

M.Sc. (CHEMISTRY) IV SEMESTER  
EXAM. MAY/JUNE 2017

SEMESTER IV

SS-711A

M-171

Paper - XVI

MCH-504 : APPLICATION OF SPECTROSCOPY

( Organic Chemistry )

Unit - I

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#### Ultraviolet and visible spectroscopy:

Various electronic transitions (185 - 800 nm) Beer-Lambert law, effect of solvents on electronic transitions, ultraviolet bands for carbonyl, unsaturated carbonyl compounds, dienes, Fieser Woodward rules for Conjugated dienes, ultraviolet spectra of aromatic compounds, chromophore and auxochrome concept, Effect of conjugation on  $\lambda_{max}$ , allowed and forbidden transitions.

Unit - II

#### Infrared Spectroscopy:

Basic theory, spectrum, molecular vibrations , Detailed study of vibrational frequencies of carbonyl compounds ( Ketone's, aldehydes, esters, amides, acids, anhydrides, lactones, lactams ). Effect of hydrogen bonding and solvent effect on vibrational frequencies, intra molecular factors affecting the carbonyl absorption, overtones, combination bands and Fermi resonance.

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, olefinic, aldehydic and aromatic ) and other nuclei ( alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto ) chemical exchange, effect of deuteration, complex spin - spin interaction between two, three, four and five nuclei ( first order spectra ), Stereochemistry, hindered rotation, Karplus curve variation of coupling constant

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with disordered angle. Simplification of complex spectra, nuclear magnetic double resonance, NMR shift reagents, solvent effect. Fourier transform technique, nuclear overhauser effect (NOE).

#### Unit – IV

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##### Carbon – 13 NMR Spectroscopy:

General considerations, chemical shift ( aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbon ), coupling constants. Two dimensional NMR spectroscopy – COSY, NOESY, DEPT, INEPT and INADEQUATE techniques.

#### Unit – V

##### Mass spectrometry:

Introduction, ion production, FAB, Factors affecting fragmentation, ion analysis, ion abundance Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak. Mc Lafferty rearrangement, Ortho effect, Retro Diels-Alder reaction, homolytic and heterolytic cleavage, Hydrogen transfer reaction, Nitrogen rule. High resolution mass spectrometry. Example of mass spectral fragmentation of organic compounds.

##### Book Suggested:

1. Physical Methods for chemistry, R . S. Drago, Saunders company.
2. structural Methods in Inorganic chemistry, E.A.V. Ebswoth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman spectral : Inorganic and Cordination 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.

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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 and T. C. Morrill, John Wiley.
10. Introduction to NMR Spectroscopy, R. J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application Spectroscopy of organic compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in organic chemistry D.H. Williams, I. Fleming, Tata McGraw - Hill.

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## MCH-505: SOLID STATE CHEMISTRY

### Unit - I

#### Solid State Reactions:

General principles, experimental procedure, co-precipitation as a precursor 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 solids, band theory band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions. Optical properties- Applications of optical and electron microscopy. Magnetic Properties- classification of materials : Effect of temperature, calculation of Magnetic moment,

### Unit-IV

#### Organic Solids:

Electrically conducting solids. Organic charge transfer complex, Organic metals, super conductors , types and applications, new super conductors.

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**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.

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