

TEACHING PLAN

(July, 2025 to November, 2025)

Name of the Teacher: Dr. Asha Dhara

Subject: Inorganic Chemistry

Class: M.Sc. 1st year (Chemistry)

Paper: 24 CHE 201 DSOI (Coordination and Crystal Chemistry)

1 st week	Introduction of Chapter Metal-Ligand Bonding, Crystal Field Theory, Discussion of Spectrochemical Series, Calculation of CFSE for low and high spin complex of 3d-series elements.
2 nd week	Discussion on Applications of CFSE, limitations of crystal field theory, Revision of crystal field theory applications and limitations.
3 rd week	Discussion on Jahn-Teller effect and its applications, Ligand field theory, Molecular orbital theory and M.O diagrams; Explanation of M.O diagrams for octahedral and square planar complex including both σ and π bonding, factors affecting ΔE .
4 th week	Test & discussion of full unit - I, Metal-Ligand Bonding.
5 th week	Introduction of Reaction Mechanism of Octahedral transition metal complex - I
6 th week	Discussed topics: Inert and labile complexes & mechanisms for ligand replacement reactions, Revision of discussed topics in class, formations of complexes from aqua ions. Ligand displacement reactions in octahedral complexes - hydrolysis, base hydrolysis, Anation reaction, H_2O ligand exchange reactions, factors affecting ligand substitution in octahedral complexes.
7 th week	Optical rotation, Cotton effect, racemization of tris-chelate complexes, electrophilic attacks on ligands.
8 th week	Discussion on the topic: Thermodynamic aspects (Unit-II) Full text of Unit - I Again & Doubts taken in the class. Thermodynamic aspects: factors affecting stability of metal complexes, Irving-Williams series.

9 th week	Discussion on Reaction mechanism of square-planar Transition metal complexes - II Introduction of ligand displacement reactions (mechanism) in square planar complexes and related Numericals
10 th week	oxidative addition & reductive elimination reaction, Explanation of Trans effect, Applications of Trans effect. Test and revision of completed topics of Unit - III.
11 th week	Explanation of Electron Transfer Processes. Revision of Important Topics of Unit - III Electron transfer Process: Type and mechanism - outer sphere electron transfer and inner sphere electron transfer reactions, electron exchange reactions, factors affecting rate of electron transfer reactions and role of non-bridging ligands.
12 th week	Test of full Unit - III, Assignment given on imp. topics of Unit - III Discussion on topics which are important in Unit - III.
13 th week	Introduction of Unit - IV: Isopoly and Heteropoly acids and salts of mol W Isopoly acids and Isopoly ions, Preparation and Structure of Paramolybdate and Octamolybdate. Revision work given.
14 th week	Again Revision of all topics in Unit - IV. Explanation of heteropoly acids (any clarification into six groups), Keggin's structure of 1:11 and 1:12 - Heteropoly acids and structure of 1:6 heteropoly acids and heteropoly blues.
15 th week	Test of Isopoly and Heteropoly acids - full portion. (Part - 1) Introduction and explanation of crystal structures.
16 th week	Explanation of structures of some binary and ternary crystalline solids such as Fluorite, anti-fluorite, rutile, anti-rutile, crystalite, layered lattices - CdI_2 , BiI_3 , ReO_3 , Mo_2O_7 , NiAs , corundum, perovskite
17 th week	Short Notes written with on topics: Ilmenite, calcite, normal spinel, inverse spinel mineral, well equation and tolerance factor.
18 th week	Test of full Unit - IV. Points resolved and imp. topics discussed in class - (Unit IV).

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Name of the Teacher: Dr. Asha Deka

Subject: Physical Chemistry

Class: M.Sc 1st year. (Chemistry)

Paper: 24CHE201DS02 [Quantum, Thermodynamics and Electrochemistry]

1 st week	Elementary idea of Quantum mechanics, Schrodinger wave eqn for a particle in one dimensional box and its pictorial representation. Schrodinger wave eqn for a particle in 3-D box.
2 nd week	Concept of degeneracy, Schrodinger wave equation for a linear harmonic oscillator and its soln by polynomial method. Zero point energy of a particle possessing harmonic motion.
3 rd week	Schrodinger wave eqn for three dimensional rigid rotator, energy of rigid rotator, space quantization. Schrodinger wave eqn for Hydrogen atom, separation of variable in polar spherical coordinates and its solution.
4 th week	Discussion of Quantum Mechanics, Summary of Quantum mechanics Discussion of Text topics Given.
5 th week	Introduction to laws of thermodynamics, Topics Given for presentation in thermodynamics: law of mass action, Classical - Debye eqn, Applications, etc.
6 th week	Discussion of Text: Unit II Thermodynamics, Assignments checked (on Thermodynamics)
7 th week	Rate law for consecutive and Parallel reaction (1 st order), ionic reactions: Single and double sphere models. Detailed discussion in class on topics single and double sphere models.
8 th week	Influence of solvent and ionic strength, Chain reactions: Hydrogen-bromine reaction & Hydrogen-chlorine reaction, Chain length, apparent

9 th week	apparent activation energy of chain reactions. photochemical reactions (hydrogen-bromine & hydrogen-chlorine sys.). Rice-Herzfeld mechanism of organic molecules decomposition (ethane, acetaldehyde).
10 th week	Discussion on enzyme kinetics, Michaelis-Menten treatment, Lineweaver-Burk plot and Eadie-Hofstee methods, competitive and non-competitive inhibition.
11 th week	Test of full unit - III, Chemical dynamics Doubts resolved & soln given on chemical dynamics.
12 th week	Debye-Huckel theory of ion-ion interaction and activity coefficient, applicability and limitations of Debye-Huckel limiting law, the
13 th week	Its modifications for finite-sized ions, effect of ion-solvent interaction on activity coefficient. physical significance of activity coefficients, mean activity coefficient of an electrolyte. Debye-Huckel-Onsager ^{activity} treatment for aqueous soln and its limitations. Revision of all topics
14 th week	discussion in class of (unit - IV) Electrochemistry. Debye-Huckel-Onsager theory for non-aqueous solutions, Solvent effect on the mobility at infinite dilution.
15 th week	Equivalent conductivity (Λ_{eq}) vs. Concentration $C^{1/2}$ as a function of solvent, effect of ion association upon conductivity (Bjerrum equation)
16 th week	Discussion on Ion Transport in Solution: Ionic movement under the influence of an electric field, mobility of ions ionic drift velocity and its relation with current density, Einstein relation (by absolute mobility and diffusion coefficient).
17 th week	Stokes-Einstein relation, Nernst-Einstein eqn, Walden's rule.
18 th week	Revision of Nernst-Einstein eqn. Test of full (unit - IV), Electrochemistry.

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(July, 2025 to November, 2025)

Name of the Teacher: Dr. Asha Datta

Subject: Organic Chemistry

Class: M.Sc. 1st year (Chemistry)

Paper: 24CHE201DSO3

1 st week	<u>Introduction on nature of bonding in organic mol. Explanation of delocalized chemical bonding. Term conjugation explained, cross conjugation resonance, hyperconjugation studied. Resonance, hyperconjugation and tautomerism.</u>
2 nd week	<u>Aromaticity in benzoic and non-benzoic compounds, Hückel's rule, Detailed study of energy level of π-molecular orbitals, annulenes, Antiaromaticity, Hückel's rule, PMO approach.</u>
3 rd week	<u>Alternate and non-alternate hydrocarbons. Bond weaker than covalent, addition compounds crown ether complexes and cryptates, inclusion compounds, cyclodextrins, catenanes, and rotaxanes.</u>
4 th week	<u>Discussion of imp. topics in class, Text of full unit - I in class, Doubts and revision of 1st unit.</u>
5 th week	<u>Stereochemistry term explanation, Discussion on chirality, elements of symmetry, molecules with more than one chiral centre, diastereomerism, method of resolution, optical purity, Racemate, enantiopure and diastereopure.</u>
6 th week	<u>Group and faces, asymmetric synthesis, Cram's rule, and its modification, Reel's rule, Explanation of conformational analysis of decalins, optical activity in the absence of chiral carbon (Biphenyls, allenes and spiranes).</u>
7 th week	<u>Chirality due to helical, shape, Geometrical isomerism in alkenes and amines, methods of determination, determining the configuration, Practice of CIP rules in class, on Geometrical isomerism.</u>
8 th week	<u>Test of full unit - II, Again revision of stereochemistry full unit. Doubts taken & Revision.</u>

9 th week	Explanation of Topic + Structure and reactivity; types of mechanism. Thermodynamic and kinetic requirements, isotope and thermodynamic control. Hammett's postulate, Cushing-Hammett Principle, Pt. Energy diagram.
10 th week	Full explanation of Topic's transition state and intermediate methods of determining mechanisms, Isotope effect, Generation, Structure, Stability and reactivity of carbocation, Carbanion, free radicals.
11 th week	Carbenes and nitrenes. Effect of structure on reactivity, Hammett of Taft eq. free energy relationship, substituent and reaction constants.
12 th week	Revision of full unit - II (Reaction Mechanism). Imp. topic discussed in class of Unit - II, Text given on half unit.
13 th week	Double bond, The E ₁ , E ₂ and E1cB mechanisms, orientation of the group and medium on reactivity. Doubt and revision again. Text of full (Unit - III).
14 th week	Mechanism and orientation in pyrolytic elimination. Explanation of Topic addition to Carbon-2 multiple bonds; mechanistic and stereochemical aspects of addition reactions involving electrophiles.
15 th week	Learn and revise work of all topics discussed in class, Nucleophiles and free radicals, orientation and reactivity, addition to cyclopropane ring. Hydroseparation of double and triple bond.
16 th week	Hydrogenation of aromatic ring, Text of all topics covered in class, added to elimination reactions. Hydrocyanation reaction, Michael reaction, Sharpless asymmetric epoxidation.
17 th week	Full revision of unit - IV. Doubt and explanation of imp. topic in unit - IV.
18 th week	Text of half unit taken in class: Elimination rxns, Text of a half unit " in class: Addition to Carbon-2 multiple bonds.

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(July, 2025 to November, 2025)

Name of the Teacher: Dr. Asla Duka

Subject: Organic Chemistry Spectral-1

Class: M.Sc. Chemistry 2nd year (Sem-III)

Paper: 2SCHE203 D 503 (Organic Spectroscopy)

1 st week	Introduction of Ultraviolet and visible Spectroscopy. origin, general appearance and designation of UV bands, Selection rules, absorption laws and measurement of absorption Intensity. full detailed study of Ultraviolet Spectrometer. Eg. of Woodward & Fieser rule.
2 nd week	Woodward and Fieser's rules for calculate Ultraviolet absorption maxima for substituted dienes, conjugated dienes, unsaturated carbonyl compounds and aromatic carbonyl comp. Applications of UV spectroscopy to the problems in organic chemistry.
3 rd week	Revision work given & imp. topic discussed related to unit - Ultraviolet and visible spectroscopy.
4 th week	Test of full unit - 1 (Ultraviolet and visible Spectroscopy). Doubts taken. Explained term Infrared Spectroscopy. Basic theory and instrumentation including FT-IR infrared spectrum. Intensity and position of infrared absorption bands and bands resulting from the combination or difference of vibrational frequencies.
5 th week	Assignment Given on Unit - II (Infrared Spectroscopy). Presentation Given on Particular topics throughout the full unit - II. Doubts resolved and revision work in class of imp. topics related to IR.
6 th week	Definition of NMR (Nuclear Magnetic Resonance Spectroscopy). Explanation of spin active nuclei behave as spinning nuclear magnets, orientation of spinning nuclear magnets in a uniform field and energy description of NMR phenomena.
7 th week	Revision work given in class of above topics taught in NMR spectroscopy. Continuous Wave NMR Spectrometer and Fourier transform NMR Spectrometer. Phenomena of resonance and relaxation, chemical shifts (full detail).
8 th week	Chemical Shift Parameters and internal Standards. Factors affecting the chemical shift: shielding and deshielding of a nucleus, substitution effects, leading to empirical correlations for proton chemical shift, anisotropic effect, effect of changing solvent.

9 th week	Effect of H-bonding, Influence of Chirality on the chemical shift of enantiomers, intermolecular Van der Waals' clashing, Spin-2 coupling, multiplicity of splitting and relative intensity of lines in a multiplet.
10 th week	Integration mechanism of coupling - one bond coupling (1J), two bond coupling (2J), three bond coupling (3J) including Karplus relationship. Techniques for simplification of complex spectra, solvent effect, lanthanide shift reagents.
11 th week	Spin decoupling (double resonance) - full detail & explanation, Fourier Transform Tech. and NOE effect of sensitivity of ^{13}C NMR compared to ^1H NMR, comparison of ^{13}C NMR, ^1H NMR chemical shift of ^{13}C NMR, off-resonance decoupling.
12 th week	Text of full unit-III, Doubts cleared & full topic discussion of Unit-III. Again Revision of full unit (NMR Spectroscopy).
13 th week	Explanation of Mass Spectrometry. Basic theory & Introduction, Instrumentation, Process of introducing the sample into the mass spectrometer, Revision of topic mass spectrometry.
14 th week	Methods of generation of positively charged ions, Electron ionization method, Chemical ionization, field desorption and fast atom Bombardment (FAB) techniques.
15 th week	Mass spectrum, explanation of mass spectrum with example, Revision of all above topics in Unit-IV. Base Peak, molecular and Parent ion.
16 th week	Mass to charge ratio (m/z) explained. Revision. Relative intensity, Fragment ions, even electron rule, nitrogen rule, metastable ions, McLafferty rearrangement and other effects. Determination of molecular weight and molecular formula using mass spectrometry.
17 th week	Doubts & Revision work. Text of full unit-IV mass Spectrometry. Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD) explained.
18 th week	Again full Revision of mass Spectrometry. Text of Unit-IV (Mass Spectrometry).

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(July, 2025 to November, 2025)

Name of the Teacher: Dr. Ashu Dhuka

Subject: Organic Chemistry Special-II

Class: msc chemistry, 2nd year (Sem-III)

Paper: 25 CHE 203 D 206.C Natural Products chemistry

1 st week	Introduction on vitamins, Explanation of structure and synthesis of different vitamins. like vitamin A, B ₁ , B ₂ , B ₆ .
2 nd week	Structure and synthesis of vitamins C, D, & E. Revision of above discussed topics in class. Test of all vitamins & doubts resolved in class.
3 rd week	Nicotinic acid, Pantothenic acid and biotin. Again work of revision & doubts taken in full unit-1 (vitamins)
4 th week	carotenoids: full Introduction, General methods of structure elucidation and synthesis of α -Carotene, β -Carotene, Lycopene and γ -Carotene. Biosynthesis of carotenoids.
5 th week	full revision of Carotenoids. Assignment making work given. Test of full unit of Carotenoids (unit-II) & doubts resolved in class.
6 th week	Introductory Part of Enzymes and Co-enzymes. Introduction to biological catalysis, Nomenclature, Classification and Specificity. Revision of Enzymes and Co-enzymes.
7 th week	Enzymes - Catalyzed reactions: oxidation-reduction (full explanation), Trans isomerisation explained, epimerisation, hydrolysis, phosphorylation. Revision work of all topics covered in class.
8 th week	Acylation, methylation, decarboxylation and dehydration. Revision, explanation of Co-enzymes. Chemistry of Co-enzymes Co-I, Co-II, Co-A, Carboxylase, fmn, FAD and Pyridoxal phosphate.

9 th week	Revision of full Unit - III (Enzymes and Co-enzymes, Enzymes catalyzed rxn & Co-enzymes). Doubts and soln Given. Test of full unit - III.
10 th week	Remaining Part of Unit - II (Porphyrins) explained. Term Porphyrins explained. Structure, Spectral Properties and Synthesis of porphyrins
11 th week	Structure of chlorophyll (with-out synthesis), Revision, Doubts taken on Porphyrins. Test of Half unit - II (Porphyrins) Assignment work on particular topic.
12 th week	Plant Pigments! Detailed study. Occurrence, General Chemical and Spectroscopic methods for structure determination. Revision, & Test of all topics covered in class
13 th week	Structure elucidation and synthesis of Flavone, Chrysin, Flavonol, quercetin, diosmin, xanthone, oxonanthone, cyanidin chloride.
14 th week	Revision of all topics. Malvidin chloride, his lutein chloride, Biosynthesis of flavonoids, acetate pathway and shikimic acid pathways.
15 th week	Again Revision of imp. topics of unit - IV (Plant Pigments) Test of full unit - IV (Plant Pigments)
16 th week	Again Doubts taken and Revision work Given of unit - IV Again Test of full unit - IV
17 th week	Assignment work Given unitwise and doubts taken in class. Test of each unit one by one and Revision work Given in class.
18 th week	Test of full Syllabus & soln Given & Doubts ^{taken} clared in class

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Name of the Teacher: Dr. Asha Deka

Subject: Organic Chemistry Special - III

Class: M.Sc. 2nd Year (Sem - III)

Paper: 25CHE203 D 509 (Heterocyclic Compounds, Ylides and synthetic drugs)

1 st week	Heterocyclic Compounds full Introduction, General behaviour, Classification, (revisit of aromaticity, tautomerism). Revision of all discussed topics in class. <u>Test of Heterocyclic compounds.</u>
2 nd week	Five-membered Heterocycles: Synthesis and reactions of 1,3-oxazoles - imidazole, thiazole and oxazole. Assignments & revision work given.
3 rd week	Six-membered <u>Test of half unit-I - Heterocyclic compounds</u> , Doubts cleared in class. <u>Test of full unit - I - Heterocyclic comp and five-membered Heterocycles</u>
4 th week	Six-membered Heterocycles with two heteroatoms: Detailed study of Pyrimidines and Purines, Structural elucidation of uric acid and caffeine. <u>Practice of all topics done in class & revision work given.</u>
5 th week	<u>Test of Six-membered Heterocycles with two heteroatoms.</u> <u>Again revision of unit-I is done in class.</u> <u>Introduction of Nucleosides and nucleotides.</u>
6 th week	<u>Explanation</u> <u>Structure of nucleosides and nucleotides, General synthesis of nucleotides and polynucleotides.</u> Assignment work in class is given.
7 th week	<u>Test of full unit-II in class.</u> <u>Again Practice and Revision of unit-II.</u> <u>Introduction on ylides, types and general method of preparation</u>
8 th week	<u>Practice and revision of above two units - unit I & unit-II</u> <u>Ylides: General study of reactions with their mechanism and application - Nitrogen (azomethine, diazonium and nitro).</u>

9 th week	Practice of all topics covered in class of ylides. Introduction and explanation of Phosphorous and sulfur ylides. Revision of full unit - III (ylides)
10 th week	Practice of imp. topics on ylides, which are discussed in class. Doubts resolved and further exp ⁿ are given on ylides. Text of full unit - III (ylides)
11 th week	Introductory part of Synthetic Drugs: What are synthetic drugs Relation b/w Physiological action and chemical constitution Revision of all topics discussed in class on synthetic drugs
12 th week	Antimalarials, antipyretics, analgesics. Revise & practice work on all three topics in class. Text of topic covered in class on synthetic drugs
13 th week	Supple drugs, antifertility and anticancer drugs. Again imp. topics like Antipyretics, analgesics are explained in class
14 th week	Full revision of unit - IV on synthetic drugs Assignments Given in class on short notes of synthetic drugs.
15 th week	Doubts taken and practice work in class is given on unit - IV Test of full unit - IV (Synthetic drugs).
16 th week	Again Tests taken of unit - I including five-membered Heterocycles Revision of unit - II, Revision of unit - I & unit - II in combination.
17 th week	Tests of unit - II and unit - III Revision & Practice of unit - IV - synthetic drugs. Again Test of unit - IV
18 th week	Full syllabus Test, Doubts throughout the syllabus discussed in class, Practice & Revision.