CBCS System

Scheme of Examination

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Syllabus

For

Master of Science (M.Sc.)

Chemistry

Part I & II – Semester I, II, III & IV

SESSION 2022-23

CHRISTIAN EMINENT COLLEGE, INDORE

ACADEMY OF MANAGEMENT, PROFESSIONAL EDUCATION & RESEARCH

An Autonomous Institution Established in 1996

AFFILIATED TO DEVI AHILYA VISHWAVIDYALAYA, INDORE

F-SECTOR, R.S.S. NAGAR, H.I.G. MAIN ROAD, INDORE

Scheme of Examination

M.Sc. (Chemistry) Part I – Semester I

COURSE	CREDITS	TOTAL HOURS	LECTURE HOURS PER WEEK	MIN. GRADE POINT OUT OF 10
CORE COURSE				
MCH-T101 INORGANIC CHEMISTRY I	04	64	04	04
MCH -T102 ORGANIC CHEMISTRY I	04	64	04	04
MCH -T103 PHYSICAL CHEMISTRY I	04	64	04	04
MCH -T104 GROUP THEORY & SPECTROSCOPY I	04	64	04	04
MCH -P105 PRACTICAL COURSE IN CHEMISTRY	03	48	06	04
CORE ELECTIVE COURSE (ANY ONE)				
MCH-T106 A MATHS FOR CHEMISTS	02	32	02	04
MCH-T106 B BIOLOGY FOR CHEMISTS				
SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC / GC)				
MCH – 107 SKEG (ANY ONE)	SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC/GC)			
SKEG-T103 COMMUNICATIVE ENGLISH	03	48	06	04
SKEG-T108 HEALTH EDUCATION				
SKEG-T/P114 INTRODUCTION TO ICT I				
SKEG-T116 MANAGERIAL SKILLS				
TOTAL	24	384	27	

Course	Max. Marks				Min. Marks		
	External Theory Examination	Internal Theory Examination	Practical Examination	TOTAL MARKS	External Theory Exam.	Internal Theory Exam.	Practical Marks
MCH-T101 INORGANIC CHEMISTRY I	70	30	-	100	28	12	-
MCH -T102 ORGANIC CHEMISTRY I	70	30	-	100	28	12	-
MCH -T103 PHYSICAL CHEMISTRY I	70	30	-	100	28	12	-
MCH -T104 GROUP THEORY & SPECTROSCOPY I	70	30	-	100	28	12	-
MCH -P105 PRACTICAL COURSE IN CHEMISTRY	-	-	100	100	-	-	40
MCH -T106 CORE ELECTIVE COURSE	70	30	-	100	28	12	-
MCH – T 107 SKEG (ANY ONE) SKILL ENHANCEMENT COURSE	70	30	-	100	28	12	-
TOTAL MARKS	420	180	100	700	-	-	-
SKEG-T/P107 ELECTIVE COURSE	50	30	20	100	20	12	08
TOTAL MARKS	400	180	120	700	-	-	
GRAND TOTAL	700				315		

Scheme of Examination

M.Sc. (Chemistry) Part I – Semester II

COURSE	CREDITS	TOTAL HOURS	LECTURE HOURS PER WEEK	MIN. GRADE POINT OUT OF 10
CORE COURSE				
MCH-T201 INORGANIC CHEMISTRY II	04	64	04	04
MCH-T202 ORGANIC CHEMISTRY II	04	64	04	04
MCH-T203 PHYSICAL CHEMISTRY II	04	64	04	04
MCH-T204 SPECTROSCOPY II AND DIFFRACTION METHODS	04	64	04	04
MCH -P205 PRACTICAL COURSE IN CHEMISTRY	03	48	06	04
MCH-T206 COMPUTER FOR CHEMISTS	02	32	02	04
SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC / GC)				
MCH – 207 SKEG (ANY ONE)	SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC/GC)			
SKEG-T108 HEALTH EDUCATION	03	48	03	04
SKEG-T/P115 INTRODUCTION TO ICT II				
SKEG-T116 MANAGERIAL SKILLS				
SKEG-T119 PERSONALITY DEVELOPMENT				
TOTAL	24	384	27	

Course	Max. Marks				Min. Marks		
	External Theory Examination	Internal Theory Examination	Practical Examination	TOTAL MARKS	External Theory Exam.	Internal Theory Exam.	Practical Marks
MCH-T201 INORGANIC CHEMISTRY II	70	30	-	100	28	12	-
MCH-T202 ORGANIC CHEMISTRY II	70	30	-	100	28	12	-
MCH-T203 PHYSICAL CHEMISTRY II	70	30	-	100	28	12	-
MCH-T204 SPECTROSCOPY II AND DIFFRACTION METHODS	70	30	-	100	28	12	-
MCH -T205 PRACTICAL COURSE IN CHEMISTRY	-	-	100	100	-	-	40
MCH-T206 COMPUTER FOR CHEMISTS	70	30	-	100	28	12	-
MCH – T 207 SKEG (ANY ONE) SKILL ENHANCEMENT COURSE	70	30	-	100	28	12	-
TOTAL MARKS	420	180	100	700	-	-	-
SKEG-T/P207 ELECTIVE COURSE	50	30	20	100	20	12	08
TOTAL MARKS	400	180	120	700	-	-	
GRAND TOTAL	700				315		

Scheme of Examination

M.Sc. (Chemistry) Part II – Semester III

COURSE	CREDITS	TOTAL HOURS	LECTURE HOURS PER WEEK	MIN. GRADE POINT OUT OF 10
CORE COURSE				
MCH-T301 APPLICATION OF SPECTROSCOPY - I	04	64	04	04
MCH –T302 PHOTO CHEMISTRY	04	64	04	04
MCH –T303 ENVIRONMENTAL CHEMISTRY	04	64	04	04
MCH –P304 PRACTICAL COURSE IN CHEMISTRY	03	48	06	04
CORE ELECTIVE COURSE				
MCH-T305 Optional 1 (ANY ONE)	03	48	06	04
MCH-T306 Optional 2 (ANY ONE)	03	48	06	04
SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC / GC)				
MCH – 207 SKEG (ANY ONE)	SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC/GC)			
SKEG-T108 HEALTH EDUCATION	03	48	03	04
SKEG-T109 INTRODUCTION TO PHARMACEUTICAL BIOTECHNOLOGY				
SKEG-T116 MANAGERIAL SKILLS				
SKEG-T/P114 INTRODUCTION TO ICT I	02+01	32+16	02+02	04
TOTAL	24	384	33/34	

Course	Max. Marks				Min. Marks		
	External Theory Examination	Internal Theory Examination	Practical Examination	TOTAL MARKS	External Theory Exam.	Internal Theory Exam.	Practical Marks
MCH-T301 APPLICATION OF SPECTROSCOPY - I	70	30	-	100	28	12	-
MCH –T302 PHOTO CHEMISTRY	70	30	-	100	28	12	-
MCH –T303 ENVIRONMENTAL CHEMISTRY	70	30	-	100	28	12	-
MCH –P304 PRACTICAL COURSE IN CHEMISTRY	-	-	100	100	-	-	40
MCH –T305 CORE ELECTIVE COURSE	70	30	-	100	28	12	-
MCH –T306 CORE ELECTIVE COURSE	70	30	-	100	28	12	-
MCH – T 207 SKEG (ANY ONE) SKILL ENHANCEMENT COURSE	70	30	-	100	28	12	-
TOTAL MARKS	420	180	100	700	-	-	-
SKEG-T/P307 ELECTIVE COURSE	50	30	20	100	20	12	08
TOTAL MARKS	400	180	120	700	-	-	-
GRAND TOTAL	700				315		

Scheme of Examination

Scheme of Examination

M.Sc. (Chemistry) Part II – Semester IV

COURSE	CREDITS	TOTAL HOURS	LECTURE HOURS PER WEEK	MIN. GRADE POINT OUT OF 10
CORE COURSE				
MCH-T401 APPLICATION OF SPECTROSCOPY II	03	48	03	04
MCH-T402 SOLID STATE CHEMISTRY	03	48	03	04
MCH-T403 BIOCHEMISTRY	04	64	04	04
MCH –P404 PRACTICAL COURSE IN CHEMISTRY	03	48	06	04
CORE ELECTIVE COURSE				
MCH-T405 OPTIONAL 1 (ANY ONE)	03	48	06	04
MCH-T406 OPTIONAL 2 (ANY ONE)	03	48	06	04
SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC / GC)				
MCH – 207 SKEG (ANY ONE)	SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC/GC)			
SKEG-T108 HEALTH EDUCATION	03	48	03	04
SKEG-T109 INTRODUCTION TO ORGANIC FARMING				
SKEG-T116 MANAGERIAL SKILLS				
SKEG-T/P115 INTRODUCTION TO ICT II	02+01	32+16	02+02	04
INTERNSHIP / PROJECT WORK				
MCH-P408 INTERNSHIP / PROJECT WORK	02	32	-	04
TOTAL	24	384	33/34	

Scheme of Examination

M.Sc. (Chemistry) Part II – Semester IV

Course	Max. Marks				Min. Marks		
	External Theory Examination	Internal Theory Examination	Practical Examination	TOTAL MARKS	External Theory Exam.	Internal Theory Exam.	Practical Marks
MCH-T401 APPLICATION OF SPECTROSCOPY II	70	30	-	100	28	12	-
MCH-T402 SOLID STATE CHEMISTRY	70	30	-	100	28	12	-
MCH-T403 BIOCHEMISTRY	70	30	-	100	28	12	-
MCH –P404 PRACTICAL COURSE IN CHEMISTRY	-	-	100	100	-	-	40
MCH –T405 CORE ELECTIVE COURSE	70	30	-	100	28	12	-
MCH –T406 CORE ELECTIVE COURSE	70	30	-	100	28	12	-
MCH – T 407 SKEG (ANY ONE) SKILL ENHANCEMENT COURSE	70	30	-	100	28	12	-
MCH –P408 INTERNSHIP / PROJECT WORK	-	-	100	100	-	-	40
TOTAL MARKS	420	180	200	800	-	-	-
SKEG-T/P407 ELECTIVE COURSE	50	30	20	100	20	12	08
TOTAL MARKS	400	180	220	800	-	-	-
GRAND TOTAL	800				360		

Scheme of Examination

Under CBCS System

Part I & II – Semester I, II, III & IV

- Under CBCS System every PG Course and B.Ed. has been distributed in two parts namely – Core and Elective. The subjects related to course are Core and are compulsory. In each semester the students have to opt one Elective Course from prescribed electives.
- The minimum credits for each course are 20 and maximum may be 24. The credits are finalized with the requirements of respective course.
- The total minimum credits for completing the Post Graduate course and B.Ed are 80.
- For each course there will be 70% marks for External Examinations and 30% for Internal Examinations (CCE). The students have to clear both External and Internal Examinations separately.
- The pass marks in individual paper will be **40%** and in aggregate **45%**.
- The subject wise marks obtained by the student will be converted into prescribed 10 Point Grade Scale. The prescribed Grade Scale and related information are available in Examination Rules and for details follow or refer prescribed CBCS Guidelines.
- The students who are **awarded ATKT in two subjects** will be eligible to appear in the examination of next semester. However the student **will not be allowed** to appear in the next semester examination with more than **four ATKT at a time**.
- In case of more than two ATKT in a particular semester will be considered as fail in that semester and the student has to reappear in that particular semester examination.
- ATKT students have to follow the old syllabus but repeaters have to take the examination with the new syllabus.
- A student will have to compulsorily clear a program within **Three Academic Years** including the academic year of the admission, failing which he /she will not be allowed to continue the course. If a student doesn't clear all the semesters of the course in the above three years completely, then all his/ her previous result will be treated as null and void.
- Only those students who clear the program in one attempt and without gap will be eligible for position in the **Merit List**.
- A student who fails in aggregate is permitted to appear in **any one or two** papers of his/her choice to make up for the shortfall in the aggregate. Such a student can also appear in all the papers of that semester as an ex-student, provided the student applies for the same in the beginning of the semester.
- The students who are declared fail in aggregate will be eligible to appear in external theory examination of the corresponding papers only.
- Any point regarding the examination in the above scheme, which is not covered, will be applicable as per the examination scheme of respective course declared by the University or M.P. Government, whichever may be applicable, and the final decision in this regard will be taken by the Principal on the recommendation of Examination Committee.

Syllabus

M.Sc. (Chemistry) Part I – Semester I

MCH - T101 – CORE COURSE I – INORGANIC CHEMISTRY I

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **Total Lectures: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**12 Lectures**
Stereochemistry and Bonding in Main Group Compounds: Structure and bonding in homo and hetero molecular molecules, VSEPR Theory- Stereochemical rules and explanation of the molecules & ions of non transition elements. Walsh diagram (triatomic and penta-atomic molecules), dπ-pπ bond, Bent rule and energetics of hybridization.	
Unit-II	**12 Lectures**
Metal-Ligand Equilibrium in Solution : Stepwise and overall formation constants and their interaction, trends in stepwise constant, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand. Chelate effect and its thermodynamic origin.	
Unit-III	**16 Lectures**
Reaction Mechanism of Transition Metal Complexes: Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anion reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.	
Unit-IV	**12 Lectures**
Metal-Ligand bonding: Limitation of crystal field theory, molecular orbital theory for bonding in octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory. Principles of Coordination Chemistry related to Bioinorganic Proteins and Nucleic Acids.	
Unit-V	**12 Lectures**
HSAB Theory: Classification of acids and bases as hard and soft, HSAB principle, theoretical basis of hardness and softness, Lewis acid-base reactivity approximation, donor and acceptor numbers, E and C equation, applications of HSAB concept. Non aqueous solvents example ammonia and sulphuric acid.	

BOOKS:

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row
3. Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier
5. Magnetiochemistry, R.1. Carlin, Springer Verlag
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon

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Syllabus
M.Sc. (Chemistry) Part I – Semester I

MCH - T102 – CORE COURSE II – ORGANIC CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **Total Lectures: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**12 Lectures**
Nature of Bonding in Organic Molecules: Delocalized chemical bonding-conjugation, cross conjugation, resonance hyper conjugation, bonding in fullerenes, tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternate and non-alternate hydrocarbons. Huckel's rule, Energy. Level of π-molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach. Bonds weaker than covalent-addition compounds, crown ether complexes and cryptates.	
Unit-II	**12 Lectures**
Stereochemistry: Strain due to unavoidable crowding Elements of symmetry, concept of chirality, molecular dissymmetry, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity,,Prochiral relationship,homotopic,enantiotopic and diastereotopic atoms, groups and faces, stereo specific and stereo selective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spirane chirallity due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.	
Unit-III	**12 Lectures**
Conformational analysis and linear free energy relationship: Conformational analysis of cycloalkanes, multi substituted cycloalkanes and fused ring systems, decalines, effect of conformation on reactivity & physical properties of molecules, conformation of sugars. The Hammett equation and linear free energy relationship, substituents and reaction constants, Taft equation.	
Unit-IV	**14 Lectures**
Reaction Mechanism: Reactive Intermediates, their Structure And Reactivity**,** Generation, structure, stability and reactivity of carbonations, carbanions, free radicals, carbenes and nitrenes. Type of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates**,** methods of determining mechanisms, isotopes effects.	
Unit-V	**14 Lectures**
Aliphatic Nucleophilic Substitution: The SN2, SN1 mixed SN1 and SN2 and SET mechanism. The neighboring group mechanism, neighboring group participation by π and σ bonds, anchimeric assistance. Classical and nonclassical carbonations, phenonium ions, norbornyl systems, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations. The SN1 mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambient nucleophile, regioselectivity.	

BOOKS:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley
2. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman
3. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press
4. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall
5. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional
6. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan
7. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
8. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International

Syllabus
M.Sc. (Chemistry) Part I – Semester I

MCH - T103 – CORE COURSE III – PHYSICAL CHEMISTRY I

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week: 04 Hours **Total Lectures: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**12 Lectures**
Introduction to Exact Quantum Mechanical Results: Schrödinger equation and the postulates of quantum mechanics. The Born interpretation of the wave function. Discussion of solutions of the Schrödinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom and helium atom including shapes of atomic orbitals, tunneling and Numerical Problems Related to the topics.	
Unit-II	**12 Lectures**
Approximate Methods: The variation theorem, linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom. Molecular Orbital Theory: Huckel theory of conjugated systems bond and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical, cyclobutadiene etc. Introduction to extended Huckel theory and Numerical Problems Related to the topics..	
Unit-III	**12 Lectures**
Angular Momentum: ordinary angular momentum, generalized angular momentum, eigen functions for angular momentum, eigen values of angular momentum, operator using ladder operators, quantization, addition of angular momenta, spin , antisymmetry and Pauli's exclusion principle and Numerical Problems Related to the topics..	
Unit-IV	**14 Lectures**
Classical Thermodynamics: Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity. Activity, activity coefficient, Debye Huckel theory for activity coefficient of electrolytic solutions, determination of activity and activity coefficients, ionic strength and Numerical Problems Related to the topics.	
Unit-V	**14 Lectures**
Statistical Thermodynamics Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro-canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in terms of partition. Application of partition functions and their relation to thermodynamic quantities ,calculation for model systems. Theories of Statistics: Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac Statistics, distribution law and applications to metal.Kinetic theories of gases. Bose-Einstein statistics distribution Law and application to helium and Numerical Problems Related to the topics..	

BOOKS:

1. Physical Chemistry, P.W. Atkins, ELBS
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill
3. Quantum Chemistry, Ira N. Levine, Prentice Hall
4. Introduction to Quantum Chemistry-R.K. Prasad, New Age Publication
5. Chemical Kinetics. K.J. Laidler, McGraw-Hill
6. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, McMillan
7. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum
8. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum

Syllabus
M.Sc. (Chemistry) Part I – Semester I

MCH - T104 – CORE COURSE IV – GROUP THEORY & SPECTROSCOPY - I

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **Total Lectures: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**13 Lectures**
Symmetry elements and symmetry operation, laws of symmetry, definition of group, subgroup. Conjugacy relation and classes. Point symmetry group and their examples Schonfilies symbols, representations of groups by matrices (representation for the Cn, Cnv, Cnh, Dnh group to be worked out explicity). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use in spectroscopy. Derivation of character table for C_{2v}, C_{3v} and D_2h point group Symmetry aspects of molecular vibrations of H_2O molecule and NH_3 molecule.	
Unit-II	**12 Lectures**
Microwave Spectroscopy- principles and types of spectroscopic techniques, Classification of molecules, rigid rotor model, calculation of bond length, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field, applications.	
Unit-III	**14 Lectures**
Infrared-Spectroscopy: Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths, anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy. P.Q.R. branches, Breakdown of Oppenheimer approximation, vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies and Finger print region, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis.	
Unit-IV	**12 Lectures**
Raman Spectroscopy: Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Raman Instrumentation, Resonance Raman spectroscopy, coherent anti stokes Raman spectroscopy (CARS).	
Unit-V	**13 Lectures**
Electronic Spectroscopy - Molecular Spectroscopy Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, Types of Electronic transitions, electronic spectra of polyatomic molecules. Emission spectra, radio-active and non-radioactive decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra. **Photoelectron Spectroscopy** Basic principles, photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. Auger electron spectroscopy-basic idea.	

BOOKS:

1. Modern Spectroscopy, J.M. Hollas, John Viley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Chemical Applications of Group Theory, F.A. Cotton.
6. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
8. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.

Syllabus
M.Sc. (Chemistry) Part I – Semester I

MCH - P105 – CORE COURSE V – PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week : 06 Hours **Total Lectures: 96**

- **Practical Examination will be of 16/18 Hrs. duration.**
- **Practical examination shall be conducted separately for each branch.**
- **Practical Examination will include 10-12 Practicals per Semester from the following list :**

Inorganic Chemistry	**Marks – 33**
▪ Quantitative and quantitative Analysis	**12**
▪ Chromatography	**06**
▪ Preparation	**06**
▪ Record	**04**
▪ Viva Voce	**05**

Qualitative Analysis:

a) Analysis of less common metal ions: Ti, Mo, W, Ti, Zr, Th, V (two metal ions in cationic/anionic forms).

b) Analysis of Insoluble- Oxides, sulphates and halides.

Quantitative Analysis: Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Fe etc. involving volumetric and gravimetric methods.

Chromatography Separation, identification & determination of cations and anions by Paper Chromatography.

Preparations: Preparation of selected inorganic complexes and their analysis, test & characterization by spectral techniques (may be)

1. $VO(acac)_2$
2. $Ni(acac)_2$
3. $[Co(NH_3)_6]Cl_3$ **/$[Ni(NH_3)_6]Cl_2$**
4. $Na[Cr(NH_3)_2(SCN)_4]$
5. Prussian Blue, Turnbull's Blue.
6. Oxalate complexes of Chromium (III) & Copper (II)
7. cis-$K[Cr(C_2O_4)_2(H_2O)_2]$
8. $TiO(C_9H_8NO)2H_2O$
9. $K_3[Fe(C_2O_4)_3]$

Organic Chemistry	**Marks – 33**
▪ Qualitative Analysis	**12**
▪ Organic Synthesis	**12**
▪ Record	**04**
▪ Viva Voce	**05**

Qualitative Analysis:

Separation, purification and identification of compounds of ternary mixture using TLC and columns chromatography, chemical tests. IR spectra to be used for functional group identification.

Organic Synthesis: Acetylation:

Acetylation of cholesterol and separation of cholesteryl acetate by column chromatography. **Oxidation:** Adipic acid by chromic acid oxidation of cyclohexanol Grignard reaction: Synthesis of triphenylmethanol from benzoic acid **Nitration and polymerization.** The Products may be Characterized by Spectral Techniques.

Syllabus
M.Sc. (Chemistry) Part I – Semester I

MCH - P105 – CORE COURSE V – PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week : 06 Hours **Total Lectures: 96**

Physical Chemistry	**Marks – 34**
▪ Error Analysis and Statistical Data Analysis	**08**
▪ Chemical Kinetics	**09**
▪ Solution	**08**
▪ Record	**04**
▪ Viva Voce	**05**

Error Analysis and Statistical Data Analysis

Errors, types of errors, minimization of errors distribution curves precision, accuracy and combination, statistical treatment for error analysis, student's t- test, null hypothesis, rejection criteria. F & Q test, linear regression analysis, curve fitting. Calibration of volumetric apparatus, burette, pipette and standard flask. Adsorption To study surface tension-concentration relationship for solutions (Gibbs equation). Phase Equilibria

i. Determination of congruent composition and temperature of a binary system (e.g. diphenylamine-benzophenone system).
ii. Determination of glass transition temperature of given salt (e.g., $CaCl_2$) conductometrically.
iii. To construct the phase diagram for three component system (e.g. chloroform-acetic acid-water).

Chemical Kinetics

i. Determination of the effect of (a) Change of temperature (b) Charge of concentration of reactant and catalyst and (c) Ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reaction.
ii. Determination of the velocity constant of hydrolysis of an ester/ionic reaction in micellar media.
iii. Determination of the velocity constant for the oxidation of iodide ions by hydrogen peroxide study the kinetics as an iodine clock reaction.
iv. Flowing clock reactions (Ref : Experiments in Physical Chemistry by Showmaker).
v. Determination of the primary salt effect on the kinetics of ionic reaction and testing of the Bronsted relationship (iodide ion is oxidised by persulphate ion).
vi. Oscillatory reaction.

vii. Determination of the rate constant of hydrolysis of methyl acetate catalysed by an acid and also the energy of activation.

Solution

i. Determination of molecular weight of non-volatile and electrolyte/electrolyte by cryoscopy method and to determine the activity coefficient of an electrolyte.
ii. Determination of the degree of dissociation of weak electrolyte and to study the deviation from ideal behavior that occurs with a strong electrolyte.

Syllabus
M.Sc. (Chemistry) Part I – Semester I

MCH - T106A – CORE ELECTIVE COURSE VI – MATHEMATICS FOR CHEMISTS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week: 02 per Hour **Total Lectures: 32**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**06 Lectures**
Vectors Vectors, dot, cross and triple products (Vector and Scalar) **Matrix Algebra** Addition and multiplication, inverse, adjoint and transpose of matrices.	
Unit-II	**07 Lectures**
Differential Calculus: Functions, Rules for differentiation, applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution etc.).	
Unit-III	**06 Lectures**
Integral calculus: Basic rules for integration, integration by parts, partial fractions and substitution. Functions of several variables, partial differentiation.	
Unit-IV	**06 Lectures**
Elementary Differential equations: First-order and first degree differential equations, homogenous, exact and linear equations. Applications to chemical kinetics, secular equilibria, quantum chemistry,**Application of Differential equations to determine order of reaction** etc. second order differential equation and their solutions.	
Unit-V	**07 Lectures**
Permutation and Probability Permutations and combinations: Definition of Probability, **Chi-Square test**. Addition and Multiplication Theorems, Examples from the Kinetic Theory of Gases, Curve Fitting by Least Squares Method.	

BOOKS:

1. The Chemistry Mathematics Book, E. Steiner, Oxford University Press
2. Mathematics for Chemistry, Doggett and Suiclific, Logman
3. Mathematical for Physical Chemistry: F. Daniels, McGraw Hill
4. Chemical Mathematics D.M. Hirst, Longman
5. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall
6. Basic Mathematics for Chemists, Tebbutt, Wiley

Syllabus
M.Sc. (Chemistry) Part I – Semester I

MCH - T106B – CORE ELECTIVE COURSE VI – BIOLOGY FOR CHEMISTS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week: 02 per Hour **Total Lectures: 32**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**08 Lectures**
Cell Structure and Functions	
Structure prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animal cells. Overview of metabolic processes-catabolism and anabolism. ATP – the biological energy currency. Origin of life.	
Unit-II	**06 Lectures**
Carbohydrates	
Conformation of monosaccharides, structure and functions of important derivatives of mono-saccharides like glycosides, deoxy sugars, myoinositol, amino sugars, Disaccharides and polysaccharides. Structural polysaccharides cellulose and chitin. Storage polysaccharides-starch and glycogen. Carbohydrates of glycoproteins and glycolipids. Role of sugars in biological recognition. Blood group substances.	
Unit-III	**06 Lectures**
Lipid	
Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Lipoproteins- composition and function. Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure. Lipid metabolism, β-oxidation of fatty acids.	
Unit-IV	**06 Lectures**
Amino-acids, Peptides and Proteins	
Amino Acids: Structure & Functions. Structure of Proteins. Force responsible for holding of secondary structures. α-helix, β-sheets, super secondary structure, triple helix structure of collagen. Quaternary structure. **Study of model proteins** :**Insulin, Haemoglobin**	
Unit-V	**06 Lectures**
Nucleic Acids	
Purine and pyrimidine bases of nucleic acids, base pairing via H-bonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code.	

BOOKS:

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers
2. Biochemistry, L. Stryer, W.H. Freeman
3. Biochemistry, J. David Rawan, Neil Patterson
4. Biochemistry, Voet and Voet, John Wiley
5. Outlines of Biochemistry E.E. Conn and P.K. Stumpf, John Wiley

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Syllabus

M.Sc. (Chemistry) Part I – Semester I

MCH – 107 (SKEG) – SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC / GC) –

SKEG-T/P114 – INTRODUCTION TO ICT I

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

PART A : THEORY - MAX. MARKS: 50 + 30 **MIN. PASS MARKS: 20 + 12**

No. of Lectures per week : 02 Hours **Total Lectures: 32**

PART B : PRACTICALS - MAX. MARKS: 20 **MIN. PASS MARKS: 08**

No. of Laboratory per week: 02 Hours **Total Lectures: 32**

SKEG- T-103 – COMMUNICATIVE ENGLISH

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week: 03 Hours **Total Lectures: 48**

SKEG-T116– MANAGERIAL SKILLS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week : 03 Hours **Total Lectures: 48**

SKEG-T108 – HEALTH EDUCATION

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week : 03 Hours **Total Lectures: 48**

Syllabus

M.Sc. (Chemistry). Part I – Semester II

MCH – T201 – CORE COURSE I – INORGANIC CHEMISTRY II

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **TOTAL LECTURES: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**12 Lectures**
Electronic Spectral Studies of Transition Metal Complexes : Spin Multiplicity, Spectroscopic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), Selection rule for electronic spectroscopy. Intensity of various type electronic transitions. Calculations of 10Dq, B and β parameters, charge transfer spectra.	
Unit-II	**12 Lectures**
Magnetic Properties of Transition Metal Complexes: Anomalous magnetic moments, Quenching of Orbital contribution. Orbital contribution to magnetic moment, magnetic exchange coupling and spin crossover. Calculation of magnetic moments.	
Unit-III	**14 Lectures**
Metal π-Complexes: Metal carbonyl, classification, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls, preparation, bonding structure and important reaction of transition metal nitrosyl, tertiary phosphine as ligand.	
Unit-IV	**12 Lectures**
Metal Clusters: Higher boranes, carboranes, metalloboranes and metallocarboranes compounds with metal-metal multiple bonds , Description of $[W_2Cl_9]^{3-}$with metal-metal multiple bonds.	
Unit-V	**14 Lectures**
Optical Rotatory Dispersion and Circular Dichroism: Linearly and circularly polarized lights; optical rotatory power and circular birefringence, elipticity and circular dichroism; ORD and Cotton effect, Faraday and Kerr effects; Assignment of electronic transitions; applications of ORD and CD for the determination of (i) absolute configuration of complexes and (ii) isomerism due to non-planarity of chelate rings. Octant Rule.	

BOOKS:

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetiochemistry, R.1. Carlin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty,Pergamon.

CHRISTIAN EMINENT COLLEGE, INDORE

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2023-23

Syllabus

M.Sc. (Chemistry). Part I – Semester II

MCH – T202 – CORE COURSE II – ORGANIC CHEMISTRY II

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **TOTAL LECTURES: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I **13 Lectures**

Aromatic Electrophilic Substitution: The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reactiion, Gatterman-Koch reaction.

Aromatic NucleophilIc Substitution: The SNAr SN1, benzyne and S_RN1 mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile.

Unit-II **13 Lectures**

Free Radical Reactions: Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement.

Unit-III **12 Lectures**

Addition Reactions: The mechanism of Electrophilic addition – AdE^2 mechanism. Structural effects and reactivity. Stereochemical aspects of addition reactions involving electrophiles, nucleophile and free radicals, regio-and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bounds, hydrogenation of aromatic rings. Hydroboration, Michael reaction, sharpless asymmetric epoxidation.

Unit-IV **13 Lectures**

Addition to Carbon-Hetero Multiple bonds: Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acid esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and usaturated carbonyl compounds. Witting reaction. Mechanism of condensation reactions involving enolates- Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.

Elimination Reactions: The E2, E1 and E1 CB mechanisms and their spectrum. Orientation of the double bond. Reactivity-effects of substrate structures, attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination.

Unit-V **13 Lectures**

Pericyclic Reactions: Molecular orbital symmetry, Frontier orbitals of ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene and allyl system. Classification of periycyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach.

Electrocyclic reactions- conrotatory and disrotatory motions, 4n 4n+2 and allyl systems.

Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 additions of ketenes, 1, 3 dipolar cycloadditions and cheleotropic reactions.

Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic involving carbon moieties, 3, 3- and 5, 5 sigmatropic rearrangements. Claisen, Cope and azo-Cope rearrangements.

BOOKS:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall
6. Modern Organic Reactions, H.O. House, Benjamin
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional
8. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan
9. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
10. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International

Syllabus

M.Sc. (Chemistry). Part I – Semester II

MCH – T203 – CORE COURSE III – PHYSICAL CHEMISTRY II

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **TOTAL LECTURES: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**13 Lectures**
Chemical Dynamics: Methods of determining order of reaction., collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen bromine and hydrogen-chlorine reactions), homogenous catalysis and Numerical Problems Related to the topics. **Kinetics of enzyme reactions**: General features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method.	
Unit-II	**13 Lectures**
Surface Chemistry: Adsorption - Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon).**Micelles -** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solublization, micro emulsion, reverse micelles.	
Unit-III	**12 Lectures**
Macromolecules: Polymer-definition, **difference between Elastomer and plastomer**, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures.	
Unit-IV	**12 Lectures**
Non Equilibrium Thermodynamics: Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction and Numerical Problems Related to the topics.	
Unit-V	**14 Lectures**
Electrochemistry: Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces. Over potentials, exchange current density, derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface. Polarography theory, Ilkovic equation; half wave potential and its application of polarography in the determination of conductance and Numerical Problems Related to the topics.	

BOOKS:

1. Physical Chemistry, P.W. Atkins, ELBS
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill
3. Quantum Chemistry, Ira N. Levine, Prentice Hall
4. Coulson's Valence, R.Mc Ween y, ELBS
5. Chemical Kinetics. K.J. Laidler, McGraw Hill
6. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan
7. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum
8. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum
9. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern

Syllabus

M.Sc. (Chemistry). Part I – Semester II

MCH – T204 – CORE COURSE IV – SPECTROSCOPY II AND DIFFRACTION METHODS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **TOTAL LECTURES: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**13 Lectures**
Nuclear Magnetic Resonance Spectroscopy Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors, influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant "j" Classification (AXB, AMX, ABC, A2B2 etc.). Spin decoupling; basic ideas about instrument, NMR studies of nuclei other than proton -^{13}C, ^{19}F and ^{31}P. FT NMR, advantages of FT NMR.	
Unit-II	**11 Lectures**
Nuclear Quadrupole Resonance Spectroscopy Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting, Zeeman Effect in NQR Spectra. Applications. NQR Splitting of ^{14}N.Difference between NMR and NQR Spectroscopy.	
Unit-III	**13 Lectures**
Electron Spin Resonance Spectroscopy Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants spin Hamiltonian, spin densities, spin labeling and Mc Connell relationship**,** applications.	
Unit-IV	**14 Lectures**
X-ray Diffraction Bragg condition, Miller indices, Laue Method, Bragg method, Debye Scherer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules.	
Unit-V	**13 Lectures**
Electron Diffraction Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces. **Neutron Diffraction** Scattering of neutrons by solids measurement techniques, Elucidation of structure of magnetically ordered unit cells.	

BOOKS:

1. Modern Spectroscopy, J.M. Hollas, John Viley
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood
4. Physical Methods in Chemistry, R.S. Drago, Saunders College
5. Chemical Applications of Group Theory, F.A. Cotton
6. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill
7. Basic Principles of Spectroscopy, R. Chang, McGraw Hill
8. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH Oxford
9. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley
10. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, harper & Row

Syllabus

M.Sc. (Chemistry). Part I – Semester II

MCH – P205 – CORE COURSE V – PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week: 06 Hours **Total Lectures: 96**

- **Practical Examination will be of 16/18 Hrs. duration.**
- **Practical examination shall be conducted separately for each branch.**
- **Practical Examination will include 10-12 Practicals per Semester from the following list :**

Inorganic Chemistry	**Marks – 33**
▪ Chromatography	**12**
▪ Preparation	**12**
▪ Record	**04**
▪ Viva Voce	**05**

Chromatography Separation of cations and anions by Column Chromatography: Ion exchange.

Preparations: Preparation of selected inorganic complexes and their studies by I.R. electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and Moisture sensitive compounds

1. $[Co(NH_3)_6]$ $[Co(NO_2)_6]$
2. cis-$[Co(trien)\ (NO2)_2]Cl.H_2O$
3. $Hg[Co(SCN)_4]$
4. $[Co(Py)_2Cl_2]$
5. $[Ni(NH3)_6]Cl_2$
6. $Ni(dmg)_2$
7. $[Cu(NH_3)_4]SO_4H_2O$

Organic Chemistry	**Marks – 33**
▪ Organic Synthesis	**12**
▪ Qualitative Analysis	**12**
▪ Record	**04**
▪ Viva Voce	**05**

Organic Synthesis:

A. Synthesis involving name reactions:

i. Sandmeyer's reaction
ii. Cannizaro's reaction
iii. Diel's alder reaction
iv. Knoevenagel reaction

B. Synthesis of Dyes :

i. Phenolphthalein
ii. Flouroscein
iii. Diazotization followed by coupling

Quantitative Estimation :

1. Determination of the percentage or number of hydroxyl groups in an organic compound by Acetylation method
2. Estimation of Amines / Phenols using Bromate – Bromide solution or Acetylation method
3. Saponification value, iodine value & acid values of an oil or fat

Syllabus

M.Sc. (Chemistry). Part I – Semester II

MCH – P205 – CORE COURSE V – PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week: 06 Hours **Total Lectures: 96**

Physical Chemistry	**Marks – 34**
▪ Conductometry	**12**
▪ Potentiometry/pH metry	**13**
▪ Record	**04**
▪ Viva Voce	**05**

Conductometry

i. Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically
ii. Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically
iii. Determination of the strength of strong and weak acid in a given mixture conductometrically
iv. To study of the effect of solvent on the conductance of $AgNO_3$/acetic acid and to determine the degree of dissociation and equilibrium constant in different solvents and in their mixtures (DMSO, DMF, dioxane, acetone, water) and to test the validity of Debye-Huckel-Onsager theory
v. Determination of the activity coefficient of zinc ions in the solution of 0.002 M zinc sulphate using Debye Huckel's limiting law
vi. Titration of a moderately strong acid (Salicylic acid) conductometrically

Potentiometry/pH metry

1. Determination of strengths of halides in a mixture potentiometrically
2. Determination of the valency of mercurous ions potentiometrically
3. Determination of the strength of strong and weak acids in a given mixture using a potentiometer/pH meter
4. Determination of temperature dependence of EMF of a cell
5. Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically
6. Acid-base titration in a non-aqueous media using a pH meter
7. Determination of activity and activity coefficient of electrolytes
8. Determination of the dissociation constant of acetic acid in DMSO. DMF, acetone and dioxane by titrating it with KOH
9. Determination of the dissociation constant of monobasic/dibasic acid by Albert- Sderjeant method
10. Determination of thermodynamic constants, DG, DS, and DH for the reaction by e.m.f. method.

$Zn + H_2SO_4 \rightarrow ZnSO_4 + 2\ H$

Syllabus

M.Sc. (Chemistry). Part I – Semester II

MCH – T206 – CORE COURSE VI – COMPUTER FOR CHEMISTS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week: 02 Hours **Total Lectures: 32**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**6 Lectures**
Introduction to Computers and Computing Basic Structure and Functioning of Computers. Memory, I/O Devices. Secondary Storage. Computer Languages. Operating Systems with DOS as an Example. Introduction to UNIX and WINDOWS. Data Processing, Principle of Programming. Algorithms and Flow-Charts.	
Unit-II	**6 Lectures**
Computer Programming In C Language Elements of the Computer Programming Language: Data Types, Constants, Variables, Operators, Assignment Statement, Input and Output, Branching Statement Such as if, if-else, switch-case.	
Unit-III	**8 Lectures**
Programming in Chemistry Using C Repetitive Statement or loop control statement: for, while and do-while loops. Array and its use to store data related to physical chemistry. Developing of small computer codes using C language involving simple formula in Chemistry, such as Van der Waals' equation, chemical kinetics (determination of Rate constant) Radioactive decay (Half Life and Average Life). Determination Normality, Molarity and Molarity of solutions. Determination of molecular weight.	
Unit-IV	**6 Lectures**
Use Of Computer Programmes Data Processing, Introduction and features of Standard Programmes and Packages such as MS Word, MS Excel with Special emphasis on Calculations and Chart Formations., X-Y Plots, use of excel for data Preferably from Physical Chemistry Laboratory.	
Unit-V	**6 Lectures**
Internet Application of Internet for Chemistry with Search Engines, Various types of files like PDF, JPG,**JPEG,** RTF and Bitmap. Scanning, OMR, Web Camera. Introduction of software like METLAB and ChemSketch.	

BOOKS:

1. Fundamentals of Computer : V. Rajaraman (Prentice Hall)
2. Computers in Chemistry : K.V. Raman (Tata Mc Graw Hill)
3. Computer Programming in FORTRAN IV-V Rajaraman (Prentice Hall)

Syllabus

M.Sc. (Chemistry). Part I – Semester II

MCH – 207 (SKEG) – SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC / GC) –

SKEG-T/P115 – INTRODUCTION TO ICT II

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

PART A : THEORY - MAX. MARKS: 50 + 30 **MIN. PASS MARKS: 20 + 12**

No. of Lectures per week : 02 Hours **Total Lectures: 32**

PART B : PRACTICALS - MAX. MARKS: 20 **MIN. PASS MARKS: 08**

No. of Laboratory per week: 02 Hours **Total Lectures: 32**

SKEG- T-119 – PERSONALITY DEVELOPMENT

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week: 03 Hours **Total Lectures: 48**

SKEG-T116– MANAGERIAL SKILLS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week : 03 Hours **Total Lectures: 48**

SKEG-T108 – HEALTH EDUCATION

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week : 03 Hours **Total Lectures: 48**

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – T301 – CORE COURSE I – APPLICATION OF SPECTROSCOPY- I

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **Total Lectures: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**12 Lectures**
Electronic Spectroscopy: Molecular term symbols, Electronic Spectral Studies for d^1 – d^9 systems in octahedral, tetrahedral and square planer complexes. Derivative spectrophotometry.	
Unit-II	**12 Lectures**
Vibrational Spectroscopy Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6, mode of bonding of ambidentate ligands, nitrosyl, ethylenediamine and diketonato complexes, application of resonance Raman spectroscopy and its applications. GC-FTIR systems. IR & Raman active bands in the interpretation of complex spectra.	
Unit-III	**16 Lectures**
Nuclear Magnetic Resonance Spectroscopy-I General introduction and definition, chemical shift, spin-spin interaction, shielding and deshielding mechanism, mechanism of measurement of chemical shift values and correlation for protons bonded to carbon (aliphatic, olefin, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto), applications in medical field.	
Unit-IV	**12 Lectures**
Nuclear Magnetic Resonance Spectroscopy-II Chemical exchange, effect of deuteration, Complex spin spin interaction between two, three, four and five nuclei (I order spectra) Stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with disordered angle. NMR shift reagents, solvent effects. Nuclear Overhauser Effect (NOE). 2-D NMR.	
Unit-V	**12 Lectures**
Mössbauer Spectroscopy Basic principles, Instrumentation, spectral parameters and spectrum display. Lamb Mossbauer Factor. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds, nature of M-L bond , coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.	

BOOKS:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Company.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman Spectral: Inorganic and Coordination Compounds K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler adn T.C. Morrill, John Wiley.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
13. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – T302 – CORE COURSE II – PHOTOCHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **Total Lectures: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**12 Lectures**
Photochemical Reactions Laws of Photochemistry (Grotthus – Draper Law, Stark – Einstein Law, Beer – Lambert's Law),Jablonski Diagram Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry. **Photochemistry of excited state redox reactions.**	
Unit-II	**12 Lectures**
Determination of Reaction Mechanism Classification, rate constants and life times of reactive energy state, determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photo dissociation, gas-phase photolysis.	
Unit-III	**12 Lectures**
Photochemistry of Alkenes Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4-dienes(Di-Π) and 1,5-dienes. **Photochemistry of Aromatic Compounds:** Isomerisations, additions and substitutions. **Examples.**	
Unit-IV	**14 Lectures**
Photochemistry of Carbonyl Compounds Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic β, Υ unsaturated and α, β unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.	
Unit-V	**14 Lectures**
Miscellaneous Photochemical Reactions Photo-Fries reactions of annilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen and its reactions. Photochemical formation of smog. Photo degradation of polymers. Photochemistry of vision. **Solar energy conversion & storage**.	

BOOKS:

1. Fundamentals of photochemistry, K.K. Rothagi-Mukheriji, Wiley-Eastern.
2. Essentials of Molecular Photochemistry, A Gilbert and J. Baggott, Blackwell Scientific Publication.
3. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
4. Introductory Photochemistry, A. Cox and T. Camp, McGraw Hill.
5. Photochemistry, R.P. Kundall and A. Gilbert. Thomson Nelson.
6. Organic Photochemistry, J. Coxon and B.Halton, Cambridge University Press.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – T303 – CORE COURSE III – ENVIRONMENTAL CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **Total Lectures: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**12 Lectures**
Atmosphere: Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. Calculation of Global means temperature of the atmosphere. Pressure variation in atmosphere and scale height. Residence times. **Green Chemistry- Principles & Goals.Atmospheric Chemistry:** Introduction to green audit,Sources of trace atmospheric constituents: nitrogen oxides, sulphurdioxide and other sulphur compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons. **Tropospheric Photochemistry:** Mechanism of Photochemical decomposition of NO_2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO_2 and NO_2. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.	
Unit-II	**12 Lectures**
Air Pollution: Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health. **Air pollution laws, Air quality standards**. **Acid Rain:** Definition, Acid rain precursors and their aqueous and gas phase atmospheric oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO_2 and NO_2. Acid rain control strategies. **Stratospheric Ozone Depletion:** Mechanism of Ozone formation, Mechanism of catalytic ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies. **Urban Air Pollution:** Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.	
Unit-III	**12 Lectures**
Aquatic Chemistry and Water Pollution: Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand. Aerobic and anaerobic reactions of organic sulphur and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection. **Radiological examination**.	
Unit-IV	**14 Lectures**
Environmental Toxicology: Toxic heavy metals: Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects. **Toxic Organic Compound:** Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects. **Industrial Ecosystem Polychlorinated biphenyls:** Properties, use and environmental continuation and effects. **Polynuclear Aromatic Hydrocarbons:** Source, structures and as pollutants.	
Unit-V	**14 Lectures**
Soil and Environmental Disasters: Soil composition, micro and macronutrients, soil pollution by fertilizers, lastic and metals. Methods of re-mediation of soil. Bhopal gas tragedy, Chernobyl, three mile island, Minamata Disaster, Sevoso (Italy), London smog. **Soil pollution by detergents, determination of soil pH and total Nitrogen.**	

BOOKS:

1. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
2. Chemistry of Atmospheres, R.P. Wayne, Oxford.
3. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
4. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
5. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – P304 – CORE COURSE V – PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week : 06 Hours **Total Lectures: 96**

- **Practical Examination will be of 16/18 Hrs. duration.**
- **Practical examination shall be conducted separately for each branch.**
- **Practical Examination will include 10-12 Practicals per Semester from the following list :**

Inorganic Chemistry	**Marks – 33**
▪ Quantitative Determinations of a Three Component Mixture	**12**
▪ Chromatographic Separations	**12**
▪ Record	**04**
▪ Viva Voce	**05**

Quantitative determinations of a three component mixture:
One volumetrically and two gravimetrically

a. Cu^{+2}, Ni^{+2}, Zn^{+2}
b. Cu^{+2}, Ni^{+2}, Ag^{+}
c. Fe^{+2}, Ni^{+2}, Zn^{+2}
d. Ag^{+}, Ni^{+2}, Mg^{+2}

Chromatographic Separations & determination of Rf values: (Thin layer/ Column/ Paper Chromatography)

a. Cadmium and zinc
b. Zinc and magnesium.
c. Indicators
d. Group II metal ions
e. Cu^{+2} , Fe^{+2}, Ni^{+2} & Co^{+2}
f. Ink pigment.

Organic Chemistry	**Marks – 33**
▪ Multi-step Synthesis of Organic Compounds	**12**
▪ Quantitative Estimations	**12**
▪ Record	**04**
▪ Viva Voce	**05**

Multi-step Synthesis of Organic Compounds:
Exercise should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques:
Aniline----- p-Nitroaniline; Aniline -------- P-Bromoaniline; Phthalic acid -------- Anthranilicacid ;
Pinacol-Pinacoline rearrangement (Benzophenone -------- Benzopinacol ------- Benzopincolone);
Benzoin Benzilic acid (Bezoin --------- Benzil --------- Benzilicacid); Benzidine rearrangement (Hydrazobenzene ------- Benzidine).

Quantitative Estimations (Titrimetric method) :

1. Estimation of glucose, glycine & ascorbic acid from vitamin- C tablet.
2. Determination of DO, COD & BOD of water sample.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – P304 – CORE COURSE V – PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week : 06 Hours **Total Lectures: 96**

Physical Chemistry	**Marks – 34**
▪ Spectroscopy	**13**
▪ Chemical Kinetics	**12**
▪ Record	**04**
▪ Viva Voce	**05**

Spectroscopy

1. Interpretation of IR , NMR spectra.
2. Numerical problems on UV, IR and NMR.

Specrophotometry/ Colorimetry

1. Determination phosphate concentration in a soft drink.
2. Determination of the composition of a mixture of $K_2Cr_2O_7$and $KMnO_4$ by the application of mixture law.
3. Titration of Mohr's salt with $K_2Cr_2O_7$/$KMnO_4$ Solution.
4. Determination of order and energy of activation for the decomposition of violet colour complex formed between Ceric ion and N- phenyl anthanilic acid.

Chemical Kinetics

i. Kinetics of decomposition of complex form between Na_2S and Sodium Nitroprusside Spectorscopically.
ii. Investigate the reaction between acetone and iodine.

Conductometry

1. Determination of equivalent conductance of a weak electrolyte at different concentration and hence the dissociation constant of the electrolyte also verify Ostwald's Dilution Law.
2. Determination of equivalent conductance of a weak electrolyte at infinite dilution using Kohlrausch law.

pH metry

1. Determination of acidic and basic dissociation constant of an amino acid and isoelectric point of the acid
2. Measurement of the pH of Buffer solution (CH_3COOH +CH_3COONa) using Henderson's equation and hence pK_a

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – T305A – CORE ELECTIVE COURSE – HETEROCYCLIC CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**10 Lectures**
Nomenclature of Heterocycles: Replacement and systematic nomenclature (HantzsMCH-Widman system) for monocyclic fused and bridged heterocycles. **Aromatic Heterocycles:** General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in 1H NMR-spectra. Empirical resonance energy, delocalization energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.	
Unit-II	**10 Lectures**
Non-aromatic Heterocycles: Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1, 3-diaxial interaction. Atereo-electronic effects anomeric and related effects, Attractive interactions-hydrogen bonding and intermolecular nucleophilic and electrophilic interactions. Heterocyclic synthesis-princples of heterocyclic synthesis involing cyclization reactions and cycloaddition reactions.	
Unit-III	**09 Lectures**
Small Ring Heterocycles: Three-membered and four-membered heterocycles-synthesis and reactions of azirodines, oxiranes, thiranes, azetidines, oxetanes and thietanes. **Benzo-Fused Five-Membered Heterocycles:** Synthesis and reactions including medicinal applications of benzopyrroles, bezofurans and benzothiophenes.	
Unit-IV	**09 Lectures**
Meso-ionic Heterocycles: General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications. **Six-Membered Heterocycles with one Heteroatom:** Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium & thiopyrylium salts and phridones. Synthesis and reactions of quionlizinium and benzopyrylium salts, coumarins and chromones.	
Unit-V	**10 Lectures**
Six Membered Heterocycles with Two or More Heteroatoms: Synthesis and reactions of diazones, triazines, tetrazines and thiazines. Seven-and Large-Membered Heterocycles: Synthesis and reactions of azepines, oxepines, thiepines, diazepines, thiazepines, azocines, diazocines, dioxocines and dithiocines. **Heterocyclic Systems Containing P, As, Sb-**Heterocyclic rings containing phosphorus: Introduction, nomenclature, synthesis and characteristics of 5- and 6-membered ring systems phosphorinaes, phosphorines, phospholanes and phospholes. Heterocyclic rings containing As and Sb: Introduction, synthesis and characteristics of 5- and 6-membered ring system. Heterocyclic rings containing Bi: Introduction, synthesis reactivity of 3- 5- and 6- membered ring system.	

BOOKS:

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L.S. Hegsdus, J.R. Norton and R.G. Finke, University Science Books.
2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree. John Wiley.
3. Metallo-organic Chemistry, A.J. Pearson, Wiley.
4. Organometallic Chemistry, R.C. Mehrotra and A. Singh New Age International.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – T305 B – CORE ELECTIVE COURSE – POLYMERS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**10 Lectures**
Basics: Importance of polymers. Basic concepts, degree of polymerization Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition/radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.	
Unit-II	**10 Lectures**
Polymer Characterization: Polydispersion-average molecular weight concept, chain configuration of polymers. Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular-weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.	
Unit-III	**09 Lectures**
Analysis and testing of polymers: Liquid crystal polymers. Chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis (TGA, DSC, etc.) and physical testing-tensile strength. fatigue, impact, tear resistance, Hardness and abrasion resistance.	
Unit-IV	**09 Lectures**
Inorganic Polymers: A general survey and scope of Inorganic Polymers special characteristics, classification, homo and hetero atomic polymers. Structure, Properties and Applications of a. Polymers based on boron-borazines, boranes and carboranes. b. Polymers based on Silicon, silicone's polymetalloxanes and polymetallosiloxanes, silazanes.	
Unit-V	**10 Lectures**
Structure, Properties and Application of Polymers: Polymers based on Phosphorous-Phosphazenes, Polyphosphates a. Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds. b. Co-ordination and metal chelate polymers.	

BOOKS:

1. Inorganic Chemistry, J.E. Huheey, Harper Row.
2. Developments in Inorganic polymer Chemistry, M.F. Lappert and G.J. Leigh.
3. Inorganic polymers- N.H. Ray.
4. Inorganic polymers, Graham and Stone.
5. Inorganic Rings and Cages : D.A. Armitage.
6. Textbook of Polymers Science, F.W. Billmeyer Jr. Wiley.
7. Contemporary Polymer Chemistry, H.R. Al cock and F.W. Lambe, Prentice Hall.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – T305 C – CORE ELECTIVE COURSE – PHYSICAL ORGANIC CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I **10 Lectures**

Concepts in Molecular Orbital (MO) and Valence Bond (VB) Theory Introduction to Huckel molecular orbital (MO) method as a mean to explain modern theoretical methods. Advanced techniques in PMO and FMO theory. Molecular mechanics, semi empirical methods and ab initio and density functional methods. Scope and limitations of several computational programmes.

Unit-II **10 Lectures**

Quantitative MO theory: Huckel molecular orbital (HMO - method as applied to ethene, allyl and butadiene. Qualitative MO theory ionisation 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 hyper-conjugation. Aromaticity.Valence bond (B) 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.

Unit-III **09 Lectures**

Principles of Reactivity: Mechanistic significance of entropy, enthalpy and Gibb's free energy. Arrrhenius 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. **Kinetic Isotope Effect:** Theory of isotope effects. Primary and secondary kinetic isotope effects. Heavy atom isotope effects. Tunneling effect. Solvent effects. **Structural Effects on Reactivity:** Linear free energy relationships (LFER). The Hammett equation, substituent constants, theories of substituent effects. Interpretation of δ-values. Reaction constants. Deviations from Hammett equation. Dualparameter correlatins, inductive substituent constant. The Taft model, s1 and sR scales.

Unit-IV **09 Lectures**

Acids, Bases, Electrophiles, Nucleophiles and Catalysis: Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity functions and their applicatins. Hard and soft acids and bases. Nucleophilicity scales. Nucleofugacity. The α-effect. Ambivalent nucleophiles. Acid-base catalysis-specific and general catalysis. Bronsted catalysis, Nucleophilic and electrophilic catalysis. Catalysis by noncovalent binding-micellar catalysis. **Steric and Conformation Properties:** Various type of steric strain and their influence on reactivity. Steric acceleration. Molecular measurements of steric effects upon rates. Steric LFET, 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.

Unit-V **10 Lectures**

Nucleophilic and Electrophilic Reactivity: Structural and electronic effects on SN^1 and SN^2 reactivity. Solvent effect, Kinetic isotope effects. Intramolecular assistance. Electron transfer nature of SN^2 reaction. Nucleophilicity and SN^2 reactivity based on curved crossing mode. Relationship between polar and electron transfer reactions, SR_N1 mechanism. Electrophilic reactivity, general mechanism. Kinetic of S_E2 Ar reaction. Structural effects on rates and selectivity. Curve-crossing approach to electrophilic reactivity. **Supramolecular Chemistry:** Properties of covalent bonds-bond length, inter-bond angles, force constant, bond and molecular dipole moments. Molecular and bond polarizability, bond dissociation enthalpy, entropy. Intermolecular forces, hydrophobic effects. Electrostatic, induction, dispersion and resonance energy, magnetic interactions, magnitude of interaction energy, forces between macroscopic bodies, medium effects. Hydrogen bond.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – T305 C – CORE ELECTIVE COURSE – PHYSICAL ORGANIC CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

BOOKS:

1. Molecular Mechanics, U. Burket and N.L. Allinger, ACS Monograph 177, 1982.
2. Orgaic 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. Richadson, Harper and Row.
4. Introduction to Theoretical Organic Chemistry and Molecular Modeling.
5. Physical Organic Chemistry: N.S. Isaacs, ELBS/Longman.
6. Supramolecular Chemistry: Concepts and Perspective, J.M. Lehn, VCH.
7. The Physical Basis of Organic Chemistry: H. Maskill, Oxford University Press.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – T306 A – CORE ELECTIVE COURSE – CHEMISTRY OF MATERIALS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**10 Lectures**
A. Multiphase materials: Ferrous alloys; Fe-C phase transformations in ferrous alloys; stainless steels, non ferrous alloys, properties of ferrous and non-ferrous alloys and their applications. **B. Glasses, Ceramics, Composites and Nanomaterials:** Glassy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and applications. Microscopic composites; dispersion-strengthened and particle-reinforced, firbre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties, applications.	
Unit-II	**10 Lectures**
A. Thin Films and Langmuir-Blodgett Films: Preparation techniques; evaporation/sputtering, chemical processes, MOCVD, sol-gel etc. Languir-Blodgett (LB) film, growth techniques, photolithography, properties and applications of thin and LB films. **B Liquid Crystals:** Mesmorphic behaviour, thermotropic liquid crystals, positional order, bond orientation order, nematic and smectic mesophases; smectic-nematic transition and clearing temperature-homeotropic, planer and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.	
Unit-III	**09 Lectures**
A. Polymeric Materials: Molecuar shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their applications, conducting and ferro-electric polymers. **B. Ionic Conductors:** Types of ionic conductors, mechanism of ionic conduction, interstitial jumps (Frenkil); vacancy mechanism, diffusion superionic conductors; phase transitions and mechanism of conduction in superionic conductors, examples and applications of ionic conductors.	
Unit-IV	**09 Lectures**
High T_c Materials: Defect perovskites, high T_c superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials, normal state properties; anisotropy; temperature dependence of electrical resistance; optical phonon modes, superconducting state; heat capacity; coherence length, elastic constants, position lifetimes, microwave absorption-pairing and multigap structure in high T_c materials, applications of high T_c materials.	
Unit-V	**10 Lectures**
A. Materials of Solid State Devices: Rectifiers, transistors, capacitors-IV-V compounds, low-dimensional quantum structures; optical properties. **B. Organic Solids, Fullerenes, Molecular Devices:** Conducting organics, organic superconductors, magnetism in organic materials. Fullerenes-doped, fullerenes as superconductors. Molecular rectifiers and transistors, artificial photosynthetic devices, optical storage memory and switches-sensors.Nonlinear optical materials; nonlinear optical effects, second and third order-molecular hyperpolarisability and second order electric susceptibility – materials for second and third harmonic generation.	

BOOKS:

1. Solid State Physics, N.W.Ashcroft and N.D.Mermin, Saunders College.
2. Materials Science and Engineering, an Introduction, W.D.Callister, Wiley.
3. Principles of the Solid State, H.V. Keer, Wiley Eastern.
4. Materials Sciences, J.C.Anderson, K.D.Leaver, J.M.Alexander and R.D. Rawlings, ELBS
5. Thermotropic liquid Crystals, Edl, G.W. Gray, John Wiley.
6. Handbook of Liquid Crystals, Kelker and Hatz, Chemie Verlag.

Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH –T306B – CORE ELECTIVE COURSE – ORGANOTRANSITION METAL CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**10 Lectures**
Alkyls and Aryls of Transition Metals Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis. **Compounds of Transition Metal-Carbon Multiple Bonds** Alkylidenes, alkylidynes, low valent carbenes and carbynes-synthesis, nature of bond, structural characteristics, nucleophilic and electrophilic reactions on the ligands, role in organic synthesis.	
Unit-II	**10 Lectures**
Transition Metal π-Complexes Transition metal **π**-Complexes with unsaturated organic molecules, alkenes, alkynes, allyl, diene, dienyl, arene and trienyl complexes, preparation, properties, nature of bonding and structural features. Important reactions relating to nucleophilic and electrophilic attack on ligands and to organic synthesis.	
Unit-III	**09 Lectures**
Transition organometalic compounds: Transition metal compounds with bonds to Hydrogen, Boron, Silicon. Biological applications & Environmental aspects of organometallic compounds.	
Unit-IV	**09 Lectures**
Homogeneous Catalysis Stoichiometric reactions for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reactions involving carbon monoxide such as hydrocarbonylation of olefins (oxoreaction), explanation reactions, Hydrosilation, activation of C-H bond.	
Unit-V	**10 Lectures**
Fluxional Organometallic Compounds Fluxionality and dynamic equilibrium in compounds such as η^2 olefine, η^3-allyl, and dienyl complexes,Rate of fluxionality	

BOOKS:

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L.S. Hegsdus, J.R. Norton and R.G. Finke, University Science Books
2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree. John Wiley
3. Metallo-organic Chemistry, A.J. Pearson, Wiley
4. Organometallic Chemistry, R.C. Mehrotra and A. Singh New Age International

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Syllabus
M.Sc. (Chemistry) Part II – Semester III

MCH – 307 (SKEG) – SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC / GC) –

SKEG-T/P114 – INTRODUCTION TO ICT I

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

PART A : THEORY - MAX. MARKS: 50 + 30 **MIN. PASS MARKS: 20 + 12**

No. of Lectures per week : 02 Hours **Total Lectures: 32**

PART B : PRACTICALS - MAX. MARKS: 20 **MIN. PASS MARKS: 08**

No. of Laboratory per week: 02 Hours **Total Lectures: 32**

SKEG- T-109 – INTRODUCTION TO PHARMACEUTICAL BIOTECHNOLOGY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week: 03 Hours **Total Lectures: 48**

SKEG-T116– MANAGERIAL SKILLS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week : 03 Hours **Total Lectures: 48**

SKEG-T108 – HEALTH EDUCATION

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week : 03 Hours **Total Lectures: 48**

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T401 – CORE COURSE I –APPLICATION OF SPECTROSCOPY-II

MAX.MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**10 Lectures**
Ultraviolet and Visible spectroscopy Various electronic transitions (185-800 nm) Beer-Lambert law, Effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds. Steric effect in biphenyls.	
Unit-II	**10 Lectures**
Infrared Spectroscopy Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance.	
Unit-III	**10 Lectures**
Nuclear Magnetic Resonance of Paramagnetic Substances in Solution The contact and Pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nuclide with emphasis on ^{195}Pt and ^{119}Sn NMR.	
Unit-IV	**09 Lectures**
Carbon-13 NMR Spectroscopy General considerations, chemical shift (aliphatic olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbon), coupling constants. Two dimension NMR spectroscopy-COSY, NOESY, DEPT, HMBC and HMQC techniques.	
Unit-V	**09 Lectures**
Mass Spectrometry Introduction ion production E1, C1 FD, ESI and FAB, factors affecting fragmentation, ion analysis, ion abundance Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak. Me Lafferty rearrangement. Nitrogen rule. High resolution mass spectrometry.	

BOOKS:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman Spectral : Inorganic and Coordination Compounds K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassleradn T.C. Morrill, John Wiley.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
13. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T402 – CORE COURSE II – SOLID STATE CHEMISTRY

MAX.MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**08 Lectures**
Solid State Reactions: General principles, experimental procedure, co-precipitation as a precursor to solid state reactions, kinetics of solid state reactions.	
Unit-II	**10 Lectures**
Crystal Defects and Non-Stoichiometry: Methods of X-ray Diffraction, Perfect and imperfect crystalsand their examples**,** intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colourcentres, non-stoichiometry and defects.	
Unit-III	**10 Lectures**
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 semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties-Application of optical and electron microscopy. Magnetic Properties-Classification of materials: Effect of temperature calculation of magnetic moment, mechanism of Ferro and anti ferromagnetic ordering super exchange.	
Unit-IV	**09 Lectures**
Organic Solids: Electrically conducting solids, Examples. Organic charge transfer complex, organic metals, new superconductors.	
Unit-V	**11 Lectures**
Liquid Crystals: Types of liquid crystals: Nematic, Smectic, Ferroelectric, Antiferroelectric, Various theories of LC, Liquid crystal display, New materials.	

BOOKS:

1. Solid state chemistry and its applications, A.R. West. Peenum.
2. Principles of the Solid State, H.V. Keer, Wiley Eastern.
3. Solid State Chemistry, N.B. Hannay.
4. Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T403 – CORE COURSE III –BIOCHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **Total Lectures: 64**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I **13 Lectures**

Metal Ions in Biological Systems: Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K+/Na+ pump. **Bioenergetics and ATP Cycle:** DNA polymerization, glucose storage, metal complexes in transmission of energy; chlorophyll's, photosystem I and photosystem II in cleavage of water. **Transport and Storage of Dioxygen:** Heam proteins and oxygen uptake structure and function of hemoglobin, mygolobin, haemocyanms and hemerythrin, model synthetic complexes of iron, cobalt and copper.

Unit-II **13 Lectures**

Electron Transfer in Biology: Structure and function of metal of proteins in electron transport processes cytochromes and ion-sulphur proteins, synthetic models. **Nitrogen fixation:** Biological nitrogen fixation, and its mechanism, nitrogenase, Chemical nitrogen fixation.

Unit-III **12 Lectures**

Enzymes: Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshalnd's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michael's-Menten and Lineweaver Burk plots, reversible and irreversible inhibition.

Mechanism of Enzyme Action: Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotrypsin, ribonuclease, lysozyme and carboxypeptidase.

Kinds of Reactions Catalysed by Enzymes: Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in Isomerisation reactions, β-Cleavage and condensation, some isomerisation and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

Unit-IV **12 Lectures**

Co-Enzyme Chemistry: Cofactors as derived from vitamines, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors. **Enzyme Models:** Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrion-based enzyme models, clixarenes, ionospheres, micelles synthetic enzymes or synzymes. **Biotechnological Applications 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, syrups from cron starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T403 – CORE COURSE III –BIOCHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 04 Hours **Total Lectures: 64**

Unit-V **14 Lectures**

Biological Cell and its Constituents: Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coils transition. **Bioenergetics:** Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

Biopolymer Interactions: Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of binding processes in biological systems. Hydrogen ion titration curves. **Cell Membrane and Transport of Ions:** Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

BOOKS:

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, 1. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
3. Inorganic biochemistry vol. I and II ed. G.L. Eichhorn, Elsever.
4. Progress in Inorganic Chemistry, Vol 18 and 38 ed J.J. Lippard, Wiley.
5. Bioorganic Chemistry: A chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer Verlag.
6. Understanding Enzymes, Trevor Palmer, Prentice Hall.
7. Enzyme Chemistry: Impact and applications, Ed. Collin J suckling, chemistry.
8. Enzyme Mechanisms Ed. M.I. Page and A Williams, Royal Society of Chemistry.
9. Fundamentals of Enzymology, N.C. Price and L. Stevens. Oxford University Press.
10. Immobilized Enzymes: An Introduction and Applications in Biotechnology, Michael ID. Trevan, Hohn Wiley.
11. Enzymatic Reaction Mechanisms. C. Walsh. W.H. Freeman.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – P404– CORE COURSE V –PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week : 06 Hours **Total Lectures: 96**

- **Practical Examination will be of 16/18 Hrs. duration.**
- **Practical examination shall be conducted separately for each branch.**
- **Practical Examination will include 10-12 Practicals per Semester from the following list :**

Inorganic Chemistry	**Marks – 33**
▪ **Preparation/ Ion exchange Chromatography**	**12**
▪ **Spectrophotometric Determinations/ Flame Photometric Determinations**	**12**
▪ **Record**	**04**
▪ **Viva Voce**	**05**

Preparation

Preparation of selected inorganic compounds and their study by IR, electronic spectra, and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds involving vacuum lines. Selection can be made from the following:

1. Sodium amide. Inorg. Synth., 1946, 2, 128.
2. Atomic absorption analysis of Mg and Ca.
3. Synthesis of trichlorodiphenylantimony (V) hydrate. Inorg. Synths., 1985, 23, 194
4. Sodium tetrathionate $Na_2S_4O_6$.
5. Metal complex of dimethyl sulfoxide . J.Chem. Educ., 1982, 59, 57.
6. Synthesis of metal acethylacetonate : Inorg. Synths, 1957, 5, 130, 1963, 1, 183.
7. Cis and Trns $[Co(en)_2Cl_2]^+$.
8. Determination of Cr (III) complex. Inorg. synths., 1972, 13, 184.
9. Preparation and use of Ferrocene. J. Chem. Edu. 1966, 43, 73; 1976, 53, 730.
10. Preparation of [Co(phenathroline-5,6 quinone)].
11. $[Co(NH_3)_5Cl]Cl_2$
12. Trans-$[Co(NH_3)_5(NO_2)_2]Cl$
13. Synthesis of metal- ethylenediamine complex.

Ion exchange Chromatography

1. Capacity of cation/ anion exchange resin.
2. Separation of cobalt & Nickel on anion exchange resin & their estimation volumetrically.

Spectrophotometric Determinations / Spectroscopic identification of recorded spectra like IR, NMR, ESR and Mass

1. Manganese/Chromium in steel sample.
2. Nickel by extractive spectrophotometric method.
3. Fluoride/nitrite/phosphate.
4. Copper-Ethylene diamine complex: Slope-ratio method.

Flame Photometric Determinations

1. Sodium and potassium when present together.
2. Lithium/calcium/barium/strontium.
3. Cadmium and magnesium in tap water.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – P404– CORE COURSE V –PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week : 06 Hours **Total Lectures: 96**

Organic Chemistry	**Marks – 33**
▪ **Multi-step Synthesis of Organic Compounds**	**12**
▪ **Spectroscopy/Spectrophotometric Determinations**	**12**
▪ **Record**	**04**
▪ **Viva Voce**	**05**

Multi-step Synthesis of Organic Compounds:

1. Friedel Crafts reaction.
2. Beckmann's reaction.
3. Synthesis of symmetrical tribromobenzene from aniline.
4. Enzymatic reduction of ethylacetoacetate using Baker's yeast to yield enantiomeric excess of s-ethyl-3-hydroxybutanoate & determine its optical density.
5. Biosynthesis of ethanol from sucrose.
6. Preparation of soap from fat with isolation of glycerol.

Spectroscopic Estimations:

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

Isolations:

1. Casein from milk
2. Lycopine from tomato
3. Piperine from black pepper
4. Caffeine from tea leaves
5. Lactose from milk
6. Preparation of rose water using steam distillation

Identification of organic compound by the analysis of their spectral data (UV, IR, MS)

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – P404– CORE COURSE V –PRACTICAL COURSE IN CHEMISTRY

MAX. MARKS: 100 **MIN. PASS MARKS: 40**

No. of Laboratory per Week : 06 Hours **Total Lectures: 96**

Physical Chemistry	**Marks – 34**
▪ **Spectroscopy & Polarography/ Electronics**	**13**
▪ **Chemical kinetics & Thermodynamics**	**12**
▪ **Record**	**04**
▪ **Viva Voce**	**05**

Spectroscopy

i. Determination of PKa of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media.
ii. Determination of stoichiometry and stability constant of Ferricisothicoyanation complex ion in solution.
iii. Determination of rate constant of alkaline bleaching of Malachite green and effect of ionic strength on the rate of reaction.

Polarography

i. Identification and estimation of metal ions such as Cd+2, Pb+2, Zn+2, and Ni+2 etc. polarographically.
ii. Study of a metal ligand complex polarographically (using Lingane's Method).
iii. Determination of V-I Characteristics of a given diode in:
   A. Forwared based mode/ function
   B. Reverse based mode/ function

Chemical Kinetics

i. Determination of rate constant and formation constant of an intermediate complex in the reaction of Ce(IV) and Hypophosphorous acid at ambient temperature.
ii. Determination of energy and enthalpy of activation in the reaction of KMnO4 and benzyl alcohol in acid medium.
iii. Determination of energy of activation of and entropy of activation from a single kinetic run.
iv. Kinetics of an enzyme catalyzed reaction.

Thermodynamics

i. Determination of partial molar volume of solute (e.g. KCl) and solvent in a binary mixture.
ii. Determination of the temperature dependence of the solubility of a compound in two solvents having similar intra molecular interactions (benzoic acid in water and in DMSO water mixture and calculate the partial molar heat of solution.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T405 A – CORE ELECTIVE COURSE – ELECTROCHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I **11 Lectures**

1. Conversion and Storage of Electrochemical Energy Present status of energy consumption: Pollution problem. History of fuel cells, Direct energy conversion by electrochemical means. Maximum intrinsic efficiency of an electrochemical converter. Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. Power outputs. Electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkane fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells.

Electrochemical Energy Storage :

Properties of Electrochemical energy storage: Measure of battery performance, Charging and discharging of a battery, Storage Density, Energy Density. Classical Batteries: (i) Lead Acid (ii) Nickel-Cadmium, (iii) Zinc manganese dioxide. Modern Batteries: (i) Zinc-Air (ii) Nickel-Metal Hydride, (iii) Lithium Battery, Future Electricity stores: Storage in (i) Hydrogen, (ii) Alkali Metals, (iii) Non aqueous solutions.

Unit-II **08 Lectures**

Corrosion and Stability of Metals :

Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals, Potential - pH (or Pourbaix) Diagrams; uses and abuses, Corrosion current and corrosion potential -Evans diagrams. Measurement of corrosion rate: (i0 Weight Loss method, (ii) Electrochemical Method.

Inhibiting Corrosion : Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by charging the corroding method from external source, anodic Protection, Organic inhibitors, The fuller Story Green inhibitors.

Passivation : Structure of Passivation films, Mechanism of Passivation, Spontaneous Passivation Nature's method for stabilizing surfaces.

Unit-III **10 Lectures**

Bioelectrochemistry:

bioelectrodics, Membrane Potentials, Simplistic theory, Modern theory, Electrical conductance in biological organism: Electronic, Protonic electrochemical mechanism of nervous systems, enzymes as electrodes.

Kinetic of Electrode Process :

Essentials of Electrode reaction. Current Density, Over potential, Tafel Equation, Butler Volmer equation. Standard rate constant (K0) and Transfer coefficient (a), Exchange Current.

Irreversible Electrode processes: Criteria of irreversibility, information from irreversible wave.

Unit-IV **10 Lectures**

Methods of determining kinetic parameters for quasi-reversible and irreversible waves: Koutecky's methods, Meits Israel Method, Gellings method

Electrocatalysis: Chemical catalysts and Electrochemical catalysts with special reference to purostates, porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions, in reaction involving adsorbed species. Influence of various parameters.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T405 A – CORE ELECTIVE COURSE – ELECTROCHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

Unit-V	**09 Lectures**
Potential Sweep Method : Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cycli voltammetry. Controlled current microelectrode techniques: comparison with controlled potentials methods, chronopotentiometry, theory and applications. **Bulk Electrolysis Methods :** Controlled potential coulometry, Controlled Coulometry, Electroorganic synthesis and its important applications. Stripping analysis: anodic and Cathodic modes, Pre electrolysis and Stripping steps, applications of Stripping Analysis.	

BOOKS:

1. Modern Electrochemistry Vol. I, IIa, Vol. IIB J'OM Bockris and A.K.N. Reddy, Plenum Publication, New York.
2. Polarographic Techniques by L. Meites, Interscience.
3. "Fuel Cells: Thjeir electrochemistry". McGraw Hill Book Company, New York.
4. Modern Polarographic Methods by A.M. Bond, Marcell Dekker.
5. Polarography and allied techniques by K. Zutshi, New age International publicatin. New Delhi.
6. "Electroaalytical Chemistry by Basil H. Vessor & Galen W. ; Wiley Interscience.
7. Electroanalytical Chemistry by Basil H. Vessor & alen w. ; Wiley Interscience.
8. Topics in pure and Applied Chemistry, Ed. S. K. Rangrajan, SAEST Publication, Karaikudi (India)

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T405 B – CORE ELECTIVE COURSE – CHEMISTRY OF NATURAL PRODUCTS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**11 Lectures**
Terpenoids and Carotenoids: clasification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules: Citral, Geraniolα-Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β-Carotene.	
Unit-II	**08 Lectures**
Alkaloids: Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, synthesis and biosynthesis of the following: Ephedrine, (+) - Coniine, Nicotine, Atropine, Quinine and Morphine.	
Unit-III	**10 Lectures**
Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, Structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of Steroids.	
Unit-IV	**10 Lectures**
Plant Pigments: Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, LuteolinQuercetin, Myrcetin, Quercetin 3-glucoside, Vitexin, Diadzein, Aureusin, Cyanidin-7arabinoside, Cyanidin, Hirsutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway. **Prophyrins:** Structure and synthesis of Haemoglobin and Chlorophyll.	
Unit-V	**09 Lectures**
Prostaglandin: Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF2α. **Pyrethroids and Rotenones:** Synthesis and reactions of Pyrethroids and Rotenones. (For structure elucidation, emphasis is to be placed on the use of spectral parameters wherever possible).	

BOOKS:

1. Natural Products : Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthrope adn J.B. Harbome, Longman, Esses.
2. Organic Chemistry: Vol. 2 1L. Finar, ELBS
3. Stereoselective Synthesis: A Practical Approach, M. Norgradi, 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, Ataaur Rahman and M.L. Choudhary, Harwood Academic Publishers.
8. Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T405 C – CORE ELECTIVE COURSE – ANALYTICAL CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 4**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**11 Lectures**
Introduction: Role of analytical chemistry Classification of analytical methods classical and instrumental. Types of instrumental analysis. Selecting an analytical method. Neatness and cleanliness. Laboratory operations and practices. Analytical balance. Techniques of weighing, errors. Volumetric glassware cleaning and calibration of glassware. Sample Volumetric glassware cleaning and Calibration of glassware. Sample preparation-dissolution and decompositions. Gravimetric techniques. Selecting and handling or reagents. Laboratory notebooks. Safety in the analytical laboratory.**Errors and Evaluation** Definition of terms in mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error. Types of error in experimental data determinate (systematic), indeterminate (or random) and gross. Sources of error and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors. The uses of statistics.	
Unit-II	**08 Lectures**
Food analysis: Moisture, ash, crude protein, fat crude fiber, carbohydrates, calcium, potassium, sodium and phosphate. Food adulteration-common adulterants in food, contamination of foods stuffs. Microscopic examination of foods for adulterants. Pesticide analysis in food products. Extraction and purification of sample. HPLC. Gas chromatography for organophosphates. Thin-layer chromatography for identification of chlorinated pesticides in food products.	
Unit-III	**10 Lectures**
Analysis of Water Pollution: Origin of Waste water, types, water pollutants and their effects. Sources of water pollution-domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. Objectives of analysis-parameter for analysis- colour, turbidity, total solids, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen, Heavy metal pollution-public health significance of cadmium, chromium, copper, lead, zinc, manganese, mercury and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Measurements of DO, BOD, and COD. Pesticides as water pollutants and analysis. Water pollution laws and standards.	
Unit-IV	**10 Lectures**
Analysis of Soil, Fuel, Body Fluids and Drugs: (a) Analysis of Soil, moisture pH total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts.Fuel analysis: liquid and gas. Ultimate and proximate analysis-heating values-grading of coal. Liquid fuels-flash point, aniline point, octane number and carbon residue. Gaseous fuels-produced gas and water gas-calorific value.	
Unit-V	**09 Lectures**
(a) **Clinical Chemistry** : Composition of blood-collection and preservation of samples. Clinical analysis. Serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates. Immunoassay: principles of radio immunoassay (RIA) and applications. The blood gas analysis trace elements n the body. (b) **Drug analysis**: Narcotics and dangerous drug. Classification of drugs. Screening by gas and thin-layer chromatography and spectrophotometeric measurements.	

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T405 C – CORE ELECTIVE COURSE – ANALYTICAL CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 4**

BOOKS:

1. Analytical Chemistry, G.D. Christian, J.Wicy.
2. Fundamentals o analytical Chemistry. D.A. Skoog. D.M. West and F.J. Hooler, W.B. Saunders.
3. Analytical Chemistry-Principles. J.H. Kennedy. W.B. Saunders.
4. Analytical Chemistry-Principles and Techniques. LG. Hargis. Prentice Hall.
5. Principles of Instrumental analysis D.A. Skoog and J.L. Loary, W.B. Saunders.
6. Principles of Instrumental Analysis D.A. Skoog W.B. Saunders.
7. Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
8. Environmental Solution, S.M. Khopkar, Wiley Eastern.
9. Basic Concepts of Analysis Chemistry, S.M. Khopkar, Wiley Eastern.
10. Handbook of Instrumental Techniques for Analytical Chemistry, F. Settle, Prentice Hall

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – T406 A – CORE ELECTIVE COURSE – ORGANIC SYNTHESIS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**11 Lectures**
Disconnection Approach: An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reaction, amine synthesis. Protection of groups, chemo, region and stereo selectivity.	
Unit-II	**08 Lectures**
One Group C-C Disconnections: Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis. **Two Group C-C Disconnections:** Diels-Alder Reaction, 1,3-difunctionalised compounds, a-b- unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds. Micheal addition and Robinson annelation.	
Unit-III	**10 Lectures**
Oxidation: Introduction, Different oxidative processes. Hydrocarbons-alkenes, aromatic rings, saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones, ketals and carboxylic acids. Amines, hydrazines, and sulphides. Oxidations with ruthenium tetraoxide, iodobenzenediacetate and thallium. (III) Nitrate. **Reduction:** Introduction, Different reductive processes. Alkanes, alkenes, alkynes, and aromatic rings. Carbonyl compounds-aldehydes, ketones, acids and their derivatives. Epoxides. Nitro, nitroso, azo and oxime groups. Expoxide, Nitro, Nitroso, azo and oxime groups. Hydrogenolysis.	
Unit-IV	**10 Lectures**
Organometallic Reagents: Principle, preparations, properties and applications of the following in organic synthesis with mechanistic details. Group I and II metal organic compounds Li, Mg, Hg, Cd, Zn and Ce Compounds.	
Unit-V	**09 Lectures**
Synthesis of some complex molecules: Application of the above in the synthesis of following compounds: Canphor, longifoline, cartisone, reserpine, vitamin D, juvabion, aphidicolin and fredericamycin. A	

BOOKS:

1. Designing Organic Synthesis, S. Warren. Wiley.
2. Organic Synthesis-Concept, Methods and Starting Materials, J. Fuhrhop.
3. Some Modern Methods of Organic Synthesis. W. carruthers, Cambridge Univ. Press.
4. Modern Synthetic Reactions H.O. House, W.A Benjamin.
5. Advanced Organic Chemistry : Reactions, Mechanisms and Structure, J. March. Wiley.
6. Principles, of Organic Chemistry Part B. F.a. Carey and R.J. Sundberg, Plenum Press.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH –T406 B – CORE ELECTIVE COURSE – MEDICINAL CHEMISTRY

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per Week : 03 Hours **Total Lectures: 48**

The Question Paper will contain questions equally distributed in all Units. The Internal Choice will be given in all Questions.

Unit-I	**11 Lectures**
Structure and activity: Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis.	
Unit-II	**08 Lectures**
Pharmacodynamics: Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.	
Unit-III	**10 Lectures**
Antibiotics and antibacterials : Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular – Streptomycin, Broad spectrum antibiotics – Tetracyclines, Anticancer - Dactinomycin (Actinomycin D). Shechan's Synthesis of Penicillin.	
Unit-IV	**10 Lectures**
Antifungal – polyenes, Antibacterial – Ciprofloxacin, Norfloxacin, Antiviral – Acyclovir **Antimalarials**: Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine	
Unit-V	**09 Lectures**
Non-steroidal Anti-inflammatory Drugs : Diclofenac Sodium, Ibuprofen and Netopam **Antihistaminic and antiasthmatic agents:**Terfenadine, Cinnarizine, Salbutamol and Beclomethasonedipropionate.	

BOOKS:

1. Introduction to medicinal chemistry, A. Gringuage, Wiley-VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge.
3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age Internaitonal.
4. Burger's Medicianl Chemistry and Drug Discovery, Vol-I (Chapter 9 and Chapter 14), Ed. M.E.Wolff, John Wiley.
5. Goodman and Gilman's Pharmacoloical Basis of Therapeutics, Mc GRaw-Hill.
6. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
7. Strategies for Organic Drug synthesis and Design, D.Lednicer, John Wiley.
8. Principles of Medicinal Chemistry W.O.Foye
9. Medicinal Chemistry; The Role of organic chemist in Drug Research, S.M. Roberts and B.J. Pricer.

Syllabus

M.Sc. (Chemistry). Part II – Semester IV

MCH – 407 (SKEG) – SKILL ENHANCEMENT / GENERIC COURSE - ANY ONE (SEC / GC) –

SKEG-T/P115 – INTRODUCTION TO ICT II

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

PART A : THEORY - MAX. MARKS: 50 + 30 **MIN. PASS MARKS: 20 + 12**

No. of Lectures per week : 02 Hours **Total Lectures: 32**

PART B : PRACTICALS - MAX. MARKS: 20 **MIN. PASS MARKS: 08**

No. of Laboratory per week: 02 Hours **Total Lectures: 32**

SKEG- T-111 – INTRODUCTION TO ORGANIC FARMING

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week: 03 Hours **Total Lectures: 48**

SKEG-T116– MANAGERIAL SKILLS

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week : 03 Hours **Total Lectures: 48**

SKEG-T108 – HEALTH EDUCATION

MAX. MARKS: 70 + 30 **MIN. PASS MARKS: 28 + 12**

No. of Lectures per week : 03 Hours **Total Lectures: 48**

MCH- P408 PROJECT/INTERNSHIP WORK IN CHEMISTRY

MAX.MARKS: 100 **MIN. PASS MARKS: 40**

Total Credits: 32

The Students have to prepare a Project/Internship Report under the guidance of respective faculty.
