M.Sc. Chemistry 4th Semester

Choice Based Credit system(CBCS)

Examination Session-2017-18

Course Structure

Code	Course	C/E	L	T	P
MCH - 301	Application of spectroscopy (Organic Chemistry)	Core	3	0	0
MCH - 302	Solid state chemistry	Core	3	0	0
MCH - 303	Organotransition metal chemistry	Core	3	0	0
MCH - 304	polymer chemistry	Core	3	0	0
MCH - 305	Lab-1 (Inorganic chemistry)	Core	0	0	0
MCH - 306	Lab-2 (Organic chemistry)	Core	0	0	3
MCH - 307	Lab-3 (Physical chemistry)	Core	0	0	3
MCH - 308	Industrial Training/Project work	Core	0	0	3
MCH - 309	Assignment	Core	0	0	1
	Total valid credits (TVS*)				20
MCH - 310	Comprehensive Viva-voce	Virtual credit (vc*)			4

TVC*; #20+VC*

SEMESTER IV

MCH-401 : APPLICATION OF SPECTROSCOPY

(Organic Chemistry)

Unit – I

Ultraviolet and visible spectroscopy:

Various electronic transitions (185 - 800 nm) Been-Lambert law, effect of solvent on electronic transitions,ultraviolet bands for carbonyl c, unsaturated carbonyl compounds, dienes, Conjugated polymers, Fieser Woodward rules for Conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds. Steric effect in bipheyls.

Unit – II

Infared Spectroscopy:

Characteristic vibrational frequencies of alkenes, alkenes, alkenes, aromatic compounds, alcohols, ether's, phenols and amines. Detailed study of carbonyl compounds (Ketone's, aldehyde's esters, amides, acids, anhydride's, lactones, lactams and Conjugated carbonyl compounds). Effect of hydrogen bonding and solvent Effect on vibrational frequencies, overtones, combination bands and Fermi resonance.

Optical Rotatory Dispersion (ORD) and Circular Dichromium (CD):

Definition, deduction of absolute configuration, octant rule for ketones.

Unit - III

Nuclear Magnetic Resonance Spectroscopy:

General introduction and definition, chemical shift, spin - spin interaction, shielding mechanism, mechanism of measurement, chemical shift values and correlation for protons bonded to carbon (aliphatic, aliphatic, aldehydic and aromatic) and other nucleir (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto) chemical exchange, effect of deuteration, complex spin – spin interaction between two, three, four and five nucleir (first order spectra), Streochmistry, hindered rotation, Karplus curvevariation of coupling constant with disordered angle. Simplification of complex spectranuclear magnetic double resonanace, NMR shift reagents, solvent effect. Fourier transform technique, nuclear overhauser effect (NOE).

Unit – IV

Carbon – 13 NMR Spectroscopy:

General considerations, chemical shift (aliphatic, oefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon),coupling constants. Two dimension NMR spectroscopy – COSY, NOESY, DEPT, IONEPT, APT and INADEQUATE techniques.

Unit – V

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. Example of mass spectral fragmentation of organic compounds with respect to their structure determination.

Book Suggested:

13. physical Methods for chemistry, R . S. Drago, Saunders company.

14. structural Methods in Inorganic chemistry, E.A.V. Ebswoth, D.W.H. Rankin and S. Cradock, ELBS.

15. Infrared and Raman spectral : Inorganic and Cordination Compounds K.Nakamoto, Wiley.

16. Progress in Inorganic chemistry vol., 8,ed., F.A. Cotton, vol., 15 ed. S. J. Lippard, Wiley.

17. Transition Metal chemistry ed. R.L. Carlin vol. 3 dekker.

18. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.

19. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic chemistry, .v. Parish, Ellis Haywood.

20. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G. J. Martin, Heyden.

21. spectrometric Identification of organic compounds, R. M. Silverstein, G. C. Bassler and T. C. Morrill, john Wiley.

22. Introduction to NMR Spectroscopy, R. J. Abraham, J. Fisher and P. Loftus, Wiley.

23. Application Spectroscopy of organic compounds, J.R. Dyer Prenice Hall.

24. Spectroscopic Methods in organic chemistry D.H. Williams, I. Fleming, Tata McGraw - Hill.

MCH-402: SOLID STATE CHEMISTRY

Unit – I

Solid State Reactions:

General principales, experimental procedure, co- precipitation as a precursory to solid state reactions, kinetics of solid state reactions.

Unit-II

Crystal Defects and Non- Stoichiometry:

Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects line and plane defects. Vacancies-Schottky defects and Frenkel defects. Thermodynamics of Schottky and Frenkel defects formation, colour centers, non-stoichiometry and defects.

Unit-III

Electronic properties and Band Theory:

Metal insulators and semiconductors, electronic structure of solidsband theory band structure of Metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties-Application of optical 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

Organic Solids:

Electrically conducting solids. Organic change transfer complex, Organic metals, new super conductors.

Unit-V

Liquid crystals:

Types of liquid crystals: Nematic, Smectic, Ferroelectric, Anti-Ferroelectric, Various theories of LC, Liquid crystal display, new materials.

Books Suggested:

1. Solid state chemistry and its application, A.R. West. Peenum.
2. Principals of Solid State, H.V. Keer, wiley Eastern.
3. Solid state chemistry, N.B. Hannay.
4. Solid state chemistry, D.K. Chakrabarty, New wiley Eastern.

MCH-403: ORGANOTRANSITION METAL CHEMISTRY

Unit - I

Alkyls and Aryls of Transition Metals:

Type, routes of synthesis, stability and decomposition pathway organocopper in organic synthesis.

Compounds of Transition Metal-Carbon multiple bonds:

Alkylidenes, alkylidynes, low valent carbenes and carbines-synthesis, nature of bond, structural characteristics, nuleophilic reactions of the ligands, role in organic synthesis.

Unit – II

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 reaction relating to nucleophilic and electrophilic attack on ligands and to organic synthesis.

Unit – III

Transition Metal Compounds with bonds to hydrogen, boron, silicon:

Transition Metal Compounds with bonds to hydrogen, boron, silicon

Unit – IV

Homogeneous Catalysis:

Stoichiometric reaction for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta Polymerization of olefins, catalytic reactions involving carbon monoxide such as hydrocarbonylation of olefins (oxo-reaction), oxopalladation reaction, acetic acid synthesis.

Fluxional Organometallic Compounds:

Flexionality and dynamic equilibrium in compounds such as acyctic alkenes, σ - bonded cyclic alkenes, π - bonded cyclic alkenes, metal carbonyls.

BOOKS SUGGESTED:

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.

MCH-404 :POLYMER

Unit – I

Basics:

Importance of polymers. Basic concepts : Monomers, repeat units, 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

Polymer Characterization:

Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersityan molecular weight distribution. The practical significancs of molecular weight. End-group, Viscosity, light scattering, osmotic and ultracentrifugation methods.

Unit – III

Analysis and testing of Polymers:

Chemical analysis of polymers, spectroscopic meathods, X-ray diffraction study. Microscopy . Tharmal analysis and physical testing-tensile strength. Fatigue, impact. Tear resistance, Hardness and abrasion resistance.

Unit – IV

Inorganic Polymers

A general survey and scope of polymers special characteristics, classification, homo and hetero atomic polymers.

Structure, Properties and Applications of

a. Polymers based on boron-boranes and carboranes.
b. Polymers based on Silicon, silicone's polymetalloxanes and polymetallosiloxanes, silazanes.

Unit – V

Structure, Properties and Applications of

a. Polymers based on Phosphorous-Phosphazenes, Polyphosphates.
b. Polymers based on Sulphure-Tetrasulphur tetranitride and related compounds.
c. Co-ordination and metal chelate Polymers.

Books Suggested

1. Inorganic Chemistry, J.E. Huheey, Harper Row.
2. Developments in Inorganic polymers 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 Plymers Science, F.W. Billmeyer Jr. Wiley.
7. Contemporary Polymer Chemistry, H.R. Al cock and F.W. Lambe, Prentice Hall.

M.Sc. IV SEMISTER
PRACTICAL

(Duration : 6-8 hrs in each branch)

Practical examination shall be conducted Separately for each branch.

INORGANIC CHEMISTRY	**M.M.60**
Preparation	12
Spectrophotometric determinations/ Flame Photometric Determinations	30
Record	08
Viva voice	10

Preparation :

Preparation of selected inorgation compounds and their studies by IR, electronic spectra and magnetic susceptibility measurements. Handing 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. Synth., 1985, 23, 194
4. Sodium tetrathionate $Na_2S_4O_6$.
5. Metal complex of dimethyl sulfoxide : $CuCl_2.2DMSO$ J.Chem. Educ., 1982,59,57.
6. Synthesis of metal acethylacetonate : Inorg. Synths, 1957, 5, 130, 1963, 1, 183.
7. Cis and Trans $[Co(en)_2Cl_2]^+$.
8. Determination of Cr (III) complex. $[Cr(H_2O)_6]$ $NO_3.3HO$,. 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)].

Spectrophotometric Determenation

a) Manganese/Chromium in steel sample.
b) Nikel by extractive Spectrophotometric method.
c) Fluoride/nitrite/phosphate.
d) Copper-Ethylene diamine complex : Slope-ratio method.

Flame Photomeric Determenation

a) Sodium and Potassium when present together
b) Lithium/calcium/barium/strontium

c) Cadmium and magnesium in tap water

ORGANIC CHEMISTRY M.M.60

Extraction of organic compounds from natural sources	21
Spectrophotometric Determenation	21
Record	08
Viva voice	10

Extraction of organic compounds from natural surces

1. Isolation of caffenine from tea lesves.

2. Isolation of casein from milk (the studends and required to try some typical color reaction of protein).
3. Isolation of Lactose from milk (purity of sugar should be checked by LC and PC and RF values reported).
4. Isolation of nicotine diorite from tobacco.
5. Isolation of piperine from black pepper.
6. Isolation of Iycopene frome tomato.
7. Isolation of b-carotene from carrots.
8. Isolation of eugenol from clove.
9. Isolation of (+) Iimonine from clove.

Spectroscopy

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

1).Amino acids 2).Proteins 3).Carbohydrates 4).Ascorbic acid5).Aspirin 6).Caffeine

PHYSICAL CHEMISTRY M.M.60

Thermodynamics	21
Polarography	21
Record	08
Viva voice	10

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 solvent having similar intramolecular in tetractions (Benzoic acid in water and in DMSO water mixture and calculate the partial molar heat of solution).

Polarography

i. Identification and estimation of metal ions such as Cd^{+2}, Pb^{+2}, Zn^{+2} and i^{+2} etc. Polarographically.

ii. Study of matal ligand complex Polarographically. (using Lingane's Method).