

M.Sc. Chemistry 2rd Semester
Choice Based Credit system(CBCS)
Examination Session-2017-18
Course Structure

Code	Course	C/E	L	T	P
MCH - 301	Application of spectroscopy (Inorganic Chemistry-III)	Core	3	0	0
MCH - 302	Photochemistry	Core	3	0	0
MCH - 303	Analytical chemistry	Core	3	0	0
MCH - 304	Medicinal 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	Seminar	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 III

MCH – 301 : Application of Spectroscopy

(Inorganic Chemistry)

Unit – I

Vibrational Spectroscopy :

Symmetry and shapes of AB₂, AB₃, AB₄, AB₅, AB₆ mode of bonding of ambidentate ligands, nitrosyl, ethylenediamine and diketonato complexes, application of resonance, Raman Spectroscopy particularly for the study of active sites of metalloproteins.

Unit – II

Electron Spin Resonance Spectroscopy :

Hyperline coupling. Spin polarization for atoms and transition metal ions. Spin - orbit coupling and significance of g- tensors, application to transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals.

Unit – III

Nuclear Magnetic Resonance of Paramagnetic Substances in Solution:

Applications of NMR spectroscopy in co-ordination compounds using examples of metal nuclide ⁷⁷Se, ¹¹³Cd, ¹¹⁹Sn, ¹²⁵Te, ¹⁹⁵Pt, ¹⁹⁹Hg, contrast agents, Shift reagent, Some application related to biochemical systems.

Unit - IV

Mossbauer Spectroscopy :

Basic principles, instrumentation, chemical shift, spectral display Application of the technique to studies of (1) bonding and structure of Fe⁺² and Fe⁺³ compounds including those of intermediate spin,

- (2) Sn^{+2} and Sn^{+4} compounds nature of M - L bond. Co - ordination number, structure and
- (3) detection of oxidation state and inequivalent MB atoms.

Unit – V

Electronic Spectroscopy :

Electronic Spectral studies for $d^1 - d^9$ systems in octahedral, tetrahedral and square planar complexes.

BOOKS SUGGESTED :

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. Craddock, ELBS.
3. Infrared and Raman Spectral Inorganic and Co-ordination 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 and 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 Mc Graw - Hill.

MCH - 302 : PHOTOCHEMISTRY

Unit-I

Photochemical Reactions :

Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

Unit - II

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

Photochemistry of Alkene :

Intramolecular reactions of olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1, 4 - and 1, 5 -dienes.

Photochemistry of Aromatic Compounds :

Isomerisation, addition and substitution.

Unit - IV

Photochemistry of Carbonyl Compounds :

Intermolecular reactions of Carbonyl Compounds-saturated, cyclic and acyclic, α, β , unsaturated and α, β unsaturated Compounds,

cyclohexadienones. Intermolecular cycloaddition reaction-dimerisations and oxetane formation.

Unit - V

Miscellaneous Photochemical Reactions :

Photo-Fries reaction of annelid's, Photo-Fries rearrangement. Barton reaction. Singlet molecular Oxygen reaction. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.

Books Suggested :

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.

MCH – 303 : Analytical Chemistry

Unit – I

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 preparation dissolution and decompositions. Gravimetric techniques.

Selecting and handling of 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

Food analysis :

Moisture, ash, crude protein, fat crude fiber, carbohydrates, calcium, potassium, sodium and phosphate food adulteration common adulterants in food, contamination of food 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

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

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-carorific value.

Unit - V

(a) Clinical Chemistry :

Composition of blood-collection and preservation of sampler. Clinical analysis. Serum electrolytes, 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 in the body.

(b) Drug analysis :

Narcotics and dangerous drug. Classification of drugs.
Screening
by gas thin-layer chromatography and spectrophotometric measurements.

Books Suggested :

1. Analysis Chemistry, G.D. Christian, J.Wicy.
2. Fundamentals o Analytical Chemistry, D.A. Skoog, D.M. West and F.J. Hooler, W.B. Sanuders.
3. Analysis Chemistry-Principles. J.H. Kennedy. W.B. Sanuders.

MCH – 304 : Medicinal Chemistry

Unit - I

Structure and activity :

Relationship between chemical structuare 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, Hansen anaiysis, relationship between free - Wilson analysis and Hanson analysis.

Unit - II

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

Antibiotics and antibacterials :

Introduction, Antibiotic β -Lactam type – Penicillins, Cephalosporins, Antitubercucular-Strephomycin, Board spectrum antibiotic – Tetracyclines, Anticancer-Dactinomycin (Actinomycin D).

Unit - IV

Antifungal - polyenes, Antibacterial - Ciprofloxacin, Norfloxacin,
Antiviral - Acyclovic

Antimalarials : Chemotherapy of malaria. SAR. Chloroquine
Chlorquanide and Mefloquine.

Unit - V

Non - steroidal Anti – inflammatory Drugs : Diclofenac Sodium,
Ibprofen and Netopam

Antihistamic and antiasthmatic agents : Terfenadine, Cinnarizine,
Salbutamol and Beclomethasone disone dipropionate.

M. Sc. III SEMISTER PRACTICAL

(Duration : 6-8 hrs in each branch)

**Practical examination shall be conducted separately of each
branch**

INORGANIC CHEMISTRY

M.M :60

Quantitative determination of a three component mixture / Chromatographic Separations	42
Record	08
Vivavoice	10

Quantitative determination of a three component :

One volumetrically and two gravimetrically

- (a) Cu^{2+} , Ni^{2+} , Zn^{2+} .
(b) Cu^{2+} , Ni^{2+} , Mg^{2+} .

Chromatographic Separations :

- (a) Cadmium and Zinc.
(b) Zinc and Magnesium.
(c) Thin-layer chromatography-separation of Nickel, Manganese, Cobalt and Zinc. Determination of Rf values.

Separation and identification of sugar present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of Rf values.

ORGANIC CHEMISTRY

M.M. :60

Multi-step synthesis of organic compounds	24
Paper Chromatography	24
Record	08
Viva voice	10

Multi-step synthesis of organic compounds :

The exercise should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques. Photochemical reaction Benzophenone \rightarrow Benzpinacol \rightarrow Benzpinacolone Beckmann rearrangement : Benzanilide from benzene Benzene \rightarrow Benzophenone \rightarrow Benzophenone oxime \rightarrow Benzanilide Benzilic acid rearrangement: Benzilic acid from benzoin Benzoin \rightarrow Benzil \rightarrow Benzilic acid Synthesis of heterocyclic compounds Skraup synthesis : Preparation of quinoline

from aniline. Fisher Indole synthesis : Preparation of 2-phenylindole from phenylhydrazine. Enzymatic synthesis Enzymatic reeducation : reduction of ethyl acetoacetate using Baker's yeast to yield enantiomeric excess of S (+) ethyl -3- hydroxybutanoate and determine its optical purity. Biosynthesis of ethanol from sucrose. Synthesis using microwave Alkylation of diethyl malonate with benzyl chloride. Synthesis using phase transfer catalyst. Alkylation of diethyl malonate or ethyl acetoacetate with an alkylhalide.

Paper Chromatography :

Separation and identification of the sugars present in the given mixture of glucose, fructose and sucrose by paper chromatography and determination of R_f values

PHYSICAL CHEMISTRY

M.M. :60

Spectroscopy	22
Chemical Kinetics	20
Record	08
Viva voice	10

Spectroscopy :

- (I) Determination of PK_a of indicator (e.g. methyl red) in (a) aqueous and (b) micellae media.
- (II) Determination of stoichiometry and stability constant of Ferricisothiocyanate complex ion solution.
- (III) Determination of rate constant of alkaline bleaching of Malachite green and effects of ionic strength on the rate of reaction.

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 KMnO_4 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.