of *E* and *Z* alkenes. **Addition to C≡C (in comparison to C=C)** Mechanism, reactivity, regioselectivity(Markownikoff and anti-Markownikoff addition) and stereoselectivity; reactions:hydrogenation, Hg (II) ion catalysed hydration, hydroborationoxidation, dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes by exploring its acidity.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003. 3. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 4. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7thEdition, Pearson Education, 2010	12	Chalk and Talk	**(PR)**
		Total	45		
Practical	**Identification of PureSingle organic Compound.** **Solid compounds** Oxalic acid, tartaric acid, citric acid, succinic acid, resorcinol, urea, glucose, cane sugar, benzoicacid and salicylic acid **Liquid Compounds**: Formic acid, acetic acid, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehydeand nitrobenzene	1. Furniss, Hannaford, Smith, Tatcholl, Vogel's Textbook of Practical OrganicChemistry,5thEdition, Pearson India, 2003 2. Practical Workbook Chemistry (Honours),	26	Chalk and Talk and Hand on Demonstration	**(PR)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I(CHEM-MD-CC3-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Practice	UGBOS, Chemistry,University of Calcutta, 2015	4		
		Total	30		

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Fundamentals of Chemistry – I (CHEM-H-CC4-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Aromatic Substitution:** **Electrophilic aromatic substitution** Mechanisms and evidences in favour of it including PKIE; orientation and reactivity; reactions:nitration, nitrosation, sulfonation, halogenation, Friedel-Crafts reaction; one-carbonelectrophiles(reactions: chloromethylation, Houben-Hoesch, Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmidt); *Ipso* substitution. **Nucleophilic aromatic substitution** Addition-elimination mechanism and evidences in favour of it; SN1 mechanism; *cine* substitution(benzyne mechanism), structure of benzyne. **Birch Reduction of benzenoid aromatics** Benzene, Alkylbenzene, Anisole, Benzoic acid (with mechanism). **General Treatment of Reaction Mechanism –II** **Concept of organic acids and bases** Concept of pKa and pKaH, effect of structure, substituent and solvent on acidityand basicity;proton sponge. **Tautomerism** Basic difference between tautomerism and resonance,prototropy (keto-enol, phenol-keto);composition of the equilibrium in different systems (simple carbonyl; 1,2- and 1,3-dicarbonylsystems, phenols and related systems), factors affecting keto-enol tautomerism,basic ideas aboutvalence tautomerism and ring-chain tautomerism.	1. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 2. Morrison, R. N. & Boyd, R. N. andBhattacharjee,Organic Chemistry, 7thEdition, Pearson Education, 2010	20	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Fundamentals of Chemistry – I (CHEM-H-CC4-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : II	**Stereochemistry –III** **Conformation-I** Basic idea of conformation.ConformationalNomenclature(Newman & Sawhorse):eclipsed,staggered, gauche, syn and anti; Special reference to preferred geometry for β-elimination.Relative stability of conformers on the basis of steric effect: butane-gauche interaction. **Substitution and Elimination Reactions:** **Nucleophilic substitution reactions** Substitution at sp3centre[systems: alkyl halides, allyl halides, benzyl halides, alcohols, ethers,epoxides, α-halocarbonyls]: mechanisms (with evidence),relative rates& stereochemical features:SN1, SN2, SN2', SN1' (allylic rearrangement) and SNi; effects of solvent, substrate structure,leaving group and nucleophiles (including ambident nucleophiles, cyanide & nitrite);substitutions involving NGP (with heteroatoms and phenyl groups). **Elimination reactions** E1, E2, E1cB and Ei (pyrolytic *syn* eliminations); formation of alkenes and alkynes; mechanisms(with evidence), reactivity, regioselectivity (Saytzeff/Hofmann)and stereoselectivity; comparisonbetween substitution and eliminationreactions, comparison between nucleophilicity and basicity.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003. 3. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 4. Morrison, R. N. & Boyd,R. N. and Bhattacharjee, OrganicChemistry,7thEdition,Pearson Education, 2010	13	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Fundamentals of Chemistry – I (CHEM-H-CC4-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Chemistry of alkenes and alkynes** **Addition to C=C** Mechanism (with evidence wherever applicable), reactivity,regioselectivity (Markownikoff andanti-Markownikoff additions) and stereoselectivity; reactions: hydrogenation, halogenation,hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation,epoxidation, *syn* and *anti*-hydroxylation, ozonolysis, addition of singlet and triplet carbenes;Simmons-Smith cyclopropanation reaction; electrophilic addition to 1,3-butadiene; conceptofkinetic and thermodynamic control of products; radical addition: HBr addition; mechanism ofallylic and benzylic bromination in competition with brominations across C=C; use of NBS;interconversion of *E* and *Z* alkenes. **Addition to C≡C (in comparison to C=C)** Mechanism, reactivity, regioselectivity(Markownikoff and anti-Markownikoff addition) andstereoselectivity; reactions:hydrogenation, Hg (II) ion catalysed hydration, hydroborationoxidation,dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes byexploring its acidity.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003. 3. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 4. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7thEdition, Pearson Education, 2010	12	Chalk and Talk	**(PR)**
		Total	45		
Practical	**Identification of PureSingle organic Compound.** **Solid compounds** Oxalic acid, tartaric acid, citric acid, succinic acid, resorcinol, urea, glucose, cane sugar, benzoicacid and salicylic acid **Liquid Compounds**: Formic acid, acetic acid, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehydeand nitrobenzene	1. Furniss, Hannaford, Smith, Tatcholl, Vogel's Textbook of Practical OrganicChemistry,5thEdition, Pearson India, 2003 2. Practical Workbook Chemistry (Honours), UGBOS,	26	Chalk and Talk and Hand on Demonstration	**(PR)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Fundamentals of Chemistry – I (CHEM-H-CC4-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Practice	Chemistry,University of Calcutta, 2015	4		
		Total	30		

LESSON PLAN: Semester-III (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Introduction to Numerical Methods for Chemists (CHEM-H-SEC3-3)

Planned			After Implementation	
Topics	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Numbers and Precision Fixed -point representation, Floating - point representation, Floating-point arithmetic, Errors in numbers,Binary representation of numbers. **Finding Roots** Iterative methods, Newton - Raphson Method.	**1.** Erwin Kreyszig, Advanced Engineering Mathematics, 10Th Edition, Wiley India **2.**Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005). **3.**S. R. Crouch, F. J. Holler, Applications of MS Excel in Analytical Chemistry. **4.**Thomson, 2004. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008).	11	Chalk and Talk and Study Material given	**(PR)**
Linear Regression Least square fit to a straight line, Polynomial regression. Coefficient of Determination, Correlation,Linear Correlation coefficient (r). **Interpolation** Lagrange Interpolation		11	Chalk and Talk and Study material given	**(SG)**
Numerical Differentiation Method of finite differences (Forward difference, Backward difference, Central difference). The second derivative. **Numerical Integration** Trapezoidal approximation (Taylor series interpretation, Geometric interpretation, Composite Trapezoidal Rule), Midpoint Rule, Simpson's 1/3rd Rule.		11	Chalk and Talk and study materiel given	**(IS)**
Numerical solution of Differential Equation (ODE Only) First Order Method (Euler) and extension to fourth order (Runge-Kutta) **The Fourier Transform**		12	Talk using ICT and Study material given	**(AS)**

LESSON PLAN: Semester-III (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Introduction to Numerical Methods for Chemists (CHEM-H-SEC3-3)

Planned				After Implementation	
Topics		**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Fourier series and Fourier Transform					
		Total	**45**		
Tutorial	**1.** Make a table of the form below to present the results in each case. Draw graphs as required. Inthe problems, take a= π and b=e, and xj =0.1, 0.3, 0.5, 0.8,1,2,3,5,7,10,20,25 to get yj. Use thesevalues in the table for calculations. Report M and C with graph(s). Find out a,b from M and C.Match with the input values a) y=ax + b, b) y = ax / (1+bx) **2**. Find the molar volume of Argon (a= 1.50 L2 atm mol^{-2},b= 0.032 L mol^{-1}) at 144 K and 30atm pressure, and hence densities of liquid and vapor formed using the van der Waals equationof state. **3.** The ionization potential and electron affinity values of a few elements of a periodic table aregiven below, along with Pauling electronegativities. Show that the Mulliken electronegativities values, defined by (IP + EA) /2, bears a good correlation with the Pauling values. [EN(P) ≈EN(M) / 270].		15	Hand on Demonstration using Computer (ICT)	**(AS)**
		Total	**15**		

LESSON PLAN: Semester-3 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code:Interdisciplinary Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-IDC3-3

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I **Introduction to Quantitative analysis and its interdisciplinary nature**:	Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method -accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD). Limitations of analytical methods.	Douglas A. Skoog, D.M. West , F. jamesHoller , Stanely R. Crouch, Fundamentals of Analytical Chemistry , Cengage learning India Pvt Ltd. 10th Edition , 2022	4	Chalk and Talk	**(SG)**
	Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance.		3	Chalk and Talk	**(SG)**
	External standard calibration -regression equation (least squares method), correlation coefficient (R^2). Presentation of experimental data and results from the point of viewof significant figures.		3	Chalk and Talk	**(SG)**
Module : II **Titrimetric analysis**:	**Principle**, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparationand dilution of reagents/ solutions using $N_1V_1 = N_2V_2$, preparation of ppm level solutions from source materials(salts).	Daniel C. Harris , Quantitative Chemical Analysis , 10th Edition , W.H. Freeman , 2020	2	Chalk and Talk	**(SB)**
	Acid-basetitrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations.		2	Chalk and Talk	**(SB)**
	Redox titrimetry: Theory, balancing redox equations, titration curves.		2	Chalk and Talk	**(SB)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code:Interdisciplinary Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-IDC3-3

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Precipitation titrimetry: Theory, titration curves, indicators for precipitation titrations.		2	Chalk and Talk	**(SB)**
	Complexometric titrimetry: Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators for EDTA titrations. Determination of hardness of water.		2	Chalk and Talk	**(AS)**
Module : III	**Water analysis:** Water availability, requirement of water. Quality of surface water and ground water. Impurities in water. Standardsof water quality for potable, domestic, industrial and agricultural purpose (color, pH, alkalinity,hardness, TDS,sulphate, fluoride, chloride etc.)	Douglas A. Skoog, D.M. West , F. jamesHoller , Stanely R. Crouch, Fundamentals of Analytical Chemistry , Cengage learning India Pvt Ltd. 10th Edition , 2022	3	Chalk and Talk	**(AS)**
	Water treatment technologies: House hold water treatment, municipal water treatment and industrial treatment (primary and secondary treatment ofindustrial effluent).Softening of water. Disinfection of water. Definition and determinations of DO, BOD and COD,and their significance.		3	Chalk and Talk	**(AS)**
	Basic laboratory practices: Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling(solids andliquids), weighing, drying,		4	Chalk and Talk	**(IS)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Anuva Samanta (AS), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code:Interdisciplinary Course (Quantitative Analysis and Basic Laboratory Practices) CHEM-H-IDC3-3

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	dissolving, Acid treatment, Rules of work in analytical laboratory, General rule forperforming quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fireprevention and accidents, First aid. Precautions to be taken whilehandling toxic chemicals, concentrated/fuming acids and organic solvents.				
		Total	30		
Tutorial:	1. Safety Practices in the Chemistry Laboratory, knowledge about common toxic chemicals and safety measures intheir handling, cleaning and drying of glass wares.		3	Chalk and Talk and Demonstration	**(IS)**
	2. Calibration of glassware, pipette, burette and volumetric flask.		3	Chalk and Talk and Demonstration	**(SG)**
	3. Preparation of TLC plates and separation of amino acids		3	Chalk and Talk and Demonstration	**(SG)**
	4. Calibration of instruments like colorimeter, pH-meter, conductivity meter, spectrophotometer using referencestandards or reference materials.		3	Chalk and Talk and Demonstration	**(AS)**
	5. Determination of alkali present in soaps/detergents.		3	Chalk and Talk and Demonstration	**(SB)**
		Total	15		

LESSON PLAN: Semester- (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: ORGANIC CHEMISTRY – III (CHEM-H-CC9-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Organic Spectroscopy -I** UV Spectroscopy Introduction; types of electronic transitions, end absorption; transition dipole moment and allowed/forbidden transitions; chromophores and auxochromes; Bathochromic and Hypsochromicshifts; intensity of absorptions (Hyper-/Hypochromic effects); relative positions of λmax considering conjugative effect, steric effect, solvent effect, effect of pH. IR Spectroscopy Introduction; modes of molecular vibrations(fundamental and non-fundamental); IR active molecules; application of Hooke's law, force constant; fingerprint region and its significance;effect of deuteration; overtone bands; vibrational coupling in IR; characteristic and diagnosticstretching frequencies of C-H, N-H, O-H, C-O, C-N, C-X, C=C (including skeletal vibrations ofaromatic compounds), C=O, C=N, N=O, C≡C, C≡N; characteristic bending vibrations areincluded; factors affecting stretching frequencies: effect of conjugation, electronic effects, masseffect, bond multiplicity, ring-size, solvent effect, H-bonding on IR absorptions; application infunctional group analysis. NMR SpectroscopyIntroduction; nuclear spin; NMR active molecules; basic principles of Proton MagneticResonance; choice of solvent and internal standard; equivalent and non-equivalent protons;chemical shift and factors influencing it; ring current effect; significance of the terms: up-/downfield, shielded and deshielded protons; spin coupling and coupling constant (1st orderspectra); relative intensities of first-ordermultiplets: Pascal's triangle; chemical and magneticequivalence in NMR ; anisotropic effects in alkene, alkyne, aldehydes	1. Kemp. W, Organic Spectroscopy, Macmillan, 3rd Edition, 2022 2. Dyer, Applications of Absorption Spectroscopy of Organic Compounds,Prentice Hall India Learning Private Limited, 1978 3. Pavia. Donald L, Introduction to Spectroscopy, 5th Edition, Cengage India Private Limited, 2015 4. Finar, I. L. Organic Chemistry (Volume 1), Vol 1, 6th Edition (Pearson Education India), 2002. 5. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry,7th Edition, Pearson Education, 2010	20	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**

LESSON PLAN: Semester- (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: ORGANIC CHEMISTRY – III (CHEM-H-CC9-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	and aromatics; Idea aboutNMR peak area, integration; relative peak positions; rapid proton exchange; interpretation ofNMR spectra of simple compounds: Ethanol, diethyl malonate, diethyl fumarate, trans-cinnamicacid, benzene, toluene, benzaldenyde, p-nitrobenzaldehyde, dinitrobenzenes, nitroanilines.Applications of IR, UV and NMR spectroscopy for identification of simple organic molecules				
Module : II	**Rearrangements (15 Lectures)** Mechanism with evidence (including crossover experiments) and stereochemical features for th following: **Rearrangement to electron-deficient carbon** Wagner-Meerwein rearrangement, pinacol rearrangement, dienone-phenol; Wolff rearrangement in Arndt-Eistert synthesis, benzil-benzilic acid rearrangement, Demjanov rearrangement, Tiffeneau–Demjanov rearrangement. **Rearrangement to electron-deficient nitrogen** Rearrangements: Hofmann, Curtius, Lossen, Schmidt and Beckmann. **Rearrangement to electron-deficient oxygen** Baeyer-Villiger oxidation, cumene hydroperoxide-phenol rearrangement and Dakin reaction. **Aromatic rearrangements: Migration from oxygen to ring carbon** Fries rearrangement and Claisen rearrangement. **Migration from nitrogen to ring carbon** *N*-azo to *C*-azo rearrangement, Bamberger rearrangement, Orton rearrangement and benzidine rearrangement.	1. Kemp. W, Organic Spectroscopy, Macmillan, 3rd Edition, 2022 2. Dyer, Applications of Absorption Spectroscopy of Organic Compounds,Prentice Hall India Learning Private Limited, 1978 3. Pavia. Donald L, Introduction to Spectroscopy, 5th Edition, Cengage India Private Limited, 2015 4. Finar, I. L. Organic Chemistry (Volume 1), Vol 1, 6th Edition (Pearson Education India), 2002. 5. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry,7th Edition, Pearson Education, 2010	15	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**

LESSON PLAN: Semester- (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: ORGANIC CHEMISTRY – III (CHEM-H-CC9-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Nitrogen compounds (10 Lectures)** **Amines: Aliphatic & Aromatic** Preparation, separation (Hinsberg's method) and identification of primary, secondary and tertiary amines; reaction (with mechanism): Eschweiler–Clarke methylation, diazo coupling reaction, formation and reactions of phenylenediamines, diazomethane and diazoacetic ester. **Nitro compounds (aliphatic and aromatic)** Preparation and reaction (with mechanism): reduction under different conditions; Nef carbonyl synthesis, Henry reaction and conjugate addition of nitroalkane anion. **Alkylnitrile and isonitrile** Preparation and reaction (with mechanism): Thorpe nitrile condensation, von Richter reaction. **Diazonium salts and their related compounds** Reactions (with mechanism) involving replacement of diazo group; reactions: Gomberg, Meerwein, Japp-Klingermann.	1. Kemp. W, Organic Spectroscopy, Macmillan, 3rd Edition, 2022 2. Dyer, Applications of Absorption Spectroscopy of Organic Compounds,Prentice Hall India Learning Private Limited, 1978 3. Pavia. Donald L, Introduction to Spectroscopy, 5th Edition, Cengage India Private Limited, 2015 4. Finar, I. L. Organic Chemistry (Volume 1), Vol 1, 6th Edition (Pearson Education India), 2002. 5. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry,7th Edition, Pearson Education, 2010	10	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**
		Total	45		

LESSON PLAN: Semester- (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: ORGANIC CHEMISTRY – III (CHEM-H-CC9-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	**Organic Preparations** A. The following reactions (at least 5) are to be performed, noting the yield of the crude product: 1. Nitration of aromatic compounds 2. Condensation reactions 3. Hydrolysis of amides/imides/esters 4. Acetylation of phenols/aromatic amines 5. Side chain oxidation of aromatic compounds 6. Diazo coupling reactions of aromatic amines 7. Bromination of anilides (Bromate-Bromide method) **Students must also calculate percentage yield, based upon isolated yield (crude) and theoretical yield.** B. Purification of the crude product is to be made by crystallization from water/alcohol, crystallization after charcoal treatment, or sublimation, whichever is applicable. C. Melting point of the purified product is to be noted.	1. Furniss, Hannaford, Smith, Tatcholl, Vogel's Textbook of Practical Organic Chemistry, 5th Edition, Pearson India, 2003 2. Practical Workbook Chemistry (Honours), UGBOS, Chemistry, University of Calcutta, 2015	26	Chalk and Talk and Hand on Demonstration	**(PR)**
	Practice		4		
		Total	30		

LESSON PLAN: Semester-5 (Under CCF) 2025

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Soumavo Ghosh (SG)

Paper Name & Code: Inorganic Chemistry – III (CHEM-H-CC10-5 (DSCC-10)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I (s- and p-block elements)	General properties of s- and p-block elements. Behavior of alkali metals in liquid ammonia.Preparation and structure of basic beryllium acetate and nitrate, beryllium halides. Relative stability of different oxidation states of Groups 13, 14 and 15.Allotropy and catenation.Hydrolytic behavior of the halides of Group 15.Structure and magnetism of gallium dichloride.Preparation,structure, bonding, properties and usesofboric acid, borates, diborane, graphitic compounds, fullerenes	1. J. E. Huheey, E. A. Keiter, R. L. Keiter, Okhil K. Medhi , Principles of Structure and Reactivity, 5th Edition ,Pearson India, 2022 2. N. N. Greenwood, & A. Earnshaw, Chemistry of the Elements, Butterworth-Heinemann, 1997.	10	Chalk and Talk	SG
	Oxides and oxoacids of nitrogen, phosphorus, sulphur and chlorine.Preparation, structure and properties of peroxo acids of sulphur, sulphur-nitrogen compounds, interhalogen compounds, polyhalides, pseudo halogens, fluorocarbons. Basic properties of halogens, super halogen. Special properties of helium. Preparation of fluorides, oxides of xenon and perxenates.Clathrates of noble gas elements. Usesof noble gases.		10	Chalk and Talk	SB
	Inorganic polymers:General characteristics, comparison with organic polymers.Preparation, structure and uses of silicones and siloxanes, borazines,polymeric boron nitride $(BN)_x$,phosphazenes and polythiazyl $(SN)_x$		10	Chalk and Talk	SB
Module : II (d- and f-block elements)	General comparison of 3d, 4d and 5d elements in terms of oxidation states, metal-metal bond, redox propertiesof Gr. 6-11	1. Concise Inorganic Chemistry, J. D. Lee, 5thEd., Wiley India Pvt. Ltd., 2008.	3	Chalk and Talk	SB
	General comparison of lanthanoids and actinoids in terms of electronic configuration, oxidation states, spectral andmagnetic properties.Lanthanoid and actinoid contraction. Separation oflanthanides (ion-exchangemethod only). Uses of lanthanoids and actinoids in spectral, magnetic and theranostic applications.		6	Chalk and Talk	SG
Module : III (Nuclear Model &Radiotracer methods)	Liquid drop model, Shell model, magic numbers. Concept of nuclear quantum number. Spin Isomerism	1. H. J. Arnikar, Essentials of Nuclear Chemistry, 5thEdition, New Age International Pvt, Ltd., 2022	3	Chalk and Talk	SG
	Overview of radioisotope production, radiometric titrations. Radiotracer methods: study of mechanism of chemical reactions, nuclear medicine, isotope dilution analysis.		3	Chalk and Talk	SG
		Total	**45**		

LESSON PLAN: Semester-5 (Under CCF) 2025

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Soumavo Ghosh (SG)

Paper Name & Code: Inorganic Chemistry – III (CHEM-H-CC10-5 (DSCC-10)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	**Analysis of materials of industrial importance** 1. Cu and Zn in brass (Complexometry) 2. $CaCO_3$ and $MgCO_3$ in Dolomite 3. Cr and Mn in steel 4. Vitamin C 5. DO in water sample 6. Fe_2O_3 in Portland cement 7. Mg in talcum powder	1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. 2. Practical Workbook Chemistry (Honours), UGBOS, Chemistry, University of Calcutta, 2015	28	Chalk and Talk and Hand on Demonstration	**(SB)**
	Practice		2		
		Total	**30**		

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Foundation of Quantum Mechanics**	**1.Levine, I. N. Physical Chemistry, 6th Edition, McGraw-Hill India,2011.** **2. McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva** **Press,1997.** **3. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry,**	**5**	**Chalk and Talk**	**(AS)**
	Particle Aspect of Radiation **Blackbody Radiation, Photoelectric Effect, Compton Effect.**		**5**	**Chalk and Talk**	**(AS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
		11th Edition, Oxford University **Press, 2018.** **4. Levine, I.N, Quantum Chemistry, 7th Edition, Pearson, , 2016.** **5. McQuarrie, D.A, Quantum Chemistry, 2nd Edition,University Science Books, 2008.**			
Module	**Particle Aspect of Radiation**	**1. McQuarrie, D. A. &**	**2**	**Chalk and**	**(AS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
: II	**Blackbody Radiation, Photoelectric Effect, Compton Effect.**	**Simons, J. D. Physical Chemistry: A Molecular Approach, Viva** **Press,1997.** **2. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, 11th Edition, Oxford University** **Press, 2018.** **3. Levine, I.N, Quantum Chemistry,**		**Talk**	
	Wave Aspect of particles **de Broglie's Hypothesis: Matter Wave, Heisenberg's Uncertainty Principle. Wave packet, time** **evolution of wave function. Group and Phase Velocities.**		**6**	**Chalk and Talk**	**(AS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
		7th Edition, Pearson, , 2016. **5. McQuarrie, D.A, Quantum Chemistry, 2nd Edition,University Science Books, 2008.**			
	Schrodinger Equation and Wavefunction **The time dependent Schrodinger equation. The time-independentSchrodinger equation; natureof the equation, acceptability conditions for the wave functions and probability interpretations ofwave function. Vector representation of wave function. Dirac's bra-ket notation. Orthonormalityof wave function.**	**1. Levine, I.N, Quantum Chemistry, 7th Edition, Pearson, , 2016.** **2. McQuarrie, D.A, Quantum Chemistry, 2nd Edition,University**	**6**	**Chalk and Talk**	**(AS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Concept of Operators **Elementary concepts of operators, eigenfunctions and eigenvalues; Linear operators;Commutation of operators, commutator and uncertainty relation; Expectation value;**	**Science Books, 2008.**			
	The Postulates and General Principles of Quantum Mechanics **Postulates of Quantum Mechanics. Hermitian operators, definition and examples. Theoremsabout Hermitian operators. Expansion of a function in terms of eigenfunctions. Eigenfunctions of** **commuting operators.**		**2**	**Chalk and Talk**	**(AS)**
			5	**Chalk and**	**(AS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
				Talk	
Module III	**Surface Chemistry** **Adsorption** **Physical and chemical adsorption; Freundlich and Langmuir adsorption isotherms; multilayer** **adsorption and BET isotherm; Gibbs adsorption isotherm and surface excess; Heterogeneous** **catalysis (single reactant);**	**1.McQuarrie, D. A. & Simons, J. D. Physical Chemistry: A Molecular Approach, Viva** **Press,1997.** **2. Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, 11th Edition, Oxford**	**9**	**Chalk and Talk**	**(IS)**
	Colloids		**6**	**Chalk and**	**(IS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Lyophobic and lyophilic sols, Origin of charge and stability of lyophobic colloids, Coagulation **and Schultz-Hardy rule, Zeta potential and Stern double layer (qualitative idea), Tyndall effect;Electrokinetic phenomena (qualitative idea only); Stability of colloids and zeta potential;** **Micelles, reverse micelles; micellization equilibrium; thermodynamics of micellization.**	**University** **Press, 2018**		**Talk**	
	Electrical Properties of molecules **Dipole moment and polarizability** **Polarizability of atoms and molecules, dielectric constant and polarization, molar polarizationfor polar and non-polar molecules; Clausius-Mosotti equation and Debye equation (both**	**1.Atkins, P. W. & Paula, J. de Atkins' Physical Chemistry, 11th Edition, Oxford University**	**45**		

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	withoutderivation) and their application; Determination of dipole moments	**Press, 2018.**			
	CHEM-H-CC11-5-P **(DSCC-11)**	**1.Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015.**			
	1. Conductometric Experiments **To determine the ionization constant of a weak acid by conductometric method.**		**12**		**(AS)**
	2. Potentiometric Experiments **a) Potentiometric titration of Mohr's salt solution against**		**4**		**(AS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	standard K2Cr2O7 and KMnO4 **solutionand hence determine the standard reduction potential (E0) of Fe+3 / Fe+2 couple in the hydrogen scale.** **b) Determination of concentration of (i) AgNO3 solution and (ii) solubility product of AgCl by potentiometric titration of AgNO3 solution against standard KCl solution.** **3. Solubility Product:** **a) Determination of solubility and solubility product of a sparingly soluble salt in water, and invarious electrolytic media by titrimetric method.** **b) Determination of the activity solubility product of KHTa from the variation of concentratedsolubility product with the**				

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry (CHEM-H-CC11-5)

(DSCC-11)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	ionic strength of the solution				
		Total	**30**		

LESSON PLAN: Semester-5 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: ORGANIC CHEMISTRY – IV (CHEM-H-CC12-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Organic Synthesis-I** **Retrosynthetic analysis** Disconnections; synthons, donor and acceptor synthons; natural reactivity and *umpolung*; latent polarity in bifunctional compounds: illogical electrophiles and nucleophiles; synthetic equivalents; functional group interconversion and addition (FGI and FGA); C-C disconnections and synthesis: one-group and two-group (1,2- to 1,5-dioxygenated compounds), reconnection (1,6-dicarbonyl); protection-deprotection strategy (alcohol, amine, carbonyl, acid). *Strategy of ring synthesis:* Thermodynamic and kinetic factors; synthesis of large rings, application of high dilution technique, Favorskii Rearrangement in relation to ring contraction.	1. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2002. 2. Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994. **3.** Organic Synthesis: The Disconnection Approach, Stuart Warren (Author), Paul Wyatt (Author)**,** 2008**.** 4. John Joule , Keith Mills , George Smith , Heterocyclic Chemistry,3rd Edition,1995, CRC Press. 5. J. Joule, Heterocyclic Chemistry,5th Edition, Wiley, 2010.	15	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**

LESSON PLAN: Semester-5 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: ORGANIC CHEMISTRY – IV (CHEM-H-CC12-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : II	**Carbocycles** **Polynuclear hydrocarbons and their derivatives** Synthetic methods include Haworth, Bardhan-Sengupta, Bogert-Cook (with mechanistic details); fixation of double bonds and Fries rule; reactions (with mechanism) of naphthalene, anthracene and phenanthrene and their derivatives. **Heterocycle-I** **Heterocyclic compounds** Reactivity, orientation and important reactions (with mechanism) of furan, pyrrole, thiophene and pyridine; synthesis (including retrosynthetic approach and mechanistic details): pyrrole: Knorr synthesis, Paal-Knorr synthesis, Hantzsch; furan: Paal-Knorr synthesis, Feist-Benary synthesis and its variation; thiophenes: Paal-Knorr synthesis, Hinsberg synthesis; pyridine: Hantzsch synthesis; benzo-fused 5-and 6-membered rings with one heteroatom: reactivity, orientation and important reactions (with mechanistic details) of indole, quinoline and isoquinoline; synthesis (including retrosynthetic approach and mechanistic details): indole: Fischer, quinoline: Skraup, isoquinoline: Bischler-Napieralski synthesis	1. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2002. 2. Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994. **3.** Organic Synthesis: The Disconnection Approach, Stuart Warren (Author), Paul Wyatt (Author)**,** 2008**.** 4. John Joule , Keith Mills , George Smith , Heterocyclic Chemistry,3rd Edition,1995, CRC Press. 5. J. Joule, Heterocyclic Chemistry,5th Edition, Wiley, 2010.	18	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**

LESSON PLAN: Semester-5 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: ORGANIC CHEMISTRY – IV (CHEM-H-CC12-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Stereochemistry and Reactions of Alicyclic Compound (12 Lectures)** Concept of I-strain (Baeyer's strain theory);conformational analysis: cyclohexane, mono and disubstituted cyclohexane; symmetry properties and optical activity; topomerisation; ring siz and ease of cyclisation; conformation & reactivity in cyclohexane system: consideration of steric and stereoelectronic requirements; elimination (E2, E1), nucleophilic substitution (S_N1, S_N2, S_Ni, NGP), merged substitution-elimination; rearrangements; oxidation of cyclohexanol, esterification, saponification, lactonisation, epoxidation, pyrolytic *syn* elimination and fragmentation reactions.	1. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), 2002. 2. Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994. **3.** Organic Synthesis: The Disconnection Approach, Stuart Warren (Author), Paul Wyatt (Author)**,** 2008**.** 4. John Joule , Keith Mills , George Smith , Heterocyclic Chemistry,3rd Edition,1995, CRC Press. 5. J. Joule, Heterocyclic Chemistry,5th Edition, Wiley, 2010.	12	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**
		Total	45		

LESSON PLAN: Semester-5 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: ORGANIC CHEMISTRY – IV (CHEM-H-CC12-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	**TLC & PAPER CHROMATOGRAPHY – AMINO ACIDS, DYESCOLUMN CHROMATOGRAPHY (DEMO)** **Chromatographic Separations** 1. TLC separation of a mixture containing 2/3 amino acids 2. TLC separation of a mixture of dyes (fluorescein and methylene blue) 3. Paper chromatographic separation of a mixture containing 2/3 amino acids 4. Column chromatographic separation of mixture of dyes (DEMO)	1. Practical Workbook Chemistry (Honours), UGBOS, Chemistry,University of Calcutta, 2015	26	Chalk and Talk and Hand on Demonstration	**(PR)**
	Practice		4		
		Total	30		

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Chemistry Minor - I (CHEM-H-CC1-1) & Chemistry MDC- I (CHEM-MD-CC1-1)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Extra nuclear structure of atoms** Wave-Particle duality; de Broglie hypothesis. Heisenberg's uncertainty principle. Introducing Schrödinger equation. Hydrogen and hydrogen like systems (detailed solution not required) .Concept of Atomic Orbital; shapes of s, p and d orbitals. Radial and angular distribution curves. Extension to multielectronic systems. Aufbau principle and its limitations; Pauli's exclusion principle, Hund's rules and multiplicity.	1.Lee,J.D.Concise Inorganic Chemistry 2. Atkins, Overton, Rourke , Weller , Armstrong; Shriver & Atkins' Inorganic Chemistry, 5th Ed., Oxford University Press (2010). 3.Huheey,J.E.;Keiter,E.A,& Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity	8	Chalk and Talk	**(SB)**
	Periodicity Effective nuclear charge. Shielding and penetration; Slater's rule. The general idea about modern periodic table, atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, trends of variation in periodic table and their application in explaining and predicting the chemical behavior of elements and compounds. Electronegativity scales (Pauling's, Mulliken's and Allred-Rochow's scales). Inert pair effect.		7	Chalk and Talk	**(SG)**
Module : II	**Basics of Organic Chemistry Bonding and Physical Properties** **Valence Bond Theory**: Nomenclature of Organic Compounds, Concept of hybridisation, shapes and structures of molecules, double bond equivalent (DBE), Resonance (including hyperconjugation) and Resonance energy.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003.	2	Chalk and Talk	**(PR)**
	Electronic displacement: Inductive effect, bond polarization and bond polarizability; steric effect, steric inhibition of resonance.		2	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Chemistry Minor - I (CHEM-H-CC1-1) & Chemistry MDC- I (CHEM-MD-CC1-1)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	MO Theory Qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about σ, σ*, π, π *, n – MOs; concept of HOMO, LUMO and SOMO; sketch and energy levels of π MOs of i) acyclic p orbital system (C=C, conjugated diene, triene, allyl and pentadienyl systems) ii) cyclic p orbital system (neutral systems: [4], [6] annulenes; charged systems: 3-,4-,5-7 membered ring systems); Hückel's rules for aromaticity up to [8] annulene; concept of antiaromaticity; non-aromatic molecules.		4	Chalk and Talk	**(PR)**
	Physical properties Melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces; polarity of molecules and dipole moments.		2	Chalk and Talk	**(PR)**
	Stereochemistry – I: Bonding geometries of carbon compounds and representation of molecules: tetrahedral nature of carbon and concept of asymmetry; Fischer, sawhorse, flying wedge and Newman projection formulae and their inter translations. Concept of chirality and symmetry: symmetry elements, molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers; concept of stereogenicity, chiral centres and number of stereoisomers: systems involving 1/2-chiral centre(s).	1. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020	5	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Chemistry Minor - I (CHEM-H-CC1-1) & Chemistry MDC- I (CHEM-MD-CC1-1)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Thermodynamics -I :** Concept of systems (open, closed and isolated) and surroundings. State of a system; Intensive and extensive variables. Partial derivatives. Exact and inexact differentials. Path function and State function. Concept of heat and work. Zeroth law of thermodynamics. Concept of thermodynamic reversibility. Concept of internal energy and 1st law of thermodynamics. Enthalpy and heat capacity, Relations between C_p and C_v. Isothermal and Adiabatic processes ; Calculations of ΔU, ΔH, q and w involving ideal gases in different processes. Enthalpy of reaction. Hess's law. Enthalpy of formation and combustion. Kirchhoff's equation.	1. Levine, I. N. Physical Chemistry, 6th Edition McGraw-Hill India, 2011 2. Castellan, G. W. Physical Chemistry, Narosa , 2004 3. Atkins, P. W. & Paula, J. de, Atkins' Physical Chemistry, 11th Edition, Oxford University Press, 2018	9	Chalk and Talk	**(IS)**
	Chemical Kinetics-I: Concept of order and molecularity. Rate laws for zero, 1st and 2nd order reactions and in general for any n-th order reaction. Determination of order of a reaction by half-life and differential methods. Rate determining step and steady state approximation. Opposing, Consecutive and parallel reactions (first order steps only).Temperature dependence of rate constant and Arrhenius equation.		6	Chalk and Talk	**(IS)**
		Total	45		

LESSON PLAN: Semester-1 (Under CCF)

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Chemistry Minor - I (CHEM-H-CC1-1) & Chemistry MDC- I (CHEM-MD-CC1-1)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	(1) Calibration and use of apparatus. (2) Preparation of primary standard solutions (Oxalic Acid and $K_2Cr_2O_7$)	1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. 2. Practical Workbook Chemistry (Honours), UGBOS, Chemistry, University of Calcutta, 2015	6	Chalk and Talk and Hand on Demonstration	**(SB)**
	Acid-Base Titrations: (3) Standardization of NaOH standard oxalic acid solution. (4) Estimation of carbonate and bicarbonate present together in a mixture (5) Estimation of acetic acid in commercial Vinegar.		8		**(SB)**
	Oxidation-Reduction Titrimetry: (6) Standardization of $KMnO_4$ standard oxalic acid solution. (7) Estimation of Fe(II) using standardized $KMnO_4$ solution. (8) Estimation of Fe(III) using standard $K_2Cr_2O_7$ solution. (9) Estimation of Fe(II) and Fe(III) in a given mixture using standard $K_2Cr_2O_7$ solution.		12		**(SB)**
	Practice		4		**(SB)**
		Total	30		

LESSON PLAN: Semester-1 (Under CCF)2025

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS),

Paper Name & Code: Skill Enhancement Course (Chemistry In Daily Life) CHEM-MD-SEC-Th

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Dairy Products**	Edward Cox Henry, The Chemical analysis of Foods , Hardcover, Hassell Street Press ,2021	5	Chalk and Talk	**(SB)**
	Food additives, adulterants, and contaminants		5	Chalk and Talk	**(SB)**
	Artificial food colorants		5	Chalk and Talk	**(SB)**
Module : II	**Vitamins**	B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)	5	Chalk and Talk	**(PR)**
	Oils and fats		5	Chalk and Talk	**(PR)**
	Soaps & Detergents		5	Chalk and Talk	**(PR)**
Module : III	**Chemical and Renewable Energy Sources**	Fred Billmeyer : Textbook of polymer science; Wiley 3rd edition.	5	Chalk and Talk	**(IS)**
	Polymers		10	Chalk and Talk	**(IS)**
		Total	**45**		
Tutorial	1. Estimation of Vitamin C		4	Chalk and Talk	**(SB)**
	2. Determination of Iodine number of oil.		3	Chalk and Talk	**(IS)**
	3. Determination of saponification number of oil.		4	Chalk and Talk	**(PR)**
	4. Determination of methyl alcohol in alcoholic beverages.		4	Chalk and Talk	**(IS)**
		Total	**15**		

LESSON PLAN: Semester-1 (Under CCF)2025

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS),

Paper Name & Code: Skill Enhancement Course (Chemistry In Daily Life) CHEM-MD-IDC-Th

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Dairy Products**	Edward Cox Henry, The Chemical analysis of Foods , Hardcover, Hassell Street Press ,2021	5	Chalk and Talk	**(SB)**
	Food additives, adulterants, and contaminants		5	Chalk and Talk	**(SB)**
	Artificial food colorants		5	Chalk and Talk	**(SB)**
Module : II	**Vitamins**	B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)	5	Chalk and Talk	**(PR)**
	Oils and fats		5	Chalk and Talk	**(PR)**
	Soaps & Detergents		5	Chalk and Talk	**(PR)**
Module : III	**Chemical and Renewable Energy Sources**	Fred Billmeyer : Textbook of polymer science; Wiley 3rd edition.	5	Chalk and Talk	**(IS)**
	Polymers		10	Chalk and Talk	**(IS)**
		Total	**45**		
Tutorial	1. Estimation of Vitamin C		4	Chalk and Talk	**(SB)**
	2. Determination of Iodine number of oil.		3	Chalk and Talk	**(IS)**
	3. Determination of saponification number of oil.		4	Chalk and Talk	**(PR)**
	4. Determination of methyl alcohol in alcoholic beverages.		4	Chalk and Talk	**(IS)**
		Total	**15**		

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Chemistry Minor - I (CHEM-H-CC1-3)&Chemistry MDC- I (CHEM-MDCC1-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Extra nuclear structure of atoms** Wave-Particle duality; de Broglie hypothesis. Heisenberg's uncertainty principle. Introducing Schrödinger equation. Hydrogen and hydrogen like systems (detailed solution not required) .Concept of Atomic Orbital; shapes of s, p and d orbitals. Radial and angular distribution curves. Extension to multielectronic systems. Aufbau principle and its limitations; Pauli's exclusion principle, Hund's rules and multiplicity.	1.Lee,J.D.Concise Inorganic Chemistry 2.Atkins, Overton, Rourke ,Weller , Armstrong; Shriver & Atkins' Inorganic Chemistry, 5th Ed., Oxford University Press(2010). 3.Huheey,J.E.;Keiter,E.A,& Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity	8	Chalk and Talk	**(SB)**
	Periodicity Effective nuclear charge. Shielding and penetration; Slater's rule. The general idea about modern periodic table, atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, trends of variation in periodic table and their application in explaining and predicting the chemical behavior of elements and compounds. Electronegativity scales (Pauling's, Mulliken's and Allred-Rochow's scales). Inert pair effect.		7	Chalk and Talk	**(SG)**
Module : II	**Basics of Organic Chemistry Bonding and Physical Properties** **Valence Bond Theory**: Nomenclature of Organic Compounds, Concept of hybridisation, shapes and structures of molecules, double bond equivalent (DBE), Resonance (including hyperconjugation) and Resonance energy.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003.	2	Chalk and Talk	**(PR)**
	Electronic displacement: Inductive effect, bond polarization and bond polarizability; steric effect, steric inhibition of resonance.		2	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Chemistry Minor - I (CHEM-H-CC1-3)&Chemistry MDC- I (CHEM-MDCC1-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	MO Theory Qualitative idea about molecular orbitals, bonding and antibonding interactions, idea about σ, σ*, π, π *, n – MOs; concept of HOMO, LUMO and SOMO; sketch and energy levels of π MOs of i) acyclic p orbital system (C=C, conjugated diene, triene, allyl and pentadienyl systems) ii) cyclic p orbital system (neutral systems: [4], [6] annulenes; charged systems: 3-,4-,5-7 membered ring systems); Hückel's rules for aromaticity up to [8] annulene; concept of antiaromaticity; non-aromatic molecules.		4	Chalk and Talk	**(PR)**
	Physical properties Melting point/boiling point and solubility of common organic compounds in terms of covalent & non-covalent intermolecular forces; polarity of molecules and dipole moments.		2	Chalk and Talk	**(PR)**
	Stereochemistry – I: Bonding geometries of carbon compounds and representation of molecules: tetrahedral nature of carbon and concept of asymmetry; Fischer, sawhorse, flying wedge and Newman projection formulae and their inter translations. Concept of chirality and symmetry: symmetry elements, molecular chirality and centre of chirality; asymmetric and dissymmetric molecules; enantiomers and diastereomers; concept of stereogenicity, chiral centres and number of stereoisomers: systems involving 1/2-chiral centre(s).	1. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020	5	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Chemistry Minor - I (CHEM-H-CC1-3)&Chemistry MDC- I (CHEM-MDCC1-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Thermodynamics -I :** Concept of systems (open, closed and isolated) and surroundings. State of a system; Intensive and extensive variables.Partial derivatives. Exact and inexact differentials. Path function and State function. Concept of heat and work.Zeroth law of thermodynamics. Concept of thermodynamic reversibility. Concept of internal energy and 1st law ofthermodynamics. Enthalpy and heat capacity, Relations between C_p and C_v. Isothermal and Adiabatic processes ;Calculations of ΔU, ΔH, q and w involving ideal gases in different processes.Enthalpy of reaction. Hess's law. Enthalpy of formation and combustion. Kirchhoff's equation.	1. Levine, I. N. Physical Chemistry, 6th Edition McGraw-Hill India, 2011 2. Castellan, G. W. Physical Chemistry, Narosa , 2004 3. Atkins, P. W. & Paula, J. de, Atkins' Physical Chemistry, 11th Edition, Oxford University Press, 2018	9	Chalk and Talk	**(IS)**
	Chemical Kinetics-I: Concept of order and molecularity. Rate laws for zero, 1st and 2nd order reactions and in general for any n-th orderreaction. Determination of order of a reaction by half-life and differential methods. Rate determining step and steadystate approximation. Opposing, Consecutive and parallel reactions (first order steps only).Temperature dependence ofrate constant and Arrhenius equation.		6	Chalk and Talk	**(IS)**
		Total	45		

LESSON PLAN: Semester-3 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS), Dr Soumavo Ghosh (SG)

Paper Name & Code: Chemistry Minor - I (CHEM-H-CC1-3)&Chemistry MDC- I (CHEM-MDCC1-3)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	(1) Calibration and use of apparatus. (2) Preparation of primary standard solutions (Oxalic Acid and $K_2Cr_2O_7$)	1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. 2. Practical Workbook Chemistry (Honours), UGBOS, Chemistry, University of Calcutta, 2015	6	Chalk and Talk and Hand on Demonstration	**(SB)**
	Acid-Base Titrations: (3) Standardization of NaOH standard oxalic acid solution. (4) Estimation of carbonate and bicarbonate present together in a mixture (5) Estimation of acetic acid in commercial Vinegar.		8		**(SB)**
	Oxidation-Reduction Titrimetry: (6) Standardization of $KMnO_4$ standard oxalic acid solution. (7) Estimation of Fe(II) using standardized $KMnO_4$ solution. (8) Estimation of Fe(III) using standard $K_2Cr_2O_7$ solution. (9) Estimation of Fe(II) and Fe(III) in a given mixture using standard $K_2Cr_2O_7$ solution.		12		**(SB)**
	Practice		4		**(SB)**
		Total	30		

LESSON PLAN: Semester-3 (Under CCF)2025

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS),

Paper Name & Code: Interdisciplinary Course in Chemistry (Chemistry In Daily Life) CHEM-MD-IDC

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Dairy Products**	Edward Cox Henry, The Chemical analysis of Foods , Hardcover, Hassell Street Press ,2021	5	Chalk and Talk	**(SB)**
	Food additives, adulterants, and contaminants		5	Chalk and Talk	**(SB)**
	Artificial food colorants		5	Chalk and Talk	**(SB)**
Module : II	**Vitamins**	B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)	5	Chalk and Talk	**(PR)**
	Oils and fats		5	Chalk and Talk	**(PR)**
	Soaps & Detergents		5	Chalk and Talk	**(PR)**
Module : III	**Chemical and Renewable Energy Sources**	Fred Billmeyer : Textbook of polymer science; Wiley 3rd edition.	5	Chalk and Talk	**(IS)**
	Polymers		10	Chalk and Talk	**(IS)**
		Total	**45**		
Tutorial	1. Estimation of Vitamin C		4	Chalk and Talk	**(SB)**
	2. Determination of Iodine number of oil.		3	Chalk and Talk	**(IS)**
	3. Determination of saponification number of oil.		4	Chalk and Talk	**(PR)**
	4. Determination of methyl alcohol in alcoholic beverages.		4	Chalk and Talk	**(IS)**
		Total	**15**		

LESSON PLAN: Semester-3 (Under CCF)2025

Department Name:Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Priyabrata Roy (PR), Dr Ishita Saha (IS),

Paper Name & Code: Skill Enhancement Course (Chemistry In Daily Life) CHEM-MD-SEC-Th

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Dairy Products**	Edward Cox Henry, The Chemical analysis of Foods , Hardcover, Hassell Street Press , 2021	5	Chalk and Talk	**(SB)**
	Food additives, adulterants, and contaminants		5	Chalk and Talk	**(SB)**
	Artificial food colorants		5	Chalk and Talk	**(SB)**
Module : II	**Vitamins**	B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)	5	Chalk and Talk	**(PR)**
	Oils and fats		5	Chalk and Talk	**(PR)**
	Soaps & Detergents		5	Chalk and Talk	**(PR)**
Module : III	**Chemical and Renewable Energy Sources**	Fred Billmeyer : Textbook of polymer science; Wiley 3rd edition.	5	Chalk and Talk	**(IS)**
	Polymers		10	Chalk and Talk	**(IS)**
		Total	**45**		
Tutorial	1. Estimation of Vitamin C		4	Chalk and Talk	**(SB)**
	2. Determination of Iodine number of oil.		3	Chalk and Talk	**(IS)**
	3. Determination of saponification number of oil.		4	Chalk and Talk	**(PR)**
	4. Determination of methyl alcohol in alcoholic beverages.		4	Chalk and Talk	**(IS)**
		Total	**15**		

LESSON PLAN: Semester-5 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I (CHEM-H-CC4-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Aromatic Substitution:** **Electrophilic aromatic substitution** Mechanisms and evidences in favour of it including PKIE; orientation and reactivity; reactions:nitration, nitrosation, sulfonation, halogenation, Friedel-Crafts reaction; one-carbonelectrophiles(reactions: chloromethylation, Houben-Hoesch, Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmidt); *Ipso* substitution. **Nucleophilic aromatic substitution** Addition-elimination mechanism and evidences in favour of it; SN1 mechanism; *cine* substitution(benzyne mechanism), structure of benzyne. **Birch Reduction of benzenoid aromatics** Benzene, Alkylbenzene, Anisole, Benzoic acid (with mechanism). **General Treatment of Reaction Mechanism –II** **Concept of organic acids and bases** Concept of pKa and pKaH, effect of structure, substituent and solvent on acidityand basicity;proton sponge. **Tautomerism** Basic difference between tautomerism and resonance,prototropy (keto-enol, phenol-keto);composition of the equilibrium in different systems (simple carbonyl; 1,2- and 1,3-dicarbonylsystems, phenols and related systems), factors affecting keto-enol tautomerism,basic ideas aboutvalence tautomerism and ring-chain tautomerism.	1. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 2. Morrison, R. N. & Boyd, R. N. andBhattacharjee,Organic Chemistry, 7thEdition, Pearson Education, 2010	20	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**

LESSON PLAN: Semester-5 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I (CHEM-H-CC4-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : II	**Stereochemistry –III** **Conformation-I** Basic idea of conformation.ConformationalNomenclature(Newman & Sawhorse):eclipsed,staggered, gauche, syn and anti; Special reference to preferred geometry for β-elimination.Relative stability of conformers on the basis of steric effect: butane-gauche interaction. **Substitution and Elimination Reactions:** **Nucleophilic substitution reactions** Substitution at sp3centre[systems: alkyl halides, allyl halides, benzyl halides, alcohols, ethers,epoxides, α-halocarbonyls]: mechanisms (with evidence),relative rates& stereochemical features:SN1, SN2, SN2', SN1' (allylic rearrangement) and SNi; effects of solvent, substrate structure,leaving group and nucleophiles (including ambident nucleophiles, cyanide & nitrite);substitutions involving NGP (with heteroatoms and phenyl groups). **Elimination reactions** E1, E2, E1cB and Ei (pyrolytic *syn* eliminations); formation of alkenes and alkynes; mechanisms(with evidence), reactivity, regioselectivity (Saytzeff/Hofmann)and stereoselectivity; comparisonbetween substitution and eliminationreactions, comparison between nucleophilicity and basicity.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003. 3. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 4. Morrison, R. N. & Boyd,R. N. and Bhattacharjee, OrganicChemistry,7thEdition,Pearson Education, 2010	13	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**

LESSON PLAN: Semester-5 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I (CHEM-H-CC4-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Chemistry of alkenes and alkynes** **Addition to C=C** Mechanism (with evidence wherever applicable), reactivity,regioselectivity (Markownikoff andanti-Markownikoff additions) and stereoselectivity; reactions: hydrogenation, halogenation,hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation,epoxidation, *syn* and *anti*-hydroxylation, ozonolysis, addition of singlet and triplet carbenes;Simmons-Smith cyclopropanation reaction; electrophilic addition to 1,3-butadiene; conceptofkinetic and thermodynamic control of products; radical addition: HBr addition; mechanism ofallylic and benzylic bromination in competition with brominations across C=C; use of NBS;interconversion of *E* and *Z* alkenes. **Addition to C≡C (in comparison to C=C)** Mechanism, reactivity, regioselectivity(Markownikoff and anti-Markownikoff addition) andstereoselectivity; reactions:hydrogenation, Hg (II) ion catalysed hydration, hydroborationoxidation,dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes byexploring its acidity.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003. 3. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 4. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7thEdition, Pearson Education, 2010	12	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	**(PR)**
		Total	45		
Practical	**Identification of PureSingle organic Compound.** **Solid compounds** Oxalic acid, tartaric acid, citric acid, succinic acid, resorcinol, urea, glucose, cane sugar, benzoicacid and salicylic acid **Liquid Compounds**: Formic acid, acetic acid, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehydeand nitrobenzene	1. Furniss, Hannaford, Smith, Tatcholl, Vogel's Textbook of Practical OrganicChemistry,5thEdition, Pearson India, 2003 2. Practical Workbook Chemistry (Honours), UGBOS,	26	Chalk and Talk and Hand on Demonstration	**(PR)**

LESSON PLAN: Semester-5 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I (CHEM-H-CC4-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Practice	Chemistry,University of Calcutta, 2015	4		
		Total	30		

LESSON PLAN: Semester-5 (Under CCF) 2025

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Soumavo Ghosh (SG)

Paper Name & Code: Inorganic Chemistry – I (CHEM-MD CC4-5 (MN-4))

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I (Chemical bonding –II)	**Molecular orbital concept of bonding:** The approximations of the theory, Linear combination of atomic orbitals (LCAO) (elementary pictorial approach): sigma and pi bonds and delta interaction, multiple bonding. Orbital designations: gerade, ungerade, HOMO, LUMO. Orbital mixing,. MO diagrams of H_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2, and their ions wherever possible; Heteronuclear molecular orbitals: CO, NO, NO^+, CN^-, HF, BeH_2, CO_2 and H_2O. Bond properties: bond orders, bond lengths.	1. G. L. Miessler, D. A. Tarr, Inorganic Chemistry , 3rd Edition, Pearson India, 2008 2. A. G. Sharpe, C. E. Housecroft, Inorganic Chemistry 3rd Edition,Pearson India ,2002	18	Chalk and Talk	SB
	Metallic Bond Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.		5	Chalk and Talk	SB
	Weak Chemical Forces Hydrogen bonding (theories of hydrogen bonding, valence bond treatment), receptor-guest interactions, Halogenbonds. Effects of chemical force, melting and boiling points.		5	Chalk and Talk	SG
Module : II (Acids and bases)	**Acid-Base concept** Arrhenius concept, theory of solvent system (in H_2O, NH_3, SO_2 and HF), Bronsted-Lowry's concept, Lux Floodconcept, Lewis concept, group characteristics of Lewis acids, solvent levelling and differentiating effects. Relativestrength of acids, Pauling's rules. HSAB principle.	1. G. L. Miessler, D. A. Tarr, Inorganic Chemistry , 3rd Edition, Pearson India, 2008 2. A. G. Sharpe, C. E. Housecroft, Inorganic Chemistry 3rd Edition,Pearson India ,2002	6	Chalk and Talk	SG
	Acid-baseequilibria in aqueous solution: Proton transfer equilibria in water, pH, buffer. Acid-base neutralization curves; indicator, choice of indicators.		6	Chalk and Talk	SG
Module : III (Radioactivity)	**Nuclear stability:** Nuclear stability and nuclear binding energy.**Nuclear Reactions:** Artificial radioactivity, fission, fusion and spallation.**Radiocarbon dating**	A. G. Sharpe, C. E. Housecroft, Inorganic Chemistry 3rd Edition,Pearson India ,2002	5	Chalk and Talk	SG
		Total	**45**		

LESSON PLAN: Semester-5 (Under CCF) 2025

Department Name: Chemistry

Name of Faculty: Dr Sharmila Bhattacharya (SB), Dr Soumavo Ghosh (SG)

Paper Name & Code: Inorganic Chemistry – I (CHEM-MD CC4-5 (MN-4))

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	**Complexometric Titration** 1. Ca(II) and Mg(II) in a mixture 2. Hardness of water 3. Fe(III) and Al(III) in a mixture 4. Cu(II) and Zn(II) in a mixture 5. Cu(II) and Ni(II) in a mixture	1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009. 2. Practical Workbook Chemistry (Honours), UGBOS, Chemistry, University of Calcutta, 2015	28	Chalk and Talk and Hand on Demonstration	**(SB)**
	Practice		2		
		Total	**30**		

LESSON PLAN: Semester-5 (Under CCF)2025

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry – II (CHEM-MD-CC6-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I Stereochemistry – IV	**Conformation-II** Concept of dihedral angle, torsion angle; energy barrier of rotation, concept of torsional and steric strains; relativestability of conformers on the basis of steric effect, dipole-dipole interaction and H-bonding; butane gaucheinteraction; conformational analysis of ethane, propane, *n*-butane, and 2-methylbutane; 1,2-dihaloalkanes and ethyleneglycol.	Nasipuri, D. Stereochemistry of OrganicCompounds, 4th Edition, New Age International Pvt Ltd, 2020	4	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	
	Concept of prostereoisomerism Prostereogenic centre; concept of (pro)nchirality: topicity of ligands and faces (elementary idea); pro-R/pro-S, pro-E/pro-Z and Re/Si descriptors; pro-*r* and pro-*s* descriptors of ligands on propseudoasymmetric centre.		4		
	Chirality arising out of stereoaxis Stereoisomerism of substituted cumulenes with even and odd number of double bonds; chiral axis in allenes, andbiphenyls; related configurational descriptors (*Ra/Sa*); atropisomerism; racemisation of chiral biphenyls		4		

LESSON PLAN: Semester-5 (Under CCF)2025

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry – II (CHEM-MD-CC6-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : II Chemistry of carbonyl Compounds	**Nucleophilic Addition to C=O** Structure and reactivity of carbonyl compounds; mechanism (with evidence), reactivity, equilibrium and kineticcontrol; formation of hydrates, cyanohydrins and bisulphite adduct; nucleophilic addition-elimination reactions withalcohols, thiolsand nitrogen-based nucleophiles;reactions: benzoin condensation, Cannizzaro and Tischenkoreactions, reactions with ylides: Wittig and Corey-Chaykovsky reaction; Rupe rearrangement, oxidations andreductions: Clemmensen, Wolff-Kishner, LiAlH4, NaBH4, MPVO redox equilibrium, acyloin condensation;oxidation of alcohols with PDC and PCC; periodic acid and lead tetraacetate oxidation of 1,2-diols.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson Education , 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson Education,2003. 3. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7th Edition(Pearson Education), 2010	10	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials. .	
	Exploitation of acidity of α-H of C=O Formation of enols and enolates; kinetic and thermodynamic enolates; reactions (mechanism withevidence):halogenation of	1. Finar, I. L. Organic Chemistry	10		

LESSON PLAN: Semester-5 (Under CCF)2025

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry – II (CHEM-MD-CC6-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	carbonyl compounds under acidic and basic conditions, Hell-Volhard-Zelinsky (H. V. Z.)reaction, nitrosation, SeO2 (Riley) oxidation; condensations (mechanism with evidence): Aldol,Tollens',Knoevenagel, Claisen-Schmidt, Claisen ester including Dieckmann; Mannichreaction,Perkin reaction; alkylation ofactive methylene compounds; synthetic applications of diethyl malonate and ethyl acetoacetate; specific enolequivalents (lithium enolates, enamines and silyl enol ethers) in connection with alkylation, acylation and aldol typereaction	(Volume 1), 6th Edition , Pearson Education , 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson Education,2003. 3. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7th Edition(Pearson Education), 2010			
	Nucleophilic addition to α, β -unsaturated carbonyl system General principle and mechanism (with evidence); direct and conjugate addition, addition of enolates (Michaelreaction), Robinson annulations reaction. **Substitution at sp2 carbon (C=O system)** Mechanism (with evidence): BAC2, AAC2, AAC1, AAL1 (inconnection to acid and ester); acid derivatives: amides,anhydrides & acyl halides (formation and hydrolysis including comparison).		8		

LESSON PLAN: Semester-5 (Under CCF)2025

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry – II (CHEM-MD-CC6-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Organometallics** Grignard reagents ,Organolithiums; Gilman cuprates: preparation and reactions (mechanism with evidence); additionof Grignard and organolithium to carbonyl compounds; substitution on -COX; directed *ortho* metalation of arenesusing organolithiums, conjugate addition by Gilman cuprates;Corey-House synthesis; abnormal behaviour ofGrignard reagents; comparison of reactivity among Grignard, organolithiums and organocopper reagents;Reformatsky reaction; concept of umpolung.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson Education , 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson Education,2003. 3. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7th Edition(Pearson Education), 2010	5	Classroom lectures with chalk and board, PowerPoint presentations, interactive discussions, and distribution of study materials.	
		Total	**45**		

LESSON PLAN: Semester-5 (Under CCF)2025

Department Name: Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry – II (CHEM-MD-CC6-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	**Qualitative analysis of single solid organic compound:** 1. Detection of special elements (N, S, Cl) by Lassaigne's test 2. Solubility and classification (solvents: H2O, 5% HCl, 5% NaOH and 5% NaHCO3) 3. Detection of the following functional groups by systematic chemical tests: aromatic amino (Ar-NH2), aromatic nitro (-NO2), amido (-CONH2, including imide), phenolic –OH, carboxylic acid (-COOH), carbonyl (distinctionbetween -CHO and >C=O); only one test for each functional group is to be reported. Each student, during laboratory session, is required to carry out qualitative chemical tests for all the special elements and the functional groups in known and unknown (at least six) organic compounds.	1 .Practical Workbook Chemistry (Honours), UGBOS, Chemistry, University of Calcutta, 2015 2. Furniss, Hannaford, Smith, Tatcholl, Vogel's Textbook of Practical Organic Chemistry ,5th Edition , Pearson India, 2003	28	Chalk and Talk and Hand on Demonstration	
	Practice		2		
		Total	**30**		

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry MDC– VII (CHEM-MD-CC7-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Transport processes and Liquid State:** **Viscosity** General features of fluid flow (streamline flow and turbulent flow); Newton's equation, viscositycoefficient; Poiseuille's equation; principle of determination of viscosity coefficient of liquids by fallingsphere method and using Ostwald's viscometer. Temperature variation of viscosity of liquids andcomparison with that of gases. Relation between viscosity coefficient of a gas and mean free path.	**Levine, I. N. Physical Chemistry, 6thEdition McGraw-Hill India, 2011**	5	Chalk and Talk	**(IS)**
	Surface tension and energy Surface tension, surface energy, excess pressure, capillary rise and surface tension; Work of cohesion andadhesion, spreading of liquid over other surface; Temperature dependence of surface tension		4	Chalk and Talk	**(AS)**
Module : II	**Solid State** **Bravais Lattice and Laws of Crystallography** Types of solid, Bragg's law of diffraction; Laws of crystallography (Haüy's law and Steno's law);Permissible symmetry axes in crystals; Lattice, space lattice, unit cell, crystal planes, Bravais lattice.Packing of uniform hard sphere, close packed arrangements (fcc and hcp); Tetrahedral and octahedralvoids. Void space in cubic systems.	**Castellan, G. W. Physical Chemistry, Narosa, 2004**	6	Chalk and Talkand supplied study material	**(AS)**
	Crystal planes Distance between consecutive planes [cubic and orthorhombic		6	Chalk and Talk	**(AS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry MDC– VII (CHEM-MD-CC7-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	lattices]; Indexing of planes, Miller indices;calculation of dhkl; Relation between molar mass and unit cell dimension for cubic system; Bragg's law . Determination of crystal structure: Structure of NaCl and KCl crystals.				
Module : III	**Application of Thermodynamics – II:** **Colligative properties** Vapour pressure of solution; Ideal solution, ideally dilute solution and colligative properties; Raoult's law.Thermodynamic derivations(using chemical potential) relating (i) Elevation of boiling point of an ideallydilute solution containing a non- volatile nonelectrolyte solute, (ii) Depression of freezing point of anideally dilute solution containing a non -volatile nonelectrolyte solute (iii) Osmotic pressure of an ideallydilute solution containing a non-volatile nonelectrolyte solute with the molality / molar concentrationofsolute in solution. Applications in calculating molar masses of normal, dissociated and associated solutesin solution; Abnormal colligative properties	**Atkins, P. W. & Paula, J. de, Atkins' Physical Chemistry, 11th Edition, Oxford University Press, 2018**	8	Chalk and Talk	**(IS)**
	Phase Equilibrium		8	Chalk and Talk	**(IS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry MDC– VII (CHEM-MD-CC7-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Definitions of phase, component and degrees of freedom; Phase rule and its derivations; Definition ofphase diagram; Phase diagram for water, CO2, Sulphur.First order phase transition and Clapeyronequation; Clausius-Clapeyron equation - derivation and use; Binary solutions: Liquid vapour equilibrium for two component systems. Ideal solution at fixed temperature and pressure;Lever Rule. Principle of fractional distillation; Duhem-Margules equation; Henry's law; Konowaloff's rule; Positive and negative deviations from ideal behaviour; Azeotropic solution; Liquid-liquid phase diagram using phenol- water system; Solid-liquid phase diagram; Eutectic mixture				
	ELECTROCHEMISTRY-II **Electromotive Force** Rules of oxidation/reduction of ions based on half-cell potentials; Chemical cells, reversible andirreversible cells with examples; Electromotive force of a cell and its measurement, Nernst equation;	**Atkins, P. W. & Paula, J. de, Atkins' Physical Chemistry, 11th Edition, Oxford**	8	Chalk and Talk and supplied study material	**(AS)**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry MDC– VII (CHEM-MD-CC7-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Standard electrode (reduction) potential and its application to different kinds of half-cells. Application ofEMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibriumconstants, and (iii) pH values, using glass electrodes. Concentration cells with and without transference, liquid junction potential; Potentiometric Titration.	**University Press, 2018**			
		Total	**45**		

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry MDC– VII (CHEM-MD-CC7-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Practical	**Physical Chemistry Practical:** **1. Surface tension measurements using Stalagmometer:** a)Determine the surface tension of a given solution by drop weight method using a stalagmometer. b) Study the variation of surface tension of acetic acid solutions with concentration and hence determinegraphically the concentration of an unknown solution of acetic acid. **2. Viscosity measurement using Ostwald's viscometer:** a)Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and(iii) sugar at roomtemperature. b)Study the variation of viscosity of sucrose solution with the concentration of solute and hence determinegraphically the concentration of an unknown solution. **3. Solubility Product:** a) Determination of solubility and solubility product of a sparingly soluble salt in water, and in variouselectrolytic media bytitrimetric method. b) Determination of the activity solubility product of KHTa from the variation of concentrated solubilityproduct with the ionic strength of the solution	**Practical Workbook Chemistry (Honours), UGBOS, Chemistry, University of Calcutta, 2015**		Chalk and Talk and Hand on Demonstration	**AS/IS**

LESSON PLAN: Semester-V (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr. Anuva Samanta (AS), Dr. Ishita Saha (IS)

Paper Name & Code: Chemistry MDC– VII (CHEM-MD-CC7-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
		Total	**30**		

LESSON PLAN: Semester-5 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I(CHEM-MD-CC3-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : I	**Aromatic Substitution:** **Electrophilic aromatic substitution** Mechanisms and evidences in favour of it including PKIE; orientation and reactivity; reactions:nitration, nitrosation, sulfonation, halogenation, Friedel-Crafts reaction; one-carbonelectrophiles(reactions: chloromethylation, Houben-Hoesch, Vilsmeier-Haack, Reimer-Tiemann, Kolbe-Schmidt); *Ipso* substitution. **Nucleophilic aromatic substitution** Addition-elimination mechanism and evidences in favour of it; SN1 mechanism; *cine* substitution(benzyne mechanism), structure of benzyne. **Birch Reduction of benzenoid aromatics** Benzene, Alkylbenzene, Anisole, Benzoic acid (with mechanism). **General Treatment of Reaction Mechanism –II** **Concept of organic acids and bases** Concept of pKa and pKaH, effect of structure, substituent and solvent on acidityand basicity;proton sponge. **Tautomerism** Basic difference between tautomerism and resonance,prototropy (keto-enol, phenol-keto);composition of the equilibrium in different systems (simple carbonyl; 1,2- and 1,3-dicarbonylsystems, phenols and related systems), factors affecting keto-enol tautomerism,basic ideas about valence tautomerism and ring-chain tautomerism.	1. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 2. Morrison, R. N. & Boyd, R. N. andBhattacharjee,Organic Chemistry, 7thEdition, Pearson Education, 2010	20	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-5 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I(CHEM-MD-CC3-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : II	**Stereochemistry –III** **Conformation-I** Basic idea of conformation.ConformationalNomenclature(Newman & Sawhorse):eclipsed, staggered, gauche, syn and anti; Special reference to preferred geometry for β-elimination. Relative stability of conformers on the basis of steric effect: butane-gauche interaction. **Substitution and Elimination Reactions:** **Nucleophilic substitution reactions** Substitution at sp3centre[systems: alkyl halides, allyl halides, benzyl halides, alcohols, ethers, epoxides, α-halocarbonyls]: mechanisms (with evidence),relative rates& stereochemical features: SN1, SN2, SN2', SN1' (allylic rearrangement) and SNi; effects of solvent, substrate structure, leaving group and nucleophiles (including ambident nucleophiles, cyanide & nitrite); substitutions involving NGP (with heteroatoms and phenyl groups). **Elimination reactions** E1, E2, E1cB and Ei (pyrolytic *syn* eliminations); formation of alkenes and alkynes; mechanisms (with evidence), reactivity, regioselectivity (Saytzeff/Hofmann)and stereoselectivity; comparison between substitution and eliminationreactions, comparison between nucleophilicity and basicity.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003. 3. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 4. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7thEdition, Pearson Education, 2010	13	Chalk and Talk	**(PR)**

LESSON PLAN: Semester-5 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I(CHEM-MD-CC3-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
Module : III	**Chemistry of alkenes and alkynes** **Addition to C=C** Mechanism (with evidence wherever applicable), reactivity, regioselectivity (Markownikoff and anti-Markownikoff additions) and stereoselectivity; reactions: hydrogenation, halogenation, hydrohalogenation, hydration, oxymercuration-demercuration, hydroboration-oxidation, epoxidation, *syn* and *anti*-hydroxylation, ozonolysis, addition of singlet and triplet carbenes; Simmons-Smith cyclopropanation reaction; electrophilic addition to 1,3-butadiene; concept ofkinetic and thermodynamic control of products; radical addition: HBr addition; mechanism of allylic and benzylic bromination in competition with brominations across C=C; use of NBS; interconversion of *E* and *Z* alkenes. **Addition to C≡C (in comparison to C=C)** Mechanism, reactivity, regioselectivity(Markownikoff and anti-Markownikoff addition) and stereoselectivity; reactions:hydrogenation, Hg (II) ion catalysed hydration, hydroborationoxidation, dissolving metal reduction of alkynes (Birch); reactions of terminal alkynes by exploring its acidity.	1. Finar, I. L. Organic Chemistry (Volume 1), 6th Edition , Pearson, 2002 2. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson, 2003. 3. Nasipuri, D. Stereochemistry of Organic Compounds, 4th Edition, New Age International Pvt Ltd , 2020 4. Morrison, R. N. & Boyd, R. N. and Bhattacharjee, Organic Chemistry, 7thEdition, Pearson Education, 2010	12	Chalk and Talk	**(PR)**
		Total	45		
Practical	**Identification of PureSingle organic Compound.** **Solid compounds** Oxalic acid, tartaric acid, citric acid, succinic acid, resorcinol, urea, glucose, cane sugar, benzoicacid and salicylic acid **Liquid Compounds**: Formic acid, acetic acid, ethyl alcohol, acetone, aniline, dimethylaniline, benzaldehydeand nitrobenzene	1. Furniss, Hannaford, Smith, Tatcholl, Vogel's Textbook of Practical OrganicChemistry,5thEdition, Pearson India, 2003 2. Practical Workbook Chemistry (Honours),	26	Chalk and Talk and Hand on Demonstration	**(PR)**

LESSON PLAN: Semester-5 (Under CCF)

Department Name:Chemistry

Name of Faculty: Dr Priyabrata Roy (PR)

Paper Name & Code: Organic Chemistry-I(CHEM-MD-CC3-5)

Planned				After Implementation	
Unit / Group / Module / Article	**Topics**	**Reference Books**	**No of Lecture Planned**	**Content Delivery Technique**	**Remarks / Comments**
	Practice	UGBOS, Chemistry,University of Calcutta, 2015	4		
		Total	30		