

Course Code: BO20701T Semester-I : Course Title: Transition Metal Chemistry

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• understand the energetics and Mechanistic pathways of various type of substitution reactions in octahedral, tetrahedral & square planar complexes	S	S	M	M	S
CLO2	• Introduce the clusters and study the structures of clusters of metal carbonyls, Boranes, carboranes and metallocarboranes.	S	M	S	M	M
CLO3	• Apply the wade's rule to distinguish the clusters based on their structures.	M	S	S	M	S
CLO4	• Knowledge about Isopoly and heteropoly acids.	M	S	M	M	M
CLO5	• Learn the synthetic routes for preparation of alkyls & aryls of transition metals like Cu, Zn, Pb, Cd, Li etc.	S	M	M	M	S

S = strong

M = Medium

CLOs = Course Learning Outcomes

PLOs = Programme Learning Outcomes

Course Code: B020402T

Semester-I

: Course Title: Reaction Mechanism

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Understand the concept of aromaticity & Huckel's rule. Distinguish aromatic, antiaromatic, benzenoid & non-benzenoid compounds. Conformations in cycloalkanes & decline.	M	S	S	M	S
CLO2	• Explain necessities of optical and geometrical isomerism. Assess to nomenclature of various optical isomers and geometrical isomers. Stereochemistry in reactions.	M	M	S	M	S
CLO3	• Discuss the energetics and various factors affecting the reactivities of organic substances.	S	M	S	S	M
CLO4	• Elaborate the various types of aliphatic nucleophilic substitutions mechanisms - $SN^1$ , $SN^2$ , $SN^1$ , $SN^2$ and $SN^3$ .	S	M	S	M	M
CLO5	• Explain the electrophilic and nucleophilic substitution reactions on aromatic compounds.	M	M	S	S	M

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Course Code: B020703T : Semester-I : Course Title: Quantum, Thermodynamics & Biophysics

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Understand the basic concepts of postulates of quantum mechanics and applications of schrodinger wave equation to simple systems.	S	M	S	S	S
CLO2	• Understand the variation and perturbation methods for evaluation of energy of Helium atom.	M	M	M	S	S
CLO3	• Introduce and discuss the concept of partial molar properties, fugacity and their experimental determinations.	S	M	S	M	S
CLO4	• Explain the chemical potential and thermodynamic properties of mixing of ideal & non-ideal system.	M	S	S	M	M
CLO5	• acknowledge the non-equilibrium thermodynamics. explain the terms and principles behind this.	S	S	M	M	M

S = strong

M = Medium

CLO<sub>s</sub> = Course Learning Outcomes

PLO<sub>s</sub> = Programme Learning Outcomes

Course Code: BD20704T

Semester-I

Course Title: Analytical Chemistry-I

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	Describe the basic theoretical tools and terms used in analytical chemistry. Evaluate the mean & medians for data.	S	M	M	S	M
CLO2	Elaborate the method, instrumentation and applicability of thermometric analysis.	M	S	M	S	S
CLO3	Acknowledge the detail quantitative application of voltametry and polarographic methods.	S	M	M	M	S
CLO4	Determination of pH of Buffer solutions.	S	S	S	S	S
CLO5	Learn and understand the various types of separation techniques viz. HPLC, ion-exchange chromatography.	S	S	M	S	S

S = strong

M = Medium

CLOs = Course Learning Outcomes

PLOs = Programme Learning Outcomes

Semester-I

Course Code: B020705P : Course Title: Chemistry Practical

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• To understand the principles behind qualitative analysis of acidic, basic and rare earth metals.	M	S	M	S	S
CLO2	• Apply the semimicro analysis method in qualitative analysis of radicals & transition metal ions.	S	M	S	S	S
CLO3	• Apply and perform the qualitative analysis of mixture of binary organic compounds.	S	S	S	M	S
CLO4	• Examine the systematic separation of binary mixture of organic compounds.	M	S	S	S	M
CLO5	• Construct the phase diagram for a ternary system • conductometric & pH-metric titrations.	S	S	S	M	S

S = strong

M = Medium

CLO<sub>s</sub> = Course Learning Outcomes

PLO<sub>s</sub> = Programme Learning Outcomes

Course Code: B020706 R : Course Title: Project/Industrial Training/Internship

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Development of new analytical methods.	S	M	S	M	S
CLO2	• Analysis of environmental samples.	S	S	M	S	S
CLO3	• Quality control of pharmaceuticals	M	M	S	S	M
CLO4	• Synthesis of organic compounds.	S	M	M	S	S
CLO5	• Investigation of thermodynamic properties, kinetic of catalysed reactions and learning computational models.	S	S	S	S	M

S = strong

M = Medium

CLO<sub>s</sub> = Course Learning OutcomesPLO<sub>s</sub> = Programme Learning Outcomes

Course Code: B020201T Semester-II : Course Title: Some Properties of Co-ordination compounds

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Understand and assess the point symmetry groups of compounds.	S	M	S	M	S
CLO2	• Introduce the basic principles in the colour and constitution of transition metal complexes.	S	S	M	M	S
CLO3	• Acknowledge with the charge-transfer spectra in complexes.	S	M	S	M	S
CLO4	• Elaborate detailed of optical isomerism in complexes • Assess the various configurations viz R-S, EZ etc.	S	S	S	M	S
CLO5	• study and determine the magnetic properties in complexes; • Understand the factors affecting magnetism.	S	M	S	S	M

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M = Medium  
CLO<sub>s</sub> = Course Learning Outcomes  
PLO<sub>s</sub> = Programme Learning Outcomes

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Elaborate the mechanistic and stereochemical aspects of addition reactions of $C=C$ bonds.	S	M	S	S	S
CLO2	• Extend the addition reactions to carbon-heteroatom multiple bonded compounds.	S	M	S	S	M
CLO3	• Analyze and correlate the various types of elimination reactions and applications	M	S	S	S	M
CLO4	• Develop a knowledge about pericyclic reactions and categorise the various types viz. cyclo-addition and sigmatropic reactions.	S	S	S	M	S
CLO5	• Elaborate the sigmatropic rearrangements, fluxional tautomerism, Ene reaction.	S	M	S	M	S

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PLOs = Programme Learning Outcomes

Course Code: B020203T : Course Title: Dynamics, Surface and Electrochemistry  
Semester- II

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Explain the various important theories and kinetics of reactions in solutions.	S	S	M	S	S
CLO2	• Elaborate the determination of rate expression of various free radical dynamic reactions, photochemical reactions and oscillatory reactions.	S	S	S	M	S
CLO3	• Interpret the surface chemistry with reference to adsorption & Micelle formation, CMC concept.	S	M	S	M	S
CLO4	• Extend the knowledge of surface chemistry in electrochemical phenomena.	S	M	M	S	S
CLO5	• Understand the electrocatalysis and study the principle & applications of Polarography, Corrosion & its monitoring	M	S	S	S	M

S = strong

M = Medium

CLOs = Course Learning Outcomes

PLOs = Programme Learning Outcomes

Course Code: BO20804T : Semester-II : Course Title: Chemical Kinetics

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Understanding the principles of chemical kinetics of gaseous reactions.	S	S	M	S	S
CLO2	• Apply kinetic theories to reactions between ionic reactants and determine various kinetic parameters.	M	M	S	S	S
CLO3	• Elaborate the kinetics and mechanistic routes of polymerisation reactions.	S	S	M	S	S
CLO4	• Determine the degree of polymerization and kinetic chain length of polymerization reactions.	M	S	S	M	S
CLO5	• Understand and discuss the rate determination & kinetics of fast reactions.	S	M	M	S	S

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M = Medium

CLO<sub>s</sub> = Course Learning Outcomes

PLO<sub>s</sub> = Programme Learning Outcomes

Semester-II  
 Course Code: B020305P : Course Title: Chemistry Practical

CLO Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Discuss the concepts and systematic quantitative analysis of two metal ions involving volumetric and gravimetric methods.	S	S	S	M	S
CLO2	• Preparation and interpretation of some inorganic complexes using spectral data.	S	M	S	M	S
CLO3	• Synthesize and characterize the products of some important name reactions viz. Aldol condensation, Cannizzaro reaction, Friedel-Crafts reaction, AAE condensation.	S	S	M	M	S
CLO4	• Study and determine the kinetics of acidic hydrolysis of ester. Observe the effects of conc. of catalyst, ionic strength on rates.	S	S	M	S	S
CLO5	• Illustrate the applications of potentiometric method to determine the strengths of halides in a mixture, valency of mercurous ion, temperature dependence of e.m.f. of a cell, acid-base titration in non-aqueous med.	S	S	M	M	M

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PLOs = Programme Learning Outcomes

## Semester - III

Course Code: B020901T

Course Title: Spectroscopy-I

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understand the basic principles and about the importance of spectroscopic techniques.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Learn and explain the microwave spectroscopic technique.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Elaborate the basic theoretical aspects of IR spectra and its applications in determining structures of some simple compounds.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Interpretation of UV-visible spectroscopic method along with applications in structural determination.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>An explanation of Raman spectra and theoretical aspects of X-ray diffraction method.</li> </ul>					

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# Semester - III

Course Code: B020902T

Course Title: Organic Synthesis-I and Photochemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>study in details of different Oxidative reactions including hydrocarbons, Alcohols, carbonyl compounds, Amines etc.</li> <li>Learning the oxidation by <math>\text{RuO}_4</math>, IBDA, <math>\text{Ti}(\text{NO}_3)_3</math>.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>elaborate the various reductive process in organic reactions which are synthetically important.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Understand and explain the rearrangement reactions in various named synthetic reactions.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Understand the photochemical reactions with reference to initiation &amp; estimation of quantum efficiency.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>An elaborated discussion of mechanism, stereochemistry and efficiency of many photochemical reactions viz alkenes, carbonyl compounds, aromatics and named reactions.</li> </ul>					

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## Semester - III

Course Code: B020903T(A)

Course Title: Co-ordination Chemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Describe the electronic configurations and term symbols of electronic states of multi-electron systems.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Elaborate the MOT for complexes and correlate MO energy and their symmetry.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Understand the construction of Orgel diagrams</li> <li>Study the Tanabe-Sugano diagrams and determine the <math>B</math> and <math>\Delta_0</math> for complexes.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>An extended study of spectra of complexes with special reference to John-Teller distortion.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Describe the magnetic susceptibility of complexes and define the type of magnetism.</li> <li>Explain the effects of temperature on magnetic behaviour of complexes.</li> </ul>					

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## Semester - III

Course Code: B020903T (B) Course Title: Medicinal Chemistry.

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	• Understanding the fundamental principles of medicinal chemistry, including drug design, synthesis and SAR.					
CLO2	• Utilize the knowledge of drug design and SAR to understand the structure and synthesis of Antibiotics.					
CLO3	• Describe the biochemical and physiological effects of antimetabolites drugs.					
CLO4	• Elaborate the applications of antineoplastic drugs in chemotherapy in cancer treatment					
CLO5	• Build a knowledge on the drug designs with their classification, SAR and recent developments - Antifungal, Antiviral, Anaesthetics, Hypnotics & sedative drugs.					

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## Semester - III

Course Code: B020903TCC; Course Title: Solid State Chemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understanding the solid state structures and various types of imperfections in crystals.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Acknowledge the different types of bonding in solids - metals, insulators and semi conductors.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Optimize the existing solid-state materials &amp; elaborate the basic knowledge of semi-conductors and pre-history of their preparation.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Understand the solid-state reactions in various phase-couples.</li> <li>Describe the physical properties like magnetic, dielectric and optical properties.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Learn the nucleation and crystal growth and understand various routes of crystal growth.</li> </ul>					

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### Semester - III

Course Code: B020904T(A) Course Title: Structural Inorganic Chemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	<ul style="list-style-type: none"> <li>Interpret the basic requirements for complexes to show NMR-spectra</li> <li>Understand the contact-shift reagents &amp; apply to resolve the NMR spectra of complexes.</li> </ul>					
CLO2	<ul style="list-style-type: none"> <li>An elaboration of applications of ESR spectra to transition metal complexes</li> </ul>					
CLO3	<ul style="list-style-type: none"> <li>Describe the basic principle of Mossbauer spectroscopy including the applications to study inorganic structural problems.</li> </ul>					
CLO4	<ul style="list-style-type: none"> <li>Understand the modes of vibrations in ambidentate and some simple chelating ligands.</li> </ul>					
CLO5	<ul style="list-style-type: none"> <li>Illustrate the various electronic states and electronic transitions in complexes.</li> <li>Light on the principles of electronic transition and charge-transfer spectra.</li> </ul>					

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## Semester - III

Course Code: BD20904(TCB) Course Title: Chemistry of Natural products

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>• Explain the properties structure elucidation of some important Terpenoids and carotenoids.</li> <li>• Understand the stereochemistry &amp; synthesis of Citral, Menthol &amp; Carotene.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>• Illustrate the structure of alkaloids and describe the importance in medicinal fields.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>• Understand the structure, stereochemistry and synthetic routes of Cholesterol, Testosterone, Progesterone and Aldosterone.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>• Acknowledge with structure and isolation of plant pigments.</li> <li>• Account the synthesis of Quercetin &amp; Cyanidin.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>• Discuss the structure and synthesis of Haemoglobin &amp; Chlorophyll.</li> <li>• Light on synthesis &amp; physiological effects of Prostaglandins.</li> </ul>					

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### Semester - III

Course Code: B020904T(C) Course Title: Electrochemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Describe the Debye-Huckel Theory to explain the behaviour of strong electrolytes in solution. Account the various factors affecting magnitude of Activity Co-efficient of strong electrolytes.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Introduce the interface chemistry on the electrodes; mentioning Double layer Models, electrocapillarity, surface excess etc.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Understand the advanced electrochemical concepts including electrode kinetics, Butler-Volmer equation, polarizable and non-polarizable interfaces etc.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Gain of knowledge with electro-catalysis comprising comparative electrocatalytic activity of various metals as electrodes.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Learning of principles and applications of various types of concentration cells.</li> </ul>					

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Semester - III

Course Code: B020904T(D)

Course Title: Bio-inorganic Chemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	<ul style="list-style-type: none"> <li>Understand the principles of bioenergetics, including energy conversion, ATP synthesis and ATP cycle in plants.</li> </ul>					
CLO2	<ul style="list-style-type: none"> <li>Acknowledge with mechanism of oxygen transport in biological systems including the role of metalloproteins like Hb, haemocyanins etc.</li> </ul>					
CLO3	<ul style="list-style-type: none"> <li>Familiar with the role of nitrogenase enzyme mentioning the types of enzyme and biochemical mechanism.</li> </ul>					
CLO4	<ul style="list-style-type: none"> <li>Introduce the metalloenzymes explaining their classification with structures.</li> </ul>					
CLO5	<ul style="list-style-type: none"> <li>Focus on the role of metalloproteins in electron transport system in biological world and outline the importance of metals in medicine with reference to drug in cancer treatment.</li> </ul>					

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## Semester - III

Course Code: B020905P

Course Title: Chemistry Practical

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Perform and analyze the mixture of three components of organic compounds.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Analyze and learn the separation of sugars present in mixture of glucose, fructose &amp; sucrose by Paper chromatographic method.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Practice of interpretation of <del>data</del> data and determine the structure of organic compounds.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Learn and handle the spectrophotometric apparatus for estimation of organic compounds as well as inorganic components in mixed form.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Analyze the three component mixture of transition metals by volumetric and gravimetric methods.</li> </ul>					

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## Semester - III

Course Code: B02090BR

Course Title: Project/Internship/Industrial training.

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understand and apply the chemical principles and theories to real-world problems.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>knowledge of laboratory techniques and instrumentation including chromatography, spectroscopy and electrochemistry.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Learn and understand industrial processes, and technologies including chemical synthesis, separation and purification.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Ability to design and conduct experiments to test hypothesis &amp; solve problems.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>skill in analyzing and interpreting data from laboratory experiments &amp; industrial processes.</li> </ul>					

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Semester - IV

Course Code: BD20001T

Course Title: Spectroscopy-II

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Knowledge and utilize the principles of NMR spectroscopy (PMR) to determine molecular structure.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Understand the principles of <math>^{13}\text{C}</math> nmr spectroscopy and acknowledge with applications.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Discuss the basic principles and applications of mass spectroscopy.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Describe the theoretical basis of ESR spectroscopy and interpret the spectrum of compounds.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Introduce photoelectron spectroscopy including applications to some simple molecules.</li> </ul>					

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LOs number	CLO statement	Mapping with PLO				
		PLO1	PLO2	PLO3	PLO4	PLO5
01	<ul style="list-style-type: none"> <li>Understand the organometallic compounds in reference to M-C bonding, organic ligands and structures of organometallics.</li> </ul>					
02	<ul style="list-style-type: none"> <li>Elaborate the structural diagnosis, preparations and substitutive reactions of metal carbonyls and metal nitrosyls.</li> </ul>					
03	<ul style="list-style-type: none"> <li>Describe the concept of homogeneous catalytic reactions of transition metal complexes with organic ligands; understanding various consistent reaction steps viz. co-ordination, Insertion, Addition-elimination etc.</li> </ul>					
04	<ul style="list-style-type: none"> <li>A detailed study and applications of Fischer-Tropsch process, Wacker Process, including concept of fluxional isomerism.</li> </ul>					
05	<ul style="list-style-type: none"> <li>Understand and categorise the organometallics involving <math>\pi</math>-bonding ligands including the structure &amp; bonding in such complexes.</li> </ul>					

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## Semester - IV

Course Code: BO20003T(A) Course Title: Photo-Inorganic Chemistry

CLOs Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	• Discuss the fundamental principles of photochemical reactions, photo-induced electron transfer and photoluminescence.					
CLO 2	• Light on the reactivity, structure & photochemical kinetics of metal complexes in their excited states.					
CLO 3	• Distinguish and explain the excited state activity of organic compounds, charge-transfer complexes and charge transfer excitations.					
CLO 4	• A survey of ligand field photochemistry including photo substitution, photo oxidation, lability & <del>selectivity</del> selectivity in organometallics.					
CLO 5	• Acknowledge with the details of redox reactions by excited metal complexes and utilization of metal complex as sensitizer.					

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## Semester - IV

Course Code: BO20003T(B)

Course Title: Organic Synthesis-II

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understand the principles and strategies of the disconnection approach in organic synthesis.</li> <li>Knowledge of retro-synthetic analysis to complex organic molecules, identifying potential disconnections and synthetic routes.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Familiar with common protecting groups including their properties, structure, advantages &amp; limitations.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Describe the common one group C-C disconnection reactions including mechanism, advantages &amp; limitations.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Mention two group C-C disconnection approach focusing on to select and optimize C-C disconnection reactions for specific organic synthesis problems.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Learn how to apply ring synthesis in retrosynthetic analysis to plan organic synthesis.</li> <li>Familiar to synthetic routes of Camphor, Reserpine and Vitamin D.</li> </ul>					

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## Semester - IV

Course Code: B020003T(C) Course Title: Advanced Quantum Chemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Review the major principles of quantum mechanics including Born-Oppenheimer approximation and Slater rules.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Understand the AB initio computational method and SCE-MO method.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Elaborate the MOT for homonuclear diatomics and treatment of HMOs theory to evaluate the energy of MOs of various molecules like ethylene, Buta-dienes, cyclopropenyl radical etc.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>A detail theory and application of perturbation theory including advantages over variation theory.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Introduce the method of SCF.</li> </ul>					

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 M = Medium.

## Semester - IV

Course Code: B020004T(A)

Course Title: Analytical Chemistry - II

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understanding of food composition and contaminations including pesticides, heavy metals and microorganisms.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Analyze the water pollutants and learn the purification of water specially drinking water, waste water and utilize environmental monitoring.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Understand soil quality regulations and guidelines including those related to agricultural land use and environmental monitoring.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Survey for fuel analysis using various analytical techniques heating, grading, caloric value etc.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Learn and practice of clinical analysis regarding blood collection, serum, blood glucose, blood urea etc.</li> <li>Practice and learning of drug analysis.</li> </ul>					

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CLOs number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Learn the classification and nomenclature of heterocyclic compounds.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Elaborate the principles and steps involved in synthesis of heterocyclic compounds.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Learn heterocyclic synthesis specially three membered &amp; four membered ring.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Discuss and learn the synthetic steps for heterocyclic systems related to medicinal importance.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>A detailed study of synthesis, chemistry and applications of six-membered, mesoionic &amp; seven membered heterocyclic compounds.</li> </ul>					

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	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
1	<ul style="list-style-type: none"> <li>Understanding the structure, perspectives and biological catalytic properties of enzymes.</li> </ul>					
2	<ul style="list-style-type: none"> <li>Describe classification, extraction and purification of enzymes including a detail study of the properties of enzymes affinity, inhibition, enzyme kinetics etc.</li> </ul>					
3	<ul style="list-style-type: none"> <li>Discuss the mechanism of action of enzymes including their orientation, steric, strain or distortion factors.</li> </ul>					
4	<ul style="list-style-type: none"> <li>Learn the energetics and thermodynamics of enzyme catalysed reactions.</li> </ul>					
5	<ul style="list-style-type: none"> <li>Introduce co-enzymes explaining their importance</li> <li>Understand the structure and biological function of biological co-enzymes.</li> </ul>					

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## Semester - IV

Course Code: B020004T(C) Course Title: Enzyme Chemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understanding the structure, perspectives and biological catalytic properties of enzymes.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Describe classification, extraction and purification of enzymes including a detail study of the properties of enzymes affinity, inhibition, enzyme kinetics etc.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Discuss the mechanism of action of enzymes including their orientation, steric, strain or distortion factors.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Learn the energetics and thermodynamics of enzyme catalysed reactions.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Introduce co-enzymes explaining their importance</li> <li>Understand the structure and biological function of biological co-enzymes.</li> </ul>					

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Course Code: B020004T(C)

Course Title: Enzyme Chemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understanding the structure, perspectives and biological catalytic properties of enzymes.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Describe classification, extraction and purification of enzymes including a detail study of the properties of enzymes affinity, inhibition, enzyme kinetics etc.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Discuss the mechanism of action of enzymes including their orientation, steric, strain and distortion factors.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Learn the energetics and thermodynamics of enzyme catalysed reactions.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Introduce co-enzymes explaining their importance</li> <li>Understand the structure and biological function of biological co-enzymes.</li> </ul>					

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LOs number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
LO1	<ul style="list-style-type: none"> <li>Introduce and renew the basic principles and terms used in statistical thermodynamics.</li> </ul>					
LO2	<ul style="list-style-type: none"> <li>Elaborate study of various distribution laws including applications to correlate the thermodynamic functions.</li> </ul>					
LO3	<ul style="list-style-type: none"> <li>Utilize the partition function to evaluate the energies of translational, rotational, vibration electronic systems.</li> </ul>					
LO4	<ul style="list-style-type: none"> <li>Discuss the application of statistical Approach to evaluate the thermal properties of crystals.</li> </ul>					
LO5	<ul style="list-style-type: none"> <li>Apply the statistical Approach to study the non-equilibrium states including structural study of liquids.</li> </ul>					

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Semester -

Course Code: B020004T(E)

Course Title: Chemistry of Materials

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understand the properties and composition of various materials including mechanical, thermal, electrical and optical properties.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Acknowledge with compositions, preparations and applications of ceramics, composites and nano-materials.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Study &amp; Learn of preparation techniques of thin films of materials including use of Langmuir &amp; Blodgett film methods.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Understand physics and chemistry of polymeric materials including their structure, configurations, electrical behaviour.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Introduce principles of high temperature superconducting materials including structure, properties and applications.</li> </ul>					

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## Semester - IV

Course Code: B020004TCF) Course Title: Environmental Chemistry

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Understand and analyze the biogeochemical cycles, aquatic pollution, including the measurement of water quality standards.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>study soil analysis and analysis of pesticides, fertilizers, plastics, metals including waste treatment.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Understand the composition of atmosphere and analyze the pollutants in air: including understanding Green house effect &amp; Acid rain.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>A detail survey of industrial waste management to check the industrial made pollution.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Describe the environmental toxicology and their impacts on biological organisms mention Bhopal Gas Tragedy, Minamata disaster.</li> </ul>					

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Semester - IV

Course Code: BD20005P

Course Title: Chemistry Practical

CLOs Number	CLO statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Analyse and exercise the use of organic reagents in various types of classical organic synthesis including photochemical, Beckmann rearrangement synthesis of heterocyclics, Skraup-Synthesis etc.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Learn and exercise the extraction of various types of natural products from plant parts.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Estimate the three component mixture of cations including volumetric &amp; gravimetric analysis of metals in silver coins.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Learn and acknowledge with the spectrophotometric methods for analysis of various organo-transition metal mixtures.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Learn &amp; Apply the flame photometric methods and Nephelometric determinations.</li> </ul>					

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## Semester - IV

Course Code: BD20006R.

Course Title: Project/ Internship/ Industrial training

CLOs Number	CLO Statement	Mapping with PLOs				
		PLO1	PLO2	PLO3	PLO4	PLO5
CLO 1	<ul style="list-style-type: none"> <li>Plan &amp; strategize scientific problems and implement within a reasonable time frame.</li> </ul>					
CLO 2	<ul style="list-style-type: none"> <li>Learn to work independently project/ dissertation and any analytical work in research work.</li> </ul>					
CLO 3	<ul style="list-style-type: none"> <li>Ability to collect &amp; study the research papers and articles from library and other internet media.</li> </ul>					
CLO 4	<ul style="list-style-type: none"> <li>Understand the interpretation of spectral data obtained from various spectroscopic techniques.</li> </ul>					
CLO 5	<ul style="list-style-type: none"> <li>Empower the students for critical thinking, skill developments, scientific writing and doing scientifically based researches.</li> </ul>					

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