

## Lesson Plan

**MCM DAV College for Women, Sector – 36A, Chandigarh**  
**Monthly Teaching Plans (Odd Semester)**  
**Session – (2022-23)**

**Name of the Teacher/s:** Dr. Shefali Dhiman, Dr. Rishu

**Department:** Chemistry

**Class:** M.Sc.II

**Subject:** Applications of Spectroscopy CH-511

S. No.	Date (Monthly)		Topics to be Covered	Academic Activity Undertaken*
	From	To		
1.	21-07-2023	02-08-2023	Electron Spin Resonance Spectroscopy: Hyperfine coupling, spin polarization for atoms and transition metal ions, spin orbit coupling and significance of g-tensors, application of transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as $\text{PH}_4$ , $\text{F}_2$ and $[\text{BH}_3]$ .	Lecture Method, PPT) Case Studies and Online Sources
2.	03-08-2023	20-08-2023	Ultraviolet and Visible Spectroscopy: Various electronic transitions (185-800nm), Beer-Lambert law, effect of solvent on electronic transition, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser- Woodward rules for conjugated dienes and carbonyl, ultraviolet spectra of aromatic and heterocyclic compounds. Steric effect in biphenyls.	Lecture Method, PPT and Group Discussion
3.	21-08-2023	12-09-2023	Nuclear Magnetic Resonance of Paramagnetic: Substances in Solution The contact and pseudo contact shifts, factors affecting nuclear relaxation Some applications including biochemical systems, an overview of NMR of metal nuclides with emphasis on $^{195}\text{Pt}$ and $^{119}\text{Sn}$ NMR.	Lecture Method, PPT and Online Sources
4.	13-09-2023	05-10-2023	Infrared Spectroscopy: Instrumentation and sample handling. Characteristics vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers phenols and amines.	Lecture Method, PPT and Group Discussion

			Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters amides acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding of solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance. FT-IR of gaseous, solid and polymeric materials. Nuclear Magnetic Resonance Spectroscopy: General introduction and definition, chemical shift, spin interaction, shielding mechanism of measurement, chemical shift values and correlation for protons bonded to carbon (aliphatic,olefinic,aldehydic and aromatic) another nuclei (alcoholic, phenols, enols, carboxylic acids, amines, amides & mercaptan),chemical exchange.	
5.	06-10-2023	Till exam	Mossbauer Spectroscopy: Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe +2 and Fe +3 compounds including those of intermediate spin, (2) Sn +2 and Sn +4 compounds- nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.	Lecture Method, , PPT Case Studies and Online Sources)
6.	21-07-2023	03-08-2023	Effect of deuteration, complex spin-spin interaction between two, three, four, five nuclei (first order spectra) virtual coupling, stereochemistry, hindered rotation, Karplus curve variation of coupling constant with dihedral angle. simplification of complex spectra- nuclear magnetic double resonance, contact shift reagents, solvent effects, Fourier transform technique, nuclear over hauser effect (NOE) resonance of other nuclei –F, P	Lecture Method, PPT and Group Discussion
7.	04-08-2023	22-08-2023	Vibrational Spectroscopy: Symmetry and shapes of AB <sub>2</sub> , AB <sub>3</sub> , AB <sub>4</sub> , AB <sub>5</sub> and AB <sub>6</sub> mode of bonding of ambidentate ligands. Ethylenediamine and diketonato complexes, applications of resonance	Lecture Method and Online Sources
8.	23-08-2023	15-09-2023	Carbon-13 NMR spectroscopy: General considration chemical shift (aliphatic olefinic alkyne aromatic eteroaromatic and carbonyl carbon) coupling constants. Two-dimension NMRspect-	Lecture Method, PPT and Group Discussion

			rospectroscopy –COSY, NOESY, DEPT, APT and INADEQUATE technique.	
9.	16-09-2023	08-10-2023	Raman spectroscopy particularly for the study of active sites of metalloproteins.	Lecture Method and Online Sources
10.	08-10-2023	Till exam	NMR spectroscopy –COSY, NOESY, DEPT, APT and INADEQUATE technique. Mass Spectrometry: Introduction, ion production –EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional group, molecular ion peak, metastable peak, McLafferty rearrangement. nitrogen rule, high resolution mass spectrometry. Example of mass spectral fragmentation of organic compounds with respect to their structure determination.	Lecture Method, PPT and Group Discussion
<b>Departmental Meeting to Coordinate and Review the Monthly completion of Syllabus as per lesson plans</b>				
18 <sup>th</sup> August, 2023	The teachers have completed the scheduled chapters and topics as shown in the lesson plan			
<b>Departmental Meeting to Coordinate and Review the Monthly completion of Syllabus as per lesson plans</b>				
16 <sup>th</sup> September, 2023	The teachers have completed the scheduled chapters and topics as shown in the lesson plan			
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20 <sup>th</sup> October, 2023	The teachers have completed the scheduled chapters and topics as shown in the lesson plan			
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\***Any of these** – (i) Lecture Method; (ii) PPT; (iii) Online Sources; (iv) Group Discussion; (v) Case Studies etc. Other Methods adopted by the teacher – Please write the specific teaching method

## Lesson Plan

**MCM DAV College for Women, Sector – 36A, Chandigarh**  
**Monthly Teaching Plans (Odd Semester)**  
**Session – (2023-24)**

**Name of the Teachers:** Dr. Madhuri Tanaji Patil

**Department:** Chemistry

**Class:** M.Sc II

**Subject:** Heterocyclic Chemistry (CH-513)

Date (Monthly)		Topics to be Covered	Academic Activity Undertaken*
From	To		
21.07.2023	05.09.2023	UNIT 1: Nomenclature of Heterocycles Replacement and systematic nomenclature (Hantzschwidman System) for monocyclic fused and bridged heterocycles Aromatic Heterocycles. General chemical behaviour of aromatic heterocycles classification (structural type) criteria of aromaticity (bond length ring current and chemical shift in H NMR- Spectra empirical resonance energy delocalization energy and Dewar resonance energy Diamagnetic susceptibility exaltations) Non- aromatic Heterocycles. Strain-bond angle and torsional strains and their consequences in small ring heterocycles.	Lecture Method & Group Discussion about Introduction to relevant reference books And marking system in final paper
06.09.2023	20.09.2023	UNIT 1: Nomenclature of Heterocycles Conformation of six-membered heterocycles with reference to molecular Geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Stereo-electronic effects- anomeric and related effects Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions.	Lecture Method & Case Studies. For Practice of nomenclature
21.09.2023	04.10.2023	. UNIT 2: Heterocyclic synthesis Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition Reactions. Three- membered and four-membered heterocycles- synthesis and reactions of aziridines, oxiranes, thiiranes, azetidines, oxetanes and thietanes. Synthesis and reaction including medicinal applications of benzo pyrroles, benzofurans and benzothiophenes	Lecture Method & Group Discussion for paper solving by giving Assignment

05.10.2023	18.10.2023	<p>UNIT 3: Meso-ionic Heterocycles</p> <p>General classification chemistry of some important meso-ionic heterocycles of type-A and B and their applications.</p> <p>Six-Membered Heterocycles with One Heteroatom</p> <p>Synthesis and reactions of pyrylium salt and pyrones and their comparison with Pyridinium &amp; thiopyrylium salt and Pyridones synthesis and reactions of Quinolizinium and benzopyrylium salt coumarins and chromones</p> <p>Six-Membered Heterocycles with Two or More Heteroatoms: Synthesis and reactions of diazines, triazines, tetrazines and thiazine</p>	Lecture Method & group Discussion. Revision and question papers discussion
19.10.2023	31.10.2023	<p>Unit 4: 1,2-Azoles: pyrazoles, isothiazoles and isoxazoles</p> <p>Introduction to 1,2-azoles, synthesis of 1,2-azoles.</p> <p>Addition on nitrogen: protonation, N-alkylation, N-acylation. Reaction with electrophilic and nucleophilic reagents. Reaction with bases: reaction of N-metallated pyrazole, reaction of C-metallated 1,2-azoles. Reaction with oxidizing and reducing agents</p>	
01.10.2023	Till exams	<p>Unit 4: 1,3-Azoles: imidazole, thiazoles and oxazoles</p> <p>Introduction to 1,3-azoles, synthesis of 1,3-azoles.</p> <p>Addition at nitrogen: protonation, N-alkylation, N-acylation. Reaction with electrophilic and nucleophilic reagents. Reaction with bases: reaction of N-metallated imidazole, reaction of C-metallated 1,3-azoles. Reaction with oxidizing and reducing agents. Synthesis and reaction of quaternary 1,3-azolium salt and 1,3-azole-N-oxide.</p>	
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11 <sup>th</sup> November, 2023	The teachers have completed the scheduled chapters and topics as shown in the lesson plan
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## Lesson Plan

**MCM DAV College for Women, Sector – 36A, Chandigarh**  
**Monthly Teaching Plans (Odd Semester)**  
**Session – (2023-24)**

**Name of the Teacher/s:** Dr. Aanchal Batra

**Department:** Chemistry

**Class:** MSc II

**Subject:** Organtransition Metal Chemistry

S.No.	Date (Monthly)		Topics to be Covered	Academic Activity Undertaken*
	From	To		
1	21.08.2023	04.09.2023	Basic Reactions: Oxidative Addition, Reductive elimination, Migratory Insertion, Beta hydride elimination. 18 electron Rule, Metal Carbonyl complexes	Lecture Method and Online Sources
			Compounds of Transition Metal Carbon multiple Bonds Alkylidenes, alkylidyne, low valent Carbenes and carbynes-Synthesis, nature of bond, Structural Characteristics, nucleophilic and Electrophilic reaction on the ligands, role in organic synthesis	Lecture Method, Online Sources and Group discussions
2	05.09.2023	19.09.2023	Alkyls and Aryls of Transition Metals Types, routes of synthesis, Stability and decomposition Pathways, organocopper in Organic Synthesis	Lecture Method, Group discussions and assignments
			Transition Metal Compounds with Bonds to Hydrogen Transition metal Compounds with bonds to hydrogen	Lecture Method, Class seminars, Unit test
3	20.09.2023	05.10.2023	Homogeneous Catalysis  Stoichiometric reaction for catalysis, homogeneous catalytic hydrogenation,	Lecture Method and Diagrammatic Representations

4.	06.10.2023	19.10.2023	Transition Metal Complexes of alkenes, alkynes, allyls Transition Metal Complexes with unsaturated Organic molecules, alkenes, alkynes, Allyl, diene, dienyl, arene and trienyl complexes, preparations, properties, nature of bonding and structural features important reactions relating to nucleophilic and electrophilic attack on ligands and to organic synthesis	Lecture Method and Diagrammatic Representations
5	20.10.2023	31.10.2023	Homogeneous Catalysis (cont.) Zeigler-Natta polymerization of olefins, catalytic reactions involving carbon monoxide such as hydrocarbonylation of olefins (oxo reaction) oxopalladation reactions, activation of C-H bond	Lecture Method, Class seminars, Unit test
6	01.10.2023	Till exams	Fluxional Organometallic Compounds Fluxionality and dynamic equilibria in compounds such as $\eta^2$ olefin, $\eta^2$ Allyl and dienyl Complexes	Lecture Method, Class seminars, Unit test
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## Lesson Plan

**MCM DAV College for Women, Sector – 36A, Chandigarh**  
**Monthly Teaching Plans (Even Semester)**  
**Session – (2023-24)**

**Name of the Teacher/s:** Dr. Aanchal Batra

**Department:** Chemistry

**Class:** MSc II

**Subject:** Biophysical Chemistry

S.No.	Date (Monthly)		Topics to be Covered	Academic Activity Undertaken*
	From	To		
1	09 -01- 2024	31-01-2024	Biological Cell and its Constituents Biological cell, DNA and RNA in living systems. Basic consideration. Proximity effects and molecular adaptation	Lecture Method and Online Sources
			Bioenergetics and ATP cycle Standard free energy change in biochemical reaction, exergonic, endergonic reactions. Hydrolysis of ATP, synthesis of ATP from ADP, metal complexes and transition of energy, chlorophylls, photo system I and photo system II in cleavage of water	Lecture Method, PPT, Assignments, Unit test
2	01.02.2024	29.02.2024	Enzymes, Mechanism of Enzyme Action Introduction and historical perspective, chemical and biological catalysis, Remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michaelis-Menten	Lecture Method, Group discussions and assignments

			and Lineweaver-Burk plots, reversible and irreversible inhibition.	
			<p>Thermodynamics of biopolymer solutions, Cell membranes and transport of ions</p> <p>Thermodynamics of biopolymers solutions, osmotic pressure, membrane equilibrium, muscular contraction and energy generations in mechanochemical system.</p> <p>Structure and function of cell membrane, ion transport through cell membrane, Na<sup>+</sup> /K<sup>+</sup> Pump. Irreversible treatment of membrane transport. Nerve conduction.</p>	Lecture Method, PPT, Group discussions
3	01.03.2024	15.04.2024	<p>Kinds of reactions Catalysed by Enzymes, Co-enzyme Chemistry</p> <p>Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reaction, enolic intermediates in isomerization reactions, β-cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation</p> <p>Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological function of coenzyme A, thiamine pyrophosphate, Pyridoxal phosphate, NAD<sup>+</sup>, NADP<sup>+</sup>, FMN, FAD, lipoic acid, vitamin B12. Mechanism of reaction catalyzed by the above cofactors</p>	Lecture Method and Diagrammatic Representations

			Biological macromolecules, interactions & structural transitions Nucleotide, torsion angles in poly nucleotide chains, the helical structure of polynucleic acids, high order structure in polynucleotides. Basic principles of interaction between molecules, water structure and its interaction with biomolecules, dipole interactions, side chain interactions, electrostatic interactions, base pairing in nucleic acids, base stacking, hydration and the hydrophobic effect. Coil – helix transitions in proteins, statistical methods for predicting protein secondary structures; melting and annealing of polynucleotide duplexes, helical transitions in double stranded DNA, super coil dependent DNA transitions predicting helical structures in genomic DNA.	Lecture Method, PPT, Assignments, Unit test
4	16.04.2024	Till exam	Biological Macromolecules, Proteins Basic features of macromolecules, their configurations and conformations. Amino acids, the unique protein sequence, secondary structures of proteins, helical symmetry, effect peptide bond on protein conformations, the structure of globular proteins.	Lecture Method Diagrammatic Representations, Referred many books
			Separation & Characterization of biological macromolecules Sedimentation, moving boundary sedimentation, zonal sedimentation, general principles of electrophoresis, electrophoresis of proteins and nucleic acids, capillary electrophoresis.	Lecture Method, PPT, Class seminars by students
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23-02-2024	The teachers have completed the scheduled chapters and topics as shown in the lesson plan
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27-04-2024	The teachers have completed the scheduled chapters and topics as shown in the lesson plan
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## Lesson Plan

**MCM DAV College for Women, Sector – 36A, Chandigarh**  
**Monthly Teaching Plans (Even Semester)**  
**Session – (2023-24)**

**Name of the Teacher/s:** Dr. Swatika Sharma

**Department:** Chemistry

**Class:** M.Sc. II

**Subject:** Natural Products

S. No.	Date (Monthly)		Topics to be Covered	Academic Activity Undertaken*
	From	To		
1	09 -01- 2024	28-01-2024	Unit 1: <u>Terpenoids and Carotenoids</u>  Classification, nomenclature occurrence isolation general methods of structure determination, isoprene rule. Structure determination stereochemistry, Biosynthesis and synthesis of : citral, Terpeneol, Farnesol, santonin, phytol, Abietic Acid and Beta-Carotene.	Lecture method, Online sources
2	29.01.2024	27.02.2024	Unit-II: <u>Alkaloids</u> :  Definition, nomenclature and physiological action occurrence isolation general method of structure elucidation degradation classification based on nitrogen heterocyclic ring role of alkaloids in plants. Structure stereochemistry, synthesis and biosynthesis of: Ephedrin, Conine,	Lecture method

			Nicotine, Atropine, Quinine and Morphine.	
3	28.02.2024	23.03.2024	Unit-III: <u>Steroids</u> Occurrence nomenclature basic skeleton. Diel's hydrocarbon and Stereochemistry, isolation, structure determination and synthesis of: Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of steroids.	Lecture Method, Online Sources
4	24.03.2024	Till exam	Unit-IV: Plant pigments Occurrence nomenclature and general methods of structure determinations, isolation and synthesis of: Quercetin, Quercetin-3-Glucoside, Vitexin, Diadzein, Cyanidin-7-arabinoside, cyanidine, Histidine. Biosynthesis of Flavonoids: Acetate pathway and shikimic acid pathway. Porphyrins: structure and synthesis of haemoglobin and chlorophyll Prostaglandins: Occurrence, nomenclature biogenesis and synthesis of: PGE2 and PGF2 Synthesis and reaction of Pyrethroids and Rotenone.	Lecture Method
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## Lesson Plan

**MCM DAV College for Women, Sector – 36A, Chandigarh**  
**Monthly Teaching Plans (Even Semester)**  
**Session – (2023-24)**

**Name of the Teachers:** Dr. Qudrat Hundal, Dr. Madhuri Tanaji Patil

**Department:** Chemistry

**Class:** M.Sc II

**Subject:** Organic Synthesis I (CH-522)

Sr. No.	Date (Monthly)		Topics to be Covered	Academic Activity Undertaken*
	From	To		
1	09.01.2024	31.01.2024	Unit I: Organometallic Reagents Principle, Preparations, of the Organolithium and organomagnesium compounds in organic synthesis with mechanistic details Unit II Organic Synthesis: Introduction to Retrosynthesis, Electrophilic substitution reactions, Discussion of possible retrosynthesis routes of a target molecule and their comparison, Latent polarity, Linear and Convergent synthesis, Umpolung and synthesis of cyclic molecules.	Lecture method PPT Group Discussion
2	01-02-2024	18.02.2024	Unit I: properties and applications Organolithium and organomagnesium compounds: Hg, Zn and Ce Compounds Transition metals: Cu, Pd, Ni, Fe, Co, Rh, Cr and Ti Compounds Unit II Organic Synthesis: Functional Group Interconversions (FGIs), Retrosynthesis: Strategy and Planning, Practice examples elucidating all principles, Chemoselectivity, protecting groups laying more emphasis on protection of carbonyl groups, alcohols and	Lecture method Group Discussion

			amines. Protection of just one of two identical groups. How to avoid the use of protecting groups and its advantages and disadvantages. Regioselectivity, Methods for the preparation of alkenes, regioselective additions to alkenes, ketones, nucleophilic addition to $\alpha$ , $\beta$ -unsaturated carbonyl compounds, nucleophilic addition to epoxides, Oxidation of ketones to esters and Practice examples	
3	19-02-2024	05-03-2024	<p>Unit I: Other elements: Si, B and iodine (I) Compounds</p> <p>Unit II Organic Synthesis: Stereoselectivity, Stereospecific reactions and stereoselective reactions, Cram's rule and Falkin-Ahn model and discussion of practice examples.</p> <p>Unit III Oxidation: Introduction, Oxidation of alkenes i.e. Epoxidation, Perhydroxylation using <math>\text{KMnO}_4</math>, <math>\text{OsO}_4</math>, Oxidation with iodine and silver carbonate (Woodward reaction and Prevost reaction), Wacker process, oxidative cleavage of double bond, Lemieux reagent, Oxidation of Aromatic rings and Aromatic amines, Oxidation of saturated C-H groups (activated and inactivated), Oxidation of alcohols by chromic acid, DMSO, Ders-Martin reagent, <math>\text{MnO}_2</math>, silver carbonate, Oppenauer oxidation. Oxidation of diols, oxidation of aldehydes and ketones.</p>	<p>Lecture method Group Discussion <b>Assignment given</b></p> <p>Lecture method Presentation using OHP Presentation by students</p>
4	06-03-2024	16.03.2024	<p>Unit IV: Reduction Introduction Different reductive processes Hydrocarbons-alkanes, alkenes, alkynes and aromatic rings carbonyl compounds-aldehydes, ketones, acids and their derivatives</p>	<p>Lecture method Group Discussion</p>
5	18.03.2024	25.03.2024	<p>Unit III: Reduction epoxides. nitro, nitroso, azo and oxime groups. Hydrogenolysis</p>	<p>Lecture method Assignment given</p> <p>Question papers discussed.</p>

6	26.03.2024	08.04.2024	. Unit III Oxidation: Oxidation of Carboxylic acids, amines, hydrazine and sulphides. Oxidation with Ruthenium Tetroxide, Thallium nitrate and iodobenzene diacetate.	Lecture method, PPT, Online sources & Revision
7	09.04.2024	Till exam	Unit IV Rearrangements: Introduction, migratory aptitude, memory effects, Pinacol-pinacolone rearrangement, Wagner Merwin, Demjanov, Wolff, Beckmann, Hoffmann, Curtius, Schmidt, Baeyer-villager, Neber, Shapiro, Favorskii and benzylic rearrangements	Lecture method Group Discussion

**Departmental Meeting to Coordinate and Review the Monthly completion of Syllabus as per lesson plans**

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**Departmental Meeting to Coordinate and Review the Monthly completion of Syllabus as per lesson plans**

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## Lesson Plan

**MCM DAV College for Women, Sector – 36A, Chandigarh**  
**Monthly Teaching Plans (Even Semester)**  
**Session – (2023-24)**

**Name of the Teacher/s:** Dr. Yesbinder, Dr. Manjot

**Department:** Chemistry

**Class:** M.Sc. II  
Chemistry

**Subject:** Photochemistry & Solid-State

S. No.	Date (Monthly)		Topics to be Covered	Academic Activity Undertaken*
	From	To		
1	09 -01- 2024	31-01-2024	Unit 3: Solid state Chemistry Solid state reactions: general principles, experimental procedures, co-precipitation as a precursor to solid state reactions, kinetics of solid-state reactions. Organic Solids: Electrically conducting solids, organic charge transfer complexes, organic metals, new superconductors.	Lecture method, Online sources
2	01.02.2024	29.02.2024	Crystal defects and non-stoichiometry: Perfect and imperfect crystals, intrinsic and extrinsic defects- point defects, line defects, vacancies-Schottky defects and Frenkel defects, Thermodynamics of Schottky defects and Frenkel defect formation, Colour Centres, non-stoichiometry and defects.	Lecture method
3	01.03.2024	28.03.2024	Unit 4 Electronic properties and Band Theory Metals, insulators and semiconductors, electronic structure of solids-band theory of metals, insulators and semiconductors, intrinsic and	Lecture Method, Online Sources

			extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors.	
4	29.03.2024	Till exam	Optical properties-Optical reflectance, photoconduction-photoelectric effects. Magnetic properties-Classification of materials: Quantum theory of paramagnetic- cooperative phenomena-magnetic domains, hysteresis.	Lecture Method
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