

DEPARTMENT OF CHEMISTRY

**SKELETON OF NEW SYLLABUS OF M Sc ORGANIC CHEMISTRY, ACCORDING
TO CHOICE BASED CREDIT SYSTEM (CBCS)**

M.Sc Sem I and II (w e f June 2016)

The following is the skeleton for the syllabus of Sem I and II for M.Sc Chemistry students.

Semester I:

Type of Course	Name of the course	Hours per week	Credits	Marks
CH(C)- 101	Inorganic Chemistry	04	04	100
CH(C)- 102	Organic Chemistry	04	04	100
CH(C)- 103	Physical Chemistry	04	04	100
CH(C)- 104	Spectroscopy and Separation Techniques	04	04	100
CH(ID)- 105	Environmental Chemistry / Education	03	04	100
CCPR 106	Combined Practicals	12	06	200
	Total	31	26	700

Semester II:

Type of Course	Name of the course	Hours per week	credits	Marks
CH(C)- 201	Inorganic Chemistry	04	04	100
CH(C)- 202	Organic Chemistry	04	04	100
CH(C)- 203	Physical Chemistry	4	04	100
CH(C)- 204	Analytical Chemistry	4	04	100
CH(ID)- 105	Research Methodology	4	04	100
CCPR - 206	Combined Practicals	12	06	200
	Total		26	700

M Sc Semester – I

CH-(C)-101: INORGANIC CHEMISTRY

Total Marks : 70

Time : 3 hours

EACH UNIT IS OF 14 MARKS

Unit – 1: Quantum Mechanics and its applications :

14 hours

Basic vector algebra, matrix, determinant, Eigen value equations, quantum mechanical operators, orthogonal functions, Schmidt's orthogonalization technique. Planck's quantum theory, wave-particle duality, uncertainty principle, postulates of quantum mechanics, Schrodinger equation, free particle, particle in a box, degeneracy, harmonic oscillator, rigid rotator, the hydrogen atom, angular momentum, electron spin, spin-orbit coupling. Born-Oppenheimer approximation, Hartree-Fock method, Brillouin theorem, Koopman's theorem, Roothan's equations, models of chemical bonding- Molecular orbital (MO) and Valence bond (VB) theories, application to diatomic molecules such as, H_2 , H_2^+ etc. Quantitative MO theory-Huckel -electron theory and its application to ethylene, butadiene and benzene, energy levels of di- and tri- atomic molecules. Walsh diagrams and molecular geometry.

Unit – 2: Inorganic Reaction Mechanisms

12 hours

Mechanisms of substitution reactions of tetrahedral, square planar, trigonal bipyramidal, square pyramidal and octahedral complexes. Potential energy diagrams, transition states and intermediates, isotope effects, Berry's pseudo rotation mechanism, factors affecting the reactivity of square planar complexes, Swain-Scott equation, Trans effect and its application to synthesis of complexes.

Unit – 3: Moss Bauer Spectroscopy:

10 hours

Introduction of Moss Bauer effect, Isomer shift, Magnetic hyperfine interactions, Applications of the technique to the studies of (i) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (ii) Sn^{+2} and Sn^{+4} compounds – nature of M-L bond, co-ordination number, structure and (iii) detection of oxidation state and in equivalent MB atoms.

Unit – 4: Electron Spin Resonance Spectroscopy:

12 hours

Introduction to ESR, technique of ESR, interaction between nuclear spin and electron spin: hyperfine splitting, calculation and energies of Zeeman levels, ESR spectrum when one electron is influenced by a single proton and one electron delocalized over two equivalent protons, difference between ESR and NMR, EPR spectroscopy- origin of g-shifts and hyperfine coupling, line shape.

Unit – 5: Chemical Bonding:**12 hours**

LCAO-MO theory, Metallic bonding, band theory, hydrogen bonding, VSEPR model. Bonding in alloys, intermetallic compounds. Bonding in non-transition element compounds.

Reference Books:

1. Cotton F A and Wilkinson G: Advanced inorganic chemistry, 5th Ed, J. Wiley & sons, New York (1988).
2. Concept and Models of Inorganic Chemistry, Bodie Douglas, Darl McDaniel, John Alexander
3. Chandra A K: Introductory Quantum Chemistry, 3rd Ed Tata Magrow Hill, New Delhi (1988).
4. Basolo F and Pearson R G : Mechanism of Inorganic Reactions, 2nd Ed, J. Wiley & Sons, New York (1988).
5. Chandra M: Atomic structure and Chemical Bonding (including molecular spectroscopy), 3rd Ed, Tata Magrow Hill, New Delhi (1991).
6. Chatwal & Anand: Quantum Mechanics, Himalaya Publishing House. Katakis, D. & Gordon, G. *Mechanism of Inorganic Reactions* John Wiley & Sons: N. Y (1987).
7. Tobe, M. in *Inorganic Reaction Mechanisms* F. C. Wadlington, Ed., Thomas Nelson: London (1973).
8. Inorganic Chemistry, J.E. Huhey, Harpes & Row.

M.Sc. Semester – I

CH-(C)-102: ORGANIC CHEMISTRY

Total Marks : 70

Time : 3 hours

EACH UNIT IS OF 14 MARKS

Unit – 1: Reactive Intermediates:

12 hours

Carbocations: Classical and non-classical, neighboring group participation, ion-pairs, molecular rearrangements in acyclic, monocyclic and bicyclic systems, stability and reactivity of bridge-head carbocations.

Carbanions: Generation, structure and stability, ambient ions and their general reactions; HSAB principle and its applications.

Carbenes: Formation and structure, reactions involving carbenes and carbenoids.

Nitrenes: Generation, structure and reactions of nitrenes.

Unit – 2: Selected organic reactions and reagents:

12 hours

Chichibabin, Ene, Favorskii, Hofmann-Löffler-Freytag, Michael addition, Lauckart Reaction, Wittig reaction, Stork-enamine, Robinson annulation, Ardent-Estert Reaction

Baker Yeast, Dicyclohexylcarbodiimide(DCC), Gilman's reagent, Tri-*n*-butyl tin hydride(TBTH), Lithium di-isopropyl amide (LDA), 1,3-dithiane, Phase-transfer catalysts, Trimethyl silyl iodide(TMS-I), N-Borosuccinimide (NBS), Osmium tetroxide

Unit – 3: Aromaticity:

12 hours

Introduction, Concept of Aromaticity, non-aromaticity and antiaromaticity, NMR in aromatic character, Huckel's rule and its limitations, non-benzenoid compounds (aromaticity), annulenes, fulvenes, fulvalenes, azulenes.

Unit – 4: Free Radical Reactions

12 hours

Radicals: Generation, structure, stability and reactions, cage effects; Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, reactivity in the attacking radicals, the effect of solvents on reactivity, allylic halogenations (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation.

Unit 5: Elimination Reactions:**12hours**

Mechanism and orientation, reactivity, mechanism and orientation in pyrolytic elimination, Reactions—dehydration of alcohols, Shapiro reaction, conversion of epoxide to olefines, dehalogenation of vicinal halide.

Reference Books:

1. Finar I L: Organic Chemistry, Vol 1 (The Fundamental Principles) 6th Ed Longman (1973).
2. Finar I L: Organic Chemistry, Vol 2 (Stereochemistry and chemistry of Natural Products) 6th Ed Longman (1973).
3. March Jerry: Advanced Organic Chemistry, 4th Ed, Wiley Eastern Ltd., New Delhi (1985).
4. V K Ahluwalia, R K Parasar : Organic Reaction Mechanism, 2nd Ed.
5. G R Chatwal: Reaction Mechanism and Reagents in Organic Chemistry.
6. Morrison R T and Boyd R N : Organic Chemistry, Prentice Hall of India Pvt Ltd., 6th Ed (2003).
7. J P Trivedi: Reaction Intermediates in Organic chemistry, University Granth Nirman Board, Ahmedabad.
8. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
9. Principles in Organic Synthesis, R.O.C. Norman and J.M. Coxon.
10. Organic Chemistry, 7th Edn. T.W Graham Solomons and Craig B Fryhle, John Wiley & Sons, Inc, 2000, New York.

M.Sc. Semester – I

CH-(C)-103: PHYSICAL CHEMISTRY

Total Marks : 70

Time : 3 hours

EACH UNIT IS OF 14 MARKS

Unit - 1: Thermodynamics 12 hours

Brief review of laws of thermodynamic and thermodynamics functions, relation between C_p and C_v , enthalpies of physical and chemical changes, temperature dependence of enthalpies, entropy, Gibbs-Helmholtz equation and calculation of entropy.

Unit - 2: Chemical equilibrium: 14 hours

Free energy and entropy of mixing, partial molar properties, chemical potential, Gibbs-Duhem equation, chemical equilibrium, temperature dependence of equilibrium constant, phase diagram of one and two component systems, phase rule, thermodynamic description of phase transitions, Clapeyron-Clausius equation.

Unit - 3: Ideal and non-ideal solutions: 12 hours

Excess properties, activities, concepts of hydration number, activities in electrolytic solutions, mean ionic activity coefficient, Debye-Hückel treatment of dilute electrolyte solutions.

Unit - 4: Non-equilibrium thermodynamics: 08 hours

Postulates and methodologies, linear laws, Gibbs' equation, Onsager's theory.

Unit - 5: Statistical thermodynamics: 14 hours

Thermodynamics probability and entropy, ensembles, distribution laws of MB, FD and BE, partition functions, rotational, translational, vibrational and electronic partition functions for diatomic molecules, calculation of thermodynamic functions and equilibrium constants, theories of specific heats of solids.

Reference Books:

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Encyclopedia of Physical Chemistry, Vol I – IV, J.C. Moore.
3. Physical chemistry, I.N. Levine, McGraw Hill.
4. Physical chemistry, G.W. Castellan, Narosa.

M Sc Semester – I

CH-(C)-104: SPECTROSCOPY AND SEPARATION TECHNIQUES

Total Marks : 70

Time : 3 hours

EACH UNIT IS OF 14 MARKS

Unit - 1: Infra-Red Spectroscopy: 12 hours

Introduction, basic theory, Instrumentation, Sample handling; Characteristic vibrational frequencies of alkanes, alkenes, alkynes, alcohols, ethers, aromatic compounds, phenols, amines; Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds); Hydrogen bonding and solvent effects on vibrational frequencies, overtones, combination bands and Fermi resonance, FT-IR.

Unit - 2: Mass Spectrometry: 12 hours

Introduction, basic theory, instrumentation and modifications; Unit mass and molecular ions; Important terms-singly and doubly charged ions, metastable peak, base peak, isotropic mass peaks, relative intensity, FTMS, etc.; Recognition of M^+ ion peak; General fragmentation rules; Fragmentation of various classes of organic molecules, including compounds containing oxygen, sulphur, nitrogen and halogens; α -, β -, allylic and benzylic cleavage; McLafferty rearrangement.

Unit - 3: 14 hours

(a) **High Performance Liquid Chromatography:**

Introduction, Principle, instrumentation and Applications

(b) **Gas Liquid Chromatography:**

Introduction, Principle, Instrumentation and Applications

Unit – 4: Hyphenated Techniques: 12 hours

Introduction, Principle, theory, instrumentation and Applications of
GC-MS, LC-MS, HP-TLC

Unit – 5: Ion Exchange and Affinity Chromatography: 10 hours

Introduction, Principle, theory, instrumentation and Applications

Reference Books:

- (1) Bartt L et al : Vogel's Textbook of Quantitative Inorganic Analysis, ELBS 6th Ed.
- (2) Sharma B K : Instrumental methods of Chemical Analysis, Goel Publishing House.
- (3) Silverstein R M, Bassler G C : Spectrometric Identification of Organic Compounds, John Wiley.
- (4) Sharma Y R : Elementary Organic Spectroscopy, Jalandhar.
- (5) Kalsi P S : Spectroscopy of Organic Compounds, New Age International Ltd.
- (6) Sethi P D, High Performance Liquid Chromatography.
- (7) Skoog D A., Loary J I and Saunder W B, Principles of Instrumental Analysis.
- (8) Skoog D A, West D M, Holler F J and Saunder W B, Fundamentals of Analytical Chemistry.
- (9) Sethi P D, HPTLC.

M Sc Semester – I Interdisciplinary

CH-(ID)-105: Environmental Chemistry / Education

Total Marks : 70

Time : 3 hours

Unit – I: Atmospheric Chemistry

20 hours

Composition, structure and functions of atmosphere, atmospheric chemistry, classification of elements, earth's energy budget, reactions in the lower and upper atmosphere, radioactivity in the atmosphere, atmospheric stability, inversions and mixing heights, wind roses

Unit – II: Hydrosphere Chemistry

20 hours

Hydrosphere: Structure and properties of water and their environmental significance, distribution of water in earth, fresh water and its chemistry, solubility of gases in water, role of water in environment Marine chemistry: seawater properties and its constituents, nutrients and salts, Metallic and nonmetallic mineral resources like manganese nodules etc.

Unit – III: Lithosphere and Analytical Tools

20 hours

Lithosphere: Factors and processes of soil development, soil types and their formation, soil profiles, physical and chemical properties Principles of analytical methods: Titrimetry, gravimetry, centrifugation, colourimetry, flame photometry, spectrophotometry, chromatography, electrophoresis, atomic absorption spectrometry

References:

1. K. S. Valdiya, Environmental Geology: Indian Context
2. Hanley, Nick, Jason F. Shrogen & Ben White: Environmental Economics in Theory and Practice, New Delhi: Macmillan – India, 1997
3. A Text book of environmental - C.S. Rao, wiley eastern limited, 1993 pollution and control
4. Environmental chemistry – by B.K.sharma S.H.kaur , goel publishing house meerut, 1992
5. Environmental chemistry – moor, W.A. and moore E.A
6. Chemistry and the Environmental – Johnson , D.O.netterville, J.T. wood, J.C. and james, M., 1973 W.B. saunders company, Philadelphia

PRACTICALS SEM.: I

Inorganic Chemistry:

1. Preparation of Metal Complexes. **40 marks**
2. Qualitative Analysis: Six radicals' separation with one less common ion. **40 marks**

Physical Chemistry: (any two)

80 marks

1. Conductometry: Mono and biprotic acids, mixtures of acids against strong / weak bases, argentometric, complexometric, replacement titrations, verification of Onsager's equation, dissociation of weak acids.
2. Ultrasonic: Acoustical parameters of liquids.
3. Refractometry: Binary mixtures and solids.
4. Polarimetry: Optically active compounds.
5. Partition coefficient: Dimerization of acids, I-I₂ system, Cu₂-NH₃ complexes.
6. Potentiometric: Acid-base, redox and argentometric titrations.
7. pH-metry: Acid-base titration, pK_a of acids.
8. Spectrophotometry: Lambert-Beer's law, binary mixture, kinetics of iodination etc.
9. Chemical Kinetics: Energy coefficient of IInd order reactions.

Viva Voce Examination:

40 marks

EXAM PATTERN

Day 1: Inorganic Chemistry

80 marks

Day 2: Physical Chemistry and Viva

120 marks

Time: 7 hours on each day.

STYLE OF QUESTION PAPER

Q.1 TO Q.5

Each question from one unit of the syllabus. Each question carries **14 marks**. Sub question (a) answer any three out of four or five. Each question of 3 marks and sub question (b) answer any one out of two. Each question of 5 marks.

OR

10 marks of sub question (a) and sub question (b) 4 marks.

Hence Q.1 to Q.5 will be of 70 marks.

Total 70 marks + 30 marks internal.

FORMAT OF INTERNAL ASSESSMENT

TOTAL MARKS 30.

Written test of 50 marks for each paper; Attendance 30 marks; Assignments 100 marks; Behavior 20 marks;

15 % of the above 200 marks.

M Sc Semester – II

CH-(C)-201: INORGANIC CHEMISTRY

Total Marks : 70

Time : 3 hours

EACH UNIT IS OF 14 MARKS

Unit – 1

Magnetic Properties & Electronic Structure of Transition Metal Complexes 14 hours

Brief review of different types of magnetic behavior, spin-orbit coupling, quenching of orbital angular momenta, temperature-independent paramagnetism, measurement of magnetic susceptibility using Gouy and Faraday methods, Term symbols for metal ions; Crystal field theory and its application to explain magnetic properties of coordination compounds, spin crossover; Structural effects: ionic radii and Jahn-Teller effect; octahedral vs. tetrahedral coordination, magnetic properties of Lanthanides and Actinides and splitting of f-orbitals in octahedral field.

Unit - 2: Organometallic Compounds. 10 hours

Introduction and nature of bonding in organometallic compounds of transition metals; σ -bonded organo transition metal compounds, general characteristics, chemical reactions, bonding and structure; π -bonded organometallic compounds: (a) η^2 -alkene complexes; preparative methods, physical and chemical properties, bonding and structure; (b) η^3 -allyl (or enoyl) complexes preparation, physical and chemical properties.

Unit - 3: Bio Inorganic Chemistry 10 hours

Introduction to Bio Inorganic Chemistry, classification and role of metal ions according their action in biological system, essential trace elements and chemical toxicology, introduction of trace elements, the essential ultra-trace metals and nonmetals, iodine and thyroid hormones, toxic elements, toxicity and deficiency, metalloporphyrins, oxygen carriers – hemoglobin and myoglobin, physiology of blood.

Unit - 4: Symmetry and Group Theory in Chemistry 14 hours

Representation of groups – some properties of matrices and vectors, the great Orthogonality theory and its consequences, character tables, Wave functions as the basis for irreducible representations, direct product, identifying non-zero matrix elements, application of symmetry to molecular orbitals, hybrid orbitals, and molecular vibrations.

Unit – 5: Chemistry of d-and f-block elements:**12 hours**

Term-symbols, Russel-Saunders states, Crystal field theory and splitting in O_h , T_d , D_{4h} and C_{4v} systems, Orgel and Tanabe-Sugano diagrams, determination of Dq and Racah parameters, oxidation states and electronic absorption spectra of complex ions. Spectrochemical series and effects of covalency, nephelauxetic series, magnetic properties of transition metal complexes, metal-metal bonds, cluster compounds of d -block elements, poly-oxo metallates of Ru, Os, Mo. Structure and bonding in complexes containing π -acceptor ligands. Relativistic effects affecting the properties of heavier transition elements.

Reference Books:

1. Chandra A K : Introductory Quantum Chemistry, 3rd Ed Tata Magrow Hill, New Delhi (1988).
2. Mehrotra R C and Singh A : Organo Metallic Chemistry, Willey Eastern Pvt. Ltd, New Delhi (1991).
3. K. Hussain Reddy : Bioinorganic Chemistry, New Age International Publishers, New Delhi (2007).
4. Cotton F A : Chemical Applications of group theory, Wiley Estern Pvt. Ltd, New Delhi (1978).
5. Jaffe H H and Orchin M : Symmetry orbitals and spectra, Wiley Interscience (1971).
6. Jaffe H H and Orchin M : Symmetry in Chemistry, Willey Eastern Pvt. Ltd, New Delhi (1991).
7. Concept and Models of Inorganic Chemistry, Bodie Douglas, Darl McDaniel, John Alexander, J Wiley.
8. Dutta & Shyamal : S. Chand & Co.
9. P. Atkins, T. Overton, J. Rourke, M. Weller & F. Armstrong, *Shriver and Atkins Inorganic Chemistry*, Oxford University Press (2006).
10. Sutton, D. *Electronic Spectra of Transition Metal Complexes* McGraw-Hill: New York (1968).
11. Mabbs, F. E. & Machin, D. J. *Magnetism and Transition Metal Complexes* Chapman and Hall: U.K. (1973).

M.Sc. Semester – II

CH-(C)-202: ORGANIC CHEMISTRY

Total Marks : 70

Time : 3 hours

EACH UNIT IS OF 14 MARKS

Unit – 1: Rearrangement Reactions: 12 hours

Rearrangement types, Rearrangement of nitrenes (Hoffman, Curtius, Schmidt, Lossen, Beckman rearrangement) reaction involving acyl cation, PPA cyclization and Fries rearrangement, rearrangement of carbenes (Wolff & Arndt-Eistert synthesis), Rearrangement involving carbonation (Wagner-Meerwein, Pinacol-Pinacolone rearrangement)S.

Unit - 2: Methods in Organic Synthesis 12 hours

Organosilicon Compounds: Preparation and applications in organic synthesis; Applications of Pd(0) and Pd(II) complexes in organic synthesis- Stille, Suzuki and Sonogashira coupling, Heck reaction and Negishi Coupling, Preparation and applications of lithium organocuprates.

Unit – 3: Pericyclic Reactions: 14 hours

Introduction, Main features of Pericyclic reactions; Woodward-Hoffman rules, correlation diagram and FMO approaches; Electrocyclic reactions – Conrotatory and Disrotatory motions for $4n$ and $4n+2$ systems; Cycloadditions – Antrafacial and Suprafacial additions, [2+2] and [4+2] reactions ($h\nu$ and $_$), 1,3-dipolar cycloadditions and chelotropic reactions; Sigmatropic $[i, j]$ shifts of C-H and C-C bonds; Sommelet-Hauser, Claisen, Thio-Claisen, Cope and Aza-Cope rearrangements.

Unit-4: Organic Photochemistry: 10 hours

Introduction to photochemical reactions, *cis-trans* isomerisation, Paterno-Buchi reaction, Norrish type I & II reaction, photo reduction of Ketones, dipimethane rearrangement, photochemistry of arenes, Barton reaction.

Unit -5: Green Chemistry and its applications: 12 hours

Introduction, Principles of Green Chemistry; Concept of green approach; Classification of enzymes and its applications in organic syntheses, biotransformation; Principles and applications of ultrasound, sonication and microwave assisted organic syntheses, Reactions in ionic liquids.

Reference Books:

1. Finar I L: Organic Chemistry, Vol 1 (The Fundamental Principles) 6th Ed Longman (1973).
2. Finar I L: Organic Chemistry, Vol 2 (Stereochemistry and chemistry of Natural Products) 6th Ed Longman (1973).
3. March Jerry: Advanced Organic Chemistry, 4th Ed, Wiley Eastern Ltd., New Delhi (1985).
4. V K Ahluwalia, R K Parasar: Organic Reaction Mechanism, 2nd Ed.
5. P S Kalsi : Stereochemistry of Organic Compounds.
6. S M Mukherjee: Pericyclic Reactions.
7. J Coxon and B Halton: Introduction to Photochemistry.
8. Carey, F.A. & Sundberg, R. J.: *Advanced Organic Chemistry*, Parts A & B, Plenum: U.S. (2004).
9. Carruthers, W.: *Modern Methods of Organic Synthesis* Cambridge University Press (1971).
10. Introduction to Green Chemistry: Albert S. Matlack, CRC Press, Taylor & Francis Group

M.Sc. Semester – II

CH-(C)-203: PHYSICAL CHEMISTRY

Total Marks : 70

Time : 3 hours

EACH UNIT IS OF 14 MARKS

Unit - 1: Reaction Kinetics: 12 hours

Methods of determinations of reaction rates laws, mechanism of photochemical chain and oscillatory reactions, Collision theory of reaction rates, steric factor, treatment of unimolecular reactions, Activated complex theory, comparison of results with Eyring and Arrhenius equations.

Unit - 2: Ionic reactions: 12 hours

Salt-effect, Homogeneous catalysis and Michaelis-Menten kinetics, heterogeneous catalysis. Fast reactions: Luminescence and energy transfer process, study of fast reactions by stopped flow method, relaxation method, flash photolysis, T and P jump and nuclear magnetic resonance method.

Unit - 3: Electrochemistry: 12 hours

Electrodes and electrochemical cell, Nernst equation, electrode kinetics, electrical double layer, electrode/electrolyte interface, batteries, primary and secondary fuel cells, corrosion and its prevention.

Unit - 4: Surface phenomena: 10 hours

Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization; Application of photoelectron spectroscopy; ESCA and Auger spectroscopy to the study of surfaces.

Unit - 5: Solid State Chemistry 14 hours

Solid State Reactions: Types; sintering; nucleation; Factors influencing the reactivity of solids; Precursors to solid state reactions; Tammann and Hedvall mechanism; Wagner's diffusion theory of reaction; Material transport in solid state reaction—counter diffusion, Kirkendall effect; Huttig's mechanism; Kinetic model: Reaction in powder compact, parabolic rate law, Jander's rate equation.

Reference Books:

1. Modern Electrochemistry, Vol. I & II, J.O.M. Bokris and A.K.N. Reddy, Plenum
2. Chemical Kinetics, K.J. Laidler, McGraw Hill.
3. Physical Chemistry, P.W. Atkins, ELBS.
4. Encyclopedia of Physical Chemistry, Vol I – IV, J.C. Moore.
5. Solid State Chemistry, D.K. Chakrabarty, New Age Publishers.
6. Physical Chemistry of Surfaces, Wiley, A.W. Adamson.
7. Textbook of Polymer Science, F.W. Billmeyer, Wiley.
8. A. R. West. *Solid State Chemistry and its Applications*, John Wiley (1998).
9. N. B. Hannay. *Solid State Chemistry*, Prentice-Hall (1979).
10. D. K. Chakraborty. *Solid State*, New Age International, New Deldi (1996).

M.Sc. Semester – II

CH-(C)-204: ANALYTICAL CHEMISTRY

Total Marks : 70

Time : 3 hours

EACH UNIT IS OF 14 MARKS

Unit -1:

14 hours

(a) Food Analysis:

Introduction; Important constituents, Protein, Fat, Crude fiber, Carbohydrate; Essential elements; Oil and fat analysis; Food adulteration and contamination.

(b) Clinical Chemistry: An introduction to the principles and procedures of Clinical Chemistry; Clinical significance of test results, including quality control and reference values; Basic chemical laboratory technique and safety.

Analysis of Body fluids: Introduction to body fluids; Blood samples-collection and preservation; acid-base balance, proteins, carbohydrates, lipids, enzymes, endocrine function, and toxicology, Serum electrolytes, trace elements in the body; blood glucose, blood urea nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphatases; Immunoassay: principles of radio immunoassay (RIA) and applications.

Unit - 2: Fluorimetry and Phosphorimetry:

12 hours

Principle, origin of fluorescence and phosphorescence spectra, types of relaxation processes, variables affecting fluorescence and phosphorescence spectra, instrumentation and applications.

Unit - 3: Dissolution study of Pharmaceutical Drugs

10 hours

Definition, Introduction, Purpose, USP Dissolution Apparatus 1 to 4, sampling and Applications

Unit – 4: Thermal Methods

12 hours

Introduction, Principle, theory, instrumentation and applications of thermogravimetry (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC).

Unit – 5: X-rays methods:**12 hours**

Introduction, Basic theory, Instrumentation and applications of X-ray diffraction, X-ray fluorescence, X-ray absorption and X-ray emission spectroscopy.

Reference Books:

- (1) Skoog D A, West D M : Fundamentals of Analytical Chemistry, Thomson Asia Pvt Ltd. 8th Ed, (2004).
- (2) Bartt L et al : Vogel's Textbook of Quantitative Inorganic Analysis, ELBS 6th Ed.
- (3) Sharma B K : Instrumental methods of Chemical Analysis, Goel Publishing House.
- (4) Mahindru S N : Food Analysis, Swan Publishing House, 23rd Ed.
- (5) Khopkar S M: Basics concepts of Analytical Chemistry, Wiley Eastern
- (6) Physical Methods in Chemistry, R.S. Drago, Saunders College.
- (7) Modern Spectroscopy, J.M. Hollas, John Wiley.
- (8) Instrumental Methods of Analysis, H.H. Willard, East West Press
- (9) Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 4th Edition; David Bruns, Edward Ashwood , Carl Burtis

PRACTICALS SEM II

Organic Chemistry: **40 + 40 marks**

1. Preparation of organic compounds: 1 and 2 stage preparation
2. Organic spotting with spectral interpretation / 2 component mixture separation.

Analytical Chemistry: (ANY ONE IN EXAM) **40 marks**

1. Practicals based on food analysis: Milk, honey, oil, tea-leaves, turmeric powder etc.
2. Drug Analysis: Aspirin, benzyl benzoate, Ascorbic acid, etc.
3. Volumetric and/or gravimetric analysis: Esters, peroxides, etc.

Chromatography (Inorganic) **40 marks**

Viva Voce Examination: **40 marks**

EXAM PATTERN

Day 1: Organic Chemistry **80 marks**

Day 2: Analytical Chemistry, Chromatography and viva **120 marks**

Time: 7 hours on each day.

STYLE OF QUESTION PAPER

Q.1 TO Q.5

Each question from one unit of the syllabus. Each question carries **14 marks**. Sub question (a) answer any three out of four or five. Each question of 3 marks and sub question (b) answer any one out of two. Each question of 5 marks.

OR

10 marks of sub question (a) and sub question (b) 4 marks.

Hence Q.1 to Q.5 will be of 70 marks.

Total 70 marks + 30 marks internal..

FORMAT OF INTERNAL ASSESSMENT

TOTAL MARKS 30.

Written test of 50 marks for each paper; Attendance 30 marks; Assignments 100 marks;
Behavior 20 marks;

15 % of the above 200 marks.

DEPARTMENT OF CHEMISTRY

SKELETON OF NEW SYLLABUS OF M Sc ORGANIC CHEMISTRY, ACCORDING TO CHOICE BASED CREDIT SYSTEM (CBCS)

M.Sc Sem III and IV (w e f June 2017)

The following is the skeleton for the syllabus of Sem III and IV for M.Sc Chemistry students.

Semester III:

Type of Course	Name of the course	Hours per week	Credits	Marks
CCCH – 301	Spectroscopic Techniques	04	04	100
CCCH – 302	Advanced Medicinal Chemistry-I	04	04	100
CCCH – 303	Heterocyclic Chemistry	04	04	100
CECH -304-A	Natural Product Chemistry	04	04	100
CECH -304-B	Selected Topics of Modern Organic Chemistry	04	04	100
CCPR 305	Combined Practicals	12	06	200
		Total	26	700

Semester IV:

Type of Course	Name of the course	Hours per week	credits	Marks
CCCH – 401	Industrial Chemistry	04	04	100
CCCH – 402	Advanced Medicinal Chemistry-II	04	04	100
CCCH -403	Dissertation / Industrial / Institutional Training (2 months) - Report	24	12	400
Viva Voce	Viva Voce	-	06	100
		Total	26	700

In Semester IV, the industrial or institutional training for two months will have to be completed first and then the two compulsory papers shall be taught.

Electives for Semester 3:

Selected Methods in Analytical Chemistry, Bio Organic Chemistry, Advanced Nanotechnology, Computational Chemistry, Instrumentation as a developing Approach in Analytical Chemistry, Synthetic Dye Chemistry,

STYLE OF QUESTION PAPER

Q.1 TO Q.4

Each question from one unit of the syllabus. Each question carries **15 marks**. Sub question (a) answer any three out of 5, 3 marks each, 09 marks of sub question (a). Sub question (b) 6 marks.

Q.5 To attempt any five out the eight short questions, 2 marks each. 2 questions from each unit.

Hence Q.1 to Q.5 will be of 70 marks.

Total 70 marks + 30 marks internal.

FORMAT OF INTERNAL ASSESSMENT

TOTAL MARKS 30.

Assignments, Mid Semester Exam, Skill and attendance.

M.Sc. Semester – III
CCCH-301: Spectroscopic Techniques

Total Marks : 70

Time : 3 hours

Unit-1: (14 hours)

Raman spectroscopy

Introduction, History, Theoretical basis, Raman shift, Instrumentation, Comparison between infrared spectroscopy and Raman spectroscopy, Comparison between fluorescence and Raman spectroscopy, Nature of Raman spectra, Advantages and limitations, Applications.

Unit-2: (14 hours)

Inductively coupled plasma mass spectrometry (ICP - MS)

Introduction to Inductively coupled plasma and Mass spectrometry, Instrumentation, Sample Preparation, Applications.

Unit-3: (14 hours)

Atomic absorption spectroscopy (AAS)

Introduction, Principles, Preparation of samples, Instrumentation, Flame emission, Graphite furnace, Advantages and Limitations, Applications.

Unit-4: (18 hours)

Carbon-13 Nuclear Magnetic Resonance Spectroscopy

Introduction, Comparison between Proton and Carbon 13 NMR, Correlation chart of Chemical shift, Chemical shifts calculation for branched, terminal, Aromatic compounds, Instrumentation, coupling constants, two dimension NMR spectroscopy – COSY, NOESY, DEPT, TOCSY, HETCOR, HMQC HMBC, and INADEQUATE techniques.

Reference Books:

- (1) Bartt L et al : Vogel's Textbook of Quantitative Inorganic Analysis, ELBS 6th Ed.
- (2) Sharma B K : Instrumental methods of Chemical Analysis, Goel Publishing House.
- (3) Silverstein R M, Bassler G C : Spectrometric Identification of Organic Compounds, John Wiley.
- (4) Sharma Y R : Elementary Organic Spectroscopy, Jalandhar.
- (5) Kalsi P S : Spectroscopy of Organic Compounds, New Age International Ltd.
- (6) Sethi P D, High Performance Liquid Chromatography.
- (7) Skoog D A., Loary J I and Saunder W B, Principles of Instrumental Analysis.
- (8) Skoog D A, West D M, Holler F J and Saunder W B, Fundamentals of Analytical Chemistry.

M.Sc. Semester – III

CCCH-302: Advanced Medicinal Chemistry-I

Total Marks : 70

Time : 3 hours

Unit-1: [15 hours]

Introduction, History of Medicinal Chemistry:

Classification of drugs, Important Terminology used in Medicinal Chemistry, **Pharmacokinetics:**

Drug absorption, Distribution, Drug metabolism (General pathway of drug metabolism: Oxidative, reductive and hydrolytic reactions), limitation, Drug excretion, Drug administration, Concept of Pro-drug and Soft-drug.

Unit-2: [15 hours]

Pharmacodynamics:

Principles of drug action, mechanisms of drug action, Introduction to Receptors, Receptor types and subtypes (protein receptors, DNA receptors with examples of Agonists and Antagonists) Chemical messengers and drug receptor interactions, Dose-response relationships, Drug potency and efficacy, Combined effect of drugs.

Unit-3: [15 hours]

Drug Design & Development:

History and development of SAR and QSAR, Concepts drug design, Physiochemical parameters, Lipophilicity, Electronic parameters, Steric parameters, Shelton and surface activity parameters and Redox potentials, Free Wilson and Hansch analysis, other statistical methods, Approaches to lead discovery.

Unit-4: [15 hours]

Introduction, Classification, Synthesis and SAR of:

1. **Antibiotics:** Introduction, Chemical classification.
 - a) β -lactam antibiotics: β -lactamase inhibitors, Penicillins, classification (early, resistant, broad spectrum), SAR of penicillin, adverse effects of penicillin's, Synthesis of Ampicillin, Pivampicillins,
 - b) Cephalosporins: Classification and SAR, Synthesis of Cephalexin, 7- amino cephalosporonic acid,
 - c) Tetracyclines: Introduction and SAR, Synthesis of Methacycline, Doxycycline,
 - d) Macrolides: Introduction and SAR, Synthesis of Azithromycin.

- e) Other: Chloramphenicol.
 - f) Sulphonamide: Classification and SAR,
Synthesis of Sulphamethaxazole, Sulphadiazine
 - g) Sulphones: Synthesis of Dapsone.
 - h) DHFR inhibitors: Synthesis of Trimethoprim, Pyrimethamine.
 - i) Quinolones: Introduction, Classification, SAR, Synthesis of
Fluoroquinolones, Ofloxacin
2. **Anti TB Agents:** Introduction, Classification, Synthesis: Isoniazid, ethambutal, pAS
 3. **Antifungal:** Introduction, Classification, Synthesis of Ketoconazole, 5- flucytosine
 4. **Antihistamines and anti ulcer drugs:** Introduction, Chemical classifications, General SAR, Synthesis of Diphenhydramine, Cetrizine, Ranitidine, Omeprazole.
 5. **Antidepressants:** Introduction, synthesis of Isocarboxazide, dibenzazepines, doxepine, fluoxetine.
 6. **Antianginal:** Introduction, Synthesis of Isosorbiddinatrata, Dipyridamol.
 7. **Oral Hypoglycaemic:** Introduction, Synthesis of Meglitinide, Linoglriride.

Reference Books:

1. Abraham DJ, editor. Burger's Medicinal Chemistry and Drug Discovery, 6th ed. Vol 1- New Jersey: John Wiley & Sons; 2007.
2. Goodman & Gilman. Pharmacological Basis of Therapeutics, McGraw-Hill (2005).
3. S. S. Pandeya & J. R. Dimmock. Introduction to Drug Design, New Age International. (2000).
4. D. Lednicer. Strategies for Organic Drug Synthesis and Design, John Wiley (1998).
5. Graham & Patrick. Introduction to Medicinal Chemistry (3rd edn.), OUP (2005).
6. Medicinal Chemistry — A molecular and Biochemical Approach, Thomas Nogrady and Donald F. Weaver
7. Principles of Medicinal Chemistry, W. O. Foye
8. Wilson and Gisvolds Text book of Medicinal Chemistry
9. The Organic Chemistry of the Drug Design and Drug Action, Richard B. Silverman S
10. Analogue based Drug Discovery, János Fischer and C. Robin Ganellin
11. Goodman and Gilman's Text book of Pharmacology.

12. Chemoinformatics - Concepts, Methods, and Tools for Drug Discovery, Jürgen Bajorath
13. A Kar, Textbook of Medicinal Chemistry; Asian Age Publication.
14. Ahluwalia V K, Chopra Madhu, Medicinal Chemistry; Ane Books India.

M.Sc. Semester – III
CCCH-303: Heterocyclic Chemistry

Total Marks : 70

Time : 3 hours

Unit-1: [16 hours]

Introduction and Nomenclature of Heterocycles

Introduction to Heterocyclic Chemistry, Methods of nomenclature of Heterocyclic compounds for monocyclic, fused, spiro and bridged heterocycles.

Aromatic and Non aromatic Heterocycles

General Chemical Behaviour of aromatic heterocycles, classification (structural type), Introduction to bond angle strain and torsional strain, Conformation of 6 membered heterocycles with reference to molecular geometry.

Unit-2: [12 hours]

Chemistry of cyclopropane and cyclobutane hetero analogues

Preparation and properties of aziridine and azirine, oxirane and oxirene, azitidine, oxetane and thietane.

Preparation of diazirine and oxaziridine.

Unit-3: [16 Hours]

Hetero analogues of five member ring system

Preparation and properties of pyrrole, furan, thiophene, pyrazole and imidazole.

Preparation of phosphole, benzaluminol, isoindole, indolizine, dibenzofuran, isobenzofurans, carbazole, isoxazole, oxazole, isothiazole and thiazole.

Unit-4:

[16 hours]

Heterocyclic analogues of higher ring systems with one or more hetero atoms

Synthesis and reactions of pyridine, pyran, quinoline, isoquinoline, acridine and phenanthridine.

Synthesis of 2-pyrones, 4-pyrones, benzopyran, benzo-2-pyrones and benzo-4-pyrone, azepine, thiepine, diazepine.

Preparation of pyridazine, pyrimidine, pyrazine, oxazine, thiazine, dioxane, quinazoline, quinaxaline, cinnoline, pteridine, triazenes.

Reference Books:

1. Bansal R K, Heterocyclic Chemistry.
2. Acheson R H, An introduction to the chemistry of Heterocyclic compounds.
3. Trivedi J J, Chemistry of Heterocyclic Compounds.
4. Gupta R R, Kumar M and Gupta V, Heterocyclic Chemistry, Springer.
5. Eicher T and Hauptmann S, The Chemistry of Heterocycles.
6. Joule J A, Mills K and Smith G F, Heterocyclic Chemistry.
7. Gilchrist T L, Heterocyclic Chemistry.

M.Sc. Semester – III
CECH-304 A: Chemistry of Natural Products

Total Marks : 70

Time : 3 hours

Unit-1: [16 hours]

Introduction to Natural Product Chemistry.

Natural Pigments

Introduction, Classification, Carotenoids – Isolation and Separation, General properties, Methods of elucidation of constitution, Classification, Chemistry of β -carotene, Synthesis of α -carotene; Anthocyanins – Introduction, Determination of structure and synthesis; pyrrole pigments – Porphyrins, General properties and synthesis, Chemistry of haemoglobin.

Unit-2: [14 hours]

Vitamins

Introduction and classification of vitamins; Chemistry of Vitamin A, B, E and K. Synthesis of Riboflavin, Pyridoxine, Vitamin C, Niacin, Pantothenic acid, Folic acid.

Unit-3: [16 hours]

Alkaloids

Introduction of Alkaloids – Occurrence, Functions, Nomenclature, Classification, Isolation and properties, Determination of molecular structure of alkaloids, Chemistry of ricinine, atropine and papavarine, Synthesis of morphine, nicotine, colchicine and strychnine.

Unit-4: [14 hours]

Terpenoids

Introduction of Terpenoids – Isolation, Classification, General Characteristics, Structural features or Isoprene rule, Chemistry of Citral, Carvone, α -pinene, Farnesol and Squalene.

Reference Books:

1. Alta-Ur-Rehman and Chaudhary M I, New trends in Natural Product Chemistry.
2. Bhat Sujata, Chemistry of Natural Products; Springer-Narosa.
3. Singh Ayodhya, Chemistry of Natural Products Vol 1 and 2.
4. Organic Chemistry Natural Products Vol 1 and 2; Krishna Publication Media (P) Ltd., Meerut.
5. Organic Chemistry by I L Finar, Vol 2, Pearson Education India.

M.Sc. Semester – III

CECH-304 B: Selected Topics in Modern Organic Chemistry

Total Marks : 70

Time : 3 hours

Unit-1: [14 hours]

Stereochemistry

Geometrical isomerism, Stereochemistry of Allenes, Optical rotation and Optical rotatory dispersion, Uses of achiral and chiral heterogeneous and homogeneous catalysts, Stereochemistry of five & six member rings fused & bridged rings, Stereo selective synthesis and stereo regulated polymerization.

Unit-2: [18 hours]

Organic Synthesis – A disconnection approach

Introduction to disconnection, concept of Synthons, Synthetic Equivalent, functional group inter conversion, concept and design of synthesis, criteria of good disconnection.

Protecting Groups:

Protection of organic functional groups, protecting reagents and removal of protecting groups.

One Group disconnection: Disconnection and synthesis of alcohols, olefins, simple ketones, acids and its derivatives.

Two Group Disconnection: Disconnection in 1, 3-dioxygenated skeletons, preparation of β -hydroxy carbonyl compounds, α , β -unsaturated carbonyl compounds, 1, 3-dicarbonyls, 1, 5-dicarbonyls and use of Mannich Reaction.

Unit-3: [14 hours]

Fundamentals of Biochemistry:

Introduction of Biochemistry, Amino acids: peptides, primary, secondary, tertiary, and quaternary structure of proteins. Nucleic acids: Base pairing, double helices, Chemical and enzymatic hydrolysis of nucleic acids; Structure and function of mRNA, tRNA, rRNA; DNA replication, transcription and translation, Amino acid sequencing; amino acid metabolism (biosynthesis and degradation).

Fatty acid metabolism: Biological importance of fatty acids even chain and odd chain fatty acids, saturated and unsaturated fats, ketone bodies, fatty acid metabolism, biological membranes.

Protein-related transformations: urea cycle, uric acid and ammonia formation.

Unit-4:

[14 hours]

Biochemistry of naturally occurring Macro molecules:

Classification: classification based on chemical structure, physiological activity, taxonomy and biogenesis.

Monoterpenes and sesquiterpenes: bisabolene, juvabione, transchrysanthamic acid, logifolene, taxines, caryophyllene.

Steroids: Synthesis and functions of cholesterol, ergo sterol, progesterone, testosterone, cortisone.

Plant Hormones: gibberellins, gibberellic acid.

Peptides: bradykinin, oxytocin, vasopressins, gramicidins.

Carbohydrates, proteins and lipids.

Reference Books:

1. Albert L. Lehninger, David L. Nelson, Michael M. Cox., Principles of Biochemistry, CBS Publishers and Distributors, 1993.
2. Lubert Stryer, Biochemistry, W. H. Freeman and Company, 4th edition, 1995.
3. Christopher K. Mathews and K. E. Von Holder, Biochemistry, Benjamin/Cummings, 1990.
4. Eric E. Conn, Paul K. Stumpf, George Breening and Roy H. Doi, Outlines of Biochemistry, 5th edition, John Wiley and Sons, 1987.
5. F. A. Carey and R. J. Sundberg, (Eds) 3rd Edition, Part B. Plenum/Rosetta, 1990.
6. I. Fleming, Selected Organic Synthesis, John Wiley and sons, 1982.
7. Atta-ur-Rehman, Studies in Natural Products Chemistry, Vol.1 and 2, Elsevier, 1988.
8. T. Lindberg, Strategies and Tactics in Organic Synthesis, Academic Press, 1984.
9. Fuhrhop J, Organic synthesis – concept, methods and starting materials.
10. Warren, Disconnection Approach
11. Eliel, E.L., Stereochemistry of Carbon compounds MC. Graw Hill Book Company, Inc. New York
12. Stereochemistry by P. S. Kalsi (New Age International)
13. Warren S, Designing organic synthesis; Wiley.

M.Sc. Semester – III
CEPR 305
COMBINED PRACTICALS IN ORGANIC CHEMISTRY
TOTAL MARKS 200

- | | |
|---|-----------------|
| 1. Multistep synthesis of organic compound using TLC | 40 Marks |
| 2. Drug and Functional group Estimation | 40 Marks |
| 3. Organic Mixture Separation. | 40 Marks |
| 4. Spectral Analysis | 40 Marks |
| 5. Viva Voce | 40 Marks |

Exam Pattern:

Day 1. Synthesis and Drug Estimation

Day 2. Organic Mixture separation, Spectral analysis and Viva.

Time: 7 hours daily.

M.Sc. Semester – IV
CCCH-401: Industrial Chemistry

Total Marks : 70

Time : 3 hours

UNIT-1:

16 hours

Regulatory Affairs

Concept of total quality management (QC and QA), requirements of GMP, GLP, Regulatory requirements of drugs and Pharmaceutical (USFD-NDA/ANDA & ICH guide line), SOP of SOP, Standard operating procedures (SOP) and documentation.

UNIT-2:

14 hours

Industrial Skills

Basic concept, factors affecting the plant location, Plant layout, main objects of scientific layout, factors affecting layout, Management of Human Resources recruitment and selection, training and development, industrial safety, welfare of employees, Materials Management , Inventory Control and Introduction of patents.

UNIT-3:

14hours

Unit Processes and Operations

Nitration, oxidation, sulphonation, reduction, halogenations,.

Filtration, extraction, crystallization, drying, distillation.

Agrochemicals:

Pesticides: endosulphan, methyl parathione.

Fungicides: zerum, thirum, kasugancycin.

Herbicides:alachlor, suphonyl ureas.

UNIT-4:

16 hours

Ceramics and Explosives.

Ceramics: classification–Basic raw material- Application of colours to pottery porcelain and china ware- manufacture.

Glass-raw materials, Manufacture of special glass-optical Borosilicate, flint and coloured glasses.

Explosives: classification, characteristics-special explosives-nitrocellulose-T.N.T, Picric acid,Dynamite-cordite and Gunpowder.

Synthetic Perfumes

Definition, classification, synthesis and uses of: ester of cinnamic acid, linalool, phenyl ethyl alcohol, civetone, musk ambrette, alpha and β -ionones, alpha and β -irones.

Reference books:

1. Willing, S.W., & Stoker, Good Manufacturing Practicesfor Pharmaceuticals, Marcel Dekker, New York.
2. Federal Food, Drug & Cosmetic Act.
3. Pisano-FDA Regulatory Affairs.
4. Indian, Pharmacopoeia, British Pharmacopoeia and U. S. Pharmacopoeia.
5. B.K. Sharma, Industrial Chemistry.
6. Guidelines on GMP/GLP by S. Lyer.
7. Chemical process industries by N.D. Shreve.
8. Applied chemistry for Engineer by Diamont.
9. Engineering chemistry by B.K. Sharma.
10. Industrial Chemistry by BK Sharma, Goel Publishing house Meerut.
11. Dryden's outlines of Chemical Technology 2nd Edn., edited and revised by M. Gopala Rao, Marshel sitting – East West Press, 1973.

M.Sc. Semester – IV
CCCH-402: Advanced Medicinal Chemistry-II

Total Marks : 70

Time : 3 hours

UNIT-1: [15 hours]

Introduction, classification, synthesis and SAR of:

1. **Antihypertensive:** Introduction, Synthesis of Methyldopa, Propanolol, Atenolol, Nifedipine.
2. **Antihyperlipidemics:** Introduction, Synthesis of Fluvastatine, Benzafibrate, Fenofibrate.
3. **Anticonvulsants:** Introduction, General Synthesis and SAR of Hydantoins, Synthesis of Vigabatrin, Sodium valproate, Denzimol.
4. **Antipsychotic:** Introduction, Synthesis of Thiothixene, Haloperidol, Pimozide, Ziprasidone, Seretindole.
5. **Antiarrhythmic drugs:** Introduction, Synthesis of Procanamide, Mexiletine, Encainide, Flecainide, Amiodarone.
6. **Antipyretics and NSAIDs:** Introduction, Classification, Synthesis Of Aspirin, Paracetamol, Phenylbutazone, Indomethacin, Ibuprofen, Diclofenac, Ketoprofen, Tenoxicam, Nimesulide, Anlagin.
7. **Oral anticoagulants:** Introduction, Synthesis of Warfarine, Dicumarol,

UNIT-2: [15 hours]

Introduction, classification, synthesis and SAR of:

1. **Anaesthetics:** Introduction, Classification, Synthesis of **General Anaesthetics:** Halothane, Ketamine, Methohexetal sodium.
Local Anaesthetics: Benzocaine, Procaine hydrochloride, dipiperdone, Lidocaine hydrochloride.
2. **Diuretics:** Introduction, Synthesis of Acetazolamide, Methazolamide, Thiazide diuretics, Zipamide.
3. **Adrenergics:** Introduction, Synthesis of Adrenaline, Salbutamol, Ephedrine, Xylometazoline.
4. **Cholinergic drugs:** Introduction, Synthesis of Pilocarpine, Isofluorophate, Neostigmine, Cyclopentolate.
5. **Narcotic Analgesics:** Introduction, Synthesis of Levallorphan, Mepiridine (pethidine), Pentazocine.

- 6. Sedatives, Hypnotics and Anxiolytics:** Introduction, Synthesis of Phenobarbital, Diazepam, Bromazepam, Meprobamate, Zaleplan, Buspirone.
- 7. Miscellaneous CNS drugs:** Introduction, Synthesis of Levodopa, Mefanicin, Baclofen, Phenserine, Ecopizil.

UNIT-3:

[14 hours]

Chemotherapy of Cancer:

Introduction, Brief Molecular biology of cancer and types of cancer, SAR and mechanism of action of alkylating agents and antimetabolites, Antitumor antibiotics, Drug resistance in cancer chemotherapy, Novel targets and recent developments in cancer therapy.

Anti Viral Agents:

Structure and life cycle of virus and viral diseases, Antiviral agents used against DNA virus- in different diseases, Antiviral agents used against RNA virus - HIV, influenza

UNIT-4: Combinatorial Chemistry:

[16 hours]

Introduction, Terminology used in Combinatorial Chemistry, Concept including automation, Solid phase and solution phase of synthesis (**SPPS & SPOS** concept) and related other methodologies, scavengers, linkers, preparation and study of targeted-focused libraries, Approaches to lead discovery, Microwave assisted organic syntheses and applications of Combinatorial Chemistry

REFERENCE BOOKS:

1. Abraham DJ, editor. Burger's Medicinal Chemistry and Drug Discovery, 6th ed. Vol 1- New Jersey: John Wiley & Sons; 2007.
2. Hansch C, editor. Hansch's comprehensive medicinal chemistry, Delhi: Rajkamal Electronic Press; 2005.
3. Silvermann RB. The organic chemistry of drug design and drug action. 2nd ed. London: Academic press (Elsevier); 2004.
4. A Kar, Textbook of Medicinal Chemistry; Asian Age Publication.
5. Ahluwalia V K, Chopra Madhu, Medicinal Chemistry; Ane Books India.
6. Sriram D and Yogeshwari P, Medicinal Chemistry; Pearson Education.

7. Ariens EJ, editor. Drug design vol. I-X. Noida: Academic Press; 2009.
8. Lednicer D, Mitscher LA, The organic chemistry of drug synthesis, Volume-1-6. New York: A wiley-interscience publication; 2005.
9. Alagarsamy V, Text Book of Medicinal Chemistry, New Delhi; Elsevier: 2010.
10. Roth HJ, Kleemann A. Pharmaceutical Chemistry. Vol-I. Drug synthesis. New York: Ellis Horwood Limited; 1988.
11. Lemke TL, Williams DA, editor. Foye's principles of medicinal chemistry. 6th ed. New Delhi: Wolters Kluwer and Lippincott Williams & Wilkins; 2008.
12. Andrejus K. Essentials of Medicinal Chemistry. 2nd ed. New Delhi: John Wiley & Sons; 1988.
13. Testa B, Jenner P. Drug metabolism: chemical and biochemical aspects, New York: Marcel Dekker; 1976.
14. Block JH, Beale JM, editor. Wilson and Gisvold's textbook of organic medicinal and pharmaceutical chemistry. 11th ed. Baltimore: Lippincott Williams & Wilkins; 2004.
15. Gyorgy K, Istvan T. Molecular pathomechanisms and new trends in drug research. New York: Taylor & Francis; 2003.
16. Handbook of Combinatorial Chemistry: Drugs, Catalysts, Materials ISBN: 9783527305094, 3527305092, Edition: 2 Volume Set, 2002, (Publisher: John Wiley
17. Combinatorial Chemistry: Synthesis, Analysis, Screening E-Book edited by Gunther Jung (Editor), ISBN: 978-3-527-61351-9, July 2008

M.Sc. Semester – IV
CCCH-403: Dissertation / Industrial / Institutional Training
TOTAL MARKS 400

Students are supposed to undergo a vigorous training at Industrial Institutes of level of Production, Quality Control and Research & Development. The duration of training will be 2 months (8 weeks) immediately after the completion of practical and theory examination of Semester III. The students will be called for one presentation of work done by them duly endorsed by the Industry / Institution guide at the completion of one month of training. At the end of two months they shall have to study two papers. During this they shall have to present the second presentation of industrial / intuitional training and there after submit a detailed report before the start of the semester IV examination.

Teaching faculty may visit the industrial / intuitional as per prevailing circumstances during this two months training period.

Two presentations of 100 marks each shall be evaluated and from it 30 % marks will be considered for internal evaluation.

Total Marks : 400

Internal marks : 120 Dissertation: 280 marks

M.Sc. Semester – IV
Viva Voce
TOTAL MARKS 100

All students will be examined for a detailed Viva Voce of 100 marks. They will be asked questions from the entire syllabus as well as industrial training. This may be arranged after completion of theory examination of Semester IV.