CHAITANYA SCIENCE AND ARTS COLLEGE

(AUTONOMOUS)

PAMGARH, JANJGIR-CHAMPA (C.G.)

ACCREDITED "A" GRADE BY NAAC

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

POSTGRADUATE PROGRAMME

MASTER OF SCIENCE (CHEMISTRY)

PROGRAM CODE: **CCMS03**

THIRD & FOURTH SEMESTER

Approved By	Board of Studies	Academic Council
Date		

ACADEMIC YEAR 2026-27

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DEPARTMENT OF CHEMISTRY

M.Sc. (CHEMISTRY) PROGRAM CODE: CCMS03

Program Outcome (PO)

Upon completion of the M.Sc. (Chemistry) Program, the students will be able to:

PO1: Knowledge: Acquire an overview of concepts, fundamentals and advancements of science across a range of fields, with in-depth knowledge in at least one area of study. Develop focused field knowledge and amalgamate knowledge across different disciplines.

PO2: Complementary skills: Students will be able to engage in critical investigation through principal approaches or methods and through effective information search and evaluation strategies. Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies

PO3: Applied learning: Students will be able to apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and practice. Recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation or scholarly debate

PO4: Communication: Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Able to comprehend and write reports, documents, make effective presentations by oral and/or written form.

PO5: Problem-solving: Investigate, design and apply appropriate methods to solve problems in science, mathematics, technology and/or engineering.

PO6: Environment and sustainability: Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO7: Teamwork, collaborative and management skills: Recognize the opportunities and contribute positively in collaborative scientific research. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues

Program Specific Outcome (PSO)

Upon completion of the M.Sc. (Chemistry) Program, the students will be able to:

PSO1: Understand and explain the fundamental concepts in Physical Chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry and its application.

PSO2: Apply various concepts, interpret/derive/deduce expressions, reaction mechanism, structure etc.

PSO3: Solve problems/numerical using basic chemistry knowledge and concepts.

PSO4: Carry out advanced experiments, investigate and explore through projects, record the observations, present the inference/results and discuss/interpret the result.

DEPARTMENT OF CHEMISTRY

M.Sc. (CHEMISTRY) PROGRAM CODE: CCMS01 BOARD OF STUDIES ACADEMIC YEAR: 2026-27

The syllabus for M.Sc. (Chemistry) III& IV semester is hereby approved for the academic year 2026-27

Scheme of M. Sc. Chemistry under Semester System
Program Code: CCMS03

Session 2026-27

Proposed Scheme For 2-Year Postgraduate Program

PROGRAMME STRUCTURE: PART	YEAR	SEMESTER	SEMESTER
Part-I	First Year	Semester-I	Semester-II
Part-II	Second Year	Semester-III	Semester-IV

SEMESTER -III

SR. NO.	COURSE CODE	TITLE OF COURSE
1.	MCHT301	Applications of Spectroscopy
2.	MCHT302	Chemistry of Bio-inorganic & Bio organic
3.	MCHT303	Physical Organic Chemistry
4.	MCHT304	Chemistry of Heterocyclic Compounds
5.	MCHP305	Lab Course I: General

SEMESTER -IV

SR. NO.	COURSE CODE	TITLE OF COURSE
1.	MCHT401	Photochemistry &Solid State Chemistry
2.	MCHT402	Bio-physical & Environmental Chemistry
3.	MCHT403	Medicinal Chemistry
4.	MCHT404	Chemistry of Natural Products
5.	MCHP405	Lab Course I: Special Or Dissertation Seminar, Viva-Voce

SESSION-2026-27

SEMESTER-III

SR. NO.	COURSE CODE	TITLE OF COURSE	ESE	CIE (IA)	TOTAL MARKS
1.	MCHT301	Applications of Spectroscopy	70	30	100
2.	MCHT302	Chemistry of Bio-inorganic & Bio-organic	70	30	100
3.	MCHT303	Physical Organic Chemistry	70	30	100
4.	MCHT304	Chemistry of Heterocyclic Compounds	70	30	100
5.	MCHP305	Lab Course I: General	-	-	200
		TOTAL	600		

SEMESTER-IV

SR. NO.	COURSE CODE	TITLE OF COURSE	ESE	CIE *(IA)	TOTAL MARKS
1.	MCHT401	Photochemistry & Solid State Chemistry	70	30	100
2.	MCHT402	Bio-physical & Environmental Chemistry	70	30	100
3.	MCHT403	Medicinal Chemistry	70	30	100
4.	MCHT404	Chemistry of Natural Product	70	30	100
5.	MCHP405	Lab Course I: Special Or Dissertation Seminar, Viva-Voce	-	-	200
		TOTAL	**600**		

Program	**CCMS03, M.Sc. CHEMISTRY**	Semester	**III**
Course Code	**MCHT301**	Paper	**I**
Course Title	Applications of Spectroscopy		
Course Type	Theory		
Course Outcomes	CO1: To understand the principles and applications of vibrational spectroscopy, ESR spectroscopy, and NMR of paramagnetic substances in inorganic and biological systems. CO2: To know the instrumentation, electronic transitions, vibrational frequencies, and structural applications of UV-Visible and Infrared spectroscopy for organic compounds. CO3: To understand the concepts of chemical shift, spin-spin interaction, coupling constants, stereochemical effects, and structural interpretation in Proton NMR spectroscopy. CO4: To know the principles and applications of Carbon-13 NMR, ORD, CD, and Mass Spectrometry for stereochemical analysis and structure determination of organic compounds.		
Total Marks	**CIA: 30, ESE: 70, Min Passing Marks: 40**		

Unit	**Contents**	**Total Hours**
I	**Inorganic Chemistry-** Vibrational Spectroscopy: Symmetry and shape of AB_2, AB_3, AB_4, AB_5, AB_6; bonding of ambidentate ligands; ethylenediamine and diketonato complexes; resonance Raman spectroscopy applications (metallo-proteins). Electron Spin Resonance (ESR): Hyperfine coupling, spin polarization, spin-orbit coupling, g-tensors; applications to transition metal complexes (one unpaired electron), biological systems, and inorganic free radicals. NMR of Paramagnetic Substances: Nuclear relaxation factors; applications in biological systems; overview of NMR of metal nuclides (^{195}Pt, ^{119}Sn).	15
II	**Organic Chemistry** UV-Visible Spectroscopy: Instrumentation, sample handling, electronic transitions (185–800 nm), Beer-Lambert law, solvent effects, UV bands for carbonyls, dienes, conjugated polyenes; Fieser-Woodward rules; spectra of aromatic & heterocyclic compounds; steric effects in biphenyls. Infrared Spectroscopy: Instrumentation, sample handling, vibrational frequencies of alkanes, alkenes, alkynes, aromatics, alcohols, ethers, phenols, amines; detailed study of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams, conjugated systems); hydrogen bonding and solvent effects; overtones, combination bands, Fermi resonance; FT-IR; IR of gases, solids, polymers.	15
III	**Nuclear Magnetic Resonance (NMR) Spectroscopy** General introduction, definition, chemical shift, spin-spin interaction, shielding mechanism. Chemical shift values and correlations for protons bonded to carbon	15

	(aliphatic, olefinic, aldehydic, aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides, mercaptols). Spin-spin interactions (two to five nuclei, first-order spectra), vicinal coupling, stereochemistry, hindered rotation, Karplus curve, coupling constant variation with dihedral angle. Solvent effects, Fourier Transform technique, Nuclear Overhauser Effect (NOE).	
IV	**Advanced Spectroscopy and Mass Spectrometry** Carbon-13 NMR Spectroscopy: General considerations, chemical shifts (aliphatic, olefinic, alkyne, aromatic, heteroaromatic, carbonyl carbons), coupling constants. Optical Rotatory Dispersion (ORD) & Circular Dichroism (CD): Definitions, deduction of absolute configuration, octant rule for ketones. Mass Spectrometry: Introduction, ion production (EL, CL, FD), fragmentation factors, ion analysis. Mass Fragmentation Patterns: Functional groups, molecular ion peak, metastable peak, McLafferty rearrangement, Nitrogen rule; examples of fragmentation for structure determination of organic compounds	15

List of Reference Book

Here is the list with **consistent academic/reference alignment**:

1. Hollas, J. M. *Modern Spectroscopy*. John Wiley & Sons.
2. Windawi, H., & Ho, F. F. (Eds.). *Applied Electron Spectroscopy for Chemical Analysis*. Wiley-Interscience.
3. Parish, R. V. *NMR, NQR, ESR and Mössbauer Spectroscopy in Inorganic Chemistry*. Ellis Horwood.
4. Drago, R. S. *Physical Methods in Chemistry*. Saunders College Publishing.
5. Barrow, G. M. *Introduction to Molecular Spectroscopy*. McGraw-Hill.
6. Chang, R. *Basic Principles of Spectroscopy*. McGraw-Hill.
7. Jaffé, H. H., & Orchin, M. *Theory and Applications of Ultraviolet Spectroscopy*. Oxford & IBH.
8. Ghosh, P. K. *Introduction to Photoelectron Spectroscopy*. John Wiley & Sons.
9. Carrington, A., & McLachlan, A. D. *Introduction to Magnetic Resonance*. Harper & Row.
10. Ebsworth, E. A. V., Rankin, D. W. H., & Cradock, S. *Structural Methods in Inorganic Chemistry*. ELBS/Blackwell Scientific.
11. Cotton, F. A. (Ed.). *Progress in Inorganic Chemistry*, Vol. 8. Wiley.
12. Lippard, S. J. (Ed.). *Progress in Inorganic Chemistry*, Vol. 15. Wiley.

Program	**M.Sc. CHEMISTRY**	Semester	**III**
Course Code	**MCHT302**	Paper	**II**
Course Title	Chemistry of Bio-inorganic & Bio-organic		
Course Type	Theory		
Course Outcomes	CO1: To understand the role of metal ions in biological systems, bioenergetics, oxygen transport and storage, electron transfer processes, and biological nitrogen fixation. CO2: To know the principles of bio-organic chemistry, enzyme structure and function, enzyme kinetics, mechanisms of enzyme action, and enzyme inhibition. CO3: To understand various enzyme-catalyzed reactions, the role of coenzymes and cofactors in biochemical transformations, and the mechanisms of reactions mediated by vitamin-derived coenzymes. CO4: To learn the concepts of enzyme models, molecular recognition, host–guest chemistry, biomimetic systems, and the biotechnological and industrial applications of enzymes, including immobilization and recombinant DNA technology.		
Total Marks	**CIA: 30, ESE: 70, Min Passing Marks: 40**		

Unit	Contents	Total Hours
I	BIO-INORGANIC CHEMISTRY: Metal ions in Biological Systems- Essential and trace metals. Na^+/K^+ pumps- Role of metal ions in biological processes. Bio-energetic and ATP cycle- DNA polymerization, glucose storage, metal complexes in transmission of energy, chlorophylls, Photosystem-1 and Photosystem-II in Cleavage of water. Model systems. Transport and Storage of Dioxygen- Heme protein and oxygen uptake, structure and function of Hemoglobin Myoglobin. Hemocyanins and hemerythrin, model synthetic complexes iron, cobalt and copper. Electron Transfer in Biology- Structure and function of metalloproteins in electron transport processes, Cytochromes and ion-sulphur proteins, synthetic models. Nitrogenase Biological nitrogen fixation, Mo-Nitrogenase spectroscopic and other evidences. Other nitrogenases and model systems.	15
II	BIO-ORGANIC CHEMISTRY Introduction-Basic considerations, Proximity effects and molecular adaptation. Enzymes- Introduction and historical perspective, Chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extractions and purification, Fischer's lock and key, and Koshland's induced Fit hypothesis, Concepts and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics. Michaelis Menten and Lineweaver- Burk plots. Reversible and irreversible inhibition.	15

III	Kinds of Reaction catalyzed by Enzymes- Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer to sulphatase, addition and elimination reactions, enolic intermediates in isomerisation reactions, Beta-cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.Co-Enzyme Chemistry- Cofactors as derived from vitamins, coenzymes, prosthetic groups, apo-enzymes structure and biological function, coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD^+, $NADP^+$, FMN, FAD, Lipoic acid. Vitamins B12 Mechanisms of reactions catalyzed by above cofactors	15
IV	Enzyme Models Host-guest chemistry, chiral recognition and catalysis. Molecular recognition. Molecular asymmetry and prochirality. Biomimetic chemistry, Crown ethers, cryptates, cyclodextrins, cyclodextrin-based enzyme models, calixarenes, ionophores, micelles, synthetic enzymes or synzymes. Biotechnological Application of Enzymes Large scale production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese making syrup from corn starch, enzymes as targets for drug as targets for drug design. Clinical uses of enzymes, enzyme therapy. Enzymes and recombinant DNA technology.	15

Reference

1. *Principles of Bioinorganic Chemistry* — S. J. Lippard & J. M. Berg. University Science Books, Mill Valley, CA, 1994.
2. *Bioinorganic Chemistry* — I. Bertini, H. B. Gray, S. J. Lippard & J. S. Valentine. University Science Books, Mill Valley, CA, 1994.
3. *Inorganic Biochemistry*, Vols. I & II — G. L. Eichhorn (Ed.). Elsevier, Amsterdam.
4. *Progress in Inorganic Chemistry*, Vols. 18 & 38 — S. J. Lippard (Ed.). John Wiley & Sons, New York.
5. *Bioorganic Chemistry: A Chemical Approach to Enzyme Action* — H. Dugas & C. Penney. Springer-Verlag, New York, 1981.
6. *Understanding Enzymes* — T. Palmer. Ellis Horwood, Chichester; Prentice Hall, New York.
7. *Enzyme Chemistry: Impact and Applications* — C. J. Suckling (Ed.). Chapman and Hall, London, 1990.
8. *Enzyme Mechanisms* — M. I. Page & A. Williams (Eds.). Royal Society of Chemistry, London.
9. *Fundamentals of Enzymology* — N. C. Price & L. Stevens. Oxford University Press, Oxford.
10. *Immobilized Enzymes: An Introduction and Applications in Biotechnology* — M. D. Trevan. Wiley, Chichester, 1980.
11. *Enzymatic Reaction Mechanisms* — C. Walsh. W. H. Freeman, San Francisco.
12. *Enzyme Structure and Mechanism* — A. Fersht. W. H. Freeman, New York.
13. *Biochemistry: The Chemical Reactions of Living Cells* — D. E. Metzler. Academic Press, New York.
14. *Principles of Biochemistry* — A. L. Lehninger. Worth Publishers, New York.
15. *Biochemistry* — L. Stryer. W. H. Freeman, New York.
16. *Biochemistry* — J. D. Rawn. Neil Patterson Publishers, Burlington, NC.
17. *Outlines of Biochemistry* — E. E. Conn & P. K. Stumpf. John Wiley & Sons, New York.

18. *Biochemistry* — D. Voet & J. G. Voet. John Wiley & Sons, New York.
19. *Biochemistry* — L. Stryer. W. H. Freeman, New York.
20. *Biochemistry* — J. D. Rawn. Neil Patterson Publishers, Burlington, NC.
21. *Biochemistry* — D. Voet & J. G. Voet. John Wiley & Sons, New York.
22. *Fundamentals of Biochemistry* — J. L. Jain & S. Jain. S. Chand & Company, New Delhi.
23. *Bioinorganic Chemistry* — P. S. Kalsi.

Program	**M.Sc. CHEMISTRY**	Semester	**III**
Course Code	**MCHT303**	Paper	**III**
Course Title	Physical organic Chemistry		
Course Type	Theory		
Course Outcomes	CO1: To understand advanced concepts of Molecular Orbital (MO) and Valence Bond (VB) theories, aromaticity, conjugation, hyperconjugation, reaction profiles, and modern computational methods used in organic chemistry. CO2: To explain the role of solvation and solvent effects on chemical reactivity, acidity-basicity, nucleophilicity, electrophilicity, and various catalytic processes in organic reactions. CO3: To understand the principles governing chemical reactivity, reaction mechanisms, activation parameters, electron transfer processes, and the factors affecting radical and pericyclic reactions. CO4: To analyze nucleophilic and electrophilic substitution reactions, steric and conformational effects on reactivity, and the conformational behavior of organic molecules using modern mechanistic approaches.		
Total Marks	**CIA: 30, ESE: 70, Min Passing Marks: 40**		

Unit	**Contents**	**Total Hours**
I	**Concepts in Molecular orbital (MO) and Valence Bond (VB) Theory:** Introduction to Hückel molecular orbital (MO) method as a means to explain modern theoretical methods. Advanced techniques in PMO and FMO theory. Molecular mechanics. semi empirical methods and *ab-initio* and density functional methods. Quantitative MO theory Huckel molecular orbital (HMO) method as applied to ethene allyl and butadiene. Qualitative MO theory ionization potential. Electron affinities. MO energy levels. Orbital symmetry. orbital interaction diagrams. MO of simple organic systems such as ethene, allyl, butadiene, methane and methyl group. Conjugation and hyperconjugation, aromaticity. Valence bond (VB) configuration mixing diagrams-Relationship between VB configuration mixing and resonance theory, reaction profiles. potential energy diagrams curve-crossing model nature of activation barrier in chemical reactions.	15

II	Solvation and Solvent Effects & Acids, Bases, Electrophiles, Nucleophiles, Catalysis: Qualitative understanding of solvent-solute effects on reactivity. Thermodynamic measure of solvation. Effects of solvation on reaction rates and equilibria. Various empirical indexes of solvation based on physical properties. solvent-sensitive reaction rates. spectroscopic properties and scales for specifc solvation use of solvation scales in mechanistic studies. Solvent effects from the curve-crossing model. Acid-base Dissociation, Electronic and structural effects, acidity and basicity, acidity functions and their application. Hard and soft acids and bases. nucleophilicity scales, nucleofugacity. The alpha-effect. Ambivalent nucleophiles Acid-Bases catalysis-specific and General catalysis. Bronsted catalysis. Nucleophilic and Electrophilic catalysis. Catalysis by non covalent binding-micellar catalysis.	15
III	(a) Principles of Reactivity: Mechanistic significance of entropy enthalpy and Gibb's free energy. Arrhenius equation. Transition state theory. Uses of activation parameters. Hammond's postulate Bell-Evans-Polanyi principle potential energy surface model. Marcus theory of electron transfer. Reactivity and selectivity principles. (b) Radical and Pericyclic Reactions: Radical stability, polar influences, solvent and steric effects. A curve crossing approach to radical addition. Factor affecting barrier heights in additions regioselectivity in radical reaction. Reactivity specificity and periselectivity in pericyclic reactions.	15
IV	a) **Nucleophillic and Electrophilic Reactivity:** Structural and electronic effects on S_N1 and S_N2 reactivity. Solvent effects. Kinetic isotope effects. Intramolecular assistance. Electron transfer nature of S_N2 reactions. Nucleophilicity and S_N 2 reactivity based on curve-crossing model. relationship between polar and electron transfer reactions. $S_{RN}1$ mechanism. Electrophilic reactivity. General mechanism kinetic of S_E2-Ar reaction. structural effects on rates and selectivtity. Curve-crossing approach to electrophilic reactivity. b) **Steric and Conformational Properties:** Various types of steric strain and their influence on reactivity. Steric acceleration. Molecular measurement of steric effects upon rates. Steric LFER. Conformational barrier to bond rotation-spectroscopic detection of individual conformers. Acyclic and monocyclic systems. Rotation around partial double bonds. Winstein-Holness and Curtin-Hammett principle.	15

List of Reference Books:

1. Molecular mechanics U Burkert and N.L. Allinger ACD Monograph 177. 1982.
2. Organic Chemists Book of Orbitals. L. Salem and W.L. Jorgensen, Academic Press.
3. Mechanism and Theory in Organic Chemistry, T. H. Lowry and K.C. Richardson. harper and Row.
4. Introduction to Theoretical Organic Chemistry and Molecular Modeling. W.B. smith VCH. Weinheim.
5. Physical Organic Chemistry. N.S. Isaacs. ELBS/Longman.
6. Supramolecular Chemistry Concepts and Perspectives, J.M. lehn. VCH.
7. The physical Basis of Organic Chemistry, H. Maskill, Oxford University Press.

Program	**CCMS03, M.Sc. CHEMISTRY**	Semester	**III**
Course Code	**MCHT304**	Paper	**IV**
Course Title	Chemistry of Heterocyclic Compounds		
Course Type	Theory		
Course Outcomes	CO1: To understand the nomenclature systems, aromaticity criteria, chemical behaviour, reactivity and tautomerism of aromatic heterocyclic compounds. CO2: To know the structural features, strain effects, conformational behaviour and stereoelectronic effects in non-aromatic heterocyclic compounds. CO3: To understand the general principles of heterocyclic synthesis and the preparation & reactions of three- and four-membered heterocycles. CO4: To learn the synthesis, reactions and applications of six-membered, benzo-fused five-membered and seven-membered (or larger) heterocyclic systems.		
Total Marks	**CIA: 30, ESE: 70, Min Passing Marks: 40**		

Unit	Contents	Total Hours
I	(a) Nomenclature of Heterocycles- Replacement and systematic nomenclature (Hantzsch - Widman system) for monocyclic, fused and bridged heterocycles. (b) Aromatic Heterocycles - General chemical behavior of aromatic heterocycles. Classification (structure type) criteria of aromaticity (bond lengths, ring current and chemical shift in ^{1}H-NMR spectra, Empirical resonance energy, delocalization energy and Dewar resonance energy. Heteroaromatic reactivity and tautomerism in aromatic heterocycles.	15
II	Non-Aromatic Heterocycles -Strain-Bond angle and torsional strain and their consequences in small ring heterocycles. Conformation of six membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and I, 3 diaxial interaction, stereo-electronic effect, anomeric effect, Attractive interaction hydrogen bonding and intermolecular nucleophilic-eletrophilic interactions.	15
III	(a) Heterocyclic synthesis - Principle of heterocyclic synthesis involving cyclisation reactions and cyclo addition reactions. (b) Small Ring Heterocycles Three membered and four membered Heterocycles synthesis and reactions of Aziridines, Oxirane, Thirane, Azetidine. Oxetanes and Thietanes.	15

IV	(a) Six membered Heterocycles with one, two or more Hetero atom- Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium and thiopyrylium salts and pyridones. coumarins and chromones, Synthesis and reactions of diazines, Triazines and Thiazines. (b) Benzo-fused five membered Heterocycles Synthesis and reaction including medicinal application of Benzo-pyrrole. Benzo-furans and Benzo-thiophenes. (c) Seven and large membered Heterocycles Synthesis and reaction of azepines, thiepines. diazepines. Thiazepines.	15

List of Reference Books:

1. Heterocyclic Chemistry by J.A. Joule, K. Mills and G.F. Smith. Chapman & Hall

2. Heterocyclic Chemistry by T.L. Gilchrist, Longman Scientific Technical.

3. An Introduction to Heterocyclic Chemistry by R.M. Acheson. John Wiley.

4. Organic Chemistry Vol. II by I.L. Finar ELBS

5. Rodds Chemistry of Carbon Compounds Ed. S. Coffery Elsevier

6. Natural Products chemistry and Biological Significance by J. Mamm, R.S. Davidson,

J.B. Hobbs, J.B. Harborne, Longman, Essex.

7. Heterocyclic Chemistry, Vol. 1 to 3, by R.D. Gupta, Kumar and v. Gupta. Springer Verlog.

8. Chemistry of Heterocycles, by T. Eicher and S. Hanpalmann. Thieme.

9. Contemporary Heterocyclic Chemistry by G.R. Newkome

Program	**M.Sc. CHEMISTRY**	Semester	**I**
Course Code	**MCHP301**	Paper	**Lab 1**
Course Title	Lab 1 General		
Course Type	Laboratory		
Total Marks	ESE: 200, Min Passing Marks: 80		

Note: The laboratory course (general) will be of 12 hours duration spread over two days. The examinee will have to perform three experiments. These experiments will be of 40 marks each 40 marks each will be allotted for viva voce and Sessional work.

PHYSICAL CHEMISTRY

A. Conductometry

a. Verify Debye Huckel and Onsager limiting law for strong electrolyte

b. Determine the degree of hydrolysis and hydrolysis constant of (a) CH_3COONa (b) NH_4Cl (c) Aniline hydrochloride

c. Determine the basicity of an organic acid by conductometric measurements.

d. Determine the equivalent conductance of an electrolyte and determine the dissociation constant.

e. Determine solubility of sparingly soluble salts.

B. Colorimetry

a. Determine the composition of $K_2Cr_2O_7$ and $KmnO_4$, using spectrophotometer

b. Determine the dissociation constant of methyl red by Spectrophotometric method.

c. To verify additivites of absorbances of a mixture of a coloured substance of $K_2Cr_2O_7$ and $KmnO_4$using spectrophotometer.

C. pH metry

Determine pK value of given dibasic and tribasic acid by pH meter.

D. Potentiometry

Titrate ferrous ammonium sulphate against $K_2Cr_2O_7$ and $KMnO_4$, and determine redox potential of ferric system.

E. Distribution coefficient

a. Determine the equilibrium constant of the $KI+I_2 \rightleftharpoons KI_3$ by distribution method.

b. Determine the formula of complex formed between cupric ion and ammonia by distribution method.

F. Partial molar volume:

Determine the partial molar volume of NaCl in aq. solution at room temperature.

INORGANIC CHEMISTRY

A. Instrumental method and Analytical Technique

Spectrophotometric determination

a. Manganese/Chromium/Vanadium in steel sample.

b. Iron-salicylic acid complex by Job's method of continuous variation of concentration

c. Zirconium-Alizarin red-s-complex; Mole ratio method.

d. Copper Ethylenediamine Complex; Slope ratio method.

B. Separation & determination of two metal ions: Cu-Ni, Zn-Ni, Mg-Ni involvingvolumetric & gravimetric method.

C. Polarography

Composition and stability constant of complexes

D. Flame Photometric determination
Sodium and Potassium when present together
b. Lithium/Calcium/Barium/Strontium
c. Cadmium and Magnesium in tap water
E. Quantitative & Qualitative Analysis:

a. Paper chromatography-Cadmiun and Zinc and Magnesium
Determination of R, values
b. Thin layer chromatography-separation of Nickel. Manganese. Cobalt and Zinc.
c. Ion Exchange.
Solvent Extraction
Electrophoretic separation
F. (i) Analysis of Dolomite.
(ii) Estimation of available oxygen in H_2O_2, by Iodometry.
ORGANIC CHEMISTRY
A. Quantitative organic analysis Analytical Techniques.
a. Estimation of Sulphur by Messengers method.
b. Estimation of Nitrogen by Kjeldahl method.
c. Estimation of Halogen by Fusion method.
d. Estimation of carbon and hydrogen by combustion method
B. Functional Group Estimation -
a. Estimation of Aniline
b. Estimation of Amino group by Acetylation method
c. Estimation of Hydroxyl group by Acetylation method
d. Estimation of Carboxyl group by Hydrazone formation method.
e. Estimation of Glucose
f. Estimation of Sucrose
g. Estimation of methoxy group.

C. Chromatography -separation and identification of sugars present in the given mixture of glucose. Fructose, and sucrose by paper chromatography and determination of R_f value

ANALYTICAL CHEMISTRY

1. Preparation of Homo and Hetero-Polyacids of Sb. V. Nb. Ta. Cr. Mo, W etc and study their properties
2. Determination of pK_a of weak acids by pH metric and spectrophotometric methods.
3. Purification of water by using natural materials, i. e, silica, alumina, iron oxide and
4. Determination of distribution ratio and distribution co-efficient of organic and inorganic
Zeolite. dolomite, charcoal etc.
compounds.
5. Determination of percentage Extraction of Species of Interest.
6. Separation of organic compounds by the chromatographic technique i. e. TLC, paper, column
7. Analysis of carbohydrates. Amino acids, protein, alkaloid etc.
Chromatography, column chromatography, column chromatography, Electrophoresis.
8. Analysis of pharmaceutical materials.
9. Analysis of surfactants. Detergents. Soap, oil etc.
10. Analysis of ore minerals, alloy, soil sediment
11. Application of Redox titration for analysis of Sn (IV), Fe (III), Cr (VI), Mn (VII).

12. Analysis of water.
13. Collection, sampling, digestion and extraction of volatile materials.
14. Determination of equilibrium constant and composition of complexes.
15. Determination of dimerization/polymerization constant.

List of Reference Books:

1. Vogel's Textbook of Quantitative Chemical Analysis

Program	**M.Sc. CHEMISTRY**	Semester	**IV**
Course Code	**MCHT401**	Paper	**I**
Course Title	Photochemistry & Solid State Chemistry		
Course Type	Theory		
Course Outcomes	CO1: To understand the fundamental principles of photochemical reactions, excited states, quantum yield, reaction mechanisms, and photochemistry of alkenes. CO2: To know the photochemical behavior of carbonyl and aromatic compounds, including rearrangements, cycloaddition reactions, photooxidation, and environmentally significant photochemical processes. CO3: To understand the principles of solid-state reactions, crystal defects, non-stoichiometry, defect formation, and their influence on the properties of crystalline solids. CO4: To learn the electronic, optical, magnetic, and superconducting properties of solids, including band theory, semiconductors, p-n junctions, and applications of superconducting materials.		
Total Marks	**CIA: 30, ESE: 70, Min Passing Marks: 40**		

Unit	Contents	Total Hours
I	**A-PHOTOCHEMISTRY** a) Photochemistry Reaction: Interaction of electromagnetic radiation with matter, Types of excitation, Fate of excited molecule. Quantum yield. Transfer of excitation energy. Determination of reaction mechanism: Rate constant and life time of reactive energy states, determination of rate constant of reaction. Effect of light intensity on the rate of photochemical reactions. Types of photo-chemical reactions. Photo-dissociation. b) Photochemistry of Alkenes: Intermolecular reactions of olefinic bond, geometrical isomerism. Cyclisation reaction, Rearrangement of 1,4 and 1,5-dienes.	15
II	a) Photochemistry of Carbonyl compounds: Intra-molecular reaction of Carbonyl compounds, saturated cyclic and acyclic, β.γ- unsaturated and a,ß-unsaturated compounds, cyclohexadienone. Inter-molecular cyclo addition reactions. Dimerization and Oxetane formation. b) Photochemistry of Aromatic compounds: Isomerisation, Addition, Substitution. Miscellaneous photochemical reactions: Photo-Fries rearrangement, Barton reaction, singlet molecular oxygen reactions, photochemical formation of smog.	15

III	**SOLID STATE CHEMISTRY** Solid State Reactions: General principles. Experimental procedures methods, kinetics of solid state reactions. Crystal Defects and Non-stoichiometry: Perfect and imperfect crystals, intrinsic and extrinsic defects, point defects, line and plane defects, Vacancies Schottky defects and Frenkel defects. Thermodynamics and defect formation, colour centers, non-stoichiometry and defects.	15
IV	**Electronic properties and Band Theory**: Metals, insulators and semiconductors, Electronic structure of solids band theory band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semi-conductors, doping semiconductors, p-n junctions, optical properties - Photoconduction, photoelectric effects. Magnetic properties Classification of materials. Effect of temperature. Calculation of magnetic moment. Magnetic domains. Superconductivity and organic solids, Occurrence, Principle and uses of conventional, organics and New super conductors.	15

List of Reference Books:

1. Solid State chemistry and its application - A.R.West, Plenum.

2. Principles of the Solid State, H.V.Keer, Wiley Eastern.

3. Solid State Chemistry, N.B.Hannary

4. Solid State Chemistry, D.K. Chakraborty, New Age Internation

5. Fundamentals of photochemistry, K.K. Rohtagi-Mukherji, Wiley Eastern.
6. Essentials of molecular photochemistry, A. Gilbert and J. Baggott, Molecular photochemistry, N.J. Turro, W.A. Benjamin.

7. Introductory photochemistry, A. Cox and T. Camp, McGraw-Hill.

8. Photochemistry, R.P. Kundall and Gilbert, Thomson Nelson.

9. Organic Photochemistry, J. Coxon and B. Halton, Cambridge University Press.

Program	**M.Sc. CHEMISTRY**	Semester	**IV**
Course Code	**MCHT402**	Paper	**II**
Course Title	Bio-physical & Environmental Chemistry		
Course Type	Theory		
Course Outcomes	CO1: To understand the structure and functions of biological macromolecules, bioenergetics, statistical mechanics of biopolymers, and various interactions involved in biological systems. CO2: To know the thermodynamics of biopolymer solutions, membrane transport phenomena, molecular weight determination, and characterization of biopolymers using various experimental techniques. CO3: To understand the composition of the environment, biogeochemical cycles, hydrosphere chemistry, and sources and effects of aquatic pollution. CO4: To learn water quality parameters, analytical methods for pollution monitoring, water treatment processes, industrial pollution, radionuclide analysis, and waste management practices.		
Total Marks	**CIA: 30, ESE: 70, Min Passing Marks: 40**		

Unit	**Contents**	**Total Hours**
I	BIO-PHYSICAL CHEMISTRY a) Biological cell and its constituents: Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coil transition. Bioenergetics: Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP. Statistical mechanics in biopolymers: Chain configuration of macromolecules, statistical distribution end to end dimensions. Calculation of average dimensions for various chain structures, polypeptide and protein structures, introduction to protein folding problem. b) Biopolymer interactions: Forces involved in biopolymer interactions, Electrostatic changes and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of binding processes in biological systems. Hydrogen ion titration curves.	15

II	a) Thermodynamics of biopolymer solutions: Thermodynamics of biopolymer solutions, osmotic pressure, membrane equilibrium, muscular contraction and energy generation in mechanochemical systems. Cell Membrane and Transport of Ion: Structure and function of Cell membrane, ions transport through Cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction. b) Biopolymer and their Molecular Weights: Evaluation of size, shape, molecular weightand extent of hydration of biopolymer by various experimental techniques, Sedimentation equilibrium, hydrodynamic methods, diffusion, sedimentation viscosity, electrophoresis and rotational motions. c) Diffraction Methods: Light scattering, low angle X-ray scattering X-ray diffraction and photo correlation spectroscopy. ORD.	15
III	**ENVIRONMENTAL CHEMISTRY** Environment: Introduction, Composition of atmosphere, vertical temperature, heat budget of the earth atmospheric system, vertical stability atmosphere. Biogeochemical cycles of C, N, P, S, and Bio distribution of elements. Hydrosphere: Chemical composition of water bodies-lakes, streams, rivers and wet lands etc. Hydrological cycle, Aquatic pollution-inorganic, organic. Pesticide, agricultural industrial and sewage, detergents, oil spills and oil pollutants.	15
IV	Water quality parameters Dissolved oxygen, biochemical oxygen demand, solids, metals, sulphate, phosphate, Nitrate, fluoride Micro-organism and their hazardous effects on life. Water quality standard. Analytical methods for measuring BOD, DO, COD, F oils, metals (As, Cd, Cr, Hg, Pb, Se etc.) Residual chloride and chlorine demand. Purification and treatment of water (Students must be well acquainted with the physiological effects and chemical principles involved in their estimation.) Industrial pollution: Chemists overview of pollution and its possible solutions caused by industries such as Cement, sugar, distillery, paper and pulp, thermal power plants. Nuclear power plants. Metallurgy, polymers, drugs etc. Radionuclide analysis, Disposal of wastes and their management.	15

List of Reference Books:

1. Bioorganic Chemistry. A Chemical Approach to Enzyme Action, H.Dugas and C. Penny. Springer-verlag.
2. Macromolecules. Structure and Function, F. Word, Prentice Hall
3. Environmental Chemistry. S.E. Manahan. Lewis Publishers.
4. Environmental Chemistry, Sharma and Kaur, Krishna Publishers.
5. Environmental Chemistry, A.K. De. Wiley Easterm.
6. Environmental Pollution Analysis S.M.Khopkar, Wiley Eastem.
7. Standard Method of Chemical Analysis, F.J.Welcher. Vol III, Van Nostrand Reinhold Co.
8. Environmental Toxicology, Ed. J Rose. Gordon and Breach Science Publication.

9. Elemental Analysis of Airborne Particles, Ed. S. Lansberger and M Cretchman. Gordon and Breach Science Publication.
10. Environmental Chemistry, C.Baird, W.H.Freeman.

Program	**M.Sc. CHEMISTRY**	Semester	**IV**
Course Code	**MCHT403**	Paper	**III**
Course Title	Medicinal Chemistry		
Course Type	Theory		
Course Outcomes	CO1: Understand the principles of drug design, development of new drugs, SAR, QSAR, drug-receptor interactions and factors affecting drug activity. CO2: Learn the basic concepts of pharmacokinetics, pharmacodynamics, drug metabolism and applications of antineoplastic agents in cancer chemotherapy. CO3: Know the classification, mode of action and synthesis of cardiovascular drugs, antibiotics and local anti-infective agents. CO4: Understand the chemistry, mechanism of action and synthesis of psychoactive drugs including CNS depressants, antipsychotic and antidepressant drug		
Total Marks	**CIA: 30, ESE: 70, Min Passing Marks: 40**		

Unit	Contents	Total Hours
I	**Drug Design-** Development of new drugs, procedures followed in drug design, concepts 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. Quantitative structure activity relationship. History and development of QSAR. Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical 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 (Mathematical derivations of equations excluded).	15
II	**(a) Pharmacokinetics:** Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics. Mention uses of pharmacokinetic in drug development process. **(b) Pharamacodynamics** Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug metabolism, xenobiotics, bio-transformation, significance of drug metabolism in medicinal chemistry. **(c) 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,	15

	melphalan, uracil, mustards and 6-mercaptopurine. Recent development in cancer chemotherapy. Hormone and natural products.	
III	**(a)Cardiovascular Drugs:** Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators, synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol, oxyprenolol. Cell wall bio synthesis, inhibitors, -lactam rings, antibiotics inhibiting protein synthesis. Synthesis, of penicillin-G, penicillin-V, ampicillin, amoxicillin, chloramphenicol, cephalosporin, tetracycline and streptomycin. **(b) Local Anti-infective drugs** Introduction and general mode of action-synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, aminosalicylicacid, isoniazid, ethionamide, ethambutal, fluconazole, econazole, griseofulvin, Chloroquin and primaquine.	15
IV	**Psychoactive Drugs-The Chemotherapy of Mind-** Introduction, neurotransmitters, CNS depressants, general anesthetics,mode of action Introduction, neurotransmitters, CNS depressants, general anesthetics, mode of hypnotics, sedatives, anti-anxiety drugs, benzodiazipines, buspirone, neurochemistry of mental diseases. Antipsychotic drugs-the neuroleptics, antidepressants, butyrophenones, serendipity and drug development stereochemical aspects of psychotropic drugs. Synthesis of diazepam, oxazepam, clorazepam, alprazolam, phenytoin, ethosuximide, trimethadione, barbiturates, thiopental sodium. glutethimide.	15

List of Reference Books:

1. *Introduction to Medicinal Chemistry: How Drugs Act and Why* — Alex Gringauz. Wiley-VCH, New York, 1996.
2. *Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry* — John H. Block & John M. Beale, Jr. (Eds.). Lippincott Williams & Wilkins, 2004.

   Note: "Robert F. Dorge" in your original reference appears to be an error. The 11th/12th editions were edited by John H. Block and John M. Beale.
3. *An Introduction to Drug Design* — S. N. Pandeya & J. R. Dimmock. New Age International (P) Ltd., New Delhi, 1997.
4. *Burger's Medicinal Chemistry and Drug Discovery*, Vol. 1, Chapters 9 & 14 — M. E. Wolff (Ed.). John Wiley & Sons, New York.
5. *Goodman & Gilman's The Pharmacological Basis of Therapeutics* — L. L. Brunton, R. Hilal-Dandan & B. C. Knollmann (Eds.). McGraw-Hill Education, New York, 2018.
6. *The Organic Chemistry of Drug Design and Drug Action* — Richard B. Silverman. Academic Press,

1992.

7. *Strategies for Organic Drug Synthesis and Design* — Daniel Lednicer. Wiley-VCH / John Wiley & Sons, Weinheim, 2008.
8. *Drug Design and Medicinal Chemistry* — S. N. Pandeya. Your original reference may refer to another Pandeya title, such as *An Introduction to Drug Design*, which is published by New Age International.
9. *Medicinal Chemistry* — Ashutosh Kar. New Age International (P) Ltd., New Delhi, 2008.
   A later 6th edition was published by New Age International in 2015

Program	**M.Sc. CHEMISTRY**	Semester	**IV**
Course Code	**MCHT404**	Paper	**IV**
Course Title	Chemistry of Natural Product		
Course Type	Theory		
Course Outcomes	CO1: To understand the classification, nomenclature, occurrence, isolation and methods of structure determination of terpenoids and alkaloids, along with their stereochemistry, synthesis and biosynthesis. CO2: To gain knowledge of occurrence, nomenclature, basic skeleton, stereochemistry, isolation, structure determination and synthesis of steroids and hormones. CO3: To understand the occurrence, nomenclature, isolation, structure determination, synthesis and biosynthetic pathways of plant pigments including flavonoids. CO4: To acquire knowledge of structure, synthesis, spectral properties and biosynthesis of porphyrins and carotenoids along with their biological significance and relation with vitamins.		
Total Marks	**CIA: 30, ESE: 70, Min Passing Marks: 40**		

Unit	Contents	Total Hours
I	**(a) Terpenoids-** Classification, nomenclature, occurrence, isolation, general methods of structure determination, Isoprene Rule, Structure determination, stereochemistry, biosynthesis and synthesis of Citral, Geraniol, a-Terpeneol, Menthol, Camphor, a-pinene, Zingiberene, Phytol, abietic acid. **(b) Alkaloids-** Definition, nomenclature and physiological action, occurrence, isolation, general method of structure, elucidation, degradation, classification based on nitrogen heterocyclic ring. Role of alkaloids in plants. Structure elucidation, stereochemistry, synthesis and biosynthesis of Ephedrine, (+) coniine, Nicotine, Atropine, Quinine and morphine.	15
II	**Steroids and Hormones-** Occurrence, Nomenclature, Basic skeleton, Diels-Hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of cholesterol, bile acids, Androsterone, Testosterone, Ergosterol, Sigmasterol, Oestrone, Progesterone, Aldosterone.	15
III	**Plant pigments-** Occurrence, nomenclature, and general methods of structure determination. Isolation and synthesis of Bixin, Quercetin. Daidzein. Cyanin, Pelargoninchloride, Hirsutidin. Biosynthesis of flavonoids, Acetate pathway and shikimic acid pathway.	15

IV	**(a) Porphyrins& Carotenoids-** Structure and synthesis of Haemoglobin and chlorophyll, spectral properties of porphyrins. Biosynthesis of Porphyrin, Phthalocyanines. **(b) Carotene and its relation with Vitamin A. γ carotene.**	15

List of Reference Books:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R. S. Davidson, J.B. Hobbs, D.V. Banthrope and J.B. Harborne, Longman, Essesx.
2. Organic Chemistry, Vol 2, I. L. Finar, ELBS.
3. Stereoselective Synthesis: A Practical Approach, M. Nogradi, VCH.
4. Rodd's Chemistry of Carbon Compounds, Ed.S. Coffey, Elsevier.
5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston, Harwood Academic publishers.
6. Introduction to Flavonoids, B.A. Bohm, Harwood Academic publishers.
7. New Trends in Natural Product Chemistry, atta-urRahman and M.I. Choudhary, Harwood Academic Publishers.
8. Insecticides of Natural Origin, Sukh Dev, Harwood Academic publishers.

Program	**M.Sc. CHEMISTRY**	Semester	**IV**
Course Code	**MCHP401**	Paper	**L-I**
Course Title	Lab Course I: Special		
Course Type	Laboratory		
Total Marks	**ESE: 200, Min Passing Marks: 80**		

Note: Laboratory course will be of 12 hrs duration spread over two days. The examinee will have to perform three experiments. These experiments will be of 40 marks each. 40 marks each will be allotted for viva-voce and Sessional work.

ORGANIC CHEMISTRY

Qualitative Analysis

Separation, Purification and identification of the components of a mixture of binary organic compounds & mixture of three organic compounds.

Multi-step synthesis of Organic compounds (Three stage preparations. Preparation of pure crystalline product. By using any two following principles. Confirmation by melting point determination.)-

The exercises should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Photochemical reaction: Benzophenone-Benzopinacol-Benzpinacolone.
2. Beckmann rearrangement: Benzanilide from benzene, Benzene-benzophenone oxime-Benzanilide.
3. Benzilic acid rearrangement: Benzilic acid from benzoin, (Benzoin- Benzil- Benzilic acid)
4. Synthesis of heterocyclic compounds, Skraup synthesis: Preparation of quinoline from aniline, Skraup synthesis: Preparation of 2 phenyl-indole from phenyl hydrazine.
5. Sandmeyer Reaction: Preparation of o-chlorobenzoic acid from anthranilic acid.
6. Ullman reaction Preparation of N-Phenyl anthranilic acid from o-chlorobenzoic acid.
7. Preparation of Acridone from N-Phenyl anthranilic acid.
8. Preparation of p-nitro aniline
9. Preparation of p-bromo aniline
10. Preparation of methyl orange from aniline via sulphanilic acid.

Extraction of Organic compounds from Natural sources-

1. Isolation of caffeine from tea leaves
2. Isolation of casein from milk
3. Isolation of lactose from milk
4. Isolation of nicotine dipicrate from tobacco
5. Isolation of piperine from black pepper
6. Isolation of lycopene from tomatoes.
7. Isolation of β-carotene from carrots.

Paper Chromatography

Separation and identification of the sugars, dyes and amino acids present in the given mixture of sugars, dyes and amino acids by paper chromatography and determination of R_F values.

Spectroscopy:

Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR & MS).

Spectrophotometric (UV/VIS) Estimations of

1. Amino acids
2. Proteins
3. Carbohydrates
4. Aspirin

PHYSICIAL CHEMISTRY

1. Study of kinetics of exchange between ethyl iodide and the iodide ion.
2. Determination of the solubility product of lead iodide.
3. Determination of the dissociation constant of barium nitrate.
4. Determination of relative strength of the acids by studying the hydrolysis of an ester.
5. Study the hydrolysis of methyl acetate catalyzed by HCl and equimolar Urea hydrochloride and hence the degree of hydrolysis of the salt.
6. Investigate the inversion of can-sugar in presence of an acid. Determine also the energy of activation of the reaction.
7. Study in inversion of can-sugar in presence of HCl and H_2SO_4 and hence determine the relative strength of the acids.
8. Study the kinetics of hydrolysis of ethyl acetate by NaOH at two temperatures by conductance measurement, and hence the energy of activation of the reaction.
9. Study the kinetics of hydrolysis of tertiary amyl iodide, and determine the order and energy of activation of the reaction.
10. Investigate the reaction between H_2O_2 and HI.
11. Study the kinetics of decomposition of benzene diazonium chloride at different temperatures.
12. Study the kinetics of reaction between $K_2S_2O_5$and KI.

(a) Determine and rat constant and order of reaction.
(b) Study of influence of ionic strength on the rate constant.

13. Investigate the kinetics of autocatalytic reaction between $KMnO_4$ and Oxalic acid.
14. Determination of order of reaction between bromic acid and hydrobromic acids.
15. Determination of concentration f iodine in a given sample (KI) by isotope dilution technique.
16. Determination of effect of-

(a) Change of temperature.
(b) Change of concentration.
(c) Ionic strength of the media on the velocity constant of hydrolysis of an ester.

17. Determination of the primary salt effect on the kinetics of ionic reactions and testing of the Bronsted relationship (iodide ion is oxidized by persulphate ion.)
18. Investigate the adsorption of oxalic acid from aqueous solution by activated charcoal and verify Frenndlish and Langmuir's adsorption isotherms.
19. Determine adsorption isotherms of acetic acid from aqueous solution by charcoal.

List of Reference Books:

1. Vogel's Practical Organic Chemistry
2. Advanced Practical Organic Chemistry – N. K. Vishnoi
3. Practical Organic Chemistry – Ahluwalia
4. Advanced Practical Physical Chemistry – J. B. Yadav
5. Findlay's Practical Physical Chemistry

M.Sc. Chemistry – Fourth Semester

Particulars	Details
Course Code	MCHP405
Course Title	Dissertation
Marks	200

Dissertation Topics

S. No.	Proposed Topic
1	Soil Analysis
2	Cosmetics
3	Water Analysis
4	Food Adulteration
5	Medicinal Plants
6	Nanotechnology
7	Spectroscopic Techniques in Characterisation
8	Air Quality
9	Chemiluminescence
10	Material Science
11	Drug Delivery
12	Phytochemistry
13	Biochemistry
14	Surfactants
15	Ligand Chemistry

Dissertation Proforma

S. No.	Section
1	Preface
2	Acknowledgement
3	Certificates
4	Declaration
5	Introduction
6	Review of Literature
7	Materials and Methods
8	Results and Discussion
9	Conclusion