

Lecture 1 - Introduction of Organometallic Chemistry

Lecture 2 - Counting of Electrons

Lecture 3 - Ligand Substitution Reactions

Lecture 4 - Oxidative Addition [1. Concerted Mechanism]

Lecture 5 - Oxidative Addition [2. SN2 Mechanism]

Lecture 6 - Oxidative Addition [3. Radical Mechanism]

Lecture 7 - Reductive Elimination

Lecture 8 - Migratory Insertion and Elimination Reactions

Lecture 9 - Migration and Insertion Reactions

Lecture 10 - Alpha-Migratory Insertion and alpha-Elimination Reactions

Lecture 11 - Beta-Migratory Insertion

Lecture 12 - Beta-Elimination Reaction

Lecture 13 - Alpha-Abstraction and beta-Abstraction

Lecture 14 - 4-Center Reactions; [2+2] Reactions

Lecture 15 - External Attack by a Ligand and Reductive Coupling

Lecture 16 - Hydrogenation Reaction

Lecture 17 - Hydrogenation Reaction [Dihydride Catalyst]

Lecture 18 - Stereoselective Hydrogenation Reaction

Lecture 19 - Carbonylation Reaction [1. Monsanto Acetic Acid Process 2. Hydroformylation 3. Hydrocarboxylation]

Lecture 20 - Carbonylation Reaction [1. Hydroformylation 2. Hydrocarboxylation 3. Hydrocyanation]

Lecture 1 - Fundamentals of Chemical thermodynamics

Lecture 2 - Work

Lecture 3 - Tutorial-1

Lecture 4 - First Law of Thermodynamics

Lecture 5 - Tutorial-2

Lecture 6 - Adiabatic processes

Lecture 7 - Entropy

Lecture 8 - Entropy and Second Law: Basics

Lecture 9 - Entropy and Second Law: Applications

Lecture 10 - Third Law of Thermodynamics

Lecture 11 - Discussion on Helmholtz energy

Lecture 12 - Discussion on Gibbs Energy

Lecture 13 - Maxwell relations, Properties of Gibbs energy

Lecture 14 - Further discussion on properties of Gibbs energy

Lecture 15 - Fugacity

Lecture 16 - Tutorial session

Lecture 17 - Tutorial session

Lecture 18 - Chemical potential of a substance in mixture

Lecture 19 - Chemical potential of Liquids, Raoult's Law, Henry's Law

Lecture 20 - Thermodynamics of mixing, Excess functions

Lecture 21 - Partial molar volume

Lecture 22 - Activities (Accounting for deviations from Ideal behaviour)

Lecture 23 - Tutorial on thermodynamics of mixing and deviations from ideality

Lecture 24 - Further discussion on relation between  $C_p$  and  $C_v$

Lecture 25 - Chemical Equilibrium

Lecture 26 - Perfect gas equilibria

Lecture 27 - Equilibrium constant

Lecture 28 - Effect of pressure on equilibrium constant and equilibrium composition

Lecture 29 - Effect of temperature on equilibria

Lecture 30 - Biological standard states and pH

Lecture 31 - Tutorial 1 - Equilibrium constant

Lecture 32 - Tutorial 2 - Equilibrium constant

Lecture 33 - Acids and bases and Equilibrium concepts

Lecture 34 - pH Scale Strong and weak acids and bases

Lecture 35 - Strong and weak acids and bases

Lecture 36 - Acid-base titrations

Lecture 37 - pH curve for titration of weak acid with strong base Buffers and indicators

Lecture 38 - Thermodynamics in systems of biological interest

Lecture 39 - Calorimetry

Lecture 40 - Differential scanning calorimetry (DSC)

Lecture 41 - Further discussion on Differential Scanning Calorimetry (DSC)

Lecture 42 - Explaining Differential Scanning Calorimetric Profiles (DSC Profiles)

Lecture 43 - Applications of DSC in thermal unfolding of proteins and protein-solvent interactions

Lecture 44 - Further discussion on applications of DSC in thermal unfolding of proteins and protein-solvent interactions

Lecture 45 - Isothermal Titration calorimetry (ITC)

Lecture 46 - Further discussion on Isothermal Titration calorimetry (ITC)

Lecture 47 - ITC Experimental Design and Isothermal Titration Calorimetry (ITC) in Drug Design

Lecture 48 - Isothermal Titration Calorimetry (ITC) in Drug Design

Lecture 49 - Isothermal Titration Calorimetry (ITC) in Engineering Binding Affinity

Lecture 50 - Calorimetry in identifying partially folded states of proteins (Molten Globule State)

Lecture 51 - Thermodynamic Characterization of Partially Folded States of Proteins

Lecture 52 - Quantitative Thermodynamic Characterization of Partially Folded States of Proteins

Lecture 53 - ITC in Drug-Protein Interactions

Lecture 54 - Identifying sites for Drug-Protein Interactions by ITC

Lecture 55 - Identifying sites for Drug-Protein Interactions, DSC of Protein-Ligand Complexes. Enthalpy-Entropy Compensation

Lecture 56 - Estimation of Binding Constants in Strong to Ultratight Protein-Ligand, Interactions Using Differential Scanning Calorimetry

Lecture 57 - Continuation of discussion on... Estimation of Binding Constants in Strong to Ultratight Protein-Ligand Interactions Using Differential Scanning Calorimetry

Lecture 58 - Thermal unfolding of protein by non-calorimetric methods, Addressing thermodynamics of the process

Lecture 59 - Titration Calorimetry as a tool to determine thermodynamic and Kinetic parameters of enzymes

Lecture 60 - Summary of the course

Lecture 1 - Classification of Elements and Periodic Properties

Lecture 2 - Periodic Properties, Periodic Trends and Classification of Main Group Compounds

Lecture 3 - Classification of Main Group Compounds

Lecture 4 - Effective Nuclear Charge

Lecture 5 - Structure and Bonding Aspects: Lewis Structures and VSEPR Theory

Lecture 6 - Structure and Bonding Aspects: VSEPR Theory

Lecture 7 - Structure and Bonding Aspects: Valence Bond Theory

Lecture 8 - Structure and Bonding Aspects: Valence Bond Theory

Lecture 9 - Structure and Bonding Aspects: MO Theory

Lecture 10 - Structure and Bonding Aspects: MO Theory

Lecture 11 - Structure and Bonding Aspects: MO Theory

Lecture 12 - Structure and Bonding Aspects: MO Theory

Lecture 13 - Chemistry of Hydrogen

Lecture 14 - Chemistry of Hydrogen

Lecture 15 - Chemistry of Hydrogen, Hydrides and Hydrogen Bonding

Lecture 16 - Chemistry of Group 1 Elements

Lecture 17 - Chemistry of Group 1 Elements

Lecture 18 - Chemistry of Group 1 Elements

Lecture 19 - Chemistry of Group 1 Elements

Lecture 20 - Chemistry of Group 2 Elements

Lecture 21 - Chemistry of Group 2 Elements

Lecture 22 - Chemistry of Group 2 Elements

Lecture 23 - Chemistry of Group 2 Elements

Lecture 24 - Chemistry of Group 2 Elements

Lecture 25 - Chemistry of Group 13 Elements

Lecture 26 - Chemistry of Group 13 Elements

Lecture 27 - Chemistry of Group 13 Elements

Lecture 28 - Chemistry of Group 13 Elements

Lecture 29 - Chemistry of Group 13 Elements

Lecture 30 - Wades Rules

Lecture 31 - Chemistry of Group 13 Elements

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[Lecture 33 - Chemistry of Group 14 Elements](#)

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[Lecture 51 - Chemistry of Group 16 Elements](#)

[Lecture 52 - Chemistry of Group 17 Elements](#)

[Lecture 53 - Chemistry of Group 17 Elements](#)

[Lecture 54 - Chemistry of Group 18 Elements](#)

[Lecture 55 - Chemistry of Group 12 Elements](#)

[Lecture 56 - Organometallic Compounds of Main Group Elements](#)

[Lecture 57 - Organometallic Compounds of Main Group Elements](#)

[Lecture 58 - Organometallic Compounds of Main Group Elements](#)

[Lecture 59 - Organometallic Compounds of Main Group Elements](#)

[Lecture 60 - Overall Summary](#)

Lecture 1 - History of Organometallic Compounds

Lecture 2 - Polarity and Reactivity of M-C bonds

Lecture 3 - Reactivity of Organometallic Compounds

Lecture 4 - Reactivity of Organometallic Compounds

Lecture 5 - 18 Valence Electron Rule and Classification

Lecture 6 - 18 Valence Electron Rule and Classification

Lecture 7 - Reactivity and types of Organometallic compounds

Lecture 8 - Sigma-Donor Ligands

Lecture 9 - Preparation of Sigma-Alkyl Compounds

Lecture 10 - Preparation and Properties of Sigma-Alkyl Compounds

Lecture 11 - Properties of Sigma-Alkyl Compounds

Lecture 12 -  $\beta$ -elimination in Sigma-Alkyl Compounds

Lecture 13 -  $\beta$ -elimination in Detail

Lecture 14 - TM Sigma-Alkyl Complexes and its Application

Lecture 15 - TM Sigma-Alkyl Complexes and its Application

Lecture 16 - C-H Activation

Lecture 17 - C-H Activation in Details

Lecture 18 - C-H Activation in Details

Lecture 19 - Characterization of C-H Activation

Lecture 20 - Bonding in C-H Activation

Lecture 21 - C-C Bond Activation

Lecture 22 - C-C Bond Activation

Lecture 23 - C-C Bond Activation in Details

Lecture 24 - Transition Metal Perfluoroalkyl (RF-TM) Complexes

Lecture 25 - Preparation of Transition Metal Perfluoroalkyl (RF-TM) Complexes

Lecture 26 - C-F Activation

Lecture 27 - Transition Metal Alkenyl/Aryl Complexes

Lecture 28 - Transition Metal Aryl Complexes

Lecture 29 - Transition Metal Aryl/Alkyne Complexes

Lecture 30 - Transition Metal Alkyne/Carbene Complexes

Lecture 31 - Transition Metal Carbene Complexes: Preparations

- Lecture 32 - Transition Metal Carbene Complexes: Properties
- Lecture 33 - Transition Metal Carbene Complexes: Reactivities
- Lecture 34 - Transition Metal Carbene Complexes: Reactivities
- Lecture 35 - Transition Metal Carbene Complexes: Reactivities
- Lecture 36 - Transition Metal Carbene Complexes: Reactivities
- Lecture 37 - Reactivity of Schrock type Carbene Complexes and Transition Metal Carbynes
- Lecture 38 - Transition Metal Carbynes: Preparation
- Lecture 39 - Transition Metal Carbynes: Properties
- Lecture 40 - Transition Metal Carbynes: Properties
- Lecture 41 - Properties of Transition Metal Carbynes And Transition Metal Carbonyls
- Lecture 42 - Transition Metal Carbonyls
- Lecture 43 - Transition Metal Carbonyls
- Lecture 44 - Transition Metal Carbonyls: Bonding Properties
- Lecture 45 - Transition Metal Carbonyls: Bonding properties
- Lecture 46 - Transition Metal Carbonyls: Reactivities
- Lecture 47 - Transition Metal Carbonyls: Reactivity and Carbonyl Metallates
- Lecture 48 - Transition Metal Carbonyl Hydrides
- Lecture 49 - Application of Carbonyl Metallates and Metal Halides
- Lecture 50 - Application of Metal Halides and Metal Alkenes
- Lecture 51 - Transition Metal Olefin Complexes
- Lecture 52 - Transition Metal Olefin Complexes
- Lecture 53 - Transition Metal Olefin Complexes: Reactivity
- Lecture 54 - Bonding Properties in Olefin Complexes
- Lecture 55 - Transition Metal Diolefin Complexes
- Lecture 56 - Transition Metal Diolefin and Alkyne Complexes
- Lecture 57 - Transition Metal Alkyne Complexes
- Lecture 58 - Transition Metal Alkyne Complexes: Reactivity
- Lecture 59 - Transition Metal Alkyne Complexes: Reactivity
- Lecture 60 - Summary: Transition Metal Organometallic Chemistry: Principles to Applications

Lecture 1 - Assymmetric Hydrogenation

Lecture 2 - Transition Metal Carbenes Fischer and Schrock Carbenes

Lecture 3 - Olefin Metathesis

Lecture 4 - Alkyne Metathesis

Lecture 5 - Cyclopropanation Reaction

Lecture 6 - Catalytic Cyclopropanation Reaction and Introduction to Cross Coupling Reaction

Lecture 7 - Kumada Coupling Reaction

Lecture 8 - Suzuki Coupling Reaction

Lecture 9 - Stille Coupling Reaction

Lecture 10 - Assymmetric Suzuki Coupling Reaction

Lecture 11 - Sonogashira Coupling Reaction

Lecture 12 - Heck Coupling Reaction

Lecture 13 - Assymmetric Heck Reaction Introduction to Buchwald-Hartwig Coupling Reaction

Lecture 14 - Buchwald-Hartwig Coupling Reaction

Lecture 15 - Role of Ligands its Influence in Buchwald-Hartwig Coupling Reaction

Lecture 16 - Oxidative Cyclization Process

Lecture 17 - Application of Oxidative Cyclization in Natural Product Synthesis

Lecture 18 - Synthesis of Reactive Metallacycle Intermediate Via-Beta-Abstraction and their Applications

Lecture 19 - Kulinkovich Reaction and its Mechanism

Lecture 20 - Pauson's Khand Reaction



Lecture 1 - Overview of inorganic chemistry of life

Lecture 2 - Elements in biology and or life

Lecture 3 - Selection and criteria for elements

Lecture 4 - Biomolecules

Lecture 5 - Coordination in enzymes

Lecture 6 - Amino acids, peptides and proteins - An introduction

Lecture 7 - Nucleoside, nucleotide and nucleic acids and DNA: An introduction

Lecture 8 - General introduction of metalloproteins

Lecture 9 - Coordination chemistry aspects - An introduction

Lecture 10 - Stability and lability

Lecture 11 - Techniques used inorganic chemistry life

Lecture 12 - Techniques used inorganic chemistry life (Continued...)

Lecture 13 - Techniques used inorganic chemistry life (Continued...)

Lecture 14 - Techniques used inorganic chemistry life (Continued...)

Lecture 15 - Recap on metalloenzymes

Lecture 16 - Role of Alkali, Alkaline earth elements in life

Lecture 17 - Role of Alkali, Alkaline earth elements in life (Continued...)

Lecture 18 - Role of Alkali, Alkaline earth elements in life (Continued...) Ion transport and ionophores

Lecture 19 - Role of Alkali, Alkaline earth elements in life (Continued...) Ion transport and ionophores

Lecture 20 - Functioning of ATPases and nucleases [Na,K]ATPase

Lecture 21 - Role of vanadium in life - General perspectives

Lecture 22 - Role of vanadium in life - Haloperoxidases

Lecture 23 - Enzymes based on manganese in life

Lecture 24 - Role of Iron in life - General perspectives

Lecture 25 - Role of Iron in life - Transport systems

Lecture 26 - Role of Iron in life - Transport and Storage systems

Lecture 27 - Role of Iron in life - Electron transfer

Lecture 28 - Role of Iron in life - Perspectives of electron transfer proteins

Lecture 29 - Role of Iron in life - Monooxygenases: Cytochrome P450

Lecture 30 - Role of Iron in life - Mono-and di-oxygenases

Lecture 31 - Role of Iron in life - Reductases

- Lecture 32 - Role of Iron in life - Reductases and Phosphatases
- Lecture 33 - Role of Iron in life - Reductases and Phosphatases (Continued...)
- Lecture 34 - Role of Cobalt in life
- Lecture 35 - Role of Nickel in life - General perspectives
- Lecture 36 - Role of Nickel in life - Hydrolase, hydrogenase and SOD
- Lecture 37 - Role of Nickel in life - Carbonmonoxide dehydrogenase (CODH)
- Lecture 38 - Role of Copper in life - General perspectives
- Lecture 39 - Role of Copper in life - Type I and Type 2 copper enzymes
- Lecture 40 - Role of Copper in life - Multicenter copper oxidases and SOD
- Lecture 41 - Role of Zinc in life - General perspectives including oxidoreductases and hydrolases
- Lecture 42 - Role of Zinc in life - Carbonic anhydrase and carboxypeptidase
- Lecture 43 - Role of Zinc in life - Transferases, ligases and isomerases
- Lecture 44 - Role of Molybdenum in life - Introductory aspects
- Lecture 45 - Role of Molybdenum in life - Nitrogenase
- Lecture 46 - Role of Molybdenum in life - Oxidoreductases
- Lecture 47 - Role of Mercury in the environment - Mercury reductase
- Lecture 48 - Role of Selenium in life - Glutathione peroxidase
- Lecture 49 - Inorganics in medicine - Introductory aspects and cis-platin
- Lecture 50 - Inorganics in medicine - Apoptosis
- Lecture 51 - Inorganics in medicine - PDT, MRI and Barium tests
- Lecture 52 - Inorganics in medicine - Titanium in biomedical
- Lecture 53 - Highlights of the course - Part I
- Lecture 54 - Highlights of the course - Part II
- Lecture 55 - Highlights of the course - Part III
- Lecture 56 - Highlights of the course - Part IV
- Lecture 57 - Tutorials - Part I
- Lecture 58 - Tutorials - Part II
- Lecture 59 - Tutorials - Part III
- Lecture 60 - Tutorials - Part IV and overall

Lecture 1 - Symmetry point group: Introduction

Lecture 2 - Symmetry point group: Examples - Part I

Lecture 3 - Symmetry point group: Examples - Part II

Lecture 4 - Symmetry point group: Examples - Part III

Lecture 5 - Symmetry point group: Examples - Part IV

Lecture 6 - Transformation matrices and Matrix representation

Lecture 7 - More on Matrix representation: Cartesian coordinates in  $C_{2v}$  point group

Lecture 8 - Matrix representation: the way ahead

Lecture 9 - Introduction to Group Theory

Lecture 10 - Group Multiplication Tables

Lecture 11 - Groups and subgroups

Lecture 12 - Classes, Similarity transformations

Lecture 13 - Introduction to Matrices

Lecture 14 - Application of matrices in solution of simultaneous equations

Lecture 15 - Matrix eigenvalue equation

Lecture 16 - Matrix eigenvalue equation: an example

Lecture 17 - Similarity Transformations

Lecture 18 - Back to transformation matrices

Lecture 19 - Matrix representation revisited

Lecture 20 - Function space and Transformation Operators

Lecture 21 - Transformation Operators form the same group as transformation matrices

Lecture 22 - Transformation Operators form a unitary representation for orthonormal basis

Lecture 23 - Transformation Operators: Switching Bases

Lecture 24 - Equivalent representations

Lecture 25 - Unitary Transformation

Lecture 26 - Unitary Transformations (Continued...)

Lecture 27 - Reducible and Irreducible Representations

Lecture 28 - Irreducible Representations and Great Orthogonality Theorem

Lecture 29 - Character Tables:  $C_{2v}$

Lecture 30 - Character Tables:  $C_{2v}$  and  $C_{3v}$

Lecture 31 - Practice Session: Review of Some Questions and Solutions

- Lecture 32 - Reducible to Irreducible Representations
- Lecture 33 - Character Tables of Cyclic Groups
- Lecture 34 - Symmetry of Normal Modes: D<sub>3h</sub>
- Lecture 35 - Symmetry of Normal Modes: D<sub>3h</sub> (Continued...)
- Lecture 36 - Symmetry of Normal Modes: a shortcut
- Lecture 37 - Recap: Reducible Representation for Normal Modes
- Lecture 38 - Contribution of internal motion to normal modes
- Lecture 39 - Normal mode analysis: some examples
- Lecture 40 - Infrared and Raman spectroscopy
- Lecture 41 - IR and Raman activity
- Lecture 42 - IR and Raman activity: examples
- Lecture 43 - Symmetry Adapted Linear Combinations (SALC)
- Lecture 44 - SALC:BeH<sub>2</sub>
- Lecture 45 - SALC:CH<sub>4</sub> Introduction
- Lecture 46 - SALC:CH<sub>4</sub>
- Lecture 47 - Projection Operators
- Lecture 48 - Projection Operators (Continued...)
- Lecture 49 - Generating SALCs using Projection Operators
- Lecture 50 - Generating SALCs using Projection Operators (Continued...)
- Lecture 51 - Oh complex and Group-subgroup relation
- Lecture 52 - Group-Subgroup Relation
- Lecture 53 - SALCs as Pi-MO and Cyclopropenyl group
- Lecture 54 - SALCs as Pi-MO, Cyclopropenyl group
- Lecture 55 - SALCs as Pi-MO, Benzene
- Lecture 56 - LCAO Huckel approximation
- Lecture 57 - Huckel approximation: Naphthalene
- Lecture 58 - Stationary states, Multiplicity, Ethylene
- Lecture 59 - Naphthalene - I
- Lecture 60 - Naphthalene - II
- Lecture 61 - Naphthalene - III
- Lecture 62 - Transition Metal Complexes: CFT and LFT
- Lecture 63 - Jahn-Teller Theorem, Tetragonal Distortion MOT:ML<sub>6</sub>, Sigma and Pi Bonds
- Lecture 64 - MOT approach of bonding, H<sub>2</sub>O, Ferrocene

[Lecture 65 - MOT approach of bonding,H2O,Ferrocene](#)

[Lecture 66 - Derivation: Great Orthogonality Theorem - I \(Schurrs Lemma 1\)](#)

[Lecture 67 - Derivation: Great Orthogonality Theorem - II \(Schurrs Lemma 2\)](#)

[Lecture 68 - Derivation: Great Orthogonality Theorem - III](#)

# DIGIMAT - The No.1 Learning Management Platform for Creative Learning

**NPTEL : NOC:Computational Chemistry and Classical Molecular Dynamics (Chemistry and Biochemistry)**

**Co-ordinators : Prof. B.L. Tembe**

- Lecture 1 - Introduction to Computational Chemistry
- Lecture 2 - Writing Simple Programs: Compilation and Execution
- Lecture 3 - Programming Techniques 1 - Evaluating the sine function
- Lecture 4 - Programming Techniques 2 - Do loops and if statements
- Lecture 5 - Programming Techniques 3 - Roots of a quadratic equation and arrays
- Lecture 6 - Programming Techniques 4 - Arrays and matrices
- Lecture 7 - Practical Session of Programming 1
- Lecture 8 - Programming Techniques 5 - Formats, Functions and Subroutines
- Lecture 9 - Programming Techniques 6 - Functions and Subroutines, arranging numbers in as ascending order
- Lecture 10 - Programming Techniques 7 - Functions and Subroutines, and the common statement
- Lecture 11 - Numerical Methods. Analysis of errors
- Lecture 12 - Practical Session on Programming 2 - The exponential function
- Lecture 13 - Practical Session on Programming 3 - Functions and Subroutines
- Lecture 14 - Interpolation Methods-1
- Lecture 15 - Interpolation Methods-2: Newton's and Lagrange Interpolation
- Lecture 16 - Errors in interpolation, Matrix operations
- Lecture 17 - Gauss elimination method for matrix inversion
- Lecture 18 - Matrix diagonalization, Similarity transformations
- Lecture 19 - Matrix inversion, Matrix diagonalization
- Lecture 20 - Curve fitting, Newton Raphson method
- Lecture 21 - Random numbers, Numerical integration using Simpson's rule
- Lecture 22 - Numerical Integration and Differential Equations
- Lecture 23 - Practical Session on Programming 3: Random numbers, Simpson's rule; Introduction to Scilab
- Lecture 24 - Scilab-2: Matrix equations and Roots of Polynomials
- Lecture 25 - Scilab-3: Functions, Integrals, Differential Equations and graphs
- Lecture 26 - Scilab-4: Curve Fitting and Execution of Scilab programs
- Lecture 27 - Scilab-5: Legendre polynomials, Multiple plots and Curve fitting
- Lecture 28 - Scilab-6: Integral Transforms; Introduction to Molecular Dynamics (MD)
- Lecture 29 - Classical Molecular Dynamics-2, Force Fields and Equations of Motion
- Lecture 30 - Classical Molecular Dynamics-3, Force Fields and MD Algorithms
- Lecture 31 - Classical MD-4 Thermodynamic Properties and Distribution Functions.

[Lecture 32 - Classical MD-5, Execution of programs on liquid argon](#)

[Lecture 33 - Molecular Dynamics using Gromacs-1](#)

[Lecture 34 - Molecular Dynamics using Gromacs-2: Simulating Liquid Argon](#)

[Lecture 35 - Molecular Dynamics using Gromacs-3: Installing Gromacs](#)

[Lecture 36 - Molecular Dynamics using Gromacs-4: Liquid Water: Input Files](#)

[Lecture 37 - Molecular Dynamics using Gromacs-5: Liquid Water: Analysis of Results](#)

[Lecture 38 - Molecular Dynamics using Gromacs-6: Mixture of Water and Methanol](#)

[Lecture 39 - Molecular Dynamics using Gromacs-7: Gromacs Installation](#)

[Lecture 40 - Molecular Dynamics using Gromacs-8: Simulation of s-peptide](#)

[Lecture 41 - Molecular Dynamics using Gromacs-9: Free Energy of Solvation of Methane, Concluding remarks](#)

- Lecture 1 - Frequency Domain Spectroscopy: An Introduction
- Lecture 2 - Schematics of Instrumentation for FD Spectroscopy
- Lecture 3 - Sensitivity Light Collection and Signal to Noise Ratio
- Lecture 4 - Time Domain Spectroscopy
- Lecture 5 - Frequency Modulation for Fourier Transform Spectroscopy
- Lecture 6 - Rigid Rotor Model for Diatomic Molecules
- Lecture 7 - Recapitulation of Quantum Mechanics
- Lecture 8 - Conditions for Microwave Activity - I
- Lecture 9 - Conditions for Microwave Activity - II
- Lecture 10 - Microwave Spectra: Diatomic Molecules
- Lecture 11 - Simple Harmonic Oscillator
- Lecture 12 - Selection Rule
- Lecture 13 - High Resolution IR Spectra
- Lecture 14 - Anharmonic Oscillator and Raman Effect
- Lecture 15 - Semi Classical Treatment: Radiation-Matter
- Lecture 16 - Time Dependent Perturbation Theory
- Lecture 17 - Transition Moment Integral
- Lecture 18 - Transition Probability and Natural Linewidth
- Lecture 19 - Einstein Treatment
- Lecture 20 - Relationship Between Theoretical and Experimental Quantities
- Lecture 21 - Level System: Concluding Remark - I
- Lecture 22 - Level System: Concluding Remark - II
- Lecture 23 - Laser Basic
- Lecture 24 - Applications of Laser in Spectroscopy
- Lecture 25 - Laser in Spectroscopy : Ultrafast Dynamics
- Lecture 26 - Snapshot of Bond Breaking
- Lecture 27 - Raman Effect
- Lecture 28 - Raman Spectroscopy: Quantum Theory of Raman Effect
- Lecture 29 - Raman Spectroscopy and Beyond Dipole Approximation
- Lecture 30 - Symmetry in Chemistry : An Introduction
- Lecture 31 - Symmetry Operations : Transformation Matrices



- Lecture 32 - Representations Reducible and Irreducible
- Lecture 33 - Matrix Representation of Symmetry Point Group
- Lecture 34 - Group Theory : Character Table
- Lecture 35 - Character Table : Compendium of Irreducible Representations
- Lecture 36 - Mulliken Nomenclature, 2D Irreducible Representations and Bases
- Lecture 37 - Character Tables for Different Symmetry Point Groups
- Lecture 38 - Wave Functions as Basis
- Lecture 39 - Symmetry of Atomic and Molecular Orbitals
- Lecture 40 - Polyatomic Molecules : Normal Modes of Vibration
- Lecture 41 - Determination of Symmetries of Normal Modes of Vibration - I
- Lecture 42 - Determination of Symmetries of Normal Modes of Vibration - II
- Lecture 43 - A Shortcut to Symmetry of Normal Modes
- Lecture 44 - Normal Modes : Internal Motion IR and Raman Activity
- Lecture 45 - IR and Raman Activity - I
- Lecture 46 - IR and Raman Activity - II
- Lecture 47 - Electronic Spectroscopy : Introduction
- Lecture 48 - Electronic Spectra
- Lecture 49 - Rotational Fine Structure
- Lecture 50 - Symmetry of Electronic States
- Lecture 51 - Electronic States of Oxygen
- Lecture 52 - Electronic States and Transitions of Benzene
- Lecture 53 - Vibronic Coupling
- Lecture 54 - Electronic Spectrum of Benzene
- Lecture 55 - Basics of NMR Spectroscopy - I
- Lecture 56 - Basics of NMR Spectroscopy - II
- Lecture 57 - Spin Spin Coupling- AX systems
- Lecture 58 - Coupling in A2 systems
- Lecture 59 - Coupling in A2 systems (Continued...)
- Lecture 60 - NMR: Spectra and Measurement, FT NMR 900 Pulses
- Lecture 61 - FT NMR 1800 Pulses and Relaxation Phenomenon
- Lecture 62 - Relaxation Phenomenon: Inversion Recovery

Lecture 1 - Transition Metal Allyl and Enyl Complexes

Lecture 2 - Transition Metal Allyl and Enyl complexes: Preparation

Lecture 3 - Transition Metal Allyl and Enyl complexes: Preparation

Lecture 4 - Transition Metal Allyl and Enyl Complexes: Reactivity and Transition Metal Sandwich Complexes

Lecture 5 - Types of Transition Metal Sandwich Complexes

Lecture 6 - Transition Metal Cyclobutadiene Complexes

Lecture 7 - Transition Metal Cyclobutadiene Complexes: Preparations

Lecture 8 - Transition Metal Cyclobutadiene Complexes: Reactivity

Lecture 9 - Transition Metal Cyclopentadiene Complexes

Lecture 10 - Transition Metal Cyclopentadiene Complexes: Preparation and Properties

Lecture 11 - Transition Metal Cyclopentadiene Complexes: Bonding Properties

Lecture 12 - Transition Metal Cyclopentadiene Complexes: Molecular Orbital Diagram

Lecture 13 - Transition Metal Cyclopentadiene Complexes: Reactivity of Metallocene

Lecture 14 - Transition Metal Cyclopentadiene Complexes: Reactivity of Ferrocene

Lecture 15 - Transition Metal Cyclopentadienyl Carbonyl Complexes: Preparation

Lecture 16 - Transition Metal Cyclopentadienyl Carbonyl Complexes: Reactivity

Lecture 17 - Transition Metal Cyclopentadienyl Nitrosyl Complexes

Lecture 18 - Transition Metal Cyclopentadienyl Hydride Complexes

Lecture 19 - Transition Metal Cyclopentadienyl Hydride and Halide Complexes

Lecture 20 - Transition Metal Cyclopentadienyl Halide Complexes

Lecture 21 - Transition Metal Cyclopentadienyl Halide and Transition Metal Arene Complexes

Lecture 22 - Transition Metal Arene Complexes: Preparation, Structure and Bonding

Lecture 23 - Transition Metal Arene Complexes: Structure and Bonding

Lecture 24 - Transition Metal Arene Complexes: Reactivity

Lecture 25 - Transition Metal Arene Complexes: Reactivity

Lecture 26 - Transition Metal Arene Carbonyl Complexes: Reactivity

Lecture 27 - Transition Metal Arene Carbonyl Complexes: Reactivity

Lecture 28 - Transition Metal Arene Cyclopentadienyl Complexes

Lecture 29 - Transition Metal Arene Cyclopentadienyl and  $C_7H_7$  Complexes

Lecture 30 - Transition Metal  $C_7H_7$  Complexes: Preparation

Lecture 31 - Transition Metal  $C_7H_7$  Complexes: Reactivity

- Lecture 32 - Transition Metal C<sub>8</sub>H<sub>8</sub> and C<sub>7</sub>H<sub>7</sub> Complexes
- Lecture 33 - Transition Metal C<sub>8</sub>H<sub>8</sub> Complexes: Properties
- Lecture 34 - Transition Metal  $\pi$ - complexes of heterocycles
- Lecture 35 - C $\equiv$ C Cross Coupling Reactions
- Lecture 36 - C $\equiv$ C Cross Coupling Reactions: Allylic Alkylation
- Lecture 37 - C $\equiv$ C Cross Coupling Reactions: Heck Reaction
- Lecture 38 - C $\equiv$ C Cross Coupling Reactions: Suzuki Reaction
- Lecture 39 - C $\equiv$ C Cross Coupling Reactions: Suzuki Reaction
- Lecture 40 - C $\equiv$ C Cross Coupling Reactions: Stille Reaction
- Lecture 41 - C $\equiv$ C Cross Coupling Reactions: Stille Coupling
- Lecture 42 - C $\equiv$ C Cross Coupling Reactions: Sonogashira Coupling
- Lecture 43 - Hydrocyanation Reactions
- Lecture 44 - C $\equiv$ N heteroatom Coupling
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Lecture 24 - Further aspects of DIBAL-H based reductions and comparison with mixed chloride hydrides

Lecture 25 - Reductions with Red-Al, and Luche Reductions

Lecture 26 - Further aspects of Luche reduction, stereochemistry in reductions and reduction with LiBH<sub>4</sub>

Lecture 27 - Reductions with Zn(BH<sub>4</sub>)<sub>2</sub>, LiBHEt<sub>3</sub> (superhydride) and L and K-selectrides

Lecture 28 - Reductions with LS/KS selectrides and NaCNBH<sub>3</sub>

Lecture 29 - Dissolving metal reductions (Na, K, Mg) and McMurry coupling using Ti(0)

Lecture 30 - Stereochemistry and mechanistic aspects of McMurry coupling and metal mediated reductions of alpha, beta-unsaturated

ketones

Lecture 31 - Silanes [R<sub>3</sub>SiH, including polymethylhydrosiloxanes (PMHS)] as reducing agents

Lecture 32 - Further aspects of silanes as reducing agents and Barton-McCombie deoxygenation

Lecture 33 - Tributyltinhydride (n-Bu<sub>3</sub>SnH) based radical based reductions and C-C bond formations

Lecture 34 - Asymmetric synthesis: An introduction

Lecture 35 - Sharpless asymmetric epoxidation: Mechanism, stereochemistry and kinetic resolution

Lecture 36 - Synthetic utility of chiral 2,3-epoxy alcohols obtained from Sharpless epoxidation

Lecture 37 - Katsuki-Jacobsen epoxidation: Mechanism and stereochemistry

Lecture 38 - Further aspects of Katsuki-Jacobsen epoxidation, and Introduction to Sharpless Asymmetric Dihydroxylation

Lecture 39 - Mechanism, stereochemical aspects and synthetic applications of Sharpless Asymmetric Dihydroxylation

Lecture 40 - Asymmetric hydrogenations and reductions using rhodium and ruthenium derived chiral catalysts

Lecture 41 - Asymmetric reduction with oxazaborolidines

Lecture 42 - C-C bond formations: Introduction to enolate, enamine and enol silyl ether based chemistry

Lecture 43 - C-C bond formations using enol silyl ether and imine based chemistry including SAMP and RAMP based asymmetric alkylations

Lecture 44 - Asymmetric C-C bond formations using Oppolzer's camphorsultams and introduction to directed Aldol reactions

Lecture 45 - Further aspects of Aldol chemistry including the use of boron and silicon enolates

Lecture 46 - C-C bond formations using Evans' oxazolidinone based chemistry

Lecture 47 - Ireland-Claisen rearrangement: Emphasis of enolate geometry on the stereochemical outcome, and Claisen rearrangements

Lecture 48 - Aromatic Claisen rearrangement, Johnson-Claisen rearrangement and Eschenmoser-Claisen rearrangement and synthetic

Lecture 49 - Bellus-Claisen rearrangement, Aza-Claisen rearrangement, Thia-Claisen rearrangement, Chen-Mapp rearrangement and their synthetic applications

Lecture 50 - Zwitterionic-Claisen rearrangement, Overmann rearrangement, Bamford- Stevens and Shapiro reactions and synthetic applications

Lecture 51 - Introduction to allyl metal additions for C-C bond formation

Lecture 52 - Allylindium chemistry: Mechanism, stereochemistry and synthetic applications

Lecture 53 - Allyltin chemistry: Mechanism, stereochemistry and synthetic applications

Lecture 54 - Chemistry of allylsilanes: Mechanism, stereochemistry and synthetic applications - Part 1

Lecture 55 - Further synthetic aspects of the chemistry of allylsilanes - Part 2

Lecture 56 - Further synthetic aspects of the chemistry of allylsilanes - Part 3

Lecture 57 - Chemistry of Vinylsilanes: Mechanism, Stereochemistry and Synthetic Applications

Lecture 58 - Peterson olefination and further synthetic aspects of vinylsilane chemistry

Lecture 59 - Simmons Smith cyclopropanation: Mechanism, stereochemistry and synthetic applications

Lecture 60 - Course Summary and Conclusion



- Lecture 1 - Rate: the reaction velocity
- Lecture 2 - Its elementary - rate law equations
- Lecture 3 - Arrhenius equation: what's the fuss about?
- Lecture 4 - Dance of atoms: from Newton to Hamilton
- Lecture 5 - Boltzmann distribution: a story of Hamilton, Liouville and Boltzmann
- Lecture 6 - Maxwell Boltzmann distribution: how fast are molecules moving?
- Lecture 7 - Kinetic theory of collisions: initial estimate
- Lecture 8 - Boltzmann distribution and kinetic theory of collisions
- Lecture 9 - Kinetic theory of collisions: a discussion
- Lecture 10 - Kinetic theory of collisions: reactive cross section
- Lecture 11 - Problem solving session - 1
- Lecture 12 - Problem solving session - 2
- Lecture 13 - Kinetic theory of collision and equilibrium constant
- Lecture 14 - Critique of kinetic theory of collisions
- Lecture 15 - Transition state theory and partition functions
- Lecture 16 - Partitioning the partition function
- Lecture 17 - Translating, rotating and vibrating quantum mechanically
- Lecture 18 - Partition function and equilibrium constant
- Lecture 19 - What is a transition state?
- Lecture 20 - A puzzle: cars on highway
- Lecture 21 - Transition state theory: derivation 1
- Lecture 22 - Practical calculation of TST rate
- Lecture 23 - Calculating TST rate for the reaction  $H+HBr$
- Lecture 24 - Collision theory as a special case of TST
- Lecture 25 - TST: an intuitive proof in one dimension
- Lecture 26 - Rate as a flux across a dividing surface
- Lecture 27 - Transition state theory: derivation 2 from dynamical perspective
- Lecture 28 - Discussion of the assumptions of TST
- Lecture 29 - Thermodynamic formulation of TST
- Lecture 30 - Problem solving session - 3
- Lecture 31 - Problem solving session - 4

[Lecture 32 - Hills and valleys of potential energy surfaces](#)

[Lecture 33 - Molecular dynamics: rolling spheres on potential energy surfaces](#)

[Lecture 34 - Predictions from potential energy surfaces - rotational vs vibrational energies](#)

[Lecture 35 - Free energy and potential of mean force](#)

[Lecture 36 - Transmission coefficient and molecular dynamics](#)

[Lecture 37 - Problem solving session - 5](#)

[Lecture 38 - Microcanonical rate constant: putting balls in jars](#)

[Lecture 39 - Microcanonical rate constant: RRK model](#)

[Lecture 40 - Microcanonical rate constant: magic of Marcus - RRKM model](#)

[Lecture 41 - Canonical TST from microcanonical RRKM model](#)

[Lecture 42 - Sum and density of states](#)

[Lecture 43 - Unimolecular decay - revisited](#)

[Lecture 44 - Unimolecular decay: RRK's approach](#)

[Lecture 45 - Unimolecular decay: RRKM's approach](#)

[Lecture 46 - Problem solving session - 6](#)

Lecture 1 - Introduction to quantum theory

Lecture 2 - Schrodinger's theory

Lecture 3 - Laws of quantum mechanics

Lecture 4 - Wave functions

Lecture 5 - Quantum mechanics of a free particle

Lecture 6 - Particle in 1D box

Lecture 7 - Particle in 2D box

Lecture 8 - Spherical polar coordinates and angular momentum

Lecture 9 - Developing Hydrogen atom orbitals - 1

Lecture 10 - Developing Hydrogen atom orbitals - 2

Lecture 11 - Developing Hydrogen atom orbitals - 3

Lecture 12 - Visualizing molecular orbitals

Lecture 13 - Molecular orbital theory 1: Introduction

Lecture 14 - Molecular orbital theory 2: Diatomic molecules

Lecture 15 - Molecular orbital theory 3: Homo-diatomc molecules - I

Lecture 16 - Molecular orbital theory 4: Homo-diatomc molecules - II

Lecture 17 - Molecular orbital theory 5: Hetero-diatomc molecules

Lecture 18 - Molecular orbital theory 6: Polyatomic molecules

Lecture 19 - Molecular orbital theory 7: Ethylene (Introduction to Huckel's theory) - I

Lecture 20 - Molecular orbital theory 8: Ethylene (Introduction to Huckel's theory) - II

Lecture 21 - Molecular orbital theory 9: Butadiene - I

Lecture 22 - Molecular orbital theory 9: Butadiene - II

Lecture 23 - Concept of effective nuclear charge

Lecture 24 - Electronic configuration of elements

Lecture 25 - Properties of Elements (Size, IE, EA and EN)

Lecture 26 - Polarizability

Lecture 27 - Hard soft acid base

Lecture 28 - Predicting molecular structures: VSEPR theory

Lecture 29 - Coordination Chemistry: 18 electron rule and VBT

Lecture 30 - Crystal Field Theory: Octahedral Complex

Lecture 31 - Crystal Field Theory: Tetrahedral Complex

Lecture 32 - Crystal Field Theory: Octahedral vs. Tetrahedral Complex

Lecture 33 - Application of CFSE: Spinel and J-T Distortion

Lecture 34 - Introduction to Molecular Magnetism

Lecture 35 - Problem Solving Approach

Lecture 36 - Magnetism

Lecture 37 - Spectroscopic Term Symbol

Lecture 38 - Magnetic States of Matter: Paramagnetic, Ferro and Antiferromagnetic

Lecture 39 - Band structures of solid materials

Lecture 40 - Density of states and doping in semiconductors

Lecture 41 - Introduction to molecular spectroscopy

Lecture 42 - Rotational spectroscopy

Lecture 43 - Vibrational spectroscopy

Lecture 44 - Electronic Spectroscopy - I

Lecture 45 - Electronic Spectroscopy - II

Lecture 46 - Electronic Spectroscopy - III

Lecture 47 - Fluorescence Spectroscopy

Lecture 48 - Fundamentals of NMR spectroscopy and MRI

Lecture 49 - Surface characterization techniques

Lecture 50 - Introduction to thermodynamics: Work, heat and energy

Lecture 51 - First law of thermodynamics: Diathermic and adiabatic systems, exothermic and endothermic processes

Lecture 52 - Enthalpy, Hess's law

Lecture 53 - Second law of thermodynamics: Entropy and third law of thermodynamics

Lecture 54 - Helmholtz and Gibbs free energies, Concept of spontaneity

Lecture 55 - Electrochemical equilibrium, Nernst equation

Lecture 56 - Acid base and solubility equilibria

Lecture 57 - Corrosion

Lecture 58 - Extraction of metals

Lecture 59 - Ellingham Diagram

Lecture 60 - Problems From Thermodynamics

Lecture 61 - Intermolecular forces: Electrostatic and Ion-Dipole Interaction

Lecture 62 - Intermolecular forces: Dipole-dipole, hydrogen bonding

Lecture 63 - Real gases - Part 1

Lecture 64 - Real gases - Part 2

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[Lecture 66 - Potential energy surface of H<sub>3</sub> system](#)

[Lecture 67 - Salient features of H<sub>3</sub> potential energy surface](#)

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[Lecture 69 - Representation of three dimensional structures](#)

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[Lecture 71 - Configurations, Symmetry and Chirality](#)

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[Lecture 73 - Optical activity, Conformational analysis, and absolute configuration](#)

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[Lecture 75 - Elimination reactions](#)

[Lecture 76 - Addition, Oxidation and Reduction reactions](#)

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Lecture 2 - Overview - 2

Lecture 3 - Overview - 3

Lecture 4 - Illudin M (Kinder) Illudin C (Funk)

Lecture 5 - Total Synthesis of FR900848 (Barrett)

Lecture 6 - Total Synthesis of Cubane

Lecture 7 - Total Synthesis of Endiandric acids

Lecture 8 - Total Synthesis of Penicilin

Lecture 9 - Total Synthesis of Thienamycin

Lecture 10 - Total Synthesis of Prostaglandin (Corey)

Lecture 11 - Total Synthesis of Prostaglandin (Johnson and Stork)

Lecture 12 - Total Synthesis of Biotin and Lactacystin (i) Corey, (ii) Baldwin

Lecture 13 - Total Synthesis of Triquinanes: Isocomene 1) M. Pirrung 2) Fitjer

Lecture 14 - Total Synthesis of Triquinanes: Isocomene and Silphipherfol-6-en-5-one (Rawal)

Lecture 15 - Total synthesis of Triquinanes by radical cyclisation - I (Curran)

Lecture 16 - Total synthesis of Triquinanes by radical cyclisation - II

Lecture 17 - Total synthesis of Triquinanes by photochemical reaction - I

Lecture 18 - Total synthesis of Triquinanes by photochemical reaction - II

Lecture 19 - Total synthesis of Triquinanes by Thermal Metathesis (Mehta)

Lecture 20 - Total synthesis of Triquinanes by other reactions

Lecture 21 - Total synthesis of Longifolene (Corey and Oppolzer)

Lecture 22 - Total synthesis of Carpanone (Chapman)

Lecture 23 - Total synthesis of Mevinolin (Clive)

Lecture 24 - Total synthesis of Gibberellic Acid (Corey)

Lecture 25 - Total synthesis of Gibberellic Acid (Yamada)

Lecture 26 - Total synthesis of Perhydrohistrionicotoxin (Corey)

Lecture 27 - Total synthesis of Strychnine (Woodward)

Lecture 28 - Total synthesis of Strychnine (Rawal and Overman)

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Lecture 30 - Total synthesis of Reserpine (Woodward)

Lecture 31 - Total synthesis of Yohimbine (Tamelen and Momose)

- Lecture 32 - Total synthesis of Quinine (Woodward and Stork)
- Lecture 33 - Total synthesis of Dendrobine (Livinghouse)
- Lecture 34 - Total synthesis of Morphine (Gates and Overman)
- Lecture 35 - Total synthesis of Morphine (Parker and White)
- Lecture 36 - Total synthesis of Methylhomosecodaphniphyllate (Heathcock)
- Lecture 37 - Total synthesis of Lysergic acid (Woodward and Oppolzer)
- Lecture 38 - Total synthesis of Galanthamine (Barton and Kirby)
- Lecture 39 - Total synthesis of Epibatidine (Trost and Evans)
- Lecture 40 - Total synthesis of Swainsonine (Hashimoto)
- Lecture 41 - Total synthesis of Staurosporine (Danishefsky and Wood)
- Lecture 42 - Total synthesis of Manzamine A (Winkler)
- Lecture 43 - Total synthesis of Progesterone (Johnson)
- Lecture 44 - Total synthesis of Progesterone from Diosgenin (Marker)
- Lecture 45 - Total synthesis of Estrone (Torgov)
- Lecture 46 - Total synthesis of Taxol (Nicolaou)
- Lecture 47 - Total synthesis of Taxol (Holton)
- Lecture 48 - Total synthesis of Taxol (Danishefsky)
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- Lecture 50 - Total synthesis of Eleutherobin (Nicolaou)
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- Lecture 52 - Total synthesis of Phorbol (Wender)
- Lecture 53 - Total synthesis of Periplanone (Still and Schreiber)
- Lecture 54 - Total synthesis of Discodermolide (Schreiber)
- Lecture 55 - Total synthesis of Epothilones I (Nicolaou)
- Lecture 56 - Total synthesis of Epothilones II (Schinzer and Danishefsky)
- Lecture 57 - Total synthesis of Vineomycinone B2 (Tius and Danishefsky)
- Lecture 58 - Total synthesis of Zaragozic acid C (Carreira)

- Lecture 1 - CD Spectroscopy: Introduction
- Lecture 2 - Symmetry and Molecular properties
- Lecture 3 - Symmetry elements - I
- Lecture 4 - Symmetry elements - II
- Lecture 5 - Symmetry and point groups - I
- Lecture 6 - Symmetry and point groups - II
- Lecture 7 - Point group determination tutorial
- Lecture 8 - Chirality and point group - I
- Lecture 9 - Chirality and point group - II
- Lecture 10 - Chirality and point group - III tutorial
- Lecture 11 - Chirality and biology - I
- Lecture 12 - Chirality and biology - II
- Lecture 13 - Chirality and biology - III
- Lecture 14 - Chirality and biology - IV
- Lecture 15 - Chirality and biology - V
- Lecture 16 - Origin of chirality
- Lecture 17 - The physical background of chiral response - I
- Lecture 18 - The physical background of chiral response - II
- Lecture 19 - The physical background of chiral response - III
- Lecture 20 - The physical background of chiral response - IV
- Lecture 21 - The physical background of chiral response - IV
- Lecture 22 - The physical background of chiral response - V
- Lecture 23 - The physical background of chiral response - VI
- Lecture 24 - Circular Dichroism Spectra
- Lecture 25 - Examples of Circular Dichroism - I
- Lecture 26 - Examples of Circular Dichroism - II
- Lecture 27 - Examples of Circular Dichroism - III
- Lecture 28 - Examples of Circular Dichroism - IV
- Lecture 29 - Applications of CD spectroscopy - I
- Lecture 30 - Applications of CD spectroscopy - II
- Lecture 31 - Applications of CD spectroscopy - III



- Lecture 32 - Applications of CD spectroscopy - IV
- Lecture 33 - Applications of CD spectroscopy - V
- Lecture 34 - Applications of CD spectroscopy - VI
- Lecture 35 - CD spectroscopy: Conclusion
- Lecture 36 - Mössbauer Spectroscopy: Introduction
- Lecture 37 - Mössbauer Spectroscopy Fundamentals - I
- Lecture 38 - Mössbauer Spectroscopy
- Lecture 39 - Mössbauer Spectroscopy Fundamentals - II
- Lecture 40 - Mössbauer Spectroscopy Fundamentals - III
- Lecture 41 - Mössbauer Spectroscopy Fundamentals - IV
- Lecture 42 - Mössbauer Spectroscopy: Isomer shift - I
- Lecture 43 - Mössbauer Spectroscopy: Isomer shift - II
- Lecture 44 - Mössbauer Spectroscopy: Isomer shift - III
- Lecture 45 - Mössbauer Spectroscopy: Quadrupolar splitting - I
- Lecture 46 - Mössbauer Spectroscopy: Quadrupolar splitting - II
- Lecture 47 - Mössbauer Spectroscopy: Applications - I
- Lecture 48 - Mössbauer Spectroscopy: Applications - II
- Lecture 49 - Mössbauer Spectroscopy: Applications - III
- Lecture 50 - Mössbauer Spectroscopy: Data measurement
- Lecture 51 - Mössbauer Spectroscopy: Applications - IV
- Lecture 52 - Mössbauer Spectroscopy: Effect of ligands - I
- Lecture 53 - Mössbauer Spectroscopy: Effect of ligands - II
- Lecture 54 - Mössbauer Spectroscopy: Applications - V
- Lecture 55 - Mössbauer Spectroscopy: Probing ferrocenes - I
- Lecture 56 - Mössbauer Spectroscopy: Probing ferrocenes - II
- Lecture 57 - Mössbauer Spectroscopy: Probing ferrocenes - III
- Lecture 58 - Mössbauer Spectroscopy: Mixed valent complexes - I
- Lecture 59 - Mössbauer Spectroscopy: Mixed valent complexes - II
- Lecture 60 - Mössbauer Spectroscopy: Mixed valent complexes - III
- Lecture 61 - Conclusion section: CD spectroscopy
- Lecture 62 - Conclusion section: Mössbauer Spectroscopy

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Lecture 2 - NMR Basic Concepts - II

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Lecture 6 - Chemical Shifts and Coupling constant

Lecture 7 - Fine Structures in NMR Spectra

Lecture 8 - Pulse Excitation and FT-NMR

Lecture 9 - Practical Aspects of FT-NMR - 1

Lecture 10 - Practical Aspects of FT-NMR - 2

Lecture 11 - Practical Aspects of FT-NMR - 3

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Lecture 14 - Polarization Transfer Technique - 2

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Lecture 16 - General Concept of Multidimensional NMR - 2

Lecture 17 - 2-D NMR or 2-D Co-relation spectroscopy : General concept - 1

Lecture 18 - 2-D NMR or 2-D Co-relation spectroscopy : General concept - 2

Lecture 19 - 2-D NMR or 2-D Co-relation spectroscopy : General concept - 3

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Lecture 21 - Introduction to NOESY and HSQC - 2

Lecture 22 - Introduction to NOESY and HSQC - 3

Lecture 23 - Introduction to NOESY and HSQC - 4

Lecture 24 - Application of NMR in the area of structural Biology: Structure of DNA and RNA - 1

Lecture 25 - Application of NMR in the area of structural Biology: Structure of DNA and RNA - 2

Lecture 26 - Application of NMR in the area of structural Biology: Structure of DNA and RNA - 3

Lecture 27 - Application of NMR in the area of structural Biology: Structure of DNA and RNA - 4

Lecture 28 - Application of NMR in the area of structural Biology: Structure of DNA and RNA - 5

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Lecture 31 - Determination of Structure and Dynamics of Proteins - 1

- Lecture 32 - Determination of Structure and Dynamics of Proteins - 2
- Lecture 33 - Determination of Structure and Dynamics of Proteins - 3
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- Lecture 35 - Determination of Structure and Dynamics of Proteins - 5
- Lecture 36 - Determination of Structure and Dynamics of Proteins - 6
- Lecture 37 - NMR Analysis of Protein Dynamics - I
- Lecture 38 - NMR Analysis of Protein Dynamics - II
- Lecture 39 - NMR Analysis of Protein Dynamics - III
- Lecture 40 - NMR Analysis of Protein Dynamics - IV
- Lecture 41 - Protein-Ligand and Protein-Protein Interaction
- Lecture 42 - NMR Analysis of Ligand specific parameters in a Protein-Ligand Interaction - I
- Lecture 43 - NMR Analysis of Ligand specific parameters in a Protein-Ligand Interaction - II
- Lecture 44 - NMR Analysis of Protein Specific Parameters in a Protein-Ligand Interaction - I
- Lecture 45 - NMR Analysis of Protein Specific Parameters in a Protein-Ligand Interaction - II
- Lecture 46 - NMR in Drug Design
- Lecture 47 - NMR in Drug Discovery
- Lecture 48 - NMR in Drug metabolism - I
- Lecture 49 - NMR in Drug metabolism - II
- Lecture 50 - NMR in Drug metabolism - III
- Lecture 51 - Probing Protein Dynamics by NMR Spectroscopy - I
- Lecture 52 - Probing Protein Dynamics by NMR Spectroscopy - II
- Lecture 53 - Probing Protein Dynamics by NMR Spectroscopy - III
- Lecture 54 - Probing Protein Dynamics by NMR Spectroscopy - IV
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- Lecture 56 - Basics of solid state NMR spectroscopy - I
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- Lecture 58 - Basics of solid state NMR spectroscopy - III
- Lecture 59 - Basics of solid state NMR spectroscopy - IV
- Lecture 60 - Basics of solid state NMR spectroscopy - V

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Lecture 2 - History of Periodic Table - 2

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Lecture 5 - Introduction to Transition elements - 2

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Lecture 7 - Introduction to Transition elements - 4

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Lecture 9 - Werner's Coordination Theory

Lecture 10 - Early Bonding Concepts

Lecture 11 - Valence Bond Theory (VBT) - 1

Lecture 12 - Valence Bond Theory (VBT) - 2

Lecture 13 - Background To Crystal Field Theory (CFT)

Lecture 14 - Crystal Field Theory (CFT) Jahn-Teller Theorem

Lecture 15 - Crystal Field Theory (CFT) - 1

Lecture 16 - Crystal Field Theory (CFT) - 2

Lecture 17 - Ligand Field Theory (LFT) - 1

Lecture 18 - Ligand Field Theory (LFT) - 2

Lecture 19 - Ligand Field Theory (LFT) - 3

Lecture 20 - Ligand Field Theory (LFT) - 4

Lecture 21 - 18 Electron Rule

Lecture 22 - 18 Electron Rule

Lecture 23 - Metal-Metal Multiple Bonds

Lecture 24 - Metal-Metal Multiple Bonds [Quadruple and Quintuple Bonding]

Lecture 25 - Preparation of metal Complexes

Lecture 26 - Preparation of metal Complexes

Lecture 27 - Classification of ligands by donor atoms

Lecture 28 - Classification of ligands by donor atoms - Hydrogen

Lecture 29 - Classification of ligands by donor atoms - Carbon - 1

Lecture 30 - Classification of ligands by donor atoms - Carbon - 2

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- Lecture 32 - Classification of ligands by donor atoms - Carbon - 4
- Lecture 33 - Classification of ligands by donor atoms - Nitrogen - 1
- Lecture 34 - Classification of ligands by donor atoms - Nitrogen - 2
- Lecture 35 - Classification of ligands by donor atoms - Nitrogen - 3
- Lecture 36 - Classification of ligands by donor atoms - Oxygen, Phosphorus
- Lecture 37 - Classification of ligands by donor atoms - Phosphorus - 1
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- Lecture 39 - Classification of ligands by donor atoms - Phosphorus - 3
- Lecture 40 - Classification of ligands by donor atoms - Halogens
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- Lecture 45 - Inorganic Reaction Mechanisms
- Lecture 46 - Inorganic Reaction Mechanisms Square planar complexes
- Lecture 47 - Trans-Effect
- Lecture 48 - Substitution Reactions in Square Planar Complexes, Trans-Effect
- Lecture 49 - Substitution Reactions in Octahedral Complexes
- Lecture 50 - Substitution Reactions in Octahedral Complexes; Stereochemistry of Products
- Lecture 51 - Electron-Transfer Processes
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- Lecture 53 - Methods of Characterization UV-Visible Spectroscopy
- Lecture 54 - Methods of Characterization UV-Visible Spectroscopy
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Lecture 3 - Radioactive decay chain

Lecture 4 - Radioactive equilibria

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Lecture 6 - Nuclear force and nuclear properties

Lecture 7 - Liquid drop model

Lecture 8 - Applications of Liquid drop model

Lecture 9 - Nuclear Shell model

Lecture 10

Lecture 11 - Alpha decay

Lecture 12 - Beta decay

Lecture 13 - Gamma decay

Lecture 14 - Interaction of radiations with matter

Lecture 15 - Interaction of fast electrons with matter

Lecture 16 - Interaction of electromagnetic radiations with matter

Lecture 17 - Principles of radiation detectors

Lecture 18 - Gas filled detectors

Lecture 19 - Scintillator detectors

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Lecture 30 - Radioisotope production using charged particles

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Lecture 32 - Radioanalytical techniques and applications

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Lecture 37 - Nuclear Probes: Positron annihilation spectroscopy

Lecture 38 - Perturbed angular correlation

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Lecture 56 - Analytical chemistry of actinides

Lecture 57 - Transactinides

Lecture 58 - Fast radiochemical separations

Lecture 59 - Actinides in the environment

Lecture 60 - Actinides sorption and migration

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Lecture 2 - Configuration and Weights

Lecture 3 - Configuration and Weights (Continued...)

Lecture 4 - Boltzmann Distribution

Lecture 5 - The Molecular Partition Function

Lecture 6 - The Molecular Partition Function of a uniform ladder of energy levels

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Lecture 8 - The partition function for a particle of mass  $m$  free to move in a 3D container

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Lecture 10 - Numerical Problems Set-II

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Lecture 12 - Obtaining expression for beta

Lecture 13 - The Statistical Entropy

Lecture 14 - Connecting partition function with entropy

Lecture 15 - Solving numerical problems based on Internal energy and Entropy

Lecture 16 - Solving numerical problems based on Internal energy and Entropy

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Lecture 18 - Further discussion on  $q$  (Partition function),  $U$  (Internal energy) and  $S$  (Entropy)

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Lecture 20 - Relating Canonical Partition Function Internal Energy and Entropy

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**NPTEL : Heterocyclic Chemistry (Chemistry and Biochemistry)**

**Co-ordinators : Prof. D.R. Mal**

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Lecture 21 - Synthetic Biology (Continued...)

Lecture 22 - Nucleic Acid

Lecture 23 - Nucleic Acid (Continued...)

Lecture 24 - DNA sequencing method

Lecture 25 - DNA sequencing method (Continued...)

Lecture 26 - DNA sequencing method (Continued...)

Lecture 27 - Synthesis of oligonucleotide

Lecture 28 - Central dogma: DNA replication, transcription and translation

Lecture 29 - Central dogma: DNA replication, transcription and translation (Continued...)

Lecture 30 - Central dogma: DNA replication, transcription and translation (Continued...)

Lecture 31 - Central dogma: DNA replication, transcription and translation (Continued...)

[Lecture 32 - Central dogma: DNA replication, transcription and translation \(Continued...\)](#)

[Lecture 33 - Molecular Biology](#)

[Lecture 34 - Molecular Biology \(Continued...\)](#)

[Lecture 35 - Chemistry of cofactors/coenzymes](#)

[Lecture 36 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 37 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 38 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 39 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 40 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 41 - Introduction to Drug Discovery Process](#)

[Lecture 42 - Fundamental Principles of Drug Development Process](#)

[Lecture 43 - Combinatorial chemistry](#)

[Lecture 44 - Neurotransmitters](#)

[Lecture 45 - Catechol amine based and GABA neurotransmitters](#)

[Lecture 46 - Hypertension: humoral mechanism and renin/angiotensin system](#)

[Lecture 47 - Inhibitor design of angiotensin converting enzyme](#)

[Lecture 48 - Antimicrobial drugs](#)

[Lecture 49 - Chemistry of penicillins](#)

[Lecture 50 - Resistance to beta-lactam antibiotics](#)

[Lecture 51 - Mechanistic studies of beta-lactamase](#)

[Lecture 52 - Non beta-lactam antibiotics](#)

[Lecture 53 - Mechanistic enzymology of Isopenicillin N synthase](#)

[Lecture 54 - Polyketide Biosynthesis](#)

[Lecture 55 - Biosynthesis of macrolide polyketides and introduction to virus](#)

[Lecture 56 - Anti-viral drugs](#)

[Lecture 57 - Cancer and Chemotherapy](#)

[Lecture 58 - Anti-cancer drugs \(Continued...\)](#)

[Lecture 59 - Aromatase inhibition and Anti-ulcer drugs](#)

[Lecture 60 - Cholesterol lowering agents](#)

[Lecture 61 - Cholesterol Biosynthesis](#)

[Lecture 62 - Pharmacokinetics and pharmacodynamics](#)

[Lecture 63 - QSAR principles](#)

Lecture 1 - Importance of Polymer Science and Brief Historical background

Lecture 2 - Definitions/Terminologies, Classifications

Lecture 3 - Classifications, Nomenclature

Lecture 4 - Classification by Polymerization Mechanism, Nomenclature

Lecture 5 - Molecular Weight, Big Picture of Polymer Science, Common Polymers

Lecture 6 - Examples of Step Polymers, Linear Step Polymerization

Lecture 7 - Linear Step Polymerization: MW Control, MW Distribution, Kinetics

Lecture 8 - Linear Step Polymerization: Kinetics (Continued...), Equilibrium Consideration, General Requirements for Achieving High MW; Non-linear Step Polymerization

Lecture 9 - Linear Step Polymerization: Summary - General Requirement, Non-Linear Step Polymerization

Lecture 10 - Types of Chain polymerization, Mechanism and Kinetics of Radical Chain Polymerization

Lecture 11 - Kinetics of Radical Chain Polymerization (Continued...), Various Types of Initiators

Lecture 12 - Thermal Initiation (Continued...), Molecular Weight and Kinetic Chain Length, Other Types of Radical Initiators, Transfer Reactions

Lecture 13 - Transfer Reactions, Effect of Temperature on Rate and MW, MW Distribution, ceiling Temperature

Lecture 14 - Energetics and Thermodynamics of Chain Polymerization, MW Distribution, Common Polymers

Lecture 15 - Thermodynamics of Chain Polymerization, MW Distribution, Common Polymers

Lecture 16 - Process Conditions, Emulsion Polymerization

Lecture 17 - Emulsion Polymerization (Continued...), Common Polymers by Radical Chain Polymerization, RDRP

Lecture 18 - Reversible - Deactivation Radical Polymerizations (RDRP)

Lecture 19 - RAFT Polymerization (Continued...), Ionic Polymerization

Lecture 20 - Polymer Stereochemistry and Zeigler - Natta Coordination Polymerization

Lecture 21 - Ring Opening Polymerization, Copolymers

Lecture 22 - Copolymerization (Continued...)

Lecture 23 - Polymers in Solution : Flory - Huggins Theory

Lecture 24 - Polymers in Solution : Application of Flory - Huggins Theory

Lecture 25 - Polymers in Solution : Solubility Parameter, Polymer Phase Separation and Fractionation

Lecture 26 - Polymers Chain Dimensions

Lecture 27 - Frictional Properties of Polymer Molecules in Dilute Solution, Determination of Polymer MW (Overview)

Lecture 28 - Membrane Osmometry, End Group Analysis, Dilute Solution Viscometry

Lecture 29 - Dilute Solution Viscometry, Light Scattering Techniques for MW

Lecture 30 - Gel Permeation Chromatography

[Lecture 31 - Light Scattering Techniques for MW and Size Measurements \(Continued...\)](#)

[Lecture 32 - Mass Spectroscopy of Polymers](#)

[Lecture 33 - Polymer Processing](#)

[Lecture 34 - Mechanical Properties, Amorphous State](#)

[Lecture 35 - Thermal Properties: Amorphous State](#)

[Lecture 36 - Thermal Properties: Crystalline State](#)

[Lecture 37 - Thermal Properties: Factors Influencing  \$T\_m\$ , Determination of  \$T\_g\$  and  \$T\_m\$ , Other Thermal Properties](#)

[Lecture 38 - Thermomechanical Properties, Viscoelasticity](#)

[Lecture 39 - Thermomechanical Properties, Viscoelasticity \(Continued...\)](#)

[Lecture 40 - Optical, Electrical, Barrier Properties; Chemical Resistance and Weathering of Polymers](#)

[Lecture 41 - Polymer Additives](#)

[Lecture 42 - Polymer Blends, Concluding Remarks](#)

**NPTEL : NOC:Structure, Stereochemistry and Reactivity of Organic Compounds and Intermediates: A Problem Solving Approach (Chemistry and Biochemistry)**

**Co-ordinators : Prof. A. Basak**

Lecture 1 - Introduction to structure and stereochemistry of organic molecules: salient features of symmetry elements; Role of principal axis, sigma plane, centre of symmetry, and alternating axis of symmetry in deciding chirality

Lecture 2 - Introduction to point group notation, classification, symmetry number and order

Lecture 3 - Examples of various point group notations, chiral and achiral point groups, examples of various point groups

Lecture 4 - Solving problems on point groups ( $C_n$ ,  $C_{nv}$ ,  $C_{nh}$ ,  $D_{nd}$ )

Lecture 5 - Conformational Analysis of Perhydrophenanthrene

Lecture 6 - Concept Clearing Session on Achiral Point Groups

Lecture 7 - Axial, Planar and Helical Chirality, assignment of absolute configuration to such molecules

Lecture 8 - Concept of pseudoasymmetry; Reflection variance/invariance problem; methods of nomenclature system

Lecture 9 - Conformational analysis of bicyclic systems: the Decalins

Lecture 10 - Conformational analysis of Perhydrophenanthrene

Lecture 11 - Conformational analysis of Perhydroanthracene

Lecture 12 - Revisiting conformational analysis of Perhydrophenanthrene

Lecture 13 - Revisiting conformational analysis of Perhydroanthracene

Lecture 14 - Introduction to Linear Polarized light and interaction with chiral materials; Circular Birefringence, Circular Dichroism

Lecture 15 - ORD, CD and Cotton Effect (CE); Empirical rule to determine the sign of CE, 2-axial haloketone rule

Lecture 16 - Octant rule: application to substituted cyclohexanone and decalone system

Lecture 17 - Application of Octant rule to tricyclic system; drawing of octant projection

Lecture 18 - Application of Octant rule to steroidal ketones; drawing of octant projection

Lecture 19 - Stereoelectronic effects on conformation and reactivity

Lecture 20 - Examples of anomeric effect and Stereoelectronic effect

Lecture 21 - Baldwin rules

Lecture 22 - Cyclization in enolic systems

Lecture 23 - Problem solving on Baldwin rules

Lecture 24 - Reactive Functionalities: Chemistry of Alkynes

Lecture 25 - Reactive Functionalities: Chemistry of Alkynes (Continued...), arynes and enediynes

Lecture 26 - Reactive Functionalities: Ene-diyne (Continued...), allenes and Ketenes

Lecture 27 - Beta - Lactam Synthesis

Lecture 28 - Chemistry of radicals

Lecture 29 - Reactivity of radicals: Frontier orbital approach.

Lecture 30 - Radical mediated C-C bond formation

[Lecture 31 - Radical mediated C-C bond formation \(Continued...\)](#)

[Lecture 32 - Radical mediated decarboxylation and deoxygenation](#)

[Lecture 33 - Dynamic Stereochemistry: Conformationally rigid and mobile systems](#)

[Lecture 34 - Dynamic Stereochemistry: Conformational analysis of elimination and addition](#)

[Lecture 35 - Dynamic Stereochemistry: Stereoselectivity in carbonyl reduction](#)

[Lecture 36 - Dynamic Stereochemistry: Reactivity of unsaturated carbonyl and enolate systems](#)

[Lecture 37 - Dynamic Stereochemistry: Enolate as nucleophile](#)

[Lecture 38 - Dynamic Stereochemistry: stereochemical issues in cyclohexenone reduction and alpha-electrophilic substitution in carbonyls](#)

[Lecture 39 - Dynamic Stereochemistry: Asymmetric aldol reactions](#)

[Lecture 40 - Dynamic Stereochemistry: Asymmetric aldol reaction \(Continued...\)](#)

Lecture 1 - Review of Quantum Chemistry

Lecture 2 - Postulates of Quantum Mechanics - I

Lecture 3 - Postulates of Quantum Mechanics - II

Lecture 4 - Exactly Solvable Models - I

Lecture 5 - Exactly Solvable Models - II

Lecture 6 - Exactly Solvable Models - II (Continued...)

Lecture 7 - Variational Principle - I

Lecture 8 - Variational Principle - II

Lecture 9 - Variational Method: Applications - I

Lecture 10 - Linear Variational Method

Lecture 11 - Applications of Linear Variational Method

Lecture 12 - Variational Method in Chemical Bonding - I

Lecture 13 - Variational Method in Chemical Bonding - II

Lecture 14 - Variational Method in Chemical Bonding - III

Lecture 15 - Molecular Orbital Treatment of Polyatomics

Lecture 16 - Molecular Orbital Treatment of Polyatomics

Lecture 17 - Perturbation Theory

Lecture 18 - Examples of Perturbation Theory - I

Lecture 19 - Examples of Perturbation Theory - II

Lecture 20 - Molecular Response to Electric Field - I

Lecture 21 - Molecular Response to Electric Field - II

Lecture 22 - Degenerate Perturbation Theory

Lecture 23 - Excited States of He Atom - I

Lecture 24 - Excited States of He Atom - II

Lecture 25 - Slater Determinants - I

Lecture 26 - Slater Determinants - II

Lecture 27 - Energy Expectation Value with Slater Determinants - I

Lecture 28 - Energy Expectation Value with Slater Determinants - II

Lecture 29 - Self-Consistent Field Method

Lecture 30 - Canonical HF Equations

Lecture 31 - Hartree-Fock Energy



[Lecture 32 - Hartree-Fock-Roothan Equations](#)

[Lecture 33 - The Density Matrix](#)

[Lecture 34 - Evaluation of Molecular Properties](#)

[Lecture 35 - Basis Sets - I](#)

[Lecture 36 - Basis Sets - II](#)

[Lecture 37 - Electron Correlation and Post HF Methods](#)

[Lecture 38 - Time-Dependent Perturbation Theory - I](#)

[Lecture 39 - Time-Dependent Perturbation Theory - II](#)

[Lecture 40 - Slowly Switched Constant Perturbation](#)

[Lecture 41 - Oscillating Perturbation](#)

[Lecture 42 - Einstein's Coefficients](#)

Lecture 1 - Metal Ions In Biological Systems

Lecture 2 - Metallobiosite structures

Lecture 3 - Biomolecular structure and molecular biology component

Lecture 4 - Structures of nucleic acids

Lecture 5 - Coordination Chemistry in action

Lecture 6 - Coordination of peptide building blocks

Lecture 7 - Occurrence and availability

Lecture 8 - Potential ligands of different types

Lecture 9 - Metal ion insertion

Lecture 10 - Organic cofactors and siderophores

Lecture 11 - Introduction

Lecture 12 - CD and Raman spectroscopy

Lecture 13 - EPR

Lecture 14 - NMR and X-ray

Lecture 15 - Electrochemical methods

Lecture 16 - Metal ion assimilation

Lecture 17 - Transport of metal ions in bacteria and plants

Lecture 18 - Transport of metal ions in fungi and mammals

Lecture 19 - Homeostasis in bacteria and plants

Lecture 20 - Homeostasis in fungi and mammals

Lecture 21 - Transport across membranes

Lecture 22 - Ion channels and ion pumps

Lecture 23 - (K<sup>+</sup>) channels

Lecture 24 - (Na<sup>+</sup>) channels

Lecture 25 - (Na<sup>+</sup>)-(K<sup>+</sup>) ATPase

Lecture 26 - (Mg<sup>2+</sup>) dependent enzymes and kinases

Lecture 27 - Phosphatases and enolases

Lecture 28 - Photoreception and enzymes

Lecture 29 - (Ca<sup>2+</sup>) transporting, binding and sensor proteins

Lecture 30 - Cell signaling by (Ca<sup>2+</sup>) binding and sensing

Lecture 31 - Functions of iron ions and iron ion proteins

- Lecture 32 - Heme proteins for (O<sub>2</sub>) transport and storage
- Lecture 33 - Activators of (O<sub>2</sub>) and electron transport proteins
- Lecture 34 - Iron-sulfur proteins
- Lecture 35 - Mononuclear and dinuclear non-heme enzymes
- Lecture 36 - Oxygen transport and SOD activity
- Lecture 37 - Type 1 blue copper proteins
- Lecture 38 - Type 2 non-blue copper proteins
- Lecture 39 - Type 3 dinuclear copper proteins
- Lecture 40 - Multicopper and mixed-copper enzymes
- Lecture 41 - Coordination chemistry and function of zinc ions
- Lecture 42 - Carbonic anhydrase and lyases
- Lecture 43 - Carboxypeptidase and metalloproteinases
- Lecture 44 - Alcohol dehydrogenase and Beta-lactamase
- Lecture 45 - Redox catalysis by manganese ions
- Lecture 46 - Redox catalysis by manganese ions
- Lecture 47 - Catalysis by manganese and cobalt ions
- Lecture 48 - Cobalt ion dependent proteins and enzymes
- Lecture 49 - Nickel proteins and enzymes
- Lecture 50 - More nickel ion bearing enzymes
- Lecture 51 - Carbon, hydrogen and oxygen
- Lecture 52 - Nitrogen and Silicon
- Lecture 53 - Phosphorus
- Lecture 54 - Sulfur and Selenium
- Lecture 55 - Chlorine and Iodine
- Lecture 56 - Brain and blood-brain barrier (BBB)
- Lecture 57 - Zinc and copper ions
- Lecture 58 - Iron ions
- Lecture 59 - Metal ion based drugs and metallotherapeutics
- Lecture 60 - Chemotherapy, radiotherapy and contrast agents

- Lecture 1 - Enolate generation, structure of enolates and related topic - I
- Lecture 2 - Enolate generation, structure of enolates and related topic - II
- Lecture 3 - Enolate generation, structure of enolates and related topic - III
- Lecture 4 - Different mode of asymmetric induction in enolate alkylation
- Lecture 5 - Revisit again, Different mode of asymmetric induction in enolate alkylation
- Lecture 6 - Substrate directed stereocontrol in acyclic and cyclic system
- Lecture 7 - Substrate directed enolate alkylation in bicyclic system
- Lecture 8 - Seebach's SRS principle and related systems - I
- Lecture 9 - Seebach's SRS principle and related systems - II
- Lecture 10 - Seebach's SRS principle and related systems - III
- Lecture 11 - Evans oxazolidinone and related systems - I
- Lecture 12 - Evans oxazolidinone and related systems - II
- Lecture 13 - Evans oxazolidinone and related systems - III
- Lecture 14 - Evans oxazolidinone and related systems - IV
- Lecture 15 - Evans oxazolidinone and related systems - V
- Lecture 16 - Helmchen's auxiliary, Oppolzer's sultam based auxiliary
- Lecture 17 - Camphor based N-acyloxazolidinones as chiral auxiliary
- Lecture 18 - Myer's ephedrine, Chiral Weinreb amide equivalents and related systems
- Lecture 19 - Myer's ephedrine and related systems
- Lecture 20 - Chiral Weinreb amide equivalents and related systems
- Lecture 21 - Meyer's oxazoline based alkylation - I
- Lecture 22 - Meyer's oxazoline based alkylation - II
- Lecture 23 - Meyer's bicyclic lactam based enolate alkylation
- Lecture 24 - Meyer's bicyclic lactam based alkylation
- Lecture 25 - Meyer's bicyclic lactams, Gleason's bicyclic thioglycolate lactam based systems
- Lecture 26 - Few problem solving from Meyer's oxazoline/bicyclic lactam based alkylation
- Lecture 27 - Schollkopf's bis-lactim ether and related systems; Auxiliary induced chiral relay
- Lecture 28 - Chiral relay systems in amino acid derived enolate alkylation
- Lecture 29 - Williams oxazinone, Yamada's chiral glycine enolate and related system
- Lecture 30 - Tricycloiminolactone as chiral glycine equivalents
- Lecture 31 - Najera's auxiliary, Davies diketopiperazine and related system

Lecture 32 - Ender's RAMP/SAMP, Coltart's cyclic carbamate hydrazone, Ellman's sulfinamide and related

Lecture 33 - Ender's RAMP/SAMP based systems

Lecture 34 - Ender's RAMP/SAMP based systems

Lecture 35 - Ender's RAMP/SAMP, Coltart's cyclic carbamate hydrazone, Ellman's sulfinamide

Lecture 36 - Coltart's cyclic carbamate hydrazone and its exploration

Lecture 37 - Memory of chirality in enolate alkylation

Lecture 38 - Organocatalytic methods for enolate alkylation (SOMO activation)

Lecture 39 - Enantioselective alkylation with chiral PTC

Lecture 40 - Overall analysis of the entire discussion

Lecture 1 - Bioenergetics: Understanding the significance in Biological Systems

Lecture 2 - Regulation of Enzyme Activity

Lecture 3 - Digestion and Absorption of Carbohydrates

Lecture 4 - Glycolysis, alcohol and lactic acid fermentation

Lecture 5 - Biochemistry of TCA Cycle (I)

Lecture 6 - TCA Cycle (II) - Regulation and special characteristics

Lecture 7 - Neoglucogenesis

Lecture 8 - Regulation of Glycolysis and Neoglucogenesis - I

Lecture 9 - Regulation of Glycolysis and Neoglucogenesis - II Cori Cycle, Rapoport Leubering

Lecture 10 - Hexose Monophosphate Shunt : Steps and Phases

Lecture 11 - Hexose Monophosphate Shunt : Regulation and Significance

Lecture 12 - Glycogen Metabolism - I

Lecture 13 - Glycogen Metabolism - II

Lecture 14 - Glycogen Metabolism - III

Lecture 15 - Glycogen Metabolism - IV

Lecture 16 - Galactose Metabolism and Associated Disorders

Lecture 17 - Fructose Metabolism and Associated Disorders

Lecture 18 - Regulation of Blood Glucose

Lecture 19 - Diabetes Mellitus and Metabolic Alterations

Lecture 20 - Digestion and absorption of Lipid

Lecture 21 - Lipoprotein Metabolism - I

Lecture 22 - Lipoprotein Metabolism - II

Lecture 23 - Lipoprotein metabolism - III

Lecture 24 - Fatty acid catabolism (Oxidation of Fatty acids) - I

Lecture 25 - Fatty acid catabolism (Oxidation of Fatty acids) - II

Lecture 26 - Fatty acid catabolism (Oxidation of Fatty acids) - III

Lecture 27 - Metabolism of Ketone Bodies

Lecture 28 - Biosynthesis of Fatty acid and its regulation

Lecture 29 - Biosynthesis of triacylglycerol, phosphoglycerides and sphingolipids

Lecture 30 - Cholesterol Metabolism

Lecture 31 - Digestion and absorption of Protein

Lecture 32 - Transformation of Amino acids

Lecture 33 - Metabolism of Ammonia and ammonia toxicity

Lecture 34 - Urea cycle - Steps, Significance and Energetics

Lecture 35 - Urea Cycle - Regulation and Enzyme Deficiency Disorders

Lecture 36 - Metabolism of Phenylalanine and Associated Disorders

Lecture 37 - Tyrosine Metabolism - I

Lecture 38 - Tyrosine Metabolism - II (Catecholamines)

Lecture 39 - Tyrosine Metabolism - III

Lecture 40 - Tryptophan Metabolism

Lecture 41 - Metabolism of Sulphur containing Amino acids (Methionine and Cysteine)

Lecture 42 - Metabolism of Glycine and its disorders

Lecture 43 - Metabolism of Serine, Threonine and Alanine

Lecture 44 - Branched chain amino acid metabolism and their disorders

Lecture 45 - Metabolism of Histidine, Proline, Arginine and Lysine

Lecture 46 - Heme Metabolism - I (Heme Synthesis and Regulation)

Lecture 47 - Heme Metabolism - II (Disorders of Heme Synthesis - Porphyrrias)

Lecture 48 - Heme Metabolism - III (Heme Degradation, Transport and Bilirubin Metabolism)

Lecture 49 - Disorders of Bilirubin Metabolism

Lecture 50 - Nucleotide Metabolism - I (Purine Metabolism)

Lecture 51 - Nucleotide Metabolism - II (Disorders of Purine Metabolism)

Lecture 52 - Nucleotide Metabolism - III (Pyrimidine Metabolism and Disorders)

Lecture 53 - Inborn errors of Metabolism

Lecture 54 - Integration of Metabolism - I (Cellular and Organ level integration)

Lecture 55 - Integration of Metabolism - II (Starve feed cycle)

Lecture 56 - Integration of Metabolism - III (Metabolic Control Analysis)

Lecture 57 - Obesity, Metabolic Syndrome and Role of Adipokines

Lecture 58 - Fatty Liver and alcohol metabolism

Lecture 59 - Energy metabolism and Nutritional disorders, Protein Energy Malnutrition and Dietary

Lecture 60 - Metabolism in Cancer Cells

Lecture 1 - Introduction

Lecture 2 - System, Equilibrium States

Lecture 3 - Mathematical foundation - Exact differentials

Lecture 4 - Mathematical foundation - Inexact differentials

Lecture 5 - First law - Introduction to Internal energy

Lecture 6 - First law - Heat and work

Lecture 7 - First law - Pressure-volume work

Lecture 8 - First law - Internal energy revisited

Lecture 9 - First Law - Enthalpy

Lecture 10 - First law - Estimation of change in internal energy and enthalpy

Lecture 11 - Second law - Introduction

Lecture 12 - Second law - Carnot engine and entropy

Lecture 13 - Entropy and Third law

Lecture 14 - Entropy and Spontaneity in isolated systems

Lecture 15 - Spontaneity and equilibrium - Thermodynamic potentials

Lecture 16 - Spontaneity and equilibrium - Non-isolated systems

Lecture 17 - Thermodynamic potentials and Maxwell's relations

Lecture 18 - Application of Maxwell's relations

Lecture 19 - Thermodynamic response functions

Lecture 20 - Using Maxwell's relations to solve numerical problems

Lecture 21 - Fundamental Equation of Chemical Thermodynamics

Lecture 22 - Open systems and chemical potential

Lecture 23 - Chemical potential in one and many component ideal gas

Lecture 24 - Gibbs-Duhem relation and thermodynamics of ideal gas mixture

Lecture 25 - Numerical applications of Gibbs-Duhem relation

Lecture 26 - Phase equilibrium - Part 1

Lecture 27 - Phase equilibrium - Part 2

Lecture 28 - Phase equilibrium - Part 3

Lecture 29 - Phase equilibrium - Part 4

Lecture 30 - Numerical problems in phase equilibrium

Lecture 31 - Simple non-reactive mixtures - Part 1



- Lecture 32 - Simple non-reactive mixtures - Part 2
- Lecture 33 - Numerical problems in simple mixtures
- Lecture 34 - Numerical problems on phase equilibrium in simple mixtures
- Lecture 35 - Chemical potential of real systems - Activity and concentration
- Lecture 36 - Numerical problems on chemical potential in real systems
- Lecture 37 - Chemical Equilibrium - Part I
- Lecture 38 - Chemical Equilibrium - Part II
- Lecture 39 - Chemical Equilibrium - Part III
- Lecture 40 - Chemical Equilibrium - Part IV
- Lecture 41 - Numerical problems on chemical equilibrium
- Lecture 42 - Numerical problems on chemical equilibrium (Continued...)
- Lecture 43 - Electrochemical equilibrium - Part I
- Lecture 44 - Electrochemical equilibrium - Part II
- Lecture 45 - Electrochemical equilibrium - Part III
- Lecture 46 - Electrochemical equilibrium - Part IV
- Lecture 47 - Electrochemical equilibrium - Part V
- Lecture 48 - Electrochemical equilibrium - Part VI
- Lecture 49 - Numerical problems on electrochemistry
- Lecture 50 - Numerical problems on electrochemistry (Continued...)
- Lecture 51 - Numerical problems on electrochemistry (Continued...)
- Lecture 52 - Numerical problems on electrochemistry (Continued...)
- Lecture 53 - Numerical problems on electrochemistry (Continued...)
- Lecture 54 - Thermodynamic stability
- Lecture 55 - Thermodynamics in action - Part I
- Lecture 56 - Thermodynamics in action - Part II
- Lecture 57 - Thermodynamics in action - Part III
- Lecture 58 - Thermodynamics in action - Part IV
- Lecture 59 - Demonstration
- Lecture 60 - Concluding Lecture

Lecture 1 - Carbocation

Lecture 2 - Carbocation (Continued...)

Lecture 3 - Carbocation (Continued...)

Lecture 4 - Carbocation (Continued...)

Lecture 5 - Carbocation (Continued...)

Lecture 6 - Carbanion

Lecture 7 - Carbanion (Continued...)

Lecture 8 - Carbanion (Continued...)

Lecture 9 - Carbanion (Continued...)

Lecture 10 - Carbanion (Continued...)

Lecture 11 - Carbene

Lecture 12 - Carbene (Continued...)

Lecture 13 - Carbene (Continued...)

Lecture 14 - Carbene (Continued...)

Lecture 15 - Nitrene

Lecture 16 - Nitrene(Continued...)

Lecture 17 - Radical

Lecture 18 - Radical (Continued...)

Lecture 19 - Free Radical

Lecture 20 - Radical

Lecture 21 - Radical

Lecture 22 - Free Radical (Continued...)

Lecture 23 - Radical

Lecture 24 - Free Radical Reactions

Lecture 25 - Radical (Continued...)

Lecture 26 - Radical (Continued...)

Lecture 27 - Radical (Continued...)

Lecture 28 - Benzyne

Lecture 29 - Benzyne (Continued...)

Lecture 30 - Benzyne (Continued...)

Lecture 31 - Benzyne question answer discussion

[Lecture 32 - Organolithium](#)

[Lecture 33 - Organolithium \(Continued...\)](#)

[Lecture 34 - Organolithium \(Continued...\)](#)

[Lecture 35 - Organolithium \(Continued...\)](#)

[Lecture 36 - Organolithium \(Continued...\)](#)

[Lecture 37 - Grignard](#)

[Lecture 38 - Grignard \(Continued...\)](#)

[Lecture 39 - Organocopper](#)

[Lecture 40 - Organozinc](#)

[Lecture 41 - Organoboron Chemistry](#)

[Lecture 42 - Organoboron Chemistry \(Continued...\)](#)

[Lecture 43 - Organoboron Chemistry \(Continued...\)](#)

[Lecture 44 - Organoboron Chemistry \(Continued...\)](#)

[Lecture 45 - Organoboron](#)

[Lecture 46 - Organoboron Chemistry](#)

[Lecture 47 - Organosilicon Chemistry](#)

[Lecture 48 - Organosilicon Chemistry \(Continued...\)](#)

[Lecture 49 - Organosilicon Chemistry \(Continued...\)](#)

[Lecture 50 - Organosulfur Chemistry](#)

[Lecture 51 - Organosulfur](#)

[Lecture 52 - Organosulfur \(Continued...\)](#)

[Lecture 53 - Organosulfur \(Continued...\)](#)

[Lecture 54 - Organophosphorus Chemistry](#)

[Lecture 55 - Organophosphorus Chemistry \(Continued...\)](#)

[Lecture 56 - Tutorial 1](#)

[Lecture 57 - Tutorial 2](#)

[Lecture 58 - Tutorial 3](#)

[Lecture 59 - Tutorial 4](#)

[Lecture 60 - Tutorial 5](#)

[Lecture 61 - Tutorial 6](#)

Lecture 1 - Remembering the Masters: From Zeeman to Zavoisky

Lecture 2 - Introduction to EPR spectroscopy

Lecture 3 - Electron-Nuclear Hyperfine Interaction - I

Lecture 4 - Electron-Nuclear Hyperfine Interaction - II

Lecture 5 - Magnetic Moment in Magnetic Field - I

Lecture 6 - Magnetic Moment in Magnetic Field - II

Lecture 7 - EPR Instrumentations - I

Lecture 8 - EPR Instrumentations - II

Lecture 9 - EPR Instrumentations - III

Lecture 10 - EPR Instrumentations - IV

Lecture 11 - Quantum Mechanical Description of EPR - I

Lecture 12 - Quantum Mechanical Description of EPR - II

Lecture 13 - Introduction to Spin Relaxation

Lecture 14 - Theory of First-order EPR Spectra - I

Lecture 15 - Theory of First-order EPR Spectra - II

Lecture 16 - How to Analyse First-order EPR Spectra

Lecture 17 - How to Record EPR Spectra

Lecture 18 - Second-order Effects on EPR Spectra

Lecture 19 - Photochemistry and EPR Spectroscopy

Lecture 20 - Electron Spin Polarisation - I

Lecture 21 - Electron Spin Polarisation - II

Lecture 22 - Anisotropic Interactions in EPR Spectroscopy

Lecture 23 - Theoretical Basis of isotropic Hyperfine Coupling

Lecture 24 - Spin Relaxation and Bloch Equations - I

Lecture 25 - Spin Relaxation and Bloch Equations - II

[Lecture 1](#)

[Lecture 2](#)

[Lecture 3 - Part I](#)

[Lecture 3 - Part II](#)

[Lecture 4 - Part I](#)

[Lecture 4 - Part II](#)

[Lecture 4 - Part III](#)

[Lecture 5 - Part I](#)

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[Lecture 6 - Part I](#)

[Lecture 6 - Part II](#)

[Lecture 6 - Part III](#)

[Lecture 6 - Part IV](#)

[Lecture 7 - Part I](#)

[Lecture 7 - Part II](#)

[Lecture 8 - Part I](#)

[Lecture 8 - Part II](#)

[Lecture 8 - Part III](#)

[Lecture 9 - Part I](#)

[Lecture 9 - Part II](#)

[Lecture 9 - Part III](#)

[Lecture 10](#)

- Lecture 1 - Electromagnetic radiation
- Lecture 2 - Interaction of radiation with matter
- Lecture 3 - Introduction to chemical applications
- Lecture 4 - Analysis of spectra
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Lecture 13 - 1,3-Dipolar cycloaddition reactions (Continued...)

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**Co-ordinators : Prof. Harinath Chakrapani**

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