SYLLABUS

MASTER OF SCIENCE- CHEMISTRY

(TWO YEAR FULL TIME PROGRAMME)

(FOUR SEMESTER COURSE)

Year 2024-2026

Department of Chemistry

School of Basic & Applied Science

Lingaya's Vidyapeeth, Faridabad

Deemed to be university (u/s of UGC act 1956)

(Approved By UGS, MHRD, AICTE, BCI, PCI & ACI)

SCHEME OF EXAMINATION

(Continuous Assessment and End-Semester Examination)
Theory Courses

Sub-component	**Weightage**
MID-Semester Examination	**25**
Assignment/Quiz/Tutorial/Viva-voce (**ABQ)**	**15**
End-Semester Examination	**60**

Practical Components/Practical Courses

Examination	**Sub-component**	**Weightage**	**Total**
Internal examination	Viva-voce + Continuous lab performance	**20+25+15**	**60**
End-Semester Practical Exam (External examination)	Viva-voce + Written exam + Practical record file	**20+10+10**	**40**

LINGAYA'S VIDYAPEETH
Deemed-to-be-University u/s 3 of UGC Act 1956, Government of India

LINGAYA'S VIDYAPEETH
SCHEME OF STUDIES
SESSION: 2024-26

School: Basic and Applied Sciences	**Batch: 2024-2026**
Department: Chemistry	**Year: First**
Course: M.Sc Chemistry	**Semester: Ist**

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	**MCH–101**	Organic Chemistry-I	3	1	0	4	15	25	60	-	-	100
2	PCC	**MCH–103**	Physical Chemistry-I	3	1	0	4	15	25	60	-	-	100
3	PCC	**MCH–105**	Inorganic Chemistry-I	3	1	0	4	15	25	60	-	-	100
4	PCC	**MCH-107**	Analytical Chemistry-I	3	1	0	4	15	25	60	-	-	100
5	PCC	**MCH–151**	Organic Chemistry-Lab-I	0	0	4	2	-	-	-	60	40	100
6	PCC	**MCH–153**	Physical Chemistry- Lab-I	0	0	4	2	-	-	-	60	40	100
7	PCC	**MCH–155**	Inorganic Chemistry- Lab-I	0	0	4	2	-	-	-	60	40	100
			Total---->	**9**	**3**	**12**	**22**	**60**	**100**	**240**	**180**	**120**	**700**

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School: Basic and Applied Sciences								Batch: 2024-2026					
Department: Chemistry								Year: First					
Course: M.Sc Chemistry								Semester: II[nd]					
SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	**MCH–102**	Advance Organic Chemistry	3	1	0	4	15	25	60	-	-	100
2	PCC	**MCH–104**	Advance Physical Chemistry	3	1	0	4	15	25	60	-	-	100
3	PCC	**MCH–106**	Advance Inorganic Chemistry	3	1	0	4	15	25	60	-	-	100
4	PCC	**MCH–152**	Advance Organic Chemistry-Lab	0	0	4	2				60	40	100
5	PCC	**MCH–154**	Advance Physical Chemistry- Lab	0	0	4	2				60	40	100
6	PCC	**MCH–156**	Advance Inorganic Chemistry- Lab	0	0	4	2				60	40	100
			Total---->	**9**	**3**	**12**	**18**	**45**	**75**	**180**	**180**	**120**	**600**

LINGAYA'S VIDYAPEETH

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School: Basic and Applied Sciences	**Batch: 2024-2026**
Department: Chemistry	**Year: Second**
Course: M.Sc Chemistry	**Semester: III[rd]**

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks(IP+EXP)/2
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	PCC	**MCH–201**	Spectroscopy	3	1	0	4	15	25	60	-	-	100
2	PCC	**MCH–203**	Nanotechnology and Photochemistry	3	1	0	4	15	25	60	-	-	100
3	PCC	**MCH–205**	Bioinorganic Chemistry	3	1	0	4	15	25	60	-	-	100
4	PCC	**MCH–207**	**Departmental Elective Paper-I (Any one)** I. Heterocyclic Chemistry II. Organometallic Chemistry III. Elements of Material Chemistry IV. Conventional Ceramics	3	1	0	4	15	25	60	-	-	100
5	PCC	**MCH–209**	**Departmental Elective Paper-II** (Any one) I. Polymer Chemistry II. Medicinal Chemistry III. Bioinorganic-II IV. Chemistry of Natural Product	3	1	0	4	15	25	60			100
6	PCC	**MCH–251**	Chemistry- Lab	0	0	4	2	-	-	-	60	40	100
7	PCC	**MCH–253**	Synopsis Seminar	0	0	2	1	-	-	-	-	-	100
			Total---->	**15**	**5**	**6**	**23**	**75**	**125**	**300**	**60**	**40**	**700**

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School: Basic and Applied Sciences	**Batch: 2024-2026**
Department: Chemistry	**Year: Second**
Course: M.Sc Chemistry	**Semester: IVth**

SN	Cate-gory	Course Code	Course Name	Periods			Credits	Evaluation Scheme					Subject Total Marks(IP+EXP)/2
								Theory			Practical		
				L	T	P		ABQ	MSE	ESE	IP	EXP	
1	Project	**MCH–252**	**Dissertation (**Literature Search and Review; Thesis Submission**)**	**0**	**0**	**40**	20					100	100
			Total---->	**0**	**0**	**40**	**20**					100	**100**

Sem 1	Sem 2	Sem 3	Sem 4	Total
22	**18**	**23**	**20**	**83**

Abbreviations:

PCC-Programme Core Courses

PEC: Programme Elective Courses

Proj: Project

CE: Common Elective

HSS: Humanity and Social Science

L: Lecture

T: Tutorial

P: Practical

ABQ: Assignment Based Quiz

MSE: Mid Semester Examination

ESE: End Semester Examination

IP: Internal Practical

EXP: External Practical

PROGRAM OUTCOMES (PO'S)

PO1: Identify and resolve complex scientific issues in national and local level.
PO2: Analyze and interpret data using analytical instruments to investigate chemical problems.
PO3: To solve chemical problems, choose, plan, and implement suitable experiment techniques, as well as instrumentation handling.
PO4: Recognize and use contextual multidisciplinary information to evaluate societal, health, safety, and global problem that are important to research practices.
PO5: Adopt scientific ideas about environmental use and long-term sustainability.
PO6: Enhance skills for future employability through activities such as seminar, communication skills, industrial visit, and internship.
PO7: Recall the chemistry courses that are available for competitive test.
PO8: The students attain sound knowledge in the areas of organic, inorganic, physical, pharmaceutical chemistry and material for pursing higher education and research.

PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO 1: Understand the basic concepts, fundamental principles, and the scientific theories related tovarious scientific phenomenon and their relevancies in the day-to-day life.

PSO 2: Apply advanced concepts of Inorganic, Organic, physical and analytical chemistry for the benefit of human being.

SEMESTER-I

MCH-101 : ORGANIC CHEMISTRY-I
(Semester I)

L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. Differentiate chiral and achiral molecules.
2. Recognize and draw structural isomers (constitutional isomers), stereoisomers including enantiomers and diastereomers, racemic mixture, and meso compounds.
3. Identify the stereo centers in a molecule and assign the configuration as R or S.

COURSE OUTCOMES:

CO1. To learn the configuration of stereo centers and applications of configuration on various molecule such as Allenes, biphenyls, cyclophanes, carbocations and carbonion etc.
CO2. To understand Cyclostereoisomerism and Asymmetry induction in stereochemistry.
CO3. To apply the involvement of reactive intermediates and understand their generation, structure and reactivity.
CO4. To evaluate the Classical and non-classical, Neighbouring group participation, molecular analyze in acyclic, monocyclic and bicyclic systems.
CO5. To evaluate the participation of various reactive intermediates in organic reactions.

Unit	Contents	Lectures
I	**Stereochemistry-I:** Molecular Symmetry and Chirality: Symmetry operations and elements, point groups and symmetry number. Stereoisomerism: classification, racemisation, molecules with one, two or more chiral centres, DL, RS and EZ nomenclature. Planar and axial chirality. Stereochemistry of allenes, spiranes, alkylidine cycloalkanes, catenanes, biphenyls, bridged biphenyls and cyclophanes	13
II	**Stereochemistry-II:** Topicity of ligands & faces and their nomenclature, stereogenicity, pseudoasymmetry, stereogenic and prochiral centres. Simple chemical correlation of configurations with examples, Quasiracemates. Cyclostereoisomerism: configuration, conformation, stability of cyclohexanes (mono, di and tri-substituted), Cyclohexenes, cyclohexanones, halocyclohexanones. Asymmetry induction: Cram's, prelog's and Horeau's rules; Dynamic stereochemistry (acyclic and cyclic) Curtin-Hammett Principle, Circular Dichromism and cotton effect.	12
III	**Reactive Intermediates-I:** Linear free energy relationships and their applications (Hammett equation). Carbocations: Classical and non-classical, Neighbouring group participation, molecular rearrangements in acyclic, monocyclic and bicyclic systems, stability and reactivity of bridged-head carbocations.	9
IV	**Carbanions:** Generation, structure and stability, ambident ions and their general reactions; HSAB principle and its application. Radicals: Generation, structure and stability and reactions, radical cations and anions.	9
V	**Carbenes:** Formation and structure, reactions involving carbenes and carbenoids. Nitrenes: Formation, structure, reactions of nitrenes. Nucleophilic aromatic substitution: Benzynes. SNAr and SRN1 mechanisms; Ipso effect.	9

TEXTBOOKS/REFERENCE BOOKS:

1. F. A. Carey and R. A. Sundberg, Advanced Organic Chemistry, Part B: Reactions and Synthesis, 5th edition, Springer, New York, 2007.
2. W. Carruthers and I. Coldham, Modern methods of Organic Synthesis, First South Asian Edition 2005, Cambridge University Press.
3. J. March and M. B. Smith, March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 6th Edition, Wiley, 2007.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	1	1	-	1	-	3	3	2	3
CO2	3	2	1	-	1	-	3	3	2	3
CO3	2	2	1	-	-	-	3	3	2	3
CO4	3	-	1	3	1	-	3	3	2	3
CO5	1	2	-	-	1	2	2	1	2	2

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

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MCH-103 : PHYSICAL CHEMISTRY-I (Semester I)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:
Recognize the most significant and elementary solutions of Schrodinger equation in molecular quantum mechanics through a study of time independent perturbation theory, valence bond and molecular orbital theories.

COURSE OUTCOMES:
CO1. To learn the elementary principles and postulates of quantum mechanics.
CO2. To understand about the concept of various operators in quantum mechanics.
CO3. To apply the concept and application of Huckel molecular orbital theory for conjugated systems.
CO4. To analyze the perturbation theory and variation methods.
CO5. To evaluate the approximate methods in quantum chemistry.

Unit	Contents	Lectures
I	**Quantum Chemistry:** Postulates of quantum mechanics, Linear and Hermition operator, Commutation of operators and uncertainty principles. Differential equations, partial differential equations, series solutions and special functions, linear vector spaces, transformations of coordinate matrix, representation of operators, orthonormal sets Fourier and Laplace transforms.	13
II	**Some Exactly Soluble Problems:** Particle in a box and ring. Concept of degeneracy and Jahn-Teller distortion. Simple harmonic oscillator problem and its solution using series solutions or factorization method. Calculation of various average values using ladder operators and recursion relations of Hermite polynomials. Angular momentum operators. Eigen values and eigen functions. Ladder operators. Rigid rotator and hydrogen atom: Complete solution. Radial distributions. Virial theorem.	13
III	**Homo Method and its Applications:** π-Electron approximation, Huckel molecular orbital theory of conjugated systems, calculation of properties-delocalization energy, electron density, bond order, alternant and non-alternant hydrocarbons, pairing theorem**.**	11
IV	**Approximate Methods-I:** First order time-independent perturbation theory for non degenerate states. Variation theorem and variation methods. Use of these methods illustrated with some examples (particle in a box with a finite barrier, anharmonic oscillator, and approximate functions for particle in a box and hydrogen atom).	8
V	**Approximate Methods-II:** Ground and excited state of helium atom. Pauli's exclusion principle. Many-electron atoms. Concept of spin and determinantal wave functions.	7

TEXT BOOKS/REFERENCE BOOKS:
1.P. W. Atkins and R. S. Friedman, Molecular Quantum Mechanics, Oxford University Press, Oxford, 2004. (Must for Quantum Chemistry basics)
2. Quantum Chemistry by RK Prasad
3. Quantum Chemistry by Era Levine (For Advance Quantum Chemistry)
4. Elementary Quantum Chemistry by Frank Pilar, Mineola, N.Y. Dover, 2001

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	-	1	-	3	3	2	3
CO2	3	2	1	-	1	-	3	3	2	3
CO3	2	2	1	-	-	-	3	3	2	3
CO4	3	-	1	3	1	-	3	3	2	3
CO5	1	2	-	-	1	1	-	2	2	1

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-105: INORGANIC CHEMISTRY-I (Semester I)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

Reaction mechanisms are thoroughly discussed with emphasis on ligand substitution, oxidative addition, reductive elimination, insertion and elimination reactions, nucleophilic and electrophilic addition and abstraction at ligands, and the involvement of carbenes in metathesis and polymerization

COURSE OUTCOMES:

CO1. To learn and Identify the structure and bonding aspects of simple organometallic compounds.
CO2. To understand the concept of non aqueous solvents.
CO3. To apply the concepts of magnetic properties and to explain different catalytic reactions.
CO4. To analyze the magnetic properties of Transition metal complexes.
CO5. To evaluate different electron counting rules to predict the shape/geometry of low and high nuclearity metal carbonyl clusters

Unit	Contents	Lectures
I	**Metal Ligand Equilibria in Solution:** Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate Effect and its thermodynamic origin, determination of binary formation constants by pH-metry and Spectrophotometry.	12
II	**Non–Aqueous Solvents:** Role of Solvents in chemical reactions, physical properties of a solvent, types of solvent and their general characteristics, reactions in non-aqueous solvents with reference to liquid ammonia and liquid SO_2.	11
III	**Magnetic Properties of Transition Metal Complexes:** Magnetic properties of transition metal complexes and lanthanides, spin-orbit coupling and susceptibility of transition metal ions and rare earths; magnetic moments of metal complexes with crystal field terms of A, E and T symmetry, T.I.P., intramolecular effects, antiferromagnetism and ferromagnetism of metal complexes, super paramagnetism. High and low spin equilibria, anamolous magnetic moments, magnetic exchange coupling and spin Crossover.	10
IV	**Inorganic Materials:** Introduction to the solid state, metallic bond, band theory (zone model, brillouin zones, limitation of zone model): defects in solids, *p*-type and *n*-type, inorganic semiconductors (use in transistors, IC etc.), electrical, optical, magnetic and thermal properties of inorganic materials, superconductors, with special emphasis on the synthesis and structure of high temperature super conductors.	10
V	**Metal Clusters:** Higher boranes, carboranes and metalloboranes, compounds with metal –metal multiple bonds metal carbonyls and halide clusters.	9

TEXT BOOKS/REFERENCE BOOKS:

1.Inorganic Reaction Mechanism - F. Basolo & G. Pearson.
2. Inorganic Reaction Mechanism - J. O. Edwards.
3. Selected Topics in Inorganic Chemistry- Malik, Madan & Tuli.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	-	1	-	3	3	2	3
CO2	1	2	1	-	1	-	3	3	2	3
CO3	2	2	1	-	-	-	3	3	2	3
CO4	2	-	1	3	1	-	3	3	2	3
CO5	-	1	1	2	2	1	1	2	2	1

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-107: ANALYTICAL CHEMISTRY-I (Semester I)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

Provide theoretical background and develop practical skills to students using modern analytical methods and instruments.

COURSE OUTCOMES:

CO1. To learn the basic concepts of interfering radicals in the qualitative mixture analysis.

CO2. To understand accuracy and precision in doing experiments, methods to determine the errors and minimizing errors.

CO3. To apply the concepts of methods of extraction and fractional distillation.

CO4. To analyze the various properties through gas and High pressure chromatography techniques.

CO5. To evaluate the various properties of analytical compounds.

Unit	Contents	Lectures
I	**Introduction To Analytical Chemistry:** Scope & objectives, Analytical chemistry and chemical analysis, Classification of analytical methods, Method selection, Sample processing, Steps in a quantitative analysis, Quantitative range, Data organization, Analytical validations, Limit of detection and limit of quantization, The tools of analytical chemistry and good lab practices.	**12**
II	**Errors in Chemical Analysis and Statistical Evaluation of Data:** Systematic and random errors, Accuracy and precision, Ways of expressing accuracy and precision, Propagation of error, Useful statistical test: test of significance, the F test, the student 't' test, the chi-test, the correlation coefficient, comparison of two standard values, comparison of standard deviation with average deviation, comparison of mean with true values, significant figures, regression analysis (least-square method for linear plots), statistics of sampling and detection limit evaluation.	**14**
III	**Separation Methods: Multiple Liquid-Liquid Extraction:** Countercurrent extraction, Craig's tube and Craig's apparatus, distribution of single solute, Gaussian treatment in describing distribution pattern of solute fraction in r^{th} tube after n-transfers. Fractional Distillation: Temperature composition diagram of a binary system, concept of theoretical plates, HETP, Bubble-cap distillation column and derivation of Fenske equation.	**10**
IV	**Gas Chromatography:** Introduction, principle of gas chromatography, instruments for gas-liquid chromatography, detectors:- thermal conductivity detector, flame ionization detector, electron capture detector and others, gas chromatographic columns and stationary phases, factors affecting the efficiency of the column, resolution, retention time and other basic parameters. Interpretation of gas chromatograms. Qualitative analysis, Kovats retention index (I), Quantitative analysis, measurement of peak area, response factor; Applications of gas chromatography.	**9**
V	**High Performance Liquid Chromatography (HPLC):** Basic difference between HPLC and conventional liquid chromatography with respect to sample applications, packing materials and equipments, detectors. Advantages and applications.	**7**

TEXTBOOKS/REFERENCE BOOKS:

1. Inczedy, J. Analytical applications of complex equilibria Halsted Press: New York, NY (1976).
2. Ringbom, A. Complexation in Analytical Chemistry Wiley: New York (1963).

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	1	2	-	1	-	3	3	2	3
CO2	1	2	3	-	1	-	3	3	2	3
CO3	1	3	3	-	2	-	3	3	2	3
CO4	2	3	3	3	2	-	3	3	2	3
CO5	1	1	2	2	1	1	2	2	1	1

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

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MCH-151: ORGANIC CHEMISTRY LABORATORY -I
(Semester I)

L+T+P	:	**0+0+4**	Viva-voce + Continuous lab performance	:	**60**
Credits:	:	**2**			
Contact hours	:	**52**	Viva-voce + Written exam + Practical record file	:	**40**

COURSE OBJECTIVES:
The objective of the course Laboratory is to expose the students of M.Sc. class to experimental techniques in electronics, so that they can verify some of the things read in theory here or in earlier classes and develop confidence to handle sophisticated equipment.

COURSE OUTCOMES:
1. To learn the qualitative analysis of functional group compounds.
2. Lab/Instrumentation techniques used for analyzing reaction mechanisms.
3. To learn the concept of analytical chemistry (Paper chromatography) for separation of compounds.

S. No.	Practical Description
1.	Qualitative analysis of mono and bi-functional compounds.
2.	Purification of organic compounds by crystallization using the following solvents: a. Water b. Alcohol c. Alcohol-Water
3.	Separation of a mixture of two sugars by ascending paper chromatography
4.	Determination of the melting points of given organic compounds and unknown organic compounds
5.	Synthesis of Organic compounds using Acetylation Reaction
6.	Synthesis of Organic compounds using Bromination Reaction
7.	Synthesis of Organic compounds using Diazotization reactions and Aldol reaction
8.	Determination of Acid value of oils

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	3	1	1	-	1	3	3	2
CO2	1	2	3	-	1	-	2	3	3	2
CO3	2	2	3	-	-	-	2	3	3	3

Distribution of Evaluation Scheme

Internal Practical	External Practical	Total Marks
60	**40**	**100**

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MCH-153: PHYSICAL CHEMISTRY LABORATORY -I
(Semester I)

L+T+P	:	**0+0+4**	Viva-voce + Continuous lab performance	:	**60**
Credits:	:	**2**			
Contact hours	:	**52**	Viva-voce + Written exam + Practical record file	:	**40**

COURSE OBJECTIVES:
1. The course provides training in advanced physical chemistry laboratory techniques.
2. The experiments are guided by demonstrators and are designed both to illustrate applications of theory covered in the Chemical Physics and lecture courses, and to introduce typical instrumentation

Course Outcomes:
CO1. To learn the concept of chemical kinetics and thermodynamic parameters
CO2. To analyze the cell constant in of conductivity cells..
CO3. To evaluate equivalent conductance and molar conductance.

S. No.	Practical Description
1.	Determine the specific rate constant for the acid catalyzed hydrolysis of methyl acetate by the initial rate method.
2.	Study the reaction at two different temperatures and calculate the thermodynamic parameters.
3.	Determine the cell constant of the given conductivity cell at room temperature and study the equivalent conductance versus square root of concentration relationship of a strong electrolyte (KCl or NaCl) and weak electrolyte (acetic acid).
4.	Determine the equivalent conductance, degree of dissociation and dissociation constant (Ka) of acetic acid.
5.	Study the conductometric titration of acetic acid vs. sodium hydroxide
6.	Titrate hydrochloric acid and sodium hydroxide potentiometrically
7.	Titrate oxalic acid and sodium hydroxide potentiometrically.
8.	Determine the equivalent conductance at infinite dilution for acetic acid by applying Kohlrausch's law of independent migration of ions.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	3	1	1	-	1	3	3	2
CO2	1	2	3	-	1	-	2	3	3	2
CO3	2	2	3	-	-	-	2	3	3	3

Distribution of Evaluation Scheme

Internal Practical	External Practical	Total Marks
60	**40**	**100**

MCH-155: INORGANIC CHEMISTRY LABORATORY -I
(Semester I)

L+T+P	:	**0+0+4**	Viva-voce + Continuous lab performance	:	**60**
Credits:	:	**2**			
Contact hours	:	**52**	Viva-voce + Written exam + Practical record file	:	**40**

COURSE OBJECTIVES:

1. The main objective of volumetric analysis is to determine the amount of a substance in a given sample.
2. Recognize many fundamental bond forming reactions and how to apply them in synthesis
3. When dealing with volumetric analysis the concept of concentration cannot be avoided.

COURSE OUTCOMES:

1. To learn the concept of synthesis Inorganic compounds.
2. To analyze the concept of conductivity of ions.
3. To evaluate the molar conductivity of various coordination compounds

S. No.	Practical Description
1.	Preparation of $[Cu(NH_3)_4]SO_4.H_2O$
2.	Synthesis of $[Co(NH_3)_5Cl]Cl_2$
3.	Preparation of $[Ni(NH_3)_6]Cl_2$
4.	To determine the molar conductance of $[Co(NH_3)_5]Cl_3$, and [Co(NH3)5Cl]Cl2 by measuring conductivity of these compounds.
5.	To determine the number of chloride ions in the [Co(NH3)5]Cl3 and [Co(NH3)5Cl]Cl2
6.	Synthesis of trans-dichlorobis (ethylenediamine) cobalt (III) Chloride
7.	Synthesis of cis-Dichlorobis(ethylenediamine)cobalt (III) Chloride

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	3	1	1	-	1	3	3	2
CO2	1	2	3	-	1	-	2	3	3	2
CO3	2	2	3	-	-	-	2	3	3	3

Evaluation Scheme

Internal Practical	External Practical	Total Marks
60	**40**	**100**

SEMESTER-II

MCH-102: ADVANCE ORGANIC CHEMISTRY
(Semester II)

L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1.This course will give an introduction to catatyltic reagents, oxidation chemistry and reaction intermediates..

2.To impart the students in depth knowledge about the basic concepts and theory of pericyclic reactions and to get an idea about the orbital overlap in chemical reaction.

COURSE OUTCOMES:

CO1. To learn various catalytic reagents and their activity in the reactions.
CO2. To understand oxidation chemistry and coupling reactions.
CO3. To apply the concept of addition reactions on c-c multiple bond.
CO4. To analyze the structure, generation and stability of the reaction intermediates.
CO5. To evaluate the basic concepts of HOMO-LUMO theory on Pericyclic reactions.

Unit	Contents	Lectures
I	**Organic Synthetic Methodology:** Reduction Chemistry: Stereochemistry and selectivity of catalytic hydrogenation along with the mechanism, Applications of Lithium aluminium hydride, Sodium borohydride, sodium cyanohydride, alkoxy substituted LAH, DIBAL, diborane, diisoamylborane, thexyborane, 9-BBN as reducing agents, Homogeneous hydrogenation mechanism using Ru and Rh metal complexes along with its applications.	**14**
II	**Oxidation Chemistry**: Sharpless epoxidation, Applications of DDQ, SeO_2, $Tl(NO_3)_3$. Coupling Reactions with Pd(0) and Pd(II): Stille, Suzuki and Sonogashira coupling, Heck reaction and Negishi coupling.	**9**
III	**Addition to Carbon-Carbon Multiple Bonds:** Mechanistic and stereochemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, orientation and reactivity. Addition to cyclopropane rings. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration, Michael reaction and Sharpless asymmetric epoxidation.	**11**
IV	**Reactive intermediates In Organic Reactions:** *Carbocations:* Stability and structure, generation and fate of carbocations. Nonclassical carbocations neighbouring group participation, ion-pairs, molecular rearrangements in acyclic, monocyclic and bicyclic systems, stability and reactivity of bridge-head carbocations. Bredts rule; *Carbanions:* Stability, structure, generation and fate, ambident ions and their general reactions; Carbon free radicals: Stability and structure, generation and fate of free radicals, captodetive effects; radical-ions; *Carbenes:* Formation and structure, reactions involving carbenes and carbenoids. *Nitrenes:* Generation, structure and reactions of nitrenes; *Benzynes:* Generation, structure and reactions of benzynes; Nucleophilic substitution at aryl carbon via Meseinheimer complex.	**9**
V	**Pericyclic Reactions:** Electrocyclic, cycloaddition, sigmatropic and chelotropic reactions; General Orbital Symmetry rules, Frontier Orbital approach, PMO approach, Correlation diagrams for different systems, Hückel–Mobius approach, General pericyclic selection rule and its applications, 1,3-dipolar additions, Ene reaction	**9**

TEXTBOOKS/REFERENCE BOOKS:

1. Advanced Organic Chemistry; Jerry March, Fourth edition, Wiley & Sons, (2007).
2. Mechanisms in Organic Chemistry; Peter Sykes, Sixth edition, Pearson, (2004).
3. Organic Chemistry; Solomons & Fryhle, Eighth edition, Wiley & Sons, (2007).

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	-	1	-	3	3	2	3
CO2	1	2	1	-	1	-	3	3	2	3
CO3	2	1	1	-	-	-	3	3	2	3
CO4	2	2	1	3	1	-	3	3	2	3
CO5	2	2	1	-	2	-	3	3	2	3

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

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MCH-104: ADVANCE PHYSICAL CHEMISTRY (Semester II)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. The students will be able to understand different types of classification of polymers and sequence determination structure and synthesis of bio-polymers.
2. The students will be able to understand introduction of electrochemistry, chemical kinetics and adsorption.
3. To study the various factors which affect the rate of a chemical reaction such as concentration, temperature, solvent, catalyst etc.

COURSE OUTCOMES:

CO1. To learn classification and activity of macromolecules and polymer chemistry

CO2. To understand about the transport number and Maxwell-Boltzmann distributions, Debye-Huckel theory and activity coefficients.

CO3.To apply the concept of electrochemical properties of materials and solubility of sparingly soluble salt,

CO4.To analyze the Catalytic activity at metal surfaces.

CO5. To evaluate the adsorption properties and application of photoelectron spectroscopy.

Unit	Contents	Lectures
1	**Macromolecules:** Concepts of number average and mass molecular weights. Methods of determining molecular weights (cetylati, viscometry, sedimentation equilibrium methods). Distribution of chain lengths. Average end-to-end distance.	**10**
11	**Polymer Chemistry**: Definition, Classification of polymers, Chain configuration of macromolecules, Isotactic polymers, Atactic polymers, Syndiotactic polymers, Graft polymers, Electrically conducting polymers, Polymerizations reactions, Kinetics of polymerization, Mechanism of polymerization. Molecular mass of polymers, Number and Mass average molecular mass, Determinations of molar masses of polymers (Osmometry, Viscometry and Light scattering methods), Sedimentation, Calculation of average dimensions of various chain structures.	**12**
111	**Solution Kinetics:** Factors affecting reaction rates in solution. Effect of solvent and ionic strength (primary salt effect) on the rate constant. Secondary salt effects.	**8**
1V	**Electrochemistry:** Solutions: Activity coefficients and ion-ion interactions. Physical significance of activity coefficients, mean activity coefficient of an electrolyte and its determination. Derivation of Debye-Huckel theory of activity coefficients (both point ion size and finite ion size models). Excess functions.	**11**
V	**Adsorption.** Surface tension, Capillary action, Pressure difference across curved surface (Laplace equation), Vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, BET adsorption isotherm, Surface films (Electro-kinetic phenomenon), Catalytic activity at surfaces. Catalysis: on metal surfaces, Metal oxide surfaces. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.	**11**

TEXTBOOKS/REFERENCE BOOKS:

1. Physical Chemistry 8th Ed., P. W. Atkins and J. de Paula, Oxford University Press, 2006.
2. Physical Chemistry of Surfaces – A. W. Adamson – John Wiley Sons.
3. Catalytic Chemistry, Bruce C. Gates, John Wiley & Sons, Inc. 1992.(541.395 GAT)

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	-	1	-	3	3	2	3
CO2	1	2	1	-	1	-	3	3	2	3
CO3	1	2	1	-	-	-	3	3	2	3
CO4	2	2	1	3	1	-	3	3	2	3
CO5										

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-106: ADVANCE INORGANIC CHEMISTRY
(Semester II)

L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. This course is aimed to provide the students with a solid understanding of all the fundamental concepts in modern inorganic chemistry necessary for the study of the more advanced or specialized courses that follow.
2. The topics discussed include coordination chemistry, group theory and nuclear chemistry.

COURSE OUTCOMES:

CO1. To learn about the symmetry of the molecules.
CO2. To understand the magnetic properties of coordination compounds.
CO3. To apply the concept of stereochemistry and bonding in main group compounds.
CO4. To analyze nuclear the various nuclear models.
CO5. To evaluate nuclear binding energy and mass defects in nuclear chemistry.

Unit	Contents	Lectures
I	**Group Theory And Its Applications:** Symmetry elements and symmetry operations, Groups, subgroups, classes and its characteristics, products, classes and application of symmetry opkerations, Point group classification. Reducible and irreducible representations, character table, Wave functions for irreducible representations (p- and d- block only), Russell-Saunders coupling, vibronic coupling, non-cetrosymmetric complexes.	**15**
II	**Electronic Spectra of Transition Metal Complexes:** Spectroscopic ground states, correlation, crystal field theory and splitting in Oh, Td, D4h and C4v systems, orgel and Tanabe-Sugano diagrams for transition metal complexes (d1 –d9),Calculation of Dq, B and β Parameters ,charge transfer spectra, spectroscopic method for assignment of absolute configuration inoptically active metal chelate and their cetylation al information.	**14**
III	**Stereochemistry and Bonding in Main Group Compounds**: VSEPR, Walsh diagram (tri- and penta atomic molecules), dπ-pπ bonds, Bent rule and energetic of hybridization, simple reactions of covalently bonded molecules.	**8**
IV	**Nuclear Binding Energy**: Justifications And Applications; Nuclear Stability Rules And Decay Of Unstable Nuclei. Nuclear Structure: Nuclear Force, Liquid Drop Model, Shell Model And Collective Mode.	**7**
V	**Nuclear Reactions**: Energetics of nuclear reactions; various types of nuclear reactions including photonuclear, thermonuclear and spallation reactions; mechanism of nuclear reaction by compound nucleus model. Nuclear fission – Fission probability; energy release; theories of fission. Nuclear Fussion: Brief idea about breeder reactors.	**8**

TEXTBOOKS/REFERENCE BOOKS:

1. Chemical Applications of Group Theory: by F.A. Cotton.
2. Group Theory and Symmetry in Chemistry: by Lowell H. Hall, Butterworth (1996).
3. H. J. Arnikar, Essentials of Nuclear Chemistry, Wiley Eastern Ltd. (1995).
4. B. K. Sharma, Nuclear and Radiation Chemistry, Krishna Publication.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	1	1	-	1	-	3	3	2	3
CO2	1	2	1	-	1	-	3	3	2	3
CO3	1	1	1	-	2	-	3	3	2	3
CO4	2	2	1	3	2	-	3	3	2	3

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

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MCH-152: ADVANCE ORGANIC CHEMISTRY LABORATORY
(Semester II)

L+T+P	:	**0+0+4**	Viva-voce + Continuous lab performance	:	**60**
Credits:	:	**2**			
Contact hours	:	**52**	Viva-voce + Written exam + Practical record file	:	**40**

COURSE OBJECTIVES:

1. Students will employ the major techniques used in organic chemistry laboratory for analyses such as melting point determination, extraction, chromatography, infrared spectroscopy, distillation and chemical characterization tests.
2. Students will develop better understanding of the organic chemistry behind everyday observations such as the action of soap, or application of color dyes on variety of fabrics

COURSE OUTCOMES:

CO1. To learn the concept of saponification values in oil.
CO2. To understand the main organic reactions in experimentally.
CO3. To analyze the number of percentage of hydroxyl group.

S. No.	Practical Description
1.	Determination of percentage of hydroxyl group by Acetylation method ii. by Bromination method
2.	Estimation of amino group i. by Acetylation method ii. by bromination method
3.	Organic synthesis using some of the following reactions i. Coupling reaction iii. Oxidations and reductions iv. Grignards reaction
ii.	Determination of I_2 value of oils
iii.	Determination of Saponification value of oils

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	3	1	1	-	1	3	3	2
CO2	1	2	3	-	1	-	2	3	3	2
CO3	2	2	3	-	-	-	2	3	3	3

Distribution of Evaluation Scheme

Internal Practical	External Practical	Total Marks
60	**40**	**100**

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MCH-154: ADVANCE PHYSICAL CHEMISTRY LABORATORY
(Semester II)

L+T+P	:	**0+0+4**	Viva-voce + Continuous lab performance	:	**60**
Credits:	:	**2**			
Contact hours	:	**52**	Viva-voce + Written exam + Practical record file	:	**40**

OBJECTIVES:
The objective of the course is to present a theory of classical electrodynamics and analytical methods.
Course Outcomes:
CO1. To understand the concept of viscosity and surface tension method on liquid mixture.
CO2. To apply the concept of chemical kinetics.
CO3. To evaluate the reaction rate.

S. No.	Practical Description
1.	Determine the percentage composition of a liquid mixture by viscosity method.
2.	Determine molar surface energy of ethyl alcohol by surface tension.
3.	To find out composition of a unknown solution by surface tension measurement
4.	Verify the law of refraction for mixtures, using glycerol and water.
5.	Determine the formation of compounds between two liquids in the mixture.
6.	Study the saponification of ethyl acetate by sodium hydroxide solution.
7.	Compare the strengths of hydrochloric acid and sulphuric acid by studying the rate of hydrolysis of methyl acetate.
8.	Determine the specific reaction rate of the potassium persulphate iodide reaction by initial rate method.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	3	1	1	-	1	3	3	2
CO2	1	2	3	-	1	-	2	3	3	2
CO3	2	2	3	-	-	-	2	3	3	3

Distribution of Evaluation Scheme

Internal Practical	External Practical	Total Marks
60	**40**	**100**

MCH-156: ADVANCE INORGANIC CHEMISTRY LABORATORY
(Semester II)

L+T+P	:	**0+0+4**	Viva-voce + Continuous lab performance	:	**60**
Credits:	:	**2**			
Contact hours	:	**52**	Viva-voce + Written exam + Practical record file	:	**40**

OBJECTIVES: To understand the concept of basic principle of inorganic chemistry by preparation of Inorganic compound.

Course Outcomes:

CO1. To learn the concept of synthesis of inorganic compounds.
CO2. To apply the concept of chromatography for the separation of coordination compounds.
CO3. To evaluate the percent yield of synthesized compounds.

S. No.	Practical Description
1.	**Preparation of the following inorganic compounds** (I) $VO(acac)_2$ (II) (II) Cis-$K[Cr(C_2O_4)_2(H_2O)_2$ (III) (III) $Na[Cr(NH_3)_2(SCN)_4]$ (IV) (IV) $K_3[Fe(C_2O_4)_3]$
2.	**Quantitative Analysis** (a) Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Fe, Ba-Cu etc. involving volumetric and gravimetric methods.
3.	**Spectrophotometric Determinations** 1. Ni by extractive Spectrophotometric method. 2. Fe by Job's method of continuous variations 3. Fe in vitamin tablets 4. Nitrite in water in colorimetric method.

TEXTBOOKS/REFERENCE BOOKS:

1. Experimental Inorganic Chemistry by W.G. Palmer, Cambridge.
2. Inorganic Synthesis, MC Graw Hill.
3. Handbook of Preparative Inorganic chemistry Vol. I and II, Academic press.
4. Standard methods of chemical analysis by W.W. Scaff, Technical Press.
5. Vogel's Qualitative Inorganic Analysis (revised), Orient Longman.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	3	1	1	-	1	3	3	2
CO2	1	2	3	-	1	-	2	3	3	2
CO3	2	2	3	-	-	-	2	3	3	3

Distribution of Evaluation Scheme

Internal Practical	External Practical	Total Marks
60	**40**	**100**

SEMESTER-III

MCH-201: SPECTROSCOPY
(Semester III)

L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

After completing this unit the student will be able to:

1. Explain what it means to use spectroscopic methods for qualitative and quantitative analysis.
2. Identify the terms in and describe deviations to Beer's Law.
3. Qualitatively determine the relative error in absorbance measurements and determine the optimal range for measurement purposes.

COURSE OUTCOMES:

CO1. To learn the symmetry and group theory to the various organic molecules.
CO2. To understand the classification of polyatomic molecules and vibration-rotaion spectroscopy..
CO3. To apply the concept of electronic spectroscopy of Polyatomic molecules.
CO4. To analyze various organic compounds using mass spectroscopy a
CO5: To evaluate the application of various compounds for the determination of molecules.

Unit	Contents	Lectures
I	**Symmetry and Group Theory in Chemistry:** Character tables for C2V and C3V point groups (Construction not required). Representation reducible and irreducible, analysis of reducible representation. Simple Applications of the Character table.	**10**
II	**Infrared Spectroscopy:** Classification of polyatomic molecules. Energy levels and spectra of symmetric top molecules and asymmetric top molecules. First order Stark effect. Vibrational-rotation spectroscopy, P, Q and R branches. Breakdown of Born-Oppenheimer approximation; vibrations of polyatomic molecules, Selection rules, normal modes of vibration, group frequencies, overtones and combination bands, hot bands, factors affecting the band positions and intensities, far IR region, metal-ligand vibrations	**14**
III	**Raman Spectroscopy**: Selection rules, mutual exclusion principle. Polarization of Raman lines. Resonance Raman spectroscopy, coherent anti Stokes Raman spectroscopy (CARS).	**8**
IV	**Electronic Spectroscopy of Polyatomic Molecules:** Energy levels of molecular orbitals, vibronic transitions, vibrational progressions and geometry of excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Electronic spectra of transition metals Emission spectra: radiative and non-radiative decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra.	**10**
V	**Mass Spectroscopy:** Principle of mass spectroscopy (instrument, operation and representation of spectra), mass spectrometer, interpretation of mass spectra, fragmentation pattern, mode of fragmentation, nitrogen rule, effect of isotopes, signals of doubly charged ion, applications viz; identification of substances, determination of molecular weight and molecular formula.	**10**

TEXTBOOKS/REFERENCE BOOKS:

1. Modern Spectroscopy, J.M. Hollas, John Wiley & Sons (2004).
2. Physical Methods in Chemistry, R.S. Drago, Saunders.
3. Chemical Applications of Group Theory, F.A. Cotton

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	1	2	-	1	-	3	3	2	3
CO2	1	2	3	-	1	-	3	3	2	3
CO3	1	3	3	-	2	-	3	3	2	3
CO4	2	3	3	3	2	-	3	3	2	3
CO5	1	1	2	2	1	-	-	2	2	-

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-203: NANOTECHNOLOGY AND PHOTOCHEMISTRY
(Semester III)

L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

This course introduces the fundamentals of nano-scale engineering and manufacturing. Current and future applications of nanostructured materials will be reviewed with respect to their impact in commercial products and technologies.

COURSE OUTCOMES:

CO1. To learn the fundamental principles of nanotechnology and their application to biomedical engineering.
CO2. To understand engineering and chemistry concepts to the nano-scale and non-continuum domain.
CO3. To apply the concept of the photochemical reactions.
CO4. To analyze the application in hydrogen-bromine and hydrogen-chlorine systems.
CO5. To evaluate the theories of reaction rate and quantum yields in elementary reactions.

Unit	Contents	Lectures
I	**Fundamentals of Nanoscience and Nanotechnology** : Solid materials and their strength, Perspective of length, Nanomaterials, Nanoscience and Nanotechnology, Nanostructures in nature, Prime materials, Carbon nanostructures viz. Carbon nanotube (Single-walled and multi-walled), Fullerenes, Surface effects of Nanomaterials, Surface plasmon resonance, Quantum size effects.	**9**
II	**Applications of Nanomaterials**: Importance of Nanomaterials (Gold, Silver, Dielectric and Magnetic Oxide Nanoparticles), Some selected applications like, Nanomaterials in medicine, Nanomaterials for energy sector, Kinetic energy (KE) penetrators with enhanced lethality, High energy density batteries, Nanomaterials in Next-Generation Computer, Nanomaterials in catalysis and sensors, Nanomaterials for water purification, Nanomaterials in communication sector, Nanomaterials in food, Nanomaterials for the environment, Nanomaterials in automobiles, Nanomaterials in ceramics industry	**11**
III	**Introduction and Basic Principles of Photochemistry** : Energy of a Molecule, Photochemical Energy, Electronic transition, Spin Multiplicity, The fate of excited molecules: Physical Processes: Jablonski Diagram, Photocatalytic Clevage, Laws of Photochemistry: Gratthurs-Drapper Law and Einstein's Law of Photo Chemical Equivalence, Quantum Yield or Quantum Efficiency.	**12**
IV	**Photochemistry of carobonyl compound and photo rearragment:** Alpha cleavage or Norish Type1 Process: Norish Type1 Process given by acyclic saturated ketones, Norish Type1 Reaction of Saturated Cyclic Ketones, Norish Type1 Process given by Cyclopentanones, Alpha Cleavage given by Cyclobutanones, Paterno Buchi Reaction, Aza-Di-Pi Methane Rearrangement , Di-Pi-Methane(DPM) rearrangement.	**11**
V	**Photochemistry in Nature and Applied Photochemistry:** Photochemical Reactions in Atmosphere, Chemistry of Vision, Photography, Light Absorbing Compounds, Photochromism, Photoimaging, Photochemistry of Polymers.	**9**

TEXTBOOKS/REFERENCE BOOKS:

1. Atkins P. W. and De Paula J., Physical Chemistry, (tenth edition) Oxford University Press, 2014.N
2. Poole, C.P. & Owens, F.J. Introduction to Nanotechnology John Wiley 2003).
3. Rohatgi-Mukherjee K. K. Fundamentals of Photochemistry, New age (revised second edition).

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	1	2	-	1	-	3	3	2	3
CO2	1	2	-	-	1	-	3	3	2	3
CO3	1	3	1	-	2	-	3	3	2	3
CO4	2	1	1	1	2	-	3	3	2	3
CO5	2	2	2	1	1	2	2	1	1	2

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-205: BIO-INORGANIC CHEMISTRY (Semester III)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:
The objective of the course General Inorganic Laboratory is to expose the students of M.Sc. class to experimental techniques in electronics, so that they can verify some of the things read in theory here or in earlier classes and develop confidence to handle sophisticated equipment.

COURSE OUTCOMES:
CO1. To learn about the bioinorganic and supra-molecular & photo inorganic chemistry.
CO2. To understand the concept of metalloenzymes and their functions in human body/living body.
CO3. To apply the concept of metal chelates and their study as medicine, study about synthetic approach of antibiotics.
CO4. To analyze the EPR activity of various Iron-sulphur proteins.
CO5. To evaluate the toxicity and their remediation of the heavy metals.

Unit	Contents	Lectures
I	**Metallo-Proteins**: Biological ligands for metal ions: Macrocycle, nucleobase, nucleotides and nucleic acids, coordination of metals by protein. Heme and nonheme protein, oxygen uptake, structure and function of haemoglobin, myoglobin, hemocyanin, hemotherine.	**12**
II	**Metalloenzyme**: Principle involved and role of various metals viz. Zn, Fe, Cu and Co; carboxy peptidase, carbonic anhydrase, Alcohol dehydrogenase, Zinc Fingures, other gene regulatory Zinc proteins, cobalomine, mutase activities of coenzyme B12.	**12**
III	**Iron sulphur protein**, cytochromes, cytochrpm P-450, oxygen transfer long distance electron transfer.	**8**
IV	**Application of Bioinorganic Chemistry**: Medicinal and therapic; metal deficiency and disease, toxic effect of metals, metals used for diagnosis and chemotherapy, gold compound as Anti-Rheumatic agent. Nitrogen cycle; biological nitrogen fixation, metalloenzyme in biological nitrogen cycle, molybdenum nitrogenase, other nitrogenase model	**10**
V	**Toxicity of heavy metals** and their detoxification, role of Selenium in Biological systems with reference to its essentiality and toxicity, mechanism of metal ion induced toxicity, interaction between orally administered drugs & metal ions in guts. Drugs in hypo and hyper activity of thyroids, Inorganic drugs in dental carries, clinical disorders of alkali and alkaline earth metals and their remedies, lithium drugs in psychiatry.	**10**

TEXTBOOKS/REFERENCE BOOKS:

1. Principles of Bioinorganic Chemistry S.J. Lippard and J. M. Berg, University Science Books.
2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J. S. Valentine, University Science Books.
3. Inorganic Biochemistry, Vols. I and II, Ed. G. L. Eichhorn, Elsevier.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	2	-	1	-	3	3	2	3
CO2	1	-	-	-	1	-	3	3	2	3
CO3	1	-	1	-	2	-	3	3	2	3
CO4	1	-	1	1	2	-	3	3	2	3
CO5	1	1	2	2	3	-	-	1	1	2

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-207 (I): HETEROCYCLIC CHEMISTRY
(Semester III)

L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

The course deals with heterocyclic chemistry in a broad perspective. Emphasis is given on the most important heterocyclic systems, such as pyridines, quinolines, isoquinolines, pyrroles, furanes, tiophenes, indoles, pyrimidines, purines, imidazoles, aziridines and oxiranes.

COURSE OUTCOMES:

CO1. To learn fundamental and theoretical understanding of heterocyclic chemistry.
CO2. To understand the alternative general methods for ring synthesis and application of such methods for the preparation of specific groups of heterocyclic systems.
CO3. To apply the concept fused ring system in various bicyclic compounds.
CO4. To analyze the various properties and reactions for the most important heterocycles as well as different systems of nomenclature.
CO5. To evaluate the mechanism of rearrangement reactions.

Unit	Contents	Lectures
I	**Introduction to Heterocycles:** Nomenclature, spectral characteristics, reactivity and aromaticity.	**12**
II	**Synthesis and Reactions of three and four membered Heterocycles**: Aziridine, azirine, azetidine, oxiranes, thiarines, oxetanes and thietanes.	**12**
III	**Five-membered rings with two Heteroatoms**: pyrazole, imidazole, oxazole, thiazole, isothiazole, benzofused analogs.	**8**
IV	**Bicyclic Compounds:** Bezofused six membered rings with one, two and three heteroatoms: benzopyrans, quinolones, isoquinolines, quinoxazalines, acridines, phenoxazines, phenothiazines, benzotriazines, pteridines.	**10**
V	**Rearrangements:** General mechanistic considerations- nature of migration, migratory aptitude, memory effects, Cationotropic and Anionotropic rearrangements, Pinacol-Pinacolone, Wagner-Meerwein, Demjanov, Dienone-Phenol, Benzilic acid,Favorskii, Arndt-Eistert, Neber, Hoffmann, Losson, Curtius, Schmidt,Beckmann, BaeyerVilliger rearrangements.	**10**

TEXTBOOKS/REFERENCE BOOKS:

1. Smith M.B & March,J. Advanced organic chemistry sixth edition, John Wiley & Sons (2007). 45
2. Carey, F.A. & Sundberg, R. J. Advanced Organic Chemistry, Parts A & B, Plenum: U.S. (2004).
3. Carruthers,W. and Coldham,I. Modern methods of organic synthesis, Cambridge University Press(2004).
4. Eliel, E. L. Stereochemistry of Carbon Compounds Textbook Publishers (2003).

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	2	-	1	-	3	3	2	3
CO2	1	-	-	-	1	-	3	3	2	3
CO3	1	-	1	-	2	-	3	3	2	3
CO4	1	-	1	1	2	-	3	3	2	3
CO5	2	2	2	3	1	1	-	1	2	2

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

LINGAYA'S VIDYAPEETH

Deemed-to-be-University u/s 3 of UGC Act 1956, Government of India

MCH-207(II): ORGANOMETALLIC CHEMISTRY (Semester III)					
L+T+P	:	**4+0+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. The objective of the course Students can understand Organometallic chemistry is the major part of chemistry which deals with synthesis and chemical properties like catalysts, drugs of synthesized organometallic complexes.

COURSE OUTCOMES:

CO1. To learn about the basic concept of organometallic chemistry.
CO2. To understand the Nucleophilic and Electrophilic attack of co-ordinated ligands and elimination reactions at M-C bond & M-H bond.
CO3. To apply the concept of Stereochemical Changes in Octahedral Complexes.
CO4. To analyze the salt and solvent effects on photochemical reactions.
CO5. To evaluate the Metal ion catalysis in acid-base reactions-hydrolysis, aldol condensation, carboxylation and decarboxylation.

Unit	Contents	Lectures
I	**Organometallic Chemistry I:** Basic concept of organometallic chemistry, Metal carbonyl, Metal alkenes, alkynes & allyl complexes. Metal carbenes and carbynes, Metallocene and Metal arenes complexes. Fluxonality in Organometallic compounds. Fluxionality and dynamic equilibria, Fluxionality in tricarbonyl (Diene) Iron Complexes, Fluxionality in pi-Olefin complexes, Pi-allyl complexes, Tricarbonyl cyclooctatetraene (COT) metal complexes.	**14**
II	**Organometallic Chemistry II:** Homogeneous & Heterogeneous Catalysis, Turn Over Frequency, Turn Over No. Oxidative All & Reductive Elimination, Insertion Reaction, Hydroformylation, Zeigler Natta Catalyst, Wilkinson Catalyst, Syntheses Gas. Monasto Acetic Acid Reaction & Wacker Process.	**10**
III	**Stereochemical Changes in Octahedral Complexes-I:** Outer sphere orientations, reactions of geometrical and optical isomers SN_1 dissociation or SN_2 displacement mechanisms, stereochemistry of the acid and base hydrolysis of Co(III) complexes, optical inversion reactions of some Co(III) complexes. Nucleophilic and Electrophilic attack of co-ordinated ligands and elimination reactions, Oxidative – Addition reactions, Insertion reaction – at M-C bond & M-H bond.	**9**
IV	**Stereochemical Changes in Octahedral Complexes-II**: Isomerization reactions of octahedral complexes, recimerization of octahedral co(III) complexes, salt, salt and solvent effects, photorecimization.	**9**
V	**Metal Ion Catalysis:** Metal ion catalysis in acid-base reactions-hydrolysis, aldol condensation, carboxylation and decarboxylation, Metal ion catalysis in redox reactions autoxidation of organic substances.	**10**

TEXTBOOKS/REFERENCE BOOKS:

1. Metallo-organic Chemistry- Anthony J Pearson, John Wiley & Sons Inc, (1985).
2. Inorganic Chemistry – Principles of Structure & Reactivity, J E Huheey, Elllen A Keiter & Richard L Keiter, IV Edition (2005).
3. Introduction tom metal n-complex chemistry- M. Tsutsui, M.N. Levy, A. Nakamura, M.Ichikawa and K. Mori, Plenum Press, New York I Heme (1970).

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	1	-	-	2	3	2	3
CO2	1	1	1	-	-	-	1	3	2	3
CO3	1	1	2	-	-	-	2	3	3	2
CO4	1	2	1		-	-	2	2	2	3
CO5	1	1	1	2	2	3	1	1	2	2

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

LINGAYA'S VIDYAPEETH
Deemed-to-be-University u/s 3 of UGC Act 1956, Government of India

MCH-207(III): ELEMENTS OF MATERIAL CHEMISTRY (Semester III)					
L+T+P	:	**4+0+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:
Students will learn about:
1. the underlying structure of materials and how this links to its behaviour and properties
2. a range of contexts for teaching materials.
3. ways of supporting literacy and higher order thinking skills through the teaching of materials

COURSE OUTCOMES:
Participants will be able to design lessons that:
CO1. To learn the different contexts to the teaching of materials chemistry to students.
CO2. To understand the Multiphase materials such as Cu-Ni, Au-Cu, Fe-Ni etc.
CO3. To apply the concept of Micellization, Critical Micellar Concentration (CMC)
CO4. To analyze the various features of glass.
CO5. To evaluate the synthesis and properties of Nano-materials.

Unit	Contents	Lectures
I	**Multiphase Materials:** Introduction, solid solutions, interstitial and substitutional solid solutions, complex solid solutions intermetallic compounds, condensed phase rule, one component system Si and Fe. Binary isomorphous system: Cu-Ni, Au-Cu, Hume Rothery solid solubility rule, Liver Rule, Invarient phase Equilibrium Entetic formation (Pb-Sn) peritectic formation Fe-Ni, Fe-C phase diagram, phase transformation in Fe-C alloys, Ferrous and nonferrous alloys	**14**
II	**Catalysis:** General characteristics of catalytic reactions, Acid-base catalysis, Enzyme catalysis, Mechanism and kinetics of enzyme-catalysed reactions, Michalis-Menten equation, Heterogeneous catalysis, Surface reactions, Autocatalysis and Oscillatory reactions.	**10**
III	**Micelles:** Surface active agents, Classification of Surface active agents, Co-surfactants, Micellization, Hydrophobic interaction, Critical Micellar Concentration (CMC), Surfactant packing parameter, Factors affecting the CMC of surfactants, Counter ion binding to micelles, Thermodynamics of micellization, Mass action models, Micro-emulsions, Aggregate structures of surfactants and Phase diagram of ternary microemulsion system.	**9**
IV	**Glasses:** General features, Fabrication of glass, Factors that influence glass formation , Viscosity, Effect of electronegativity, and bond types on oxide glass, Zachariason's, Sun and Rawson criteria, Methods of glass formation, Silicate glasses, Pyrex glass, Phosphate glasses, Borate glasses, Thermodynamics of glass formation, Chalcogenide Glasses.	**9**
V	**Nanomaterials:** Nanoscale Regime, Nano particle, Nanoporous materials, Gas phase Nanoparticles, Condensed Phase Nano Partcles, Inorganic Nano Particles, Semi conductors, Dielectric (insulator) Nano particles and Properties (Physical, mechanical, chemical, magnetic, optical and electronic). Method of Preparation:- Bottom Dowuard Bottom approach, (GEM, PCB, CFCB and SMAD process), Zeolite Method, Emulsion, inverse micelles , Sol-Gel Methods , Co-Precipitation Method.	**10**

TEXTBOOKS/REFERENCE BOOKS:

1. Text Book of Polymer Science by F. W. Billmeyer
2. Materials Science and Engineering: An Introduction, W.D. Callister.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	1	-	-	2	3	2	3
CO2	1	1	1	-	-	-	1	3	2	3
CO3	1	1	2	-	-	-	2	3	3	2
CO4	1	2	1		-	-	2	2	2	3
CO5	2	2	1	1	1	3	2	2	1	1

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-207 (IV): CONVENTIONAL CERAMICS (Semester III)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. This class will introduce students to building with clay.
2. Emphasis will be placed on the design elements; line, shape, texture, and color.
3. Introduction to traditional and historical ceramic arts will be incorporated into the lab experiences.

COURSE OUTCOMES:

After successfully completing this course, the student will be able to:

CO1.To learn the ability to perceive and describe formal qualities and expressive content in Ceramic products.

CO2. To understand the technical skills needed to produce products with aesthetic qualities.

CO3.To apply the concept of forming pottery and use vocabulary related to ceramics.

CO4.To analyze the various properties of ceramic capacitors.

CO5. To evaluate the production of Aerogels, silica aerogels, organic aerogels.

Unit	Contents	Lectures
I	**Functional Ceramics:** General concepts, oxide and non-oxide ceramics-functions and applications; microstructure of ceramics; grain boundaries in ceramics, significance and their types, fabrication of polycrystalline ceramics- general aspect, brief treatment of synthesis of powders, forming processes, hot pressing, hot isostatic pressing.	12
II	**Structural Ceramics and their Properties:** oxide ceramics-classification and general characteristics, non-oxide ceramics classification and general characteristics, general aspects and characteristics of alumina, zircona, silicon nitride, silicon carbide, electronic configuration of atoms, bonding, Polymorphic forms and transformations, Physical , thermal, electrical, magnetic properties of ceramics.	11
III	**Ceramic Insulators:** Introduction, general aspects of linear dielectrics; glass- different types of glasses and their characteristics, selection criteria for glass insulators, important glass compositions and their thermal mechanical and electrical characteristics and applications, glass insulating films, thin and thick films- composition and application, sealing glass composition and applications. Procelain: triaxial porcelain- composition and application, non feldspathic porclains- compositions and applications.	10
IV	**Ceramic Capacitors:** Significance of capacitors, history of development, ferroelectricity and capacitors, Basic capacitor materials- porcelain and steatite, rutile, barium titanate, solid solutions, fine grained materials, additives, relaxor dielectrics; classification of ceramic capacitors,- thick film capacitors, single layer discrete capacitors, multilayer capacitors.	10
V	**Aerogel:** Introduction, Production of Aerogels, silica aerogels, organic aerogels, drying, structural investigations- aerogel structure, thermal and infrared optical properties and mechanical properties, applications.	9

TEXT BOOKS/REFERENCE BOOKS:

1. Introduction to Fine ceramics by Noburu Ichinose (ed.) John Wiley and Sons., New York (1987)
2. Ceramic Materials for Electronics – R.C. Buchanan (ed.) Marcel Deller, New York (1991)
3. Chemical Processing of Ceramics by Burtrand I. Lee, Edward J. A. Pope (ed) Marcel Deller

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	1	-	-	2	3	2	3
CO2	1	1	1	-	1	-	1	3	2	3
CO3	1	2	2	-	1	-	2	3	3	2
CO4	1	2	1	1	1	-	2	2	2	3
CO5	1	1	2	2	2	-	1	2	2	1

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-209 (I): POLYMER CHEMISTRY
(Semester III)

L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. Provide the students with fundamental principles of polymers, classification, preparation, Structure and properties.
2. Provides students with an opportunity to identify different types of polymers
3. Introduces students to the practical application of polymers.

COURSE OUTCOMES:

CO1. To learn the basic concepts and terms in polymer chemistry and the different types of polymerization.
CO2. To understand the relation between the polymer structure and its molecular weight.
CO3. To apply the concept of various theories on molecular structure of monomers and polymers,
CO4. To Analyze and develop the polymer reaction mechanism and their stereochemistry.
CO5. To evaluate the properties of various polymer reactions as a catalyst.

Unit	Contents	Lectures
I	**Polymer Physics-I:** Polymer Molecules, Conformation and Molecular Dimensions of Polymer Molecules, Properties of Isolated Polymer Molecules, Elasticity and Swelling of Polymer Gels, Molecular Motion of Polymers in Dilute Solutions, Amorphous Polymers, Structure of Amorphous Phase in Bulk Polymers, Mobility in Polymers, Glass Transition- Measurement of T_g, Effect of Various Parameters on T_g,.	12
II	**Polymer Physics-II:** Crystallinity in Polymers, Determination of Degree of Crystallinity, Two Phase Structure of Semi-Crystalline Polymers and its Characterization and Correlation with Properties, Crystal Morphologies: Extended Chain Crystals, Chain Folding, Lamellae, Spherulite, Melting: Determination of Polymer Melting Point, The Effect of Various Parameters on Melting, Mechanical Properties: Stress-Strain Properties.	11
III	**Polymer Characterization:** Thermodynamics of Polymer Solutions, Flory-Huggins and Lattice Theory of Polymer Solution, Entropy and Enthalpy of Mixing, Theta Temperature, Molecular Weight and Molecular Dimensions by Osmometry, Light Scattering, Viscometry and Gel Permeation Chromatography, Thermal Analysis of Polymers: Differential Scanning Calorimetry (DSC), Thermo gravimetric Analysis (TGA) and Differential Thermal Analysis (DTA).	10
IV	**Polymer Rheology:** Definition of Rheology, Geometry of Deformation, Newtonian and Non-Newtonian Behaviors, Measurement of Rheological Properties, Power Law, Free Volume Theory of Polymer Fluidity, Dynamic Flow Behavior, Time-Dependent Fluid Responses, Viscoelastic Properties, Mechanical Models of a Viscoelastic Material, Stress Relaxation, Creep and Relaxation behavior of Plastics	10
V	**Polymer Technology:** Polymers of Commercial Importance, Mass Polymerization: Solution, Emulsion and Suspension Polymerizations, Ziegler Natta Coordination Polymerization, Methathesis Polymerization.	9

TEXT BOOKS/REFERENCE BOOKS:

1. Text Book of Polymer Science By F. W. Billmeyer
2. Introduction to Polymers by R. J. Young and P. A. Lovell

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	-	-	-	2	3	2	3
CO2	2	1	1	-	1	-	2	3	2	3
CO3	1	2	2	-	1	-	2	3	3	2
CO4	1	2	1	1	1	-	2	2	2	3
CO5	1	1	-	-	2	2	2	3	2	1

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-209 (II): MEDICINAL CHEMISTRY (Semester III)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. The mission of the Medicinal Chemistry courses is to help students gain a comprehensive understanding of the fundamental concepts related to the actions and clinical uses of major classes of drugs from their chemical structures.
2. The major topics and classes of drugs covered in Medicinal Chemistry

COURSE OUTCOMES:

At the end of the course,

CO1. To learn about the depth and breadth of knowledge in biomedical, pharmaceutical, social/administrative/behavioral, and clinical sciences.

CO2. To understand the foundational sciences to explain how specific drugs or drug classes work and

CO3. To apply the concept of SAR to synthesized various drugs

CO4. To analyze and synthesize various antineoplastic and antibiotic drugs.

CO5. To evaluate the properties of antibiotics, antineoplastic drugs w.r.t foundational sciences to solve therapeutic problems.

Unit	Contents	Lectures
I	**Drug Design-I:** Development of new drugs, procedures followed in drug design, concept of lead compound and lead modification, concepts of prodrugs and soft drugs, structure-activity relationship (SAR), factors affecting bioactivity, resonance, inductive effect, isosterism, bio-isosterism, spatial considerations. Theories of drug activity: occupancy theory, rate theory, induced fit theory.	12
II	**Drug Design-II:** Quantitative structure activity relationship (QSAR). History and development of QSAR. Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physicochemical parameters: lipophilicity, partition coefficient, electronic ionization constants, steric, Shelton and surface activity parameters and redox potentials. Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson and Hansch analysis. LD-50, ED-50.	11
III	**Antineoplastic Agents:** Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors. Synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil mustards and 6-mercaptopurine. Recent development in cancer chemotherapy. Hormone and Natural products.	10
IV	**Local Antiinfective Drugs:** Introduction and general mode of action. Synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazid, ethionamide, ethambutal, fluconazole, econozole, griseofulvin, chloroquin and primaquin.	10
V	**Antibiotics:** Cell wall biosynthesis, inhibitors, β-lactam rings, antibiotics inhibiting protein synthesis. Synthesis of Penicillin G, Penicillin V, Ampicillin, Amoxicillin, Chloramphenicol, Cephalosporin, Tetracycline	9

	and Streptomycin..	

TEXT BOOKS/REFERENCE BOOKS:

1. Introduction to Medicinal Chemistry, A. Gringauge, Wiley-VCH.
2. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley & Sons Ltd.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	-	1	-	2	3	2	3
CO2	1	1	1	-	1	-	2	3	2	3
CO3	1	2	2	-	1	-	2	3	3	2
CO4	-	2	1	1	1	-	2	2	2	3
CO5	2	2	1	1	-	2	2	1	3	2

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-209 (III): BIOINORGANIC CHEMISTRY-II (Semester III)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**15**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. Biochemistry is the study of the variety of chemical structures and chemical reactions that occur in living organisms.
2. In order to truly understand the detailed mechanisms of these diverse reactions, one must assimilate aspects of organic chemistry, inorganic chemistry, and physical chemistry.

COURSE OUTCOMES:

CO1**.** To learn about the basic elements of chlorophyll and hemoglobin and their structures.
CO2. To understand the biological functions of inorganic elements.
CO3. To apply the concept of uptake, transport and storage of inorganic molecules.
CO4. To analyze the role of alkali and alkaline earth metals in biological systems.
CO5. To evaluate the functioning of various metal ions in storage and transport.

Unit	Contents	Lectures
I	**Porphyrins:** Introduction, types of chlorophylls, functions of hemoglobin and chlorophyll, structure and synthesis of hemoglobin and chlorophyll a.	12
II	**Metal Ions in Biological System:** Occurrence and availability of Inorganic elements in organisms, transport and storage of Inorganic elements, Dose response of an element, biological function of inorganic elements, beneficial and toxic elements, essential and trace metals.	11
III	**Metal Storage, Transport and Biomineralization:** Sidrophore, phytosidrophores, ferretin, fransferrin, hemosiderine, biomineralization, assembly of advanced materials e.g. calcium phosphate, calcium carbonate, iron biominerals.	10
IV	**Uptake, Transport and Storage of Inorganic Molecule:** Oxygen transport and storage through hemoglobin and myglobin, Alternative oxygen transport in lower organisms. Photosynthesis: Photochemistry, absorption spectra of photosynthetic pigments, photophosphorylation - energy conversion process.	10
V	**Transport and Function of Alkali and Alkaline Earth Metals:** Roll of Alkali and alkaline earth metals in neuro sensation. Ion Channels, ion pumps, magnesium catalysis of phosphate, ubiquitous regulatory role of calcium.	9

TEXT BOOKS/REFERENCE BOOKS:

1. Inorganic Biochemistry, Vols. I and II, Ed. G. L. Eichhorn, Elsevier.
2. Progress in Inorganic Chemistry, Vols. 18 and 38, Ed. J.J. Lippard, Wiley.
3. Organometallic Chemistry - R. C. Mehrotra & A. Singh, Wiley Eastern Ltd. (2000).

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	2	1	-	1	-	2	3	2	3
CO2	1	2	1	-	1	-	2	3	2	3
CO3	1	2	1	-	1	-	2	3	2	3
CO4	1	2	1	3	1	-	2	3	2	3
CO5	2	2	1	1	3	3	-	1	1	2

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	15	60	100

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	5	5	10
Total Marks	20	40	60

MCH-209 (IV): Chemistry of Natural Products (Semester III)					
L+T+P	:	**3+1+0**	Mid-Sessional exam	:	**25**
Credits:	:	**4**	ABQ	:	**15**
Contact hours	:	**52**	End-semester exam	:	**60**

COURSE OBJECTIVES:

1. The course provides a brief introduction to plant systematics.
2. Significant poisonous and medicinal plants, together with natural medicines, will be discussed.
3. Important classes of compounds (secondary metabolites) in and from nature will be emphasised, and stress will be put on classification, nomenclature, structure, biosynthesis, occurrence, analysis and pharmaceutical perspectives.

COURSE OUTCOMES:

After completing the course the student will be able to:

CO1. To learn and understand the field of natural product chemistry.
CO2. To understand different types of natural products
CO3. To apply the concept of natural products as starting materials in medicines.
CO4. To analyze the functions of DNA and RNAs (m-RNA, t-RNA, r-RNA).
CO5. To evaluate the structureres of nucleic acid.

Unit	Contents	Lectures
I	**Alkaloids:** Introduction, occurrence, nomenclature, physiological actions, isolation, methods of structural determination. Structure determination and synthesis of the following alkaloids: Atropine, Coniine. Ephedrine, Morphine, Nicotine and Quinine.	12
II	**Terpenoids and Carotenoids:** Introduction, occurrence, classification, nomenclature, isolation, isoprene rule, methods of structural determination. Structure determination and synthesis of the following molecules: β-Carotene, Citral, Phytol, Terpeneol and Zingiberene.	11
III	**Plants Pigments:** Introduction, occurrence, nomenclature, isolation, methods of structural determination, synthesis of Apigenin, Cyanidine, Cyaniding-7-Arabinoside, Diadzein, Luteolin, Myrcetin, Quercetin, Quercetin-3-Glucoside and vitexin.	10
IV	**Steroids:** Introduction, occurrence, nomenclature, isolation, basic skeleton, Dicl's hydrocarbon and stereochemistry, methods of structural determination. Structure determination and synthesis of the following steroids: Aldosterone, Androsterone, Cholesterol, Estrone, Progesterone and Testosterone.	10
V	**Nucleic Acids: I**ntroduction, structures and functions of DNA and RNAs (m-RNA, t-RNA, r-RNA), Chemical and enzymatic hydrolysis of DNA and RNAs, an overview of gene expression (replication, transcription and translation), genetic coIde (origin, Wobble hypothesis), genetic errors, mutation and carcinogenesis and recombinant DNA technology.	9

TEXT BOOKS/REFERENCE BOOKS:

1. I.L. Finar, Organic chemistry, Vol. II, ELBS Publications, UK.
2. J. Mann, R.S. Devison, J.B. Hobbs, D.V. Banthrope and J.B. Harborne, Natural products chemistry and biological significance, Longman Publisher, Essex, UK.

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	2	1	-	1	-	2	3	2	3
CO2	1	2	1	-	1	-	2	3	2	3
CO3	2	2	1	-	-	-	2	3	2	3
CO4	2	2	1	3	1	-	2	3	2	3
CO5	1	1	2	2	1	1	3	1	1	2

Distribution of Evaluation Scheme

MID SEM	ABQ	END SEM EXAM	TOTAL
25	**15**	**60**	**100**

Question Paper Pattern

	Section A (4 Marks)	Section B (8 Marks)	Total
No. of Questions	**5**	**5**	**10**
Total Marks	**20**	**40**	**60**

MCH-251: CHEMISTRY LABORATORY
(Semester III)

L+T+P	:	**0+0+2**	Viva-voce + Continuous lab performance	:	**60**
Credits:	:	**2**			
Contact hours	:	**52**	Viva-voce + Written exam + Practical record file	:	**40**

COURSE OBJECTIVES:

1. Students will get acquainted with the unifying principles of spectroscopy.
2. Students will learn atomic absorption spectroscopy, its basic principle, instrumentation and applications.

COURSE OUTCOMES:

1. The students have the detailed knowledge of analytical ore analysis of different element, quantitative organic compound analysis and also have the spectroscopic determination method.
2. Students will learn error analysis, statistical data analysis, volumetric analysis, chromatography, flame photometry.
3. Students will be capable of synthesizing metal complexes.

S. No.	Practical Description
1.	Synthesis of metal acetylacetonate; magnetic, IR, NMR studies
2.	Synthesis of Cis- and Trans-$[Co(en)_2Cl_2$
3.	Magnetic moment of $Cu(acac)_2.H_2O$.
4.	**Spectrophotometric Determination** a. Mn/Cr/V in steel sample b. Mo/W/V/U/ by extractive spectrophotometric method c. $F^-/NO_2^-/PO_4^{3-}$ d. Iron-phenanthroline complex: Jobs method of continous variations. e. Cu-Ethylenediamine complex: Slope-Ratio Method
5.	Fe by Job's method of continuous variations
6.	**Chromatographic Separations** (a) Cd and Zn

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	3	1	1	-	1	3	3	2
CO2	1	2	3	-	1	-	2	3	3	2
CO3	2	2	3	-	-	-	2	3	3	3

Internal Practical	External Practical	Total Marks
60	**40**	**100**

MCH-253: SYNOPSIS SEMINAR
(Semester III)

L+T+P	:	**0+0+2**	Write up	:	**25**
Credits:	:	**1**	Viva-voce	:	**25**
Contact hours	:	**13**	Presentation	:	**50**

Description
Students are required to submit a synopsis on the allotted topic and must make a presentation in front of advisory committee and M.Sc. Students. Students are expected to provide latest facts and updated information by consulting latest editions of textbooks, reference books, monographs, and peer-reviewed national & international research journals.

S. No.	**Course details**
1.	Synopsis writing
2.	Synopsis seminar
3.	Approval of synopsis by research committee
4.	Research work by taking 13 credit hours

SEMESTER-IV

MCH-252: Dissertation (Literature Review; Thesis submission)
(Semester IV)

L+T+P : **0+0+24**
Credits: : **12**
Contact hours : **156**

Description
Semester IV is only for dissertation work. There will be no theory or practical courses in this semester. Dissertation will carry marks for continuous assessment, dissertation write-up, its presentation and viva-voce. This will be evaluated at the end of fourth semester. Students will work on a research topic assigned to him/her by their supervisor/mentor with a purpose to develop a collective approach to study, analyze and solve the problem. Students are required to collect, analyze the data, and submit their dissertation at the end of the semester.

S.No.	**Course details**
1.	Research work
2.	Seminar
3.	Evaluation by Research committee
4.	Thesis writing
5.	Research work by taking 260 credit hours