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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhiraj Talukdar

Department: Chemistry **Semester: IV**

Paper Name: ORGANICCHEMISTRY-III **Paper Code: CHE-HC-4026**

Learning Objectives:

1. Students are expected to learn about different classes of N-based compounds; theirstructures, synthesis and reactivity
2. Students shall demonstrate the ability to identify and classify different types of N-based derivatives, alkaloids and hetrocyclic compounds/explain their structure mechanism and reactivity/critically examine their synthesis and reactions mechanism

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Nitrogen Containing Functional Groups	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
1-5	Preparation and important reactions of nitro compounds, nitriles and isonitriles				
6-8	**Amines/** Effect of substituent and solvent on basicity				
8-10	Preparation and properties of amines				
11	Gabriel phthalimide synthesis Carbylamine reaction				
12	Mannich reaction, Hoffmann's exhaustive methylation				

13 & 14	Hofmann-elimination reaction				
15 &16	Distinction between 1°, 2°and3° amines with Hinsberg reagent and nitrous acid				
17 & 18	Diazonium Salts :Preparation and their synthetic applications				
19					Unit test
20					Students' seminar

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhiraj Talukdar

Department: Chemistry **Semester: VI**

Paper Name: **ORGANICCHEMISTRY-V** Paper Code: **CHE-HC-6026**

Learning Objectives:

1. *Students are expected to learn about the different spectroscopic techniques and their applications in organic chemistry*
2. *Students shall be apprised with carbohydrate chemistry, dyes and polymers and their structure, reactivity and chemical properties*
3. *Students shall be able to classify/identify/critically examine carbohydrates, polymers and dye materials.*

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Carbohydrates	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
1 & 2	Occurrence, classification and their biological importance				
3-5	Monosaccharides: Constitution and absolute configuration of glucose and fructose				
6	epimers and anomers, mutarotation,				
7 & 8	determination of ring size of glucose and fructose				Home assignment

	Haworth projections and conformational structures;				
9 & 10	Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation;				
11-13	Disaccharides – Structure elucidation of maltose, lactose and sucrose				
14 & 15	Polysaccharides–Elementary treatment of starch, cellulose and glycogen.				
16					Unit Test
	Dyes				
17	Classification, Colour and constitution; Mordant and Vat Dyes				
18 & 19	Synthesis and applications of Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling)				
20 & 21	Synthesis and applications of Triphenyl Methane Dyes -Malachite Green, Rosaniline and Crystal Violet				Home assignment
22	Synthesis and applications of Phthalein Dyes – Phenolphthalein and Fluorescein;				
23	Natural dyes synthesis of Alizarin and Indigotin				
24	Edible Dyes with examples.				
25					Unit Test
	Polymers				
26	Introduction and classification				
27 & 28	Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index.				Home assignment

29 & 30	Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization;				
31 & 32	Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene);				
33 & 34	Fabrics – natural and synthetic (acrylic, polyamido, polyester)				
35 & 36	Rubbers – natural and synthetic:Buna-S, Chloroprene and Neoprene; Vulcanization; Polymeradditives				
37	Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.				
38					Students' seminar

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Teaching Plan for the Session:Jan-Jun 2023

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry
Paper Name: Physical Chemistry II
Learning Objectives:

Semester: II
Paper Code: CHE-HC-2026

1. Students are expected to learn about partial molar properties, different thermodynamic properties and also colligative properties of dilute solutions.

2. Students are expected to learn about free energy functions, Gibbs Helmholtz equations, Maxwell's relations etc.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1-2	Partial molar quantities	Books, ppt.	Black board teaching	Asking students about previous knowledge of the topic	
3	Dependence of thermodynamic parameters on composition	Book	Black board teaching		
4	Gibb's Duhem equation & discussion	Book	Black board teaching		
5	Chemical potential	Book			
6-7	Thermodynamic functions of mixing and questions solving	Book	Black board teaching	Numerical solving	
8	Thermodynamic equilibrium, degree of advancement of reaction	Previous year question paper and book			
9	Fugacity, relation between Gibbs free energy and reaction quotient	Book	Black board teaching		

10	Exoergic and endoergic reactions, equilibrium constant	Book	Black board teaching		
11	Dependence of equilibrium constant on temperature, pressure and concentration	Book	Black board teaching		
12	Free energy of mixing and spontaneity, numerical solving	Book	Black board teaching	Numerical solving	
13	Relation between K_p, K_c & K_v, numerical solving	Book	Black board teaching	Numerical solving	
14	Le Chatelier principle, ideal and condensed phase equilibrium	Book	Black board teaching		
15	Test				MCQ
16	Dilute solutions, Raoult's and Henry's law, colligative properties	Book	Black board teaching		
17	Relative lowering of vapor pressure	Book	Black board teaching		
18	Elevation of boiling point	Book	Black board teaching		
19	Depression of freezing point, osmotic pressure	Book	Black board teaching		
20	Osmotic pressure, numerical solving	Book	Black board teaching	Numerical solving	
21-22	Calculation of molar mass	Book	Black board teaching		
23	Gibbs and Helmholtz energy, Variation of S, G with T, V	Book	Black board teaching		
24	Variation of S, G with P and Variation of A with T, V, P	Book	Black board teaching		
25	Different enthalpy change processes, entropy change and free energy change, numerical	Book	Black board teaching	Numerical solving	
26	Joule-Thomson coefficient, inversion temperature, Gibbs-Helmholtz equation	Book	Black board teaching		
27	Maxwell's relations, thermodynamic equation of state	Book	Black board teaching		

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Nalbari College, Nalbari

Teaching Plan for the Session:Jan-Jun 2023

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry
Paper Name: Physical Chemistry IV
Learning Objectives:

Semester: IV
Paper Code: CHE-HC-4036

Students will understand theories of conductance and electrochemistry. Students will also expected to understand various parts of electrochemical cells along with Faraday's laws of electrolysis.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Faraday's laws of electrolysis	Books, ppt.	Black board teaching	Asking students about previous knowledge of the topic	
2	Chemical cells, reversible	Book	Black board teaching		
3	Reversible and irreversible cell	Book	Black board teaching		
4	Single electrode potential, its sign, thermodynamics of reversible and irreversible cell	Book	Black board teaching		
5	Relation between electrical energy and enthalpy, determination of ΔH, ΔG, ΔS	Book	Black board teaching		
6	Electromotive force and equilibrium constant	Previous year question paper and book		Numerical solving	
7	Nernst equation and numerical solving	Book	Black board teaching		
8	Numerical solving	Previous year question paper and		Numerical solving	

		book			
9	Electromotive force, numerical solving	Previous year question paper and book		Numerical solving	
10	Numerical	Previous year question paper and book		Numerical solving	
11	Concentration cells, electrode concentration cells	Book	Black board teaching	Discussion/revision of previous topics by questioning	
12	Electrolyte concentration cells	Book	Black board teaching		
13	Concentration cells without transference	Book	Black board teaching		
14	Concentration cells with transference	Book	Black board teaching		
15	Liquid junction potential, numerical	Book	Black board teaching	Numerical solving	
16	Determination of activity coefficients of electrolytes	Book	Black board teaching		
17	Numerical	Book		Numerical solving	
18	Determination of transference no., pH	Book	Black board teaching		
19	Limitation of quinhydrone electrode, Determination of pH using glass electrode	Book	Black board teaching		
20 & 21	Acid-base titration	Book, OER	Black board teaching		
22	Numerical & Redox titrations	Book	Black board teaching	Numerical solving	
23	Precipitation titration and oxidation-reduction indicators	Book	Black board teaching		
24	Application in metallurgy and industry	Book	Black board teaching		
25	Problem solving			Numerical solving	

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Teaching Plan for the Session:Jan-Jun 2023

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry
Paper Name: Industrial Chemicals and Environment
Learning Objectives:

Semester: VI
Paper Code: CHE-HE-6026

1. Students will understand about different forms of renewable and non-renewable sources of energy. They would also come to know about biocatalysis and the importance of sustainable development and green chemistry in future.
2. Students will get to know about water pollution, its sources, industrial waste and their effects on living organisms along with water purification and waste management techniques.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1-3	Renewable sources of energy	Books, OER	Black board teaching	Discussion	
4-5	Non-renewable sources of energy	Book, OER	Black board teaching	Discussion	
6	Nuclear energy	Book, OER	Black board teaching		
7	Nuclear pollution	Book, OER	Black board teaching		
8	Effects of Nuclear pollution, its prevention & disposal	Book, OER	Black board teaching		
9	Disposal management, nuclear disaster and its management	Book, OER	Black board teaching		
10	Introduction to biocatalysis, its classification, advantage	Book, OER	Black board teaching		

11	Specificity/selectivity, disadvantage, mechanism	Book, OER	Black board teaching		
12	Sustainable development	Book, OER	Black board teaching	Discussion	
13	Green chemistry	Book, OER	Black board teaching	Discussion	
14-17	Water treatment and purification methods	Book, OER	Black board teaching		
18-20	Effluent treatment,	Book, OER	Black board teaching		
13	Sludge disposal	Book, OER	Black board teaching		
14	Industrial waste management	Book, OER	Black board teaching		
15	Water quality parameters	Book, OER	Black board teaching		
16-18	Seminars			Group presentations	Group presentations

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Nalbari College, Nalbari

Teaching Plan for the Session: Aug-Dec 2023

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry
Paper Name: Chemistry I
Learning Objectives:

Semester: I
Paper Code: CHE0100104

Students will understand about very important states of matter, i.e., gaseous and liquid state of matter.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Gaseous state: Postulates of kinetic theory of gases	Books	Black board teaching	Asking students about previous knowledge of the topic	
2	Causes of deviation from ideal behavior, compressibility factor and its variation	Book	Black board teaching		
3	Derivation of Vander Waals equation of state	Book	Black board teaching		
4	Limitations of Vander Waals equation, Berthelot equation, virial equation of state	Book	Black board teaching		
5	Boyle temperature, continuity of states	Book	Black board teaching		
6	Critical phenomenon, Vander waals equation and critical states	Book	Black board teaching		
7	Critical compressibility factor, law of corresponding states	Book	Black board teaching		
8	Discussion/revision of previous, numerical solving	Book	Black board teaching	Questions to groups of students to think critically	

14	Test				MCQ/Exam
15	Liquid state: vacancy theory, free volume	Book	Black board teaching		
16	Vapour pressure, surface tension	Book	Black board teaching		
17	Surface tension, Effects of temperature on surface tension	Book	Black board teaching		
18	Effects of surface tension	Book	Black board teaching		
19	Viscosity, effect of temperature and pressure	Book	Black board teaching		
20	Surface active agents	Book	Black board teaching		
21	Discussion and revision of topics, numerical solving	Book	Black board teaching	Questions to groups of students to think critically	

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Nalbari College, Nalbari

Teaching Plan for the Session: Aug-Dec 2023

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry
Course Name: Basic Analytical Chemistry (SEC)
Learning Objectives:

Semester: I
Paper Code: SEC0101003

Students will learn about basic principles of chemical analysis, soil sample analysis and water sample analysis. Students will also learn about food industry, techniques of processing and preservation. The last unit deals with chromatography, which basically give a brief un

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to analytical chemistry, concept of sampling	Books, ppt.	Black board teaching		
2	Accuracy & precision, error, replicates, mean & median	Book	Black board teaching		
3	Range, standard deviation, relative standard deviation	Book	Black board teaching	Numerical solve	
4	Numerical, significant figures	Book	Black board teaching	Discussion	
5-7	Composition of soil, types of silicates	Book	Black board teaching		
8-9	Soil acidity & pH, determination	Book	Black board teaching		
10	Complexometric titrations	Book	Black board teaching		
11	Chelate effect, indicators	Book	Black board teaching		
12	Determination of calcium and	Book	Black board		

	magnesium by complexometric titration		teaching		
10	Presentation			Group seminar presentations	
11	Water sampling methods	Book	Black board teaching		
12-13	Water pollution and its sources	Book, video tutorial	Black board teaching		
14-15	Water purification methods	Book	Black board teaching		
16-17	Water analysis, determination of acidity, alkalinity and dissolved oxygen	Book	Black board teaching		
18	Test				MCQ/Quiz
19	Analysis of food products, nutritional value of food	Book	Black board teaching		
20	Food processing, classification, consequences	Book	Black board teaching		
21-22	Traditional and modern methods of Food preservation	Book	Black board teaching	Discussion	
23-24	Food adulteration, method of detection	Book	Black board teaching	Discussion	
25-26	Analysis of food preservatives	Book	Black board teaching		
27	Introduction to chromatography and its classification	Book	Black board teaching		
28	Planar chromatography, column chromatography	Book	Black board teaching		
29-30	General principle	Book	Black board teaching		
31	Mechanism behind chromatographic separation	Book	Black board teaching		
32	Modes of paper chromatography, components of TLC	Book	Black board teaching		
33	Experimental procedure of separation of mixtures	Book	Black board teaching		

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Nalbari College, Nalbari

Teaching Plan for the Session: Aug-Dec 2022

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry
Paper Name: Physical Chemistry I
Learning Objectives:

Semester: I
Paper Code: CHE-HC-1026

1. Students will understand about the gaseous state of matter. Deviation of ideal gases from real gas and different derivations.

2. Concepts molecular and crystal symmetry will help students understand about solid state chemistry and group theory in higher studies.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Gaseous state: Postulates of kinetic theory of gases	Books	Black board teaching	Asking students about previous knowledge of the topic	
2	Derivation of kinetic gas equation	Book	Black board teaching		
3	Derivation of gas laws from kinetic gas equation, collision diameter, frequency, number, cross-section	Book	Black board teaching		
4	Mean free path, effect of temperature and pressure on collision frequency and mean free path	Book	Black board teaching		
5	Maxwell's distribution of molecular velocities	Book	Black board teaching		
6	Viscosity of gases and its temperature and pressure dependence	Book	Black board teaching		
7	Behaviour of real gases, compressibility factor	Book	Black board teaching		

8	Causes of deviation, derivation of Vander Waals equation of state	Book	Black board teaching		
9	Limitations of vander waals equation, Berthelot equation, virial equation of state	Book	Black board teaching		
10	Boyle temperature, continuity of states	Book	Black board teaching		
11	Critical phenomenon, vander waals equation and critical states	Book	Black board teaching		
12	Critical compressibility factor, law of corresponding states	Book	Black board teaching		
13	Discussion/revision of previous, numerical solving	Book	Black board teaching		
14	Test				MCQ/Exam
15	Symmetry, symmetry elements and operation	Book, video tutorial	Black board teaching		
16	symmetry elements and operation with examples	Book	Black board teaching		
17	Practice with examples, point group	Book	Black board teaching		
18	Point group concept with examples	Book	Black board teaching		
19	Crystal system and Bravais lattices	Book	Black board teaching		

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Nalbari College, Nalbari

Teaching Plan for the Session: Aug-Dec 2022

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry **Semester: III**
Paper Name: Physical Chemistry III **Paper Code: CHE-HC-3036**
Learning Objectives:

1. Students will understand about reaction kinetics, rate laws and rates of different reactions. The knowledge gained will help students understand the conditions of getting maximum yield of several industrial products, environmental reactions and biological systems.

2. The study of catalysis provides students with a deep understanding of the principles underlying the acceleration of chemical reactions and their diverse applications in both laboratory and industrial settings.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Rate of reaction, order and molecularity of simple and complex reaction, rate law	Books, ppt.	Black board teaching	Asking students about previous knowledge of the topic	
2	Differential form of rate expressions upto second order, integrated form of rate expressions derivation of zero and first order reaction	Book	Black board teaching		
3	Integrated form of rate expression of second order reaction,	Book	Black board teaching		
4	Problems and Numericals of previous learning	Previous year question paper and book			Numerical solving
5	Half life period of a reaction, $t_{1/2}$ of 0^{th}, 1^{st}, 2^{nd} and n^{th} order	Book	Black board teaching		

6	Problems and Numericals on half life period	Previous year question paper and book			Numerical solving
7	Experimental methods of determination of rate law	Book	Black board teaching		
8	Experimental methods of determination of rate law and complex reaction	Book	Black board teaching		
9	Kinetics of opposing and parallel reaction and their differential rate equation	Book	Black board teaching		
10	Kinetics of consecutive reactions and their differential rate equation, chain reaction steps	Book	Black board teaching		
11	Temperature dependence of reaction rate, Arrhenius equation, activation energy	Book	Black board teaching	Discussion/revision of previous topics by questioning	
12	Collision theory derivation and discrepancies	Book	Black board teaching		
13	Activated complex theory and Eyring equation	Book	Black board teaching		
14	Lindemann theory and mechanism	Book	Black board teaching		
15	Test				MCQ/Quiz
16	Introduction to catalyst and its types, specificity and selectivity	Book	Black board teaching		
17	Acid base catalysis mechanism and kinetics	Book	Black board teaching		
18	Enzyme catalyzed reactions and mechanism	Book	Black board teaching		
19	Cases of Michaelis-Menten equation and Lineweaver-Burk method	Book	Black board teaching		
20	Mechanism of heterogeneous catalysis, nanoparticles as a catalyst	Book, OER	Black board teaching		

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Teaching Plan for the Session: Aug-Dec 2022

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry
Paper Name: Physical Chemistry V
Learning Objectives:

Semester: V
Paper Code: CHE-HC-5026

1. Students will understand about different spectroscopic techniques for characterization of samples, mainly the theory behind these techniques is included in the syllabus.

2. From the second unit the students will understand the photochemical reactions, their importance and different processes related to these reactions.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Importance of spectroscopy and its uses, Electromagnetic radiation and its interaction with matter	Books, OER	Black board teaching	Asking students about previous knowledge of the topic	
2	Various types of spectra and Born Oppenheimer approximation	Book	Black board teaching		
3	Rotational spectra of Diatomic molecule, rotational selection rule	Book	Black board teaching		
4	Intensities of spectral lines, determination of internuclear distance, rotational spectra of polyatomic molecules	Book	Black board teaching, PPT.		
5	Rotational spectra of polyatomic molecules, isotopic substitution	Book	Black board teaching		
6	Revision/Discussion and Numerical solving on the topics taught	Previous year question paper and book		Numerical solving	

7	Vibrational spectroscopy classical equation and force constant	Book	Black board teaching		
8	Diatomic vibrating rotator, Morse potential, dissociation energies, selection rule	Book	Black board teaching		
9	Anharmonic vibrations, selection rule, revision	Book	Black board teaching	Questionnaire discussion	
10 & 11	Vibration-rotation spectra of diatomic molecule, P, Q, R Branch	Book	Black board teaching		
12	Rotation vibration interaction, revision	Book	Black board teaching	Asking students to draw spectra for different transitions	
13	Isotopic substitution, numerical	Book	Black board teaching	Solve numerical from previous year question papers & Book	
14	Degree of freedom, mode of vibrations with example	Book	Black board teaching, PPT.		
15	Introduction to Raman spectra, Stokes & anti-stokes lines, selection rule, Pure rotational Raman spectra of diatomic molecule	Book	Black board teaching, PPT.		
16	Pure rotational Raman spectra of diatomic molecule, pure vibrational Raman spectra	Book	Black board teaching, PPT.		
17	Rotational-vibrational Raman spectra, effect on intensity of lines	Book	Black board teaching		
18	Rule of mutual exclusion principle, numerical	Book	Black board teaching	Solve numerical from previous year question papers & Book	
19	Electronic spectra, absorption of light	Book	Black board teaching		
20	Potential energy curve, dissociation and pre-dissociation	Book	Black board teaching		
21	Franck-Condon Principle	Book, OER	Black board teaching, PPT.		
22	Electronic transitions, fluorescence and phosphorescence	Book, OER	Black board teaching, PPT.		
23	Selection rule	Book	Black board teaching		
24	Intensity of electronic bands, factors affecting the intensity of bands	Book, OER	Black board teaching, PPT.		
25	Test				MCQ/Exam

26	Photosensitization and quenching	Book	Black board teaching		
27	Stern-Volmer equation, biochemical processes	Book	Black board teaching		
28	Luminescence, chemiluminescence, Jablonski diagram	Book	Black board teaching		
29	Photochemical equilibrium & photostationary states	Book	Black board teaching		

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Teaching Plan for the Session: Aug-Dec 2022

Name of the Teacher: Dr. Pranita Bora

Department: Chemistry
Paper Name: Basic Analytical Chemistry (SEC)
Learning Objectives:

Semester: III
Paper Code: CHE-SE-3036

Students will learn about basic principles of chemical analysis, soil sample analysis and water sample analysis.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction to analytical chemistry, concept of sampling	Books, ppt.	Black board teaching		
2	Accuracy & precision, error, replicates, mean & median	Book	Black board teaching		
3	Range, standard deviation, relative standard deviation	Book	Black board teaching		
4	Numerical, significant figures				
5-7	Composition of soil, types of silicates	Book	Black board teaching		
8-9	Soil acidity & pH, determination				
10	Complexometric titrations	Book	Black board teaching		
11	Chelate effect, indicators	Book	Black board teaching		
12	Determination of calcium and magnesium by complexometric titration	Book	Black board teaching		
10	Presentation			Group seminar presentations	

11	Water sampling methods	Book	Black board teaching		
12-13	Water pollution and its sources	Book, video tutorial	Black board teaching		
14-15	Water purification methods	Book	Black board teaching		
16-17	Water analysis, determination of acidity, alkalinity and dissolved oxygen	Book	Black board teaching		
18	Test				MCQ/Quiz

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-2023

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry **Semester: III**

Paper Name: Organic Chemistry-II **Paper Code: CHE-HC-3026**

Learning Objectives:

1. To apprise students about different classes of organic compounds, including halogenated hydrocarbons, alcohols, phenols etc.

2. To learn and differentiate between various organic functional groups.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism.	1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Graham Solomons, T.W. Organic Chemistry, John Wiley	Blackboard	Seminar by students	Home assignments
2	Mechanisms of Aldol and Benzoin condensation.				
3-4	Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction.				
5-6	Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction.				
7-8	α-substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH4,NaBH4, MPV, PDC and PGC).				
9	Addition reactions of unsaturated carbonyl compounds: Michael addition.				
10-12	Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate				

	and ethyl acetoacetate.	& Sons, Inc. 4. Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012. 5. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.			
13-14	Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids.				
15-16	hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids.				
17-19	Preparation and reactions of acid chlorides, anhydrides, esters and amides.				
20-22	Comparative study of nucleophilic sustitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters.				
23-24	Claisen condensation, Dieckmann and Reformatsky reactions, Hofmannbromamide degradation and Curtius rearrangeolysis.				
25-28	Preparation and reactions of thiols, thioethers and sulphonic acids.				

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-2023

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry

Semester: V

Paper Name: Organic Chemistry-IV

Paper Code: CHE-HC-5016

Learning Objectives:

1. To enable the students to explain/describe the important features of nucleic acids, amino acids and enzymes and develop their ability to examine their properties and applications.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1-2	Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.	1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VIth Edition. W.H. Freeman and Co. 2. Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2009) Principles of Biochemistry. IV Edition. W.H. Freeman	Blackboard	Seminar by students	Home assignments
3-4	Mechanism of enzyme action (taking trypsin as example).				
5-6	factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions.				
7	specificity of enzyme action (including stereospecificity).				
8-10	enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-				

	competitive inhibition including allosteric inhibition).	and Co. 3. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009) Harper's Illustrated Biochemistry. XXVIII edition. Lange Medical Books/ McGraw-Hill			
11-12	Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenntion of fats and oils, saponification value, acid value, iodine number, rancidity.				
13-14	Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism).				
16-18	ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD+, FAD.				
19-22	Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle.				
23-25	Overview of catabolic pathways of fat and protein. Interrelationship in the metabolic pathways of protein, fat and carbohydrate.				
26-27	Calorific value of food, standard calorie content of food types.				
28-31	Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis). Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis).				
32-35	Anelementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (turmeric), azadirachtin (neem), vitamin C and antacid (ranitidine).				

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Teaching Plan for the Session: 2022-2023

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry **Semester: V**

Paper Name: Polymer Chemistry **Paper Code: CHE-HE-5046**

Learning Objectives:

1. To introduce the theory and applications of polymer chemistry to the students.

2. Introduction of some industrially important polymers and conducting polymers.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction and history of polymeric materials: Different schemes of classification of polymers, Polymer nomenclature.	1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Eliel, E. L. & Wilen, S. H. Stereochemistry	Blackboard	Seminar by students	Home assignments
2	Molecular forces and chemical bonding in polymers, Texture of Polymers.				
3-4	Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality.				
5-7	extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems..				
8-11	Mechanism and kinetics of step growth, radical chain				

	growth, ionic chain (both cationic and anionic) and coordination polymerizations.	of Organic Compounds, Wiley: London, 1994. 4. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited. 5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005			
12-15	Mechanism and kinetics of copolymerization, polymerization techniques.				
16-20	Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.				
21-23	Determination of molecular weight of polymers (Mn, Mw, etc) by end group analysis.				
24-26	viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.				

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Teaching Plan for the Session: 2022-2023

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry **Semester: II**

Paper Name: Organic Chemistry-I **Paper Code: CHE-HC-2016**

Learning Objectives:

1. To apprise students with introduction to basic organic concepts.

2. To enable students to learn and analyse different classes of organic compounds, their reactivities and mechanisms.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Organic Compounds: Classification, and Nomenclature.	1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Eliel, E. L. & Wilen, S. H. Stereochemistry	Blackboard	Seminar by students	Home assignments
2	Hybridization, Shapes of molecules, Influence of hybridization on bond properties.				
3	Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects.				
4	hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.				
5	Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges.				
6	Electrophiles and Nucleophiles; Nucleophlicity and basicity.				
7	Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes.				
8	Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution				

	reactions.	of Organic Compounds, Wiley: London, 1994. 4. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited. 5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005			
9-10	Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions.				
11-12	Free radical substitutions: Halogenation -relative reactivity and selectivity.				
13-16	Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.				
17-20	Reactions of alkenes: Electrophilic additions and their mechanisms (Markownikoff/ Anti-Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis.				
21-24	reduction (catalytic and chemical), syn and antihydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, DielsAlder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.				
25-28	Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.				
28-32	Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.				

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Teaching Plan for the Session: 2022-2023

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry **Semester: IV**

Paper Name: Organic Chemistry-III **Paper Code: CHE-HC-4036**

Learning Objectives:

1. To introduce students to different classes of N-based compounds.

2. To study alkaloids and terpenoids and their potential application.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1-4	Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure.	1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the	Blackboard	Seminar by students	Home assignments
5-8	elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.				
9-12	Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom.				
13-18	Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine. Indole: Fischer indole synthesis and Madelung synthesis).				
19-24	Quinoline and isoquinoline: Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis,				

	Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction.	Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 4. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc. 5. Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.			
25-27	Natural occurrence, General structural features, Isolation and their physiological action Hoffmann's exhaustive methylation, Emde's modification.				
28-30	Structure elucidation and synthesis of Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.				
31-32	Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, Neral and α-terpineol.				

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Teaching Plan for the Session: 2022-2023

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry

Semester: VI

Paper Name: Organic Chemistry-V

Paper Code: CHE-HC-6026

Learning Objectives:

1. To learn about the different spectroscopic techniques and their applications in organic chemistry.

2. Students shall be apprised with carbohydrate chemistry, dyes and polymers and their structure, reactivity and chemical properties.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1-2	Introduction to absorption and emission spectroscopy.	1. Banwell, C. N. & Mc.Cash, E. M. Fundamentals of Molecular Spectroscopy, 4th Edition, McGraw Hill. 2. Pavia, Lampman, Kriz & Vyvyan, Introduction to Spectroscopy, 5th Edition, CENGAGE Learing. 3. Silverstein, R. M.;	Blackboard	Seminar by students	Home assignments
3-5	UV Spectroscopy: Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts.				
6-8	Intensity of absorption; Application of Woodward Rules for calculation of λmax for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes).				
9	distinction between cis and trans isomers.				
10-13	IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups.				

14	Effect of H-bonding, conjugation.	Webster, F. X.; Kiemle, D. J. & Bryce, D. L. Spectrometric Identification of Organic Compounds, 8th Edition, Wiley. 4. Kemp, W. Organic Spectroscopy, Palgrave			
15	resonance and ring size on IR absorptions.				
16	Fingerprint region and its significance; application in functional group analysis.				
17	NMR Spectroscopy: Basic principles of Proton Magnetic Resonance.				
18	chemical shift and factors influencing it.				
19	Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics.				
20	Interpetation of NMR spectra of simple compounds.				
21-22	Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.				
23-24	Applications of IR, UV and NMR for identification of simple organic and inorganic molecules.				

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Teaching Plan for the Session: 2023-2024

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry

Semester: I

Paper Name: Chemistry-I

Paper Code: CHE-0100104

Learning Objectives:

1. To apprise students with introduction to basic organic concepts.

2. To enable students to learn and analyse representation of organic compounds.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Representation of organic molecules in 2D and 3D.	1. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds, Wiley: London, 1994. 2. Nasipuri, D. Stereochemistry of Organic Compounds,	Blackboard	Seminar by students	Home assignments
2	Fischer, Newmann and Sawhorse projection formula.				
3	Geometrical isomerism. Cis-trans, E/Z notaions.				
4	Concept of chirarity. Enantiomers and diastereomers.				

5	Conformation and configuration, barriers and rotation.	Wiley Eastern Limited. 3. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005			
6-7	conformational analysis of ethane, butane and cyclohexane.				
8-9	Concept of electrophiles and nucleophiles.				
10-11	Inductive effect, resonance, conjugation and delocalisation.				

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Teaching Plan for the Session: 2023-2024

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry **Semester: III**

Paper Name: Organic Chemistry-II **Paper Code: CHE-HC-3026**

Learning Objectives:

1. To apprise students about different classes of organic compounds, including halogenated hydrocarbons, alcohols, phenols etc.

2. To learn and differentiate between various organic functional groups.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism.	1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Graham Solomons, T.W. Organic Chemistry, John Wiley	Blackboard	Seminar by students	Home assignments
2	Mechanisms of Aldol and Benzoin condensation.				
3-4	Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction.				
5-6	Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction.				
7-8	α-substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH4,NaBH4, MPV, PDC and PGC).				
9	Addition reactions of unsaturated carbonyl compounds: Michael addition.				
10-12	Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate				

	and ethyl acetoacetate.	& Sons, Inc. 4. Clayden, J., Greeves, N. & Warren, S. Organic Chemistry, Second edition, Oxford University Press, 2012. 5. Smith, J. G. Organic Chemistry, Tata McGraw-Hill Publishing Company Limited.			
13-14	Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids.				
15-16	hydroxy acids and unsaturated acids: succinic/phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids.				
17-19	Preparation and reactions of acid chlorides, anhydrides, esters and amides.				
20-22	Comparative study of nucleophilic sustitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters.				
23-24	Claisen condensation, Dieckmann and Reformatsky reactions, Hofmannbromamide degradation and Curtius rearrangeolysis.				
25-28	Preparation and reactions of thiols, thioethers and sulphonic acids.				

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Teaching Plan for the Session: 2023-2024

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry **Semester: V**

Paper Name: Organic Chemistry-IV **Paper Code: CHE-HC-5016**

Learning Objectives:

2. To enable the students to explain/describe the important features of nucleic acids, amino acids and enzymes and develop their ability to examine their properties and applications.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1-2	Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.	1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VIth Edition. W.H. Freeman and Co. 2. Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2009) Principles of Biochemistry. IV Edition. W.H. Freeman	Blackboard	Seminar by students	Home assignments
3-4	Mechanism of enzyme action (taking trypsin as example).				
5-6	factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions.				
7	specificity of enzyme action (including stereospecificity).				
8-10	enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-				

	competitive inhibition including allosteric inhibition).	and Co. 3. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009) Harper's Illustrated Biochemistry. XXVIII edition. Lange Medical Books/ McGraw-Hill			
11-12	Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenntion of fats and oils, saponification value, acid value, iodine number, rancidity.				
13-14	Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism).				
16-18	ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD+, FAD.				
19-22	Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle.				
23-25	Overview of catabolic pathways of fat and protein. Interrelationship in the metabolic pathways of protein, fat and carbohydrate.				
26-27	Calorific value of food, standard calorie content of food types.				
28-31	Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis). Analgesics: Ibuprofen (with synthesis), Antimalarials: Chloroquine (with synthesis).				
32-35	Anelementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (turmeric), azadirachtin (neem), vitamin C and antacid (ranitidine).				

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Teaching Plan for the Session: 2023-2024

Name of the Teacher: Dr Rupam Sarma

Department: Chemistry **Semester: V**

Paper Name: Polymer Chemistry **Paper Code: CHE-HE-5046**

Learning Objectives:

1. To introduce the theory and applications of polymer chemistry to the students.

2. Introduction of some industrially important polymers and conducting polymers.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Introduction and history of polymeric materials: Different schemes of classification of polymers, Polymer nomenclature.	1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 3. Eliel, E. L. & Wilen, S. H. Stereochemistry	Blackboard	Seminar by students	Home assignments
2	Molecular forces and chemical bonding in polymers, Texture of Polymers.				
3-4	Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality.				
5-7	extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems..				
8-11	Mechanism and kinetics of step growth, radical chain				

	growth, ionic chain (both cationic and anionic) and coordination polymerizations.	of Organic Compounds, Wiley: London, 1994. 4. Nasipuri, D. Stereochemistry of Organic Compounds, Wiley Eastern Limited. 5. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005			
12-15	Mechanism and kinetics of copolymerization, polymerization techniques.				
16-20	Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.				
21-23	Determination of molecular weight of polymers (Mn, Mw, etc) by end group analysis.				
24-26	viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.				

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Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: I**

Paper Name: Physical Chemistry **Paper Code: CHE-HC-1026**

Learning Objectives: 1. In the molecular and crystal symmetry unit they will be introduced to the elementary idea of symmetry which will be useful to understand solid state chemistry and group theory in some higher courses.

2. In solid state unit the students will learn the basic solid state chemistry application of x-ray crystallography for the determination of some very simple crystal structures.

3. The students will also learn another important topic "ionic equilibria" which contains pH, buffer solution, hydrolysis etc in this course.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE (Continuous Internal Evaluation)
1	Nature of the solid state, law of constancy of interfacial angles, law of rational indices	1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed.,	Black-board/ICT	Student's Seminar.	Unit Test for Home Assignment
2	Miller indices				
3,4	X-ray diffraction , Bragg's law, a simple account of rotating crystal method and				

	powder pattern method.	Oxford University Press. 2. Puri, B. R.; Sharma, L. R.; Pathania, M. S. Principles of Physical Chemistry, Vishal Publishing Co. 3. Kapoor, K. L. A. Textbook of Physical Chemistry (Volume 1) McGraw Hill Education; Sixth edition 4. e-PG pathsala & other internet			
5,6	Analysis of powder diffraction patterns of NaCl, CsCl and KCl.				
7,8	Defects in crystals				
9,10	Liquid crystals (Introductory idea)				
11	Doubt clearance				
12	Strong, moderate and weak electrolytes, degree of ionization				
13	factors affecting degree of ionization, ionization constant and ionic product of water.				
14	Ionization of weak acids and bases,pH scale				
15	common ion effect			Home assignment	
16,17,18	Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts.				
19	Buffer solutions; derivation of Henderson equation and its applications				
20	buffer 11 capacity,buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body				

21	Solubility and solubility product of sparingly soluble salts	resources			
22	Sessional examination				
24	applications of solubility product principle				
25	Qualitative treatment of acid – base titration curves (calculation of pH at various stages)				
26	Theory of acid–base indicators; selection of indicators and their limitations.				
27	Multistage equilibria in polyelectrolyte systems				
28	hydrolysis and hydrolysis constants				
29,30,31, 32	dissociation constants of mono-, di-and triprotic acids (exact treatment).				
33	Question answer discussion				
34,35				Seminar presentation by the students	

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: III**

Paper Name: Physical Chemistry **Paper Code: CHE-HC-3036**

Learning Objectives: 1. The students are expected to learn phase rule and its application in some specific systems.

2. The students are expected to learn systems having Eutectic point, congruent m.p, incongruent mp, immscible liquid solution, association and dissociation of solutes in presence of solvents etc.

3. The students will be able to understand different types of surface adsorption processes

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1,2	Concept of Phase, components, degrees of freedom	1.Puri, B. R.; Sharma, L. R.; Pathania, M. S. Principles of Physical	Black Board		Written examination
3,4	Gibbs Phase Rule & its Derivation for Reactive and non reactive system				

		Chemistry, Vishal Publishing Co.; 47th Ed. 2. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 5) McGraw Hill Education; 5th edition 3.Peter Atkins & Julio De Paula, Physical Chemistry 9th Ed., Oxford University Press.			
5	Construction of Phase diagram				
6,7	Clayperon equation, Clasius Clayperon				

	Equation and its application				
8	Phase diagram of One Component System, Water System				
9	Phase diagram of Sulphur System				
10	Phase rule and phase diagram for two component system				
11	Systems having eutectic points				
12,13	Systems having congruent melting points				
14,15	Systems having incongruent melting points				
16	Solid solution				
				Seminar Presentation	
17	Adsorption, types of adsorption				
18,19	Factors affecting adsorption, effect of pressure on adsorption, Freudlich adsorption isotherm				
20	Adsorption isotherms				
21	Langmuir Adsorption Isotherm				
				Seminar Presentation	
22	Partially miscible liquid solution, Critical Solution Temperature				

23	Solutions having upper critical solution temperature, solutions having lower solution temperature				
24	Solutions having upper & lower solution temperature				
25,26,27	Distribution coefficient, Nernst distribution law and its application				
28,29,30	Doubt clearing and question discussion				

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: V**

Paper Name: Physical Chemistry **Paper Code: CHE-HC-5026**

Learning Objectives:

1. The aim of this course is to introduce the students with three important areas- quantum chemistry, molecular spectroscopy and photochemistry.

2. In quantum chemistry unit the students will be taught the postulates of quantum mechanics and the application of quantum mechanical ideas in some simple systems such as particle in a box, rigid rotor, simple harmonic oscillator etc.

3. Students are expected to understand the application of quantum mechanics in some simple chemical systems such as hydrogen atom or hydrogen like ions. The students will also learn chemical bonding in some simple molecular systems

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1,2,3	Background of quantum chemistry	1. Physical Chemistry by H.K Choudhury 2. Physical	Black Board		
4	Postulates of quantum mechanics,				
5,6	quantum mechanical operators				
7	Schrödinger equation and its application to				

	free particle	Chemistry by Puri, Sarma, 3. Quantum Chemistry by Levine 4. Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi. 5. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 4)			
8,9	"particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy				
10,11,12	two and three dimensional boxes, separation of variables, degeneracy.				
13,14	Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy.				
15	Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.				
16,17	Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution.				
18				Home assignment	
19,20,21	Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus.				
22,23,24	Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).				

25	Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches,	McGraw Hill Education; 5th edition. 6. Sen, B. K. Quantum Chemistry- Including Spectroscopy, Kalyani Publishers; 4th edition 7.e-PG pathsala and other internet sources			
26	LCAO-MO treatment of H2+. Bonding and antibonding orbitals. Qualitative extension to H2				
27	Comparison of LCAO-MO and VB treatments of H2 (only wavefunctions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB)				
28,29	Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH).				
30	Localised and non-localised molecular orbitals treatment of triatomic (BeH2, H2O) molecules.				
31	Qualitative MO theory and its application to AH2 type molecules				
32.	Question Answer discussion				
33.	Introduction of Photochemistry, Characteristics of electromagnetic radiation,				
34	Lambert-Beer's law and its limitations, physical significance of absorption coefficients.				
35	Laws, of photochemistry, quantum yield				
36	actinometry, examples of low and high quantum yields,				

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Nalbari College, Nalbari

Teaching Plan for the Session: 2023-24

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry-I

Semester: I

Paper Name: Chemistry-I (3L-OT-IP)

Paper Code: CHE0100104

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

Learning Objectives: 1. On successful completion, students would have clear understanding of the concepts related to atomic and molecular structure, chemical bonding, periodicity and states of matter.

2. Students will be able to work in a chemical laboratory following standard safety protocols.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Unit VIII: Liquid state				Unit test
1	Qualitative treatment of the structure of the liquid state	1. Principles of Physical Chemistry, Puri, Sharma, Pathania, 48th Edition, Vishal Publishing Com.	Black-board		
2,3	Physical properties of liquids: vapour pressure and its determination				
4,5	surface tension and its determination, Effect of addition of various solutes on surface tension				
6,7	Coefficient of viscosity and its determination, Explanation of cleansing action of detergents				

	(micelle formation and critical micelle concentration).	2. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 1) McGraw Hill Education; Sixth edition 3. e-PG pathsala & other internet			
8	Temperature variation of viscosity of liquids and comparison with that of gases				
8	Effect of addition of various solutes on viscosity				
	Unit VII: Gaseous state				
9	Causes of deviation from ideal gas behaviour				
10	compressibility factor, Z, and its variation with pressure and temperature for different gases.				
11,12	State variables and equation of states for real gases; van der Waals equation of state, its derivation and application in explaining real gas behaviour.				
13	Reasons and examples of failure of van der Waal equation of state				
14	Interpretation of vander Waals pressure-volume isotherm				
15,16	Critical state and phenomena, mathematical definition and interpretation of critical point, relation between critical constants and vander Waals constants: along with their thermodynamic interpretation.				
17	Introduction to virial equation and virial coefficients, derivation of Boyle temperature.				
18	Doubt Clearing				

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: II**

Paper Name: Physical Chemistry **Paper Code: CHE-HC-2026**

Learning Objectives: 1.The students are expected to learn laws of thermodynamics, thermochemistry, thermodynamic functions, relations between thermodynamic properties,

2. Students will also understand Gibbs Helmholtz equation, Maxwell relations

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Basics of Thermodynamics	1. Peter, A. & Paula, J. de. Physical Chemistry 9th Ed., Oxford	Black-board/ICT		
2	Intensive and extensive variables; state and path functions				
3	isolated, closed and open systems				
4	zeroth law of thermodynamics.				

5	First law: Concept of heat, q, work, w, internal energy, U	University Press. 2. Levine, I .N. Physical Chemistry 6th Ed., Tata Mc Graw Hill. 3. Puri, B. R.; Sharma, L. R.; Pathania, M. S. Principles of Physical Chemistry, Vishal Publishing Co.; 47th Ed. 4. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 2)			
6	statement of first law;				
7,8	enthalpy, H, relation between heat capacities				
9,10,11, 12	calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.				
13	Law of equipartition of energy, degrees of freedom and molecular basis of heat capacities			Home assignments	
14	Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions				
15	enthalpy of combustion and its applications;				
16,17	calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data				
18	effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions.				
19	Adiabatic flame temperature, explosion temperature.				
20	Doubt clearing class				
21	Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics				
22	molecular and statistical interpretation of entropy				
23,24	Calculation of entropy change for reversible and irreversible processes.				
25	Third Law: Statement of third law, concept of residual entropy				
26	calculation of absolute entropy of molecules.				

27,28	Revision	McGraw Hill Education; Sixth edition 5. e-pg pathsala & other internet sources			

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Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: VI**

Paper Name: INDUSTRIAL CHEMICALS AND ENVIRONMENT **Paper Code: CHE-HE-6026**

Learning Objectives: 1.Students will learn the contribution of industrial chemicals towards air and water pollution and their effects on living organisms and the environment

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Ecosystems.,	1.K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi. 2. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.	Black-board/ICT		
2	Biogeochemical cycles of carbon				
3	Biogeochemical cycles of nitrogen				
4	Biogeochemical cycles of sulphur				
5	Air Pollution: Major regions of atmosphere.				
6	Chemical and photochemical reactions in atmosphere.				
7,8	Air pollutants: types, sources, particle size and chemical nature				

9	Photochemical smog: its constituents and photochemistry	3. Industrial Chemicals and Environment by Puri , Sharma Vishal Publishing Co 4. e-PG Pathsala & other internet sources			
10	Environmental effects of ozone,				
11,12	Major sources of air pollution.				
13	Pollution by SO_2, CO_2, CO, NOx, H_2S and other foul smelling gases.				
14,15	Methods of estimation of CO, NOx, SOx and control procedures.				
16	Effects of air pollution on living organisms and vegetation				
17	Greenhouse effect and Global warming,				
18	Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens			Home assignments	
19	removal of sulphur from coal.				
20	Control of particulates.				
21	Water Pollution: Hydrological cycle, water resources ,aquatic ecosystems,				
22,23	Sources and nature of water pollutants,				
24,25	Techniques for measuring water pollution				
26,27	Impacts of water pollution on hydrological and ecosystems.				
28,29				Seminar presentation	

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Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: IV**

Paper Name: Physical Chemistry **Paper Code: CHE-HC-4036**

Learning Objectives: 1. the students will learn theories of conductance and electrochemistry.

2. Students will also understand some very important topics such as solubility and solubility products, ionic products of water, conductometric titrations etc

3. The students will also gain basic theoretical idea of electrical & magnetic properties of atoms and molecules.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1	Arrhenius theory of electrolytic dissociation.	1. Atkins, P.W & Paula, J.D. Physical Chemistry, 9th Ed., Oxford	Black-board/ICT		
2,3	Conductivity, equivalent and molar conductivityand their variation with dilution for weak and strong electrolytes				
4	Molar conductivity at infinite dilution.				

		University Press 2. Puri, B. R.; Sharma, L. R.; Pathania, M. S. Principles of Physical Chemistry, Vishal Publishing Co.; 47th Ed. 3. Kapoor, K. L. A Textbook of Physical Chemistry (Volume 1) McGraw Hill Education; Sixth edition 4. e-pg pathsala & internet sources			

5,6	Kohlrausch law of independent migration of ions				
7,8,9,10	Debye Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules				
11,12	Ionic velocities, mobilities and their determinations				
13	transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods.			Home assignments	
14	Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water				
15,16	(iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.				
17	Question answer discussion				
18	Basic ideas of electrostatics, Electrostatics of dielectric media			Home assignment	
19	Clausius-Mosotti equation,				
20	Lorenz-Laurentz equation,				
21	Dipole moment and molecular polarizabilities and their measurements.				
22,23	Diamagnetism, paramagnetism, magnetic susceptibility and its measurement, molecular interpretation.				

24,25,26				Seminar presentation by the students	
27,28	Doubt clearing class				

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Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: III**

Paper Name: CHEMISTRY 3 CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY-I **Paper Code:** CHE-RC/HG-3016

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

Learning Objectives: 1. After completion of this course the students will able to understand the chemical system from thermodynamic points of view.

2. They will also learn two very important topics in chemistry- chemical equilibrium and ionic equilibrium.

3. In organic chemistry part, the students are expected to learn various classes of organic molecules-alkyl halides, aryl halides, alcohols, phenols, ethers, aldehydes and ketones.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Ionic Equilibria:				
1	Strong, moderate and weak electrolytes, degree of ionization,		Black-board		
2	Factors affecting degree of ionization, ionization constant				

3	Ionic product of water				
4	Ionization of weak acids and bases,				
5	pH scale, common ion effect				
6,7,8,9	Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts				
10	Buffer solutions.				
11	Solubility and solubility product of sparingly soluble salts				
12	applications of solubility product principle			Question answer discussion	
	Chemical Equilibrium:				
13	Free energy change in a chemical reaction.				
14,15	Thermodynamic derivation of the law of chemical equilibrium.				
16	Distinction between ΔG and ΔGo				
17,18	Le Chatelier's principle			Home assignments	
19	Relationships between Kp, Kc and Kx for reactions involving ideal gases				
20				Doubt Clearing	

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Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: IV**

Paper Name: CHEMISTRY4 SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY **Paper Code:** CHE- RC/HG-4016

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

Learning Objectives: 1. After completion of this course the students learn solutions, phase rule and its application in specific cases,

2. Students will also learn basics of conductance and electrochemistry.

3. Students will also learn some important topics of organic and biochemistry- carboxylic acids, amines, amino acids, peptides, proteins and carbohydrates.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Phase Equilibrium				
1,2	Phases, components and degrees of freedom of a system		Black-board		
3	criteria of phase equilibrium				

4.5	Gibbs Phase Rule and its thermodynamic derivation				
6	Derivation of Clausius – Clapeyron equation and its importance in phase equilibria				
7,8	Phase diagrams of one-component systems (water and sulphur)				
9,10,11	Phase diagrams of two component systems involving eutectics, congruent and incongruent melting points (lead-silver, FeCl3-H2O and Na-K only).				

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Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: V**

Paper Name: ANALYTICAL METHODS IN CHEMISTRY **Paper Code:** CHE-RE-5026

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

Learning Objectives: 1. On successful completion students will be have theoretical understanding about choice of various analytical techniques used for qualitative and quantitative characterization of samples.

2. At the same time through the experiments students will gain hands on experience of the discussed techniques.

3. This will enable students to take judicious decisions while analyzing different samples.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Electroanalytical methods:				
1	Classification of electroanalytical methods		Black-board		
2,3	basic principle of pH metric titration				
4,5	potentiometric titration				

6,7,8	Conductometric titrations.				
9	Techniques used for the determination of equivalence points				
10	Techniques used for the determination of pKa values.				
	Thermal methods of analysis:				
11	Theory of thermogravimetry (TG)				
12,13	Basic principle of instrumentation.				
14	Techniques for quantitative estimation of Ca and Mg from their mixture.				
15				Doubt clearing	

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Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhanju Mani Pathak

Department: Chemistry **Semester: VI**

Paper Name: INDUSTRIAL CHEMICALS AND ENVIRONMENT **Paper Code:** CHE-RE-6026

(Credits: Theory-04, Practicals-02) Theory: 60 Lectures

Learning Objectives: 1. After successful completion of the course, students would have learnt about the manufacture, applications and safe ways of storage and handling gaseous and inorganic industrial chemicals.

2. Students will get to know about industrial metallurgy and the energy generation industry.

3. Students will also learn about environmental pollution by various gaseous, liquid wastes and nuclear wastes and their effects on living beings.

4. Finally, the students will learn about industrial waste management, their safe disposal and the importance of environment friendly "green chemistry" in chemical industry.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Environment and its segments				
1,2	Ecosystems		Black-board		
3,4	Biogeochemical cycles of carbon, nitrogen and sulphur.				

5	Air Pollution: Major regions of atmosphere				
7	Chemical and photochemical reactions in atmosphere.				
8	Air pollutants: types, sources, particle size and chemical nature				
9,10	Major sources of air pollution				
11	Photochemical smog: its constituents and photochemistry				
12	Environmental effects of ozone				
13	Pollution by SO2, CO2, CO, NOx, H2S and other foul smelling gases				
14,15	Methods of estimation of CO, NOx, SOx and control procedures.				
16	Effects of air pollution on living organisms and vegetation				
17	Greenhouse effect and Global warming			Home assignment	
18	Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens				
19	Removal of sulphur from coal. Control of particulates.				
20	Water Pollution: Hydrological cycle, water resources,				
21	aquatic ecosystems				
22,23	Sources and nature of water pollutants,				
24	Techniques for measuring water pollution,				
25	Impacts of water pollution on hydrological and ecosystems.				

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Paper Name : Inorganic Chemistry - 1. Semester – I

Paper Code : CHF- HC-1014 Session : 2018, 2019, 2020, 2021, 2022

Sl no of ecture	Topic/Subtopic	Learning Resources	Mode of teaching	Mode of assessment
1	Atomic Structure : A brief description on historical development in elucidation of structure of atom.	Levine R.K. Prasad B.K. Sen	Class lecture using Chalk and Black Board. Class notes	Home assignment Unit tes
2	Bohr's theory, readius of Bohr's orbit, energy of electron of H atom in Bohr's orbit.			
3	Spectra of H-atom, limitations of Bohrs theory			
4	de-Broglie equation, Hersenberg's Uncertainity Principle. Mathematical problems.			
5	Operators, wave function etc. Postulates of quantum mechanics.			
6, 7	Schrodinger equation for H-atom and its solution, quantum numbers.			
8, 9	Radial wave function, readial probability plot, spherical harmonics, p_x, p_y, p_z orbitals			
10	Shapes of s, p, d, f orbitals. Contour boundary & probability diagream.			
11	Paulis exclusion principle, Hunds rule of maximum multiplicity.			
12	Aufbau principle and its limitations. Variation of orbital energy with atomic no.			

Dr Nabajyoti Deka

Paper Name : Inorganic Chemistry-I Semester – 1

Paper Code : CHE-HC-1014 Session : 2018, 2019, 2020, 2021, 2022

No of lecture	Topic/Subtopic	Learning Resources	Mode of teaching	Mode of assessment
1	Chemical Bonding : Covalent bonding. Lewis electron dot structure, polarity of covalent bond.	Levine B.K. Sen J.D. Lee	Class lecture using chalk and black board. Class notes.	Home assignment Unit test
2	Valence bond theory of covalent bonding			
3, 4	Hybridisation of atomic orbitals. energitics of hybridisation, equ. and non equ. hybrid orbitals. Bent's rule.			
5	Resonance, resonance energy, resonating structure.			
6	Molecular Orbital Theory of covalent bonding.			
7.	Molecular orbital diagram of some diatomic and simple polyatomic molecules.			
8	VSEPR theory, lp. bp. shapes of some molecules and ions using VSEPR theory.			
9	Multiple bonding and bond lengths.			
10.	Covalent character in ionic compounds. Fajan's rule.			
1.	Oxidation - Reduction : Oxidation and reduction reactions, electronic concepts, redox equation.	J.D. Lee Malik, Tuli & Madan	class lecture using chalk and black board Class notes	Home assignment Unit test
2.	standard electrode potential, outlines of electrochemical cell, electrode potential and its application to inorganic reaction.			
3	Principle involved in volumetric analysis, redox titration.			

Dr Nabajyoti Deka.

Paper Name: Inorganic Chemistry - II Semester - III

Paper Code: CHE-HC-3014 Session: 2018, 2019, 2020, 2021, 2022

No of lecture	Topic / Subtopic	Learning Resources	Mode of Teaching	Mode of assessment
1	General Principles of Metallurgy: Metals and non metals, minerals & ores, occurance of metals based on standard electrode potential.	J. D. Lee Puri & Sharma	Class lecture using chalk and black board. Class notes	Home assignment Unit Test
2	Furnaces used in metallurgy, Ellingham diagrams for reduction of metals using C & CO as reducing agent.			
3	Electrolytic reduction (Al from alumina) Hydrometallurgy of Cu.			
4	Purification of metals - Electrolytic, Kroll process, Parting process with specific examples.			
5	Van-Arkel-de Boer process, Mond's process, zone refining with specific examples.			
6.	Discussion on performances of unit test and recommendation.			
1.	Acids and Bases: Arrhenius theory and limitations, Bronsted-Lowry concept.	J. D Lee Malik, Tuli, Madan Puri & Sharma	Class lecture using chalk and black board Class notes	Home assignment Unit Test
2	Solvated proton, relative strength of acids. Types of Acids-Base reactions. Levelling solvent.			
3	Lewis acid-base concept, classification of Lewis acids.			
4.	Lux-Flood concept of acids and bases and its applications in metallurgy.			
5	Hard and soft acids and bases. HSAB principle and its applications.			
6.	Discussion on performances of unit test and recommendation.			
1, 2	Chemistry of s & p Block Elements: A general discussion on the periodic table.	Cotton & Wilkinson J. D. Lee Malik, Tuli, Madan	Class lecture using chalk and black board. Class notes	Home assignment Unit Test
3	Inert pair effect, relative stability of different oxidation states.			
4, 5	Diagonal relationship and anomalous behaviour of first member of each group.			
6.	Allotropy and catenation.			
7, 8	Complex formation tendency of s and p block elements			
9	Discussion on performances of unit test and recommendation.			

Dr Nabajyoti Deka

Paper Name: Inorganic Chemistry III

Paper Code: CHE-HC-4014

Semester – IV

Session: 2018, 2019, 2020, 2021, 2022

No of lecture	Topic/Subtopic	Learning Resources	Mode of Teaching	Mode of assessment
1	Coordination Chemistry: Double salt Vs coordination compounds, Primary & secondary valency, CN, OS, coordination sphere	J D Lee Cotton & Wilkinson	Class lecture using chalk and black board Class notes	Class practo Home assignmen Unit Test
2	Ligands, denticity, different types, special ligands			
3.	Werner's coordination theory			
4,5	Naming of coordination compounds.			
6.	Isomerism in coordination compounds			
7	Stereochemistry of complexes with CN 4 & 6			
8, 9	VBT of coordination complex, inner and outer orbital complex, magnetic behaviour.			
10, 11	CFT, splitting of d-orbitals and its pattern in different geometry.			
12, 13	High and low spin complexes for weak and strong field ligands, TIP.			
14, 15, 16	Splitting energy, measurement of 10 Dq. CFSE for weak & strong field ligand, pairing energy, factors affecting 10 Dq for octahedral and tetrahedral complexes.			
17, 18	Jahn-Teller distortion, octahedral Vs tetrahedral distortion.			
19	Square planar geometry.			
20, 21	MOT of coordination complexes, qualitative aspects of LFT.			
22	Chelates and chelate effect.			
23	Polynuclear complexes.			
24	Labile and inert complexes			
1.	Lanthanoids & Actinoids: Position in periodic table, electronic configuration.	J D Lee	Class lecture using chalk and black board. Class notes	Unit Tes
2	Oxidation states and its stability			
3	Colour, spectral and magnetic properties			
4	Lanthanoid contraction and consequence.			
5.	Seperation of Lanthanoid elements			

Dr Nabajyoti Deka

Paper Name: Analytical Methods in Chemistry

Semester – V

Paper Code: CHE-HE-5024

Session: 2021, 2022

No of lectures	Topic/Subtopic	Learning Resources	Mode of teaching	Mode of assessment
1.	Qualitative and Quantitative Aspects of Analysis: Sampling, evaluation of analytical data	S. J. Borca & P. Saimah	Class lecture using chalk and black board	Unit test
2	Errors, accuracy and precision, methods of their expression.			
3	Normal law of distribution of indeterminate errors.		Class notes	
4	Statistical test of data, F, Q, t test, rejection of data and confidence interval.			
5.	Discussion on performance of unit test and recommendation.			
1.	Optical Methods of Analysis: Origin of spectra, interaction of radiation with matter.	"	"	"
2	Fundamental laws of spectroscopy, selection rule.			
3.	Beer-Lamberts law and its validity.			
4.	Basic principle of UV-vis spectrophotometry.			
5	Instrumentation in single and double beam UV-Vis spectrophotometer.			
6, 7	Basic principle of quantitative analysis using UV. vis spectrophotometer.			
8	Estimation of metal ions in aq solution, geometrical isomers, keto-enol tautomers.			
9	Metal complex composition by Jobs method and mole ratio method.			
10	Preinciple of instrumentation of IR spectroscopy.			
11, 12	FT spectrophotometer, sampling technique.			
13	Structure elucidation through data interpretation.			
14	Isotopic substitution - effect and interpretation.			
15, 16	Basic principle of instrumentation of flame atomic absorption and emission spectroscopy.			
17	Technique of atomisation and sample induction.			
18	Method of back ground correction.			
19	Source of chemical interference and their method of removal.			
20, 21	Technique for quantitative estimation of trace level of metal ions from water samples.			

Dr Nabajyoti Deka

Paper Name: Inorganic Chemistry - IV

Semester - VI

Paper Code: CHE-HC-6014

Session: 2018, 2019, 2020, 2021, 2022

No of lecture	Topic/Subtopic	Learning Resources	Mode of teaching	Mode of assessment
1, 2	Organometallic compounds: Definition, earlier development and classification on the basis of bond type, concept of hepticity of organic ligands.	Gurtu & Gurtu J D Lee	Class lecture using chalk and black board. Class notes.	Unit test
3	Metal carbonyls, 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series.			
4, 5, 6	General methods of preparation of mono and binuclear carbonyls of 3d series.			
7, 8, 9	structure of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni by VBT			
10	π-acceptor behaviour of CO, synergic effect and extent of back bonding using IR data.			
11, 12	Zeise's salt, prepⁿ, structure & evidence of synergic effect			
13	Metal alkyls: Preparation and structure of methyl lithium and tetraalkyl aluminium.			
14	Multicenter bonding, concept of dimer of tetra alkyl aluminium and Ziegler Natta Polymerisation.			
15	species present in ether solution of Grignard reagent and their structure.			
16, 17	Ferrocene: Preparation, ~~st~~ reactions, structures and aromaticity.			
8, 19, 20	Bonding in ferrocene.			
1.	Theoritical Principles in Qualitative Analysis (H_2S scheme): Basic principles involved in analysis of cation and anion.	S. Barua Vogels	Lecture lab demo	Lab practical
2, 3	Chemical reactions involved in anion analysis (dry and wet test)			
4	Reactions involved in cation analysis (dry test)			
5.	solubility product and common ion effect			
6	Group seperation and group reagent			
7	Interfering anions and cause of interference.			
8	Removal of interfering anions.			

Dr Nabajyoti Deka

Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher: Dr. Dhiraj Talukdar

Department: Chemistry **Semester: IV**

Paper Name: ORGANICCHEMISTRY-III **Paper Code: CHE-HC-4026**

Learning Objectives:

1. Students are expected to learn about different classes of N-based compounds; theirstructures, synthesis and reactivity
2. Students shall demonstrate the ability to identify and classify different types of N-based derivatives, alkaloids and hetrocyclic compounds/explain their structure mechanism and reactivity/critically examine their synthesis and reactions mechanism

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Nitrogen Containing Functional Groups	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
1-5	Preparation and important reactions of nitro compounds, nitriles and isonitriles				
6-8	**Amines/** Effect of substituent and solvent on basicity				
8-10	Preparation and properties of amines				
11	Gabriel phthalimide synthesis Carbylamine reaction				
12	Mannich reaction, Hoffmann's exhaustive methylation				

Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher: Dr. Dhiraj Talukdar

Department: Chemistry **Semester: II**

Paper Name: ORGANICCHEMISTRY-I Paper Code: CHE-HC-2016

Learning Objectives:

1. *Students are expected to learn different classes learn, explain, describe and analyze different classes of organic compounds, their reactivities and mechanisms along with stereo chemical considerations.*
2. *Students will be able to identify different classes of organic compounds, describe their reactivity and explain/analyze their chemical and stereo chemical aspects*

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Stereochemistry	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
1 & 2	Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions				
3 & 4	Geometrical isomerism: cis–trans and, syn-anti isomerism				
5 & 6	E/Z notations with C.I.P rules.				
7	*Optical Isomerism/*				

	Optical Activity, Specific Rotation				
8 & 9	Chirality/ Asymmetry				
10 & 11	Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures,				
12, 13 & 14	Relative and absolute configuration: D/L and R/S designations				
15 & 16	Racemic mixture and resolution				
17					Unit Test
	Aromatic Hydrocarbons	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
18 -21	*Aromaticity:* Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples.				
22-25	Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism.				
26-29	Directing effects of the groups				
30					Unit Test
31					Students' seminar

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Teaching Plan for the Session:

Name of the Teacher: Dr. Dhiraj Talukdar

Department: Chemistry **Semester: I**

Paper Name: Chemistry I **Paper Code:** 2023-24

Learning Objectives:

1. This course aims at giving students insight into the fundamental aspects of atoms, ions and molecules in terms of their electronic structure and reactivity
2. Students would have clear understanding of the concepts related to atomic and molecular structure, chemical bonding, periodicity and states of matter
3. Students will be able to work in a chemical laboratory following standard safety protocols

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Unit IV: Structure of organic molecules	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
1	Nature of bonding				
2 & 3	Hybridisation of atomic orbitals (qualitative VB and MO approach);				
4	effect of hybridization on bond properties				
5					Unit Test

	Unit V: Stereochemistry of organic molecules	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
6 & 7	Representation of organic molecules in 2D and 3D (Fischer, Newman and Sawhorse projection formulae and their inter conversions)				
8 & 9	Geometrical isomerism (cis-trans, syn-anti, E/Z notations);				
10 & 11	Concept of chirality (enantiomers and diastereomers)				
12 & 13	configuration and conformation, barriers to rotation, conformational analysis (ethane, butane, cyclohexane)				
14					Unit Test
	Unit VI: Electronic effects in organic molecules	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
15	Concept of electrophiles and nucleophiles;				
16 & 17	inductive effects; resonance, conjugation and delocalisation				
18					Students' seminar

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhiraj Talukdar

Department: Chemistry **Semester: III**

Paper Name: ORGANIC CHEMISTRY-II Paper Code: CHE-HC-3026

Learning Objectives:

1. *Students are expected to learn and differentiate between various organic functional groups; explain, analyze and design transformations between different functional groups*
2. *Students will be able to describe and classify organic compounds in terms of their functional groups and reactivity*

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Alkyl halides	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
1, 2 & 3	Methods of preparation				
4, 5 & 6	nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.				Home assignment

7	nucleophilic substitution vs. elimination.				
	Aryl halides	ChemistryofHalogenated Hydrocarbons/ *Alkyl halides*	Books, E-resources	Chalk & Black Board & ICT	Students' seminar
8 & 9	Preparation, including preparation from diazonium salts.				
10 & 11	nucleophilic aromatic substitution; SNAr,				Home assignment
12	Benzyne mechanism.				
13 &14	Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.				
15 & 16	Organo metallic compounds of Mg and Li– Use in synthesis of organic compounds				Home assignment
17	Unit Test				
18	Students' Seminar				
	Alcohols, Phenols, Ethers and Epoxides:	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
19-21	*Alcohols:* preparation, properties and relative reactivity of 1°,2°,3°alcohols,				
22	Bouveault-Blanc Reduction; Preparation and properties of glycols				
23 & 24	Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement				
25	**Phenols:** Preparation and properties				

26	Acidity and factors effecting it				
27-29	Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism				
30 & 31	**Ethers and Epoxides:** Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and LiAlH4				Home ssignment

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Nalbari College, Nalbari

Teaching Plan for the Session: 2022-23

Name of the Teacher: Dr. Dhiraj Talukdar

Department: Chemistry **Semester: V**

Paper Name: ORGANIC CHEMISTRY-IV **Paper Code:** CHE-HC-5016

Learning Objectives:

1. *This course introduces students to nucleic acids, amino acids and pharmaceutical compounds.*

2. *Students will be familiarized with the importance of nucleic acids, amino acids*

3. *Students will develop their ability in understanding of enzymes, bioenergetics and pharmaceutical compounds.*

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
	Nucleic Acids	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
1 & 2	Components of nucleic acids; Nucleosides and nucleotides				
3	Synthesis and reactions of Adenine				
4	Synthesis and reactions of Guanine				
5	Synthesis and reactions of Cytosine				Home assignment

6	Synthesis and reactions of Uracil				
7	Synthesis and reactions of Thymine				
8 & 9	Polynucleotides: DNA and RNA				
10					Unit test
	Amino Acids, Peptides and Proteins	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test, Home assignment & Students' Seminar
11 & 12	Amino acids, Peptides and their classification				
13-17	α-Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, p*K*a values, isoelectric point and electrophoresis				
18-21	Study of peptides: determination of their primary structures-end group analysis				Home assignment
22-26	Methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups -Solid-phase synthesis				
27 & 28					Unit test & Students' Seminar

Signature of the Teacher

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Semester V

CHE-HC-5016: ORGANIC CHEMISTRY-IV
(Credits: Theory-04, Lab-02)
Theory: 60 Lectures
Course Objectives: This course introduces students to nucleic acids, amino acids and pharmaceutical compounds.
Students will be familiarized with the importance of nucleic acids, amino acids and develop basic understanding of enzymes, bioenergetics and pharmaceutical compounds.
Learning Outcome: Students will be able to explain/describe the important features of nucleic acids, amino acids and enzymes and develop their ability to examine their properties and applications.
Nucleic Acids
Components of nucleic acids; Nucleosides and nucleotides;
Synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine;
Polynucleotides: DNA and RNA
(9 Lectures)
Amino Acids, Peptides and Proteins
Amino acids, Peptides and their classification.
α-Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, p*K*a values,
isoelectric point and electrophoresis;
Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups -Solid-phase synthesis
(16 Lectures)
Enzymes
Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes.
Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action

(including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition).
(8 Lectures)
Lipids
Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenntion of fats and oils, saponification value, acid value, iodine number, rancidity.
(6 Lectures)
Concept of Energy in Biosystems
Cells obtain energy by the oxidation of foodstuff (organic molecules).
Introduction to metabolism (catabolism, anabolism).
ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change.

Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher: Dr. Dhiraj Talukdar

Department: Chemistry **Semester:V**

Paper Name: POLYMERCHEMISTRY **Paper Code:** CHE-HE-5056

Learning Objectives:

1. *Students will learn the definition and classifications of polymers,*
2. *Students will learn kinetics of polymerization, molecular weight of polymers*
3. *Students will learn glass transition temperature, and polymer solutions etc.*
4. *Students will also learn the brief introduction of preparation, structure and properties of some industrially important and technologically promising polymers*

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
1-3	Glass transition temperature (Tg) and determination of Tg	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment

4 & 5	Free volume theory, WLF equation,				
6-8	Factors affecting glass transition temperature (Tg).				
9	Unit Test				
10-12	**Polymer Solution**–Criteria for polymer solubility, Solubility parameter	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
13 &14	Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions,				
15-17	Flory- Huggins theory, Lower and Upper critical solution temperatures				
18	Unit Test				
19	**Properties of Polymer**s (Physical, thermal, Flow & Mechanical Properties). Brief introduction to preparation, structure, properties and application of the following polymers:	Books, E-resources	Chalk & Black Board & ICT	Students' seminar	Unit Test & Home assignment
20	polyolefins, polystyrene and styrene copolymers				
21	poly(vinyl chloride) and related polymers,				
22	poly(vinylacetate)andrelatedpolymers				
23	,acrylicpolymers, fluoropolymers				
24	,polyamidesandrelatedpolymers.				
25	Phenolformaldehyderesins(Bakelite,Novalac),				
26	polyurethanes, silicone polymers,				
27	polydienes, Polycarbonates,				

28	ConductingPolymers,[polyacetylene,polyaniline,poly(p-phenylene sulphide polypyrrole, polythiophene)].				
29					Unit Test
30	Students' seminar				

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Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher: Dr. Purabi Sarmah

Department: Chemistry **Semester: I**

Paper Name:INORGANIC CHEMISTRY-I (CBCS) **Paper Code:**CHE-HC-1016

Learning Objectives: On successful completion, students would have clear understanding of

1.The concepts related to atomic and molecular structure

2.Chemical bonding

3.Periodic properties of elements

4.Redox behaviour of chemical species

Students will also have hands on experience of standard solution preparation in different concentration units and learn volumetric estimation through acid-base and redox reactions.

Portions Taught:

Periodicity of Elements:16 L

s, p, d, f block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to s & p-block. (a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. (b) Atomic radii (van der Waals) (c) Ionic and crystal radii. (d) Covalent radii (octahedral and tetrahedral) (e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy. (f) Electron gain enthalpy, trends of electron gain enthalpy. (g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	The long form of periodic table:s, p, d, f block elements	J. D. LEE Miessler and Tarr James E. Huheey Puri Sharma Kalia Shriver Atkins Puri Sharma Kalia K. D. Sharma	Chalk and Board and PPT Chalk and Board	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.				
L3					
L4					
L5	Atomic radii (van der Waals), Ionic and crystal radii, Covalent radii (octahedral and tetrahedral)				
L6	Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.				
L7					
L8	Electron gain enthalpy, trends of electron gain enthalpy.				
L9	Electronegativity: Definition and its periodic variation, factors affecting electronegativity				
L10	Electronegativity scale: Pauling's scale.Problems discussion				
L11	Electronegativity scale: Mulliken'sscale				
L12	Electronegativity scale: Allred Rachow's/ and Mulliken-Jaffé's scale				
L13	Variation of electronegativity with				

L14	bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.				
L15	Tutorials				
L16					

(iii) Metallic Bond:10L

Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids. (iv) Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions.Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Qualitative idea of valence bond and band theories. Semiconductors and insulators Defects in solids	J. D. LEE Miessler and Tarr James E. Huheey Puri Sharma Kalia Shriver Atkins	Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2					
L3					
L4					
L5	Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions				
L6					
L7	Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment)				
L8					

L9	Effects of chemical force, melting and boiling points, solubility energetics of dissolution process.	Puri Sharma Kalia K. D. Sharma			
L10	Tutorial/ Doubt clearing				

Oxidation-Reduction: 4L

Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Concept of Oxidation and Reduction/Oxidizing agent and reducing agent….Redox equations	Shriver Atkins Puri Sharma Kalia K. D. Sharma	Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Standard Electrode Potential: its application to inorganic reactions				
L3					
L4	Principles involved in volumetric analysis to be carried out in class/problems discussion				

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Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher: Dr. Purabi Sarmah

Department: Chemistry

Semester: III

Paper Name:INORGANIC CHEMISTRY-II (CBCS)

Paper Code:CHE-HC-3016

Learning Objectives On successful completion of this course students would be able

1. To apply theoretical principles of redox chemistry in the understanding of metallurgical processes.
2. Students will be able to identify the variety of s and p block compounds and comprehend their preparation, structure, bonding, properties and uses.
3. Experiments in this course will boost their quantitative estimation skills and introduce the students to preparative methods in inorganic chemistry.

Portions Taught:

Chemistry of s and p Block Elements: 14 L

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Boric acid and borates, boron nitrogen compounds, boranes, carboranes and graphitic compounds, silanes, oxides and oxoacids of nitrogen, phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

Noble Gases: 8L

Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF_2, XeF_4 and XeF_6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF_2). Molecular shapes of noble gas compounds (VSEPR theory).

Inorganic Polymers: 8L

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Silicates – clays and zeolites, polyphosphazenes, metal-organic framework compounds (MOFs).

Teaching Plan:

Chemistry of s and p Block Elements: 14 L

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1 L2	Oxo compounds of Boron: Boric acid and borates - structure, bonding, preparation, properties and uses	J. D. LEE Miessler and Tarr James E. Huheey Puri Sharma Kalia A Sharpe	Chalk and Board and PPT	Concept based questions Doubt clearing Flipped Classroom	MCQ Unit Test/Sessional Exam
L3	Boron nitrogen compounds: Boron nitride, borazine, Boron triazide				
L4 L5	Boron Hydrides or Boranes: structure, bonding, preparation, properties and uses, Classification, Wedge rule, Styx code				
L6	Carboranes and graphitic compounds, Silanes				
L7	Oxides and oxoacids of nitrogen				
L8	Oxides and oxoacids of Phosphorus				
L8	Oxides and oxoacids ofChlorine				
L9	Peroxo acids of sulphur				
L10	Interhalogen compounds				

L11	Polyhalide ions				
L12	Pseudohalogens				
L13	Basic properties of halogens.				
L14	Tutorial (Doubt Clearing)				

Noble Gases: 8L

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Occurrence and uses, rationalization of inertness of noble gases, Clathrates	J. D. LEE Miessler and Tarr James E. Huheey Puri Sharma Kalia	Chalk and Board and PPT	Concept based questions Doubt clearing Flipped Classroom Seminar presentation	Unit test Home assignment
L2	Preparation, Structure and properties of XeF_2				
L3	Preparation, Structure and properties of XeF_4				
L4	Preparation, Structure and properties of XeF_6;				
L5	Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF_2)				
L6	Molecular shapes of noble gas compounds (VSEPR theory).				
L7					
L8	Tutorials				

Inorganic Polymers: 8L

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Types of inorganic polymers, comparison with organic polymers	J. D. LEE Miessler and Tarr James E. Huheey Puri Sharma Kalia	Chalk and Board and PPT	Concept based questions Doubt clearing Flipped Classroom Seminar presentation	Unit test Home assignment
L2	Silicones:synthesis, structural aspects and applications				
L3	Siloxanes:synthesis, structural aspects and applications				
L4	Silicates – clays and zeolites				
L5					
L6	Polyphosphazenes				
L7	Metal-organic frameworkcompounds(MOFs)				
L8	Tutorial				

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Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher: Dr. Purabi Sarmah

Department: Chemistry **Semester: IV**

Paper Name:INORGANIC CHEMISTRY-III (CBCS) **Paper Code:**CHE-HC-4016

Learning Objectives:

On successful completion, students will be able

1. To name coordination compounds according to IUPAC,
2. To explain bonding in Coordination compounds, understand their various properties in terms of CFSE and predict reactivity etc.
3. Also, they will be able to appreciate the general trends in the properties of transition elements in the periodic table and identify differences among the rows.
4. Through the experiments students not only will be able to prepare, estimate or separate metal complexes/compounds but also will be able to design experiments independently which they should be able to apply if and when required.

Portion Taught:

Transition Elements: 14L

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes.

Chemistry of Ti, V, Cr Mn, Fe and Co (Chemistry of first -row transition elements) in various oxidation states as halides, oxides, hydroxides.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE

L1	Transition elements: General Group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties	J. D. LEE Miessler and Tarr James E. Huheey Puri Sharma Kalia Shriver Atkins Puri Sharma Kalia K. D. Sharma	Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2					
L3	Chemistry of Ti: Compounds of Ti invarious oxidation states as halides, oxides, hydroxides /Applications				
L4					
L5	Chemistry of V: Compounds of V in various oxidation states as halides, oxides, hydroxides /Applications				
L6					
L7	Chemistry of Chromium (Cr)				
L8	Chemistry of Manganese (Mn)				
L9	Chemistry of Iron (Fe)				
L10	Chemistry of chromium (Cr)				
L11	Chemistry of Cobalt (Co)				
L12					
L13	Tutorial/ Doubt clearing				
L14					

Lanthanoids and Actinoids: 6L

Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE

L1	Introduction to Lanthanoids: Electronic configuration, oxidation states	J. D. LEE Miessler and Tarr James E. Huheey Shriver Atkins	Chalk and Board and PPT Chalk and Board	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Colour, spectral and magnetic properties,				
L3	Lanthanide contraction and its consequences				
L4	Separation of lanthanides by ion-exchange method only.				
L5	Introduction to Actinoids: Electronic configuration, oxidation states				
L6	Discussion				

Bioinorganic Chemistry:10L

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine. Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Role of Metal ions present in biological systems and their classification according to their action in biological system Geochemical effect on the distribution of metals	Miessler and Tarr	Chalk and Board and	Conceptual questions	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Sodium / K-pump				
L3	Carbonic anhydrase				

L4	Carboxypeptidase	James E. Huheey Shriver Atkins	PPT Chalk and Board	Flipped Classroom MCQ	
L5	Excess and deficiency of some trace metals- effects in our body				
L6	Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity				
L7	Use of chelating agents in medicine				
L8	Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.				
L9					
L10	Tutorial				

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Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher: Dr. Purabi Sarmah

Department: Chemistry

Semester: VI

Paper Name: Inorganic Chemistry (IV)

Paper Code: CHE-HC- 6016

Learning Objectives: By studying this course, the students will be expected

1. To learn about how ligand substitution and redox reactions take place in coordination complexes.
2. Also, to learn about organometallic compounds, comprehend their bonding, stability, reactivity and uses.
3. They will be familiar with the variety of catalysts based on transition metals and their application in industry.
4. On successful completion, students in general will be able to appreciate the use of concepts like solubility product, common ion effect, pH etc. in analysis of ions and how a clever design of reactions, it is possible to identify the components in a mixture.
5. With the experiments related to coordination compound synthesis, calculation of 10Dq, controlling factors etc. will make the students appreciate the concepts of theory in experiments.

Portion Taught:

Mechanism of Inorganic Reactions: 18L

Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans-effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes. Electron transfer reactions.

Teaching Plan:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Introduction to inorganic reaction mechanisms: Dissociative S_N^1 and Associative S_N^2				
L2					
L3	Substitution reactions in square planar complexes: Mechanism of nucleophilic substitution reactions				
L4	Trans effect: Applications of Trans effect				
L5	Theories of Trans effect: The electrostatic Polarization Theory				
L6	The pi-bonding theory		Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L7	Thermodynamic and Kinetic stability: Labile and inert complexes				
L8					
L9	Substitution reactions in octahedral complexes:Mechanism of substitution in octahedral complexes				
L10					
L11					
L12	Kinetics of octahedral substitution				
L13	Ligand field effects and reaction rates				
L14	Electron transfer reactions: Outer sphere/ Inner sphere reactions				
L15					
L16					
L17 & L18	Tutorial/ Doubt clearing/ Solution of previous year questions.				

Transition Metals in Catalysis: 10 L

Study of the following industrial processes and their mechanism: 1. Alkene hydrogenation (Wilkinson's Catalyst) 2. Hydroformylation (Co catalysts) 3. Wacker Process 4. Synthetic gasoline (Fischer Tropsch reaction) 5. Synthesis gas by metal carbonyl complexes.

Teaching Plan:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Catalysts and Catalysis: Criteria for selection of catalyst for industrial process	J. D. LEE Miessler and Tarr James E. Huheey Shriver Atkins	Chalk and Board and PPT Chalk and Board	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Alkene hydrogenation (Wilkinson's Catalyst) and comparison with other catalysts				
L3					
L4	Hydroformylation (Co catalysts)				
L5					
L6	Wacker Process				
L7	Synthetic gasoline (Fischer Tropsch reaction)				
L8	Synthesis gas by metal carbonyl complexes				
L9&L10	Tutorial/ Doubt Clearing				

Signature of the Teacher

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Nalbari College, Nalbari

Teaching Plan for the Session:

Name of the Teacher: Dr. Purabi Sarmah

Department: Chemistry **Semester:V**

Paper Name:ANALYTICAL METHODS IN CHEMISTRY (Honours Elective Paper) **Paper Code:**CHE-HE- 5026

Learning Objectives:

On successful completion of this course students will be able

1. To learn about qualitative and quantitative aspects of analysis such as errors, accuracy, precision, validation of analytical results etc.
2. To familiarize with different analytical methods as well as instrumentation techniques routinely used in chemical analysis.
3. To learn various laboratory techniques such as separation techniques viz. chromatography, solvent extraction etc.
4. To acquire knowledge about different spectroscopic tools and how they are helpful in identification of unknown compounds.
5. Through the experiments students will gain hands on experience of the analytical techniques. This will enable students to take judicious decisions while analyzing different samples.

Portion Taught:

Thermal methods of analysis: 5L

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Teaching Plan:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Theory of thermogravimetry (TG): Introduction and Classification	Analytical Methods in Chemistry by Vishal Publication	Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Basic principle of instrumentation: DTA, DSC, TMA, DMA				
L3	TGA: Instrumentation and Interpretation of TG graph				
L4	Techniques for quantitative estimation of Ca and Mg from their mixture				
L5	Tutorial				

Electroanalytical methods:10 L

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Introduction and Classification of electroanalytical methods	Analytical Methods in Chemistry by Vishal Publication	Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	pH metry: Basic principle and electrometric measurement of P^H& pH metric titrations.				
L3	Conductometric titrations: Principle and basic components				
L4	Determination of equivalence point by conductometric titration				
L5					

L6	Determination of pKa values by conductometric titration				
L7					
L8	Potentiometry: Definition Potentiometric Titration: Principle Potentiometric titration curves				
L9	Construction of electrochemical cells for potentiometric titrations				
L10	Determination of equivalence point by potentiometric titration				

Separation techniques: 15L

Teaching Plan :

Solvent extraction:5L

Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Introduction: Definition and Classification	Analytical Methods in Chemistry by Vishal Publication	Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Principle and efficiency of the technique				
L3	Mechanism of extraction: extraction by solvation and chelation				
L4	Technique of extraction: batch, continuous and counter current extractions.				
L5	Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction				

	of organic species from the aqueous and nonaqueous media.				

Chromatography: 5L

Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Teaching plan:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Introduction: Definition and Classification	Analytical Methods in Chemistry by Vishal Publication	Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Principle and efficiency of the technique				
L3	Mechanism of separation: adsorption, partition, size exclusion & ion exchange				
L4	Development of chromatograms: frontal, elution and displacement methods.				
L5	Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.				

Stereoisomeric separation and analysis:5L

Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC). Role of computers in instrumental methods of analysis.

Teaching plan:

Sl. No of Lecture	Topic/ Subtopic	Learning Resources	Mode of Teaching & ICT Tools	Experiential / Participating Learning Used	Mode of Assessment for CIE
L1	Introduction: Definition and Classification of stereoisomers/optical activity	Analytical Methods in Chemistry by Vishal Publication	Chalk and Board/ PPT	Conceptual questions Flipped Classroom MCQ	MCQ/UNIT TEST/ HOME ASSIGNMENT
L2	Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios				
L3	Why the need of separation of enantiomers and difficulty of their separation. Chiral solvents and chiral shift reagents				
L4	Determination of enantiomeric composition using NMR				
L5	Chiral chromatographic techniques using chiral columns (GC and HPLC) and Role of computers in instrumental methods of analysis.				

Signature of the Teacher

Signature of the HoD