Scheme of Examination for M.Sc. (Chemistry)

Semester IV	Internal Assessment	Total Marks	Credits
CH-401: Paper XIII (Spectroscopy)	20 Marks	80 Marks	4 Credits
CH-402: Paper XIV (Special I-Inorganic /Organic/ Physical/Analytical)	20 Marks	80 Marks	4 Credits
CH-403: Paper XV (Special II-Inorganic /Organic/ Physical/Analytical)	20 Marks	80 Marks	4 Credits
CH-404: Paper XVI (Elective- Applied Analytical/ Nuclear/ Environmental /Polymer/Medicinal)	20 Marks	80 Marks	4 Credits
CH-405: Practical VII- Special (Inorganic /Organic/ Physical/Analytical)	20 Marks	80 Marks	4 Credits
CH-406: Practical VIII- Project	20 Marks	80 Marks	4 Credits
CH-407: Seminar-IV	--------	25 Marks	1 Credit
Total:	***120 Marks***	***505 Marks***	***25 Credits***

General scheme for distribution of marks in practical examination

Time : 6-8 h (One day Examination) Total Marks : 80)

Exercise-1 - 30 Marks

Exercise-2 - 20 Marks

Viva-Voce -15Marks

Record -15 Marks

Syllabus prescribed for M.Sc. Chemistry Semester IV

CH-401: Paper XIII (Spectroscopy)

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: **15 h**

A] Ultraviolet and visible spectroscopy: Natural line width, line broadening, transition probability, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels. General nature of band spectra. Beer- Lambert Law, limitations, Frank-Condon principle, various electronic transitions, effect of solvent and conjugation on electronic transitions, Fiesher Wooodward rules for dienes, aldehydes and ketones. Structure differentiation of organic molecules by UV Spectroscopy

B] Photoelectron spectroscopy: Basic principles, photoelectric effect, ionization process, Koopman theorem, PES and XPES, PES of simple molecules, ESCA, chemical information from ESCA, Auger electron spectroscopy.

Unit II: Nuclear magnetic Resonance Spectroscopy **15 h**

Magnetic properties of nuclei, resonance condition, NMR instrumentation, chemical shift, spin spin interaction, shielding mechanism, factors affecting chemical shift, PMR spectra for different types of organic molecules, effect of deuteration, complex spin spin interaction (1^{st} order spectra), stereochemistry, variations of coupling constant with dihedral angle, electronegativity, Karplus equation etc., classification of molecules as AX, AX_2, AMX, A_2B_2, Shift reagents. NMR studies of ^{13}C, chemical shift in aliphatic, olefinic, alkyne, aromatic, heteroatomic and carbonyl compounds, ^{19}F, ^{31}P. Structure determination of organic molecules by NMR spectroscopy,

Unit III: **15 h**

A] Application of NMR spectroscopy: FT-NMR, advantages of FT-NMR, use of NMR in medical diagnosis, 2 dimensional NMR spectroscopy-COSY, NOSEY, DEPT, INEPT, APT, INADEQUATE techniques, Nuclear overhauser effect, nuclear quadrupole resonance spectroscopy: quadrupole nuclei, quadrupole moment, electric field gradient, coupling constant, splitting, applications.

B] Problems based on structure determination of organic molecules by using combined spectral techniques.

Unit IV: Diffraction techniques **15 h**

X ray diffraction: Braggs condition, Miller indices, Laue method, Bragg method, Debye Scherrer method, identification of unit cells from systematic absences in diffraction pattern,, structure of simple lattices and x-ray intensity, structure factor and its relation to intensity and electron density, absolute configuration of molecules, Ramchandran diagram.

Electron diffraction: scattering intensity vs scattering angle, Wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules, low energy electron diffraction and structure of surfaces.

Neutron diffraction: Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques, elucidation of structure of magnetically ordered unit cell.

List of books

1] Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morril, John Wally

2] Introduction to NMR spectroscopy-R. J. Abraham, J. Fisher and P Loftus Wiely

3] Application of Spectroscopy to Organic Compound-J. R. Dyer, Printice Hall

4] Organic Spectroscopy-William Kemp, ELBS with McMillan

5] Spectroscopy of Organic Molecule-PS Kalsi, Wiley, Esterna, New Delhi

6] Organic Spectroscopy-RT Morrison and RN Boyd

7] Practical NMR Spectroscopy-ML Martin, JJ Delpench, and DJ Martyin

8] Spectroscopic Methods in Organic Chemistry-DH Willson, I Fleming

9] Fundamentals of Molecular Spectroscopy-CN Banwell

10] Spectroscopy in Organic Chemistry-CNR Rao and JR Ferraro

11] Photoelectron Spectroscopy-Baber and Betteridge

12] Electron Spin Resonance Spectroscopy-J Wertz and JR Bolten

13] NMR –Basic Principle and Application-H Guntur

14] Interpretation of NMR spectra-Roy H Bible

15] Interpretation of IR spectra-NB Coulthop

16] Electron Spin Resonance Theory and Applications-W gordy

17] Mass Spectrometry Organic Chemical Applications, JH Banyon

18] Spectroscopy- H. Kaur

INORGANIC CHEMISTRY SPECIALIZATION

CH-402: Paper XIV (Special I-Inorganic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit-I **15h**

A) Nanoparticals & Nanostructural materials :Introduction, methods of preparation, physical properties, and chemical properties. Molecular Precursor routes to inorganic solids:- Introduction, sol-gel chemistry of metal alkoxide, hybrid organic-inorganic compounds. Nanoporous Materials: Introduction, Zeolites & molecular sieves, determination of surface acidity, porous lamellar solids, composition-structure, preparation & applications.

B) Solid State Reaction: General principles, reaction rates, reaction mechanism, reaction of solids, factors influencing reactivity, photographic process.

Unit-II **15h**

A) **Coordination Polymers**:

Coordination polymers and their classification. Synthesis and applications of coordination polymers. Use of polymeric ligands in synthesis of coordination polymers. Organosilicon polymers. Synthesis and their uses.

B) **Characterization of coordination polymers on the basis of**:

i) Spectra (UV, Visible, IR and NMR)

ii) Magnetic and thermal (TGA,DTA and DSC) studies

Unit-III **15h**

Catalysis: Basic principals, thermodynamic and kinetic aspects, industrial requirements, classification, theories of catalysis, homogeneous and heterogeneous catalysis.Introduction, types & characteristics of substrate-catalyst interactions, kinetics and energetic aspects of catalysis, selectivity, stereochemistry, orbital symmetry and reactivity. Catalytic reactions of coordination and Organometallic compounds including polymerization activation of small molecules, addition to multiple bonds, hydrogenation Zeigler-Natta polymerization of olefins, hydroformylations, oxidations, carbonylations and epoxidation.

Unit-IV **15h**

A) **Supramolecular chemistry:**Molecular recognition: Molecular receptors for different types of molecules including arlsonic substrate, design nad synthesis of co receptor molecules and multiple recognition. Supramolecular reactivity and catalysis.Transport processes and carrier design. Some examples of self-assembly in supramolecular chemistry.

B) **Thin films and languir-Biodgett films**: Preparation technique, evaporation/spultering, chemical processes, MOCVD, solgel etc. Languir-Biodgett(LB) film, growth techniques, photolithography properties and applications of thin and LB films.

List of books:

1. Barsoum ,M.W.,Fundamentals of Ceramics,McGraw Hill ,New Delhi
2. Ashcroft ,N.W. and Mermin,N.D.,Solid Stae Physics,Saunders College
3. Callister W.D.,Material Science and Engineering, An Introduction,Wiley
4. Keer,H.H,Principals of Solid State,Wiley Eastern
5. Anderson J.C.,Lever K.D.,Alexander J.M and Rawlings,R.D.,ELBS
6. Gray G.W.Ed.Thermotropic Liquid Crystals,John Wiley
7. Kelkar and Hatz Handbook of Liquid Crystals,Chemie Verlag.
8. Kalbunde K.I.,Nanoscale Materials in Chemistry,John Wiley,NY.
9. Shull R.D.,McMichael R.D. and Swartzendrub L.J.,Studies of Magnetic Properties of Fine particles and their relevance to Mataerials Science, Elsevier Pub. Amsterdam

CH-403: Paper XV (Special II-Inorganic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit-I **15 h**

A) Basics of Photochemistry: Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped flow techniques, Energy dissipation by radiative and no-radiative processes, absorption spectra Frank-Condon principles; photochemical stages-primary & secondary processes.

B) Properties of excited states: Photochemical kinetics,Calculation of rates of radiative processes.

C) Excited States of Metal Complexes: Electronically excited states of metal complexes, charge transfer spectra, charge transfer excitations, metods for obtaining charge transfer spectra.

Unit-II **15h**

A) Ligand field Photochemistry: photosubstitution, photo oxidation & photoreduction. Liability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero-zero spectroscopic energy, development of the equations for redox potentials of the excited states.

B) Redox reactions by Excited Metal Complexes: Energy transfer under conditions of weak interaction & strong interaction – exciplex formation, conditions of excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2-bipyridine & 1,10-Phenanthroline complexes.), illustration of reducing and oxidizing character of ruthenium (II); role of spin-orbit coupling, lie time of these processes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants in to highenergy products, chemical energy in to light.

C) Metal Complex Sensitizers: Metal Complex Sensitizers, electron relay, metal colloid systems, and semiconductor supported metal or oxide systems, water photolysis, nitrogen fixation & carbon dioxide reduction.

Unit-III **15h**

Organotransition Metal Chemistry: Alkyls and Aryls of Transition Metals: Types, routes of synthesis, stability & decomposition pathways of alkyls & aryls of transition metals. Organocopper in Organic synthesis. Compounds of Transition Metal –Carbon Multiple bonds: Alkylidenes, alkylidynes, low valent carbenes & carbynes–synthesis, nature of bond, structural characteristics, nucleophilic & electrophilic reactions on ligands, role inorganic synthesis.

Unit-IV **15h**

Transition Metal Pi Complexes-Carbon multiple bonds. Nature of bonding, structural characteristics & synthesis, properties of transition metal pi- Complexes with unsaturated organic molecules, alkenes alkynes,

allyl, diene, dienyl, arene & trienyl complexes. Application of transition metal, organometallic intermediates in oraganic synthesis relating to nucleophilic & electrophilic attack on ligands, role in organic synthesis.

List of books:

1. Elschenbroich Ch.and Salzer A.: Organometallics, VCH,Weinheim, NY.
2. Balzani Vand Cavassiti V.:Photochemistry of Coordination compounds,AP,London
3. Purcell K.F.and KotzJ.C., An Introduction to Inorganic Chemistry,Holt Sounder,Japan.
4. Rohtagi K.K.and Mukharjee,Fundamentals of Photochemistry,Wiley eastern
5. Calverts J.G.and Pits.J.N.,Photochemicals of Photochemistry,John Wiley
6. Wells,Introduction of Photochemistry
7. Paulson,Organometallic Chemistry,Arnold
8. Rochow,Organometallic Chemistry,Reinhold
9. Zeiss,Organometallic Chemistry,Reinhold
10. Gilbert A.and Baggott,J,Essential of Molecular Photochemistry,Blackwell Sci.Pub.
11. Turro N.J.and Benjamin W.A.,Molecular Photochemistry
12. CoxAand Camp,T.P.Introductory Photochemistry,McGraw-Hill
13. KundallR.P.and GilbertA,Photochemistry, Thomson Nelson Coxon J and Halton B.,Organic Photochemistry, Cambridge University Press.

CH-405: Practical-VII (Inorganic Chemistry Special)

9 h /week Marks: 80

A) Preparation and characterization of following the following complexes/organometallic compound including their structural elucidation by the available physical methods. (Element analysis, molecular weight determination, conductance and magnetic measurement and special studies) Selection can be made from the following:

i) Cis and trans isomers of bis(glycinato) copper(II) monohydratye.

ii) N,N-bis (salicylaldehyde) ethylene diaminato nickel(II)

iii) Trinitrotriamine cobalt(III)

iv) Cis and trans disubstituted octahedral Cr (III) complexes $[CrF_2(en)_2]$.

v) Preparation of Grignard reagent

vi) Ferrocene and its acelytion

vii) Sodium amide

viii) Synthesis of trichlorodiphenylantimony(V) hydrate.

ix) Synthesis of metal acetylacetonate: magnetic moment, IR, NMR.

x) Magnetic moment of $Cu(acac)_2H_2O$

xi) Determination of Cr (III) complexes: $[Cr(H_2O)_6]NO_3.3H_2O$, $[Cr(H_2O)_4Cl_2].Cl.2H_2O$, $[Cr(en)_3]Cl_3$

xii) Preparation of N,N bis (salicylaldehyde) ethylenediamine,(salen), Cobalt and copper complexes.

B) Solid State:

1) Preparation of oxides and mixed oxides (Mn_2O_3, NiO, Cu_2O, Fe_3O_4, $ZnFe_2O_4$, $ZnMn_2O_4$, $CuMn_2O_4$ and $NiFe_2O_4$)

2) Preparation of Silica and Alumina by sol-Gel technique.

3) To study the electrical conductivity of ferrites, Magnetites, doped oxides and pure samples and determine band gap.

A) Bioinorganic Chemistry

1) Extraction and absorption spectral study of chlorophylls from green leaves of students choice

2) Separation of Chlorophyll and their electronic spectral studies.

3) Complexation study of Cu(II) with biologically important amino acids

B) Inorganic reaction mechanism:

Kinetics and mechanism of following reactions:

1) Substitution reactions in octahedral complexes (Acid/Basehydrolysis)

2) Redox reactions in octahedral complexes.

3) Isomerization reaction of octahedral complexes.

D) Inorganic Photochemistry:

i) Synthesis of potassium ferrioxalate and determination of intensity of radiation

ii) photoxidation of oxalic acid by UO_2^{2+} sensitazation

iii) Photo decomposition of HI and determination of its quantum yield.

List of books:

1. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall.

2. Inorganic Experiments, J. Derck Woollins, VCH.

3. Practical Inorganic Chemistry, G. Marrand, B. W. Rockett, Van Nostrand.

4. A Text Book of Quantitative Inorganic Analysis, A. I.Vogel,Longoman.

5. EDTA Titrations. F. Laschka

6. Instrumental Methods of Analysis, Willard, Merit and Dean (CBS, Delhi).

7. Inorganic Synthesis, Jolly

8. Instrumental Methods of Chemical Analysis, Yelri Lalikov

9. Fundamental of Analytical Chemistry, Skoog D.A. andWest D.M Holt Rinehart andWinston Inc.

10. Experimental Inorganic Chemistry, W.G.Palmer, Cambridge.

11. Solid state Chemistry, N.B.Hanney

12. Introduction to Thermal Analysis, TechniquesandApplications,M.E.Brown, Springer

13. Preparation and Properties of solid state Materials, Wilcox, Vol.IandII, Dekker

14. The Structure and Properties of Materials Vol.IV, JohnWulff, Wiley Eastern.

ORGANIC CHEMISTRY SPECIALIZATION

CH-402: Paper XIV (Special II-Organic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit I:

A] Carbanions in organic Chemistry **15 h**

Ionization of carbon hydrogen bond and prototopy, Base and acid catalysed halogenation of ketones, keto-enol equilibria, structure and rate in enolisation, concerted and carbanion mechanism for tautomerism, carbanion character in phenoxide and pyrrolyl anions, geometry of carbanions, kinetic and thermodynamic control in the generation of enolates, LDA, hydrolysis of haloforms, use of malonic and acetoacetic esters, Aldol, Mannich, Cannizzaro, Darzens, Dieckmann, Claisen Baylis-Hillman reactions, Knoevenagel, benzoin condensation, Favorski reaction, alkylation of enolates and stereochemistry thereof, Conjugate additions.

B] Organometallic reagents -I

Synthesis and applications of organo Li and Mg reagents, nucleophilic addition to aldehyde, ketones, ester, epoxide, CO_2, CS_2, isocyanates, ketenes, imines, amides, lactones, Stereochemistry of Grignard addition to carbonyl compounds, *o*-metallation of arenes using organolithium compounds.

Unit II: **15 h**

A] Organometallic reagents-II

Organozinc reagents: Preparation and applications, Reformatsky reaction, Simon-Smith reaction.

Organocopper reagents: Preparation and applications in C-C bond forming reaction, mixed oragnocuprates, Gilman's reagent. Organo Hg and Cd reagents in organic synthesis.

B] Transition metals in organic synthesis

Transition metal complexes in organic synthesis-Introduction-oxidation states of transition metals, 16-18 rule, dissociation, association, insertion, oxidative addition, reductive elimination of transition metal

Organopalladium in organic synthesis-Heck reaction, allylic activation, carbonylation, wacker oxidation, isomarization formation N-aryl and N-alkyl bond transmetalation, allyl deprotection in peptides, coupling reactions: Kumada Reaction, Stille coupling, Sonogashira and Suzuki coupling reactions and their importance

Applications of $Co_2(CO)_8$, $Ni(CO)_4$, $Fe(CO)_5$ in organic synthesis. Wilkinson, Noyori, Knowls catalyst of Ruthenium and Rhodium – synthesis and uses its use in hydrogenation reactions-deallylation, C-C, C-O, C-N bond cleavages.

Olefin metathesis by Ist and IInd generation catalyst, reaction mechanism and application in the synthesis of homo and heterocyclic compounds

Unit III: **15 h**

A] Advanced Stereochemistry:

Conformation of sugars, monosaccharides, disaccharides, mutorotation, Recapitulation of Stereochemical concepts- enantiomers, diastereomers, homotopic and heterotopic ligands, Chemo-, regio-, diastereo- and enantio-controlled approaches; Chirality transfer, Stereoselective addition of nucleophiles to carbonyl group: Re-Si face concepts, Cram's rule, Felkin Anh rule, Houk model, Cram's chelate model. Asymmetric synthesis use of chiral auxiliaries, asymmetric hydrogenation, asymmetric epoxidation and asymmetric dihydroxylation,

B] Protection and Deprotection of functional groups: Protection and deprotection of functional groups like, hydroxyl, amino, carbonyl and carboxylic acids groups, Solid phase peptide synthesis.

Unit IV: Designing the synthesis based on retrosynthetic analysis **15 h**

(A) 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 reactions, amine synthesis

(B) One Group C-C Disconnections: Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis

(C)Two Group C-C Disconnections: Diels-Alder reaction, 1,3-difunctionalised compounds, α,β-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds, Michael addition and Robinson annelation, Methods of ring synthesis

List of books

1] Principle of Organic Synthesis R. O. C. Norman and J. M. Coxon

2] Modern Synthetic Reaction. H. O. House and W. A. Benjamin

3] Organic Synthesis: The Disconnection Approach-S. Warren

4] Designing Organic Synthesis-S. Warren

5] Some Modern Methods of Organic Synthesis-W. Carruthers

6] Advance Organic Reaction. Mechanism and Structure-Jerry March

7] Advance Organic Chemistry Part-B-F. A. Caray and R. J. Sundberg Plenum Press

8] Organic Reaction and their Mechanism-P. S. Kalsi

9] Protective Groups in Organic Synthesis-T. W. Greene

10] The Chemistry of Organo Phosphorous-A. J. Kirbi and S. G. Warren

11] Organo Silicon Compound-C. Eabon

12] Organic Synthesis via Boranes-H. C. Brown

13] Organo Borane Chemistry-T. P. Onak

14] Organic Chemistry of Boron-W. Gerrard

CH-403: Paper XV (Special II-Organic Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit I: Enzyme chemistry **15h**

A] 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 Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Baker's yeast catalyzed reactions, Applications of enzymes in food and drug chemistry

B] Mechanism of Enzyme Action: Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Example of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A.

C] Co-Enzyme Chemistry: Cofactors as derived from vitamins, 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.

Unit II: Heterocycles **15h**

A] Azoles: Structural and chemical properties; Synthesis of pyrazole, isothiazole and isoxazole; Synthesis of imidazoles, thiazoles and oxazoles; Nucleophilic and electrophilic substitutions; Ring cleavages

B] Benzofused heterocycles: Synthesis of indole, benzofuran and benzo-thiophene, quinoline and isoquinoline Nucleophilic, electrophilic and radical substitutions; Addition reactions; Indole rings in biology.

C] Diazines: Structural and chemical properties; Synthesis of pyridazines, pyrimidines, pyrazines; Nucleophilic and electrophilic substitutions.

Unit III: **15h**

A] Nucleic Acids: Primary, secondary and tertiary structure of DNA; DNA replication and heredity; Structure and function of mRNA, tRNA and rRNA. Purines and pyrimidine bases of nucleic acids and their preparation.

B] Lipids: Fatty acids, essential fatty acids, structures and functions of triglycerols, glycerophospho lipids, spingolipids, lipoproteins, composition and function, role in atherosclerosis

Properties of lipid aggregates, micells, bilayers, liposomes and their biological functions, biological membranes, fluid mosaic model of membrane structure, Lipid metabolism, β-Oxidation of fatty acids

C] Vitamins: Structure determination, synthesis and biosynthesis of vitamin A, E and H.

Unit IV: **15h**

A] Dyes:

General Introduction, classification on the basis of structure and methos of application dying mechanism, methods of dying, such as direct dying, vat dying, dispersive dying, formation of dye in fibre, dying with reactive dyes, study of quinoline yellow, cyamine dye, ethyl red, methylene blue, Alizarin, cyamine-green, fluorescein, cosin, erythrosine, Rhodomines and Indigo.

B]Pharmaceutical chemistry:

History, medical terms in pharmaceutical chemistry, classification of drugs, antibacterial and antifungal drugs, specific clinical applications, Serendipity and drug development, Synthesis and applications of: Benzocaine, Methyl dopa, dilantin, ciprofloxacin, acyclovir, terfenadine, salbutamol

C] Polymer chemistry: 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 co-polymerization and their mechanisms, Polymerization in homogeneous and heterogeneous systems. Ziegler-Natta polymerization with mechanism, Stereo regulated polymers, syndiotactic, isotactic and atactic polymers

List of books

1] Textbook of Polymer Science, F. W. Billmeyer Jr, Wiley

2] Polymer Science, V. R. Gowarikar, N. V. Viswanathan and J. Sreedhar, Wiley-Eastern

3] Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R. M. Ottanbrite

4] Bioorganic Chemistry: A Chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer-Verlag

5] Understanding Enzymes, Trevor Palmer, Prentice Hall

6] Enzyme Chemistry: Impact and Applications, Ed. Collin J. Suckling, Chapman and Hall

7] Enzyme Structure and Mechanism, A. Fersht, W. H. Freeman

8] Introduction to Medicinal Chemistry, A. Gringuage, Wiley-VCH

9] Wilson and Gisvold's Text Book of Organic Medical and Pharmaceutical Chemistry, Ed Robert F. Dorge

10] Burger's Medicinal Chemistry and Drug Discovery, Vol-1, Ed. M. E. Wolff, John Wiley

11] Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley

12] The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press

CH-405: Practical-VII (Organic Chemistry Special)

9 h /week Marks: 80

[A] Quantitative Analysis based on classical and instrumental technique (any 9-10)

1] Estimation of nitrogen.

2] Estimation of halogen.

3] Estimation of sulphur.

Spectrophotometric/calorimetric and other instrumental methods of estimation

4] Estimation of streptomycin sulphate.

5] Estimation of vitamin B-12.

6] Estimation of amino acids.

7] Estimation of proteins.

8] Estimation of carbohydrates.

9] Estimation of Ascorbic acid.

10] Estimation of Aspirin.

11] Solvent extraction of oil from oil seeds and determination of saponification value, iodine value of the same oil.

[B] Organic multi-step preparations (Two/Three steps): Minimum 10-12 preparations

[1] Aniline → Diaminoazobenzene → p-aminoazobenzene

[2] Benzoin → Benzyl → Dibenzyl

[3] Aniline → acetanilide → *p*-bromoacetanilide → *p*-bromoaniline

[4] Aniline → Acetanilide → *p*-nitroacetanilide → *p*-nitroaniline

[5] Benzaldehyde (thiamine hydrochloride) → benzoin → benzil → benzilic acid

[6] *p*-Nitrotoluene → *p*-nitrobenzoic acid → PABA → *p*-iodobenzoic acid

[7] *p*-Cresol → *p*-cresylacetate → 2-hydroxy-5-methyl acetophenone → 2-hydroxy chalcone

[8] Benzaldehyde → benzilidene acetophenone → 4,5-dihydro-1,3,5-triphenyl-1*H*-pyrazole

[9] Aniline → phenylthiocarbamide → 2-aminobenzthiazole (Microwave in step I)

[10] Chlorobenzene → 2,4- Dinitrochlorobenzene → 2,4- Dinitrophenylhydrazine.

[11] Acetophenone → acetophenone phenyl hydrazone → 2-phenylindole

[12] Benzion → benzoin benzoate → 2,4,5-triphenyl oxazole

[13] Benzophenone → benzpinacol → benzopinacolone (Photochemical preparation)

[14] Benzophenone → Benzophenone oxime → Benzanilide → Benzoic acid + aniline

[15] Aniline → aniline hydrogen sulphate → sulphanilic acid → Orange II

[16] Aniline → N-arylglycine → indoxyl → indigo

[17] Phthalimide → Anthranilic acid → Phenyl glycine-o-carboxylic acid → Indigo

[18] Phalic anhydride → Phthalimide → Anthranilic acid → o-chlorobenzoic acid

[19] Phalic anhydride → Phthalimide → Anthranilic acid →Diphenic acid

[20] Ethyl acetoacetate → 3-methyl-pyrazol-5-one → 4,4-dibromo-3-methyl-pyrazol-5-one → Butanoic acid

[21] Biosynthesis of ethanol from sucrose

[22] Enzyme catalyzed reactions

[C] SPECTRAL INTERPRETATION

Structure Elucidation of organic compounds on the basis of spectral data (UV, IR, ^{1}H and $^{13}CNMR$ and Mass) (Minimum 12 compounds are to be analysed during regular practicals).

PHYSICAL CHEMISTRY SPECIALIZATION

CH-402: Paper XIV (Special I-Physical Chemistry)

60h (4h/week) 15h/unit 80 Marks

UNIT-I SURFACE CHEMISTRY **15h**

A] Macromolecules: Number and average molecular mass, molecular mass determination:Osmometry, Viscometry, sedimentation, diffusion and light scattering method.

B] Chemical adsorption, application of adsorption, factors affecting adsorption, Langmuir theory, BET theory, heat and entropy of adsorption. Surface film on liquids; Electro-kinetic phenomena. types of adsorption isotherm. micelle formation, mass action model and phase separation model, shape and structure of micelles, CMC, factors affecting CMC effect of added electrolyte on the surface excess of ionic surfactants.

C] Modern techniques for investigating surfaces-Low energy electron diffraction(LEED), PES, Scanning tunneling and atomic force microscopy (STM and AFM)

UNIT II CORROSION AND CORROSION ANALYSIS **15h**

A] Scope and economics of corrosion, causes (Change in Gibbs free energy) and types of corrosion, lectrochemical theories of corrosion, dry and wet corriosion, Different types of corrosion-Pit, Soil, chemical and electrochemical, intergrannular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

B] Thermodynamics of corrosion, corrosion measurements (Weight loss, OCP measurements, polarization methods), passivity and its breakdown, corrosion prevention (electrochemical inhibitor and coating methods).

UNIT III: RADIATION CHEMISTRY **15h**

Measurement of dose. Dosimetric terms and units (Roentgen, REM, Rad, Gray, Sievert), inter conversions, calculation of absorbed dose-various types of dosimeters, chemical dosimeters (Fricke and Ceric sulphate), experimental methods, TLD badges, Radiolysis-definition, process, Radiolysis of water and aqueous solutions, hydrated electron, Effect of radiation on biological substances, genetic effects, radiation effects on organic compounds (Halides-carboxylic acids), polymers, nitrates and solid thermoluminescence.

UNIT IV: LIQUID STATE **15h**

A] Theory of liquids:- Theory of liquids, partition function method or model approach, single cell models, communal energy and entropy, LTD model, significant structure model.

B] Supercooled and ionic liquids: Supercooled and ionic liquids, theories of transport properties, non Arrhenius behavior of transport properties, Cohen- Turnbull free volume model, configurational entropy model, Macedo- litovitz model, glass transition in supercooled liquids.

Books Sugggested:

1. Y. Moroi, *Micelles : Theoretical and Applied Aspects*, Plenum Press, New York (1992).
2. E.M. Mc Cash, *Surface Chemistry*, Oxford University Press, Oxford (2001).
3. P.A. Eglestaff," An Introduction to Liquid State" Academic Press.
4. J.A.Pryde,"The Liquid State"
5. A.F.M.Barton, "The Dynamics of Liquid State", Longman.
6. Introduction to Radiation Chemistry: J. W. T. Spinks and R. J. Woods
7. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
8. G. Hughes- Radiation Chemistry- Oxford University Press, London

CH-403: Paper XV (Special II-Physical Chemistry)

60h (4h/week) 15h/unit 80 Marks

UNIT I: ELECTRICAL AND MAGNETIC PROPERTIES OF SOLIDS **15h**

A] Metals, insulators and semiconductors, electronic structure of solids-band theory, fermi gas model, electrical conductivity, thermal conductivity, Lorenz number, periodic potential, band structure of metals, insulators and semiconductors, intrinsic and extrinsic semiconductors, doping semiconductors, semiconductor p-n junctions, colors in solids.semiconductors, meissner effect, LTSC, HTSC.

B] Behaviour of substances in magnetic field, effect of temperature: Curie and Curie-weiss law, calculation of magnetic moments, magnetic materials, their structure and properties, Applications: structure/ property relations, numericals.

UNIT II: ELECTRICAL PROPERTIES OF MOLECULES **15h**

Dipole moments of molecules, basic ideas of electrostatic interactions, polarizability, orientation polarization, Debye equations, limitation of the Debye theory, Clausius-Mossotti equation. electrostatic of dielectric medium, molecular basis of dielectric behavior, structural information from dipole moment measurements, use of individual bond dipole moments, application to disubstituted benzene derivatives, dipole moment and ionic character of a molecule, determination of dipole moment from dielectric measurements in pure liquids and in solutions. The energies due to dipole-dipole, dipole induced dipole and induced dipole-induced dipole interaction. Dispersion, dielectric loss and refractive index. Lennard-Jones potential.

Unit III: LIQUID CRYSTALS **15h**

A] LIQUID CRYSTALS :Mesomorpic behavior, thermotropic liquid crystals, positional order, bond orientational order, nematic and sematic meso phases, sematic and nematic transitions and clearing temperature, homeotrpic, planer and schlieren textures twisted nematics, chiral nematics, molecular arrngement 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.

B] THIN FILMS: Langmuir- Blodgett (LB) Film, growth techniques, photolithography, properties and applications of thin and LB films.

Unit IV: **15h**

A] Liquid gas and liquid interfaces: Surface tension, methods of determination of surface tension, surface tension across curved surfaces, vapor pressure of droplet (Kelvin equation) , surface spreading , spreading coefficient, cohesion and adhesion energy, contact angle, constant angle hystereis, wetting and detergency.

B] Solid - Solid interfaces : Surface energy of solids, adhesion and adsorption, sintering and sintering mechanism, Tammann temperature and its importance, surface structure and surface composition.

List of books

1. Physical Chemistry - P.W. Atkin, ELBS fourth edition.

2. Physical Chemistry – R.A. Alberty, R.I. Bilby, Johy Wiley – 1995

3. Physical Chemistry – G.M. Barrow, Tata Mc – Graw Hill – 1988

CH-405: Practical-VII (Physical Chemistry Special)

9 h /week Marks: 80

Adsorption:

1. To verify Freundlich adsorption isotherm.

2. To verify Langmuir adsorption isotherm.

3. To verify Gibbs adsorption isotherm and to find surface excess concentration of solute.

4. To determine CMC of the given surfactant by surface tension method.

5. Study of variation of surface tension of solution of n-propyl alcohol with concentration and hence determine the limiting cross section area of alcohol molecule.

Kinetics:

6. Clock reaction- activation energy of bromide-bromate reaction.

7. Temp dependence of persulfate-iodide reaction by iodine clock method and calculation of thermodynamic and Arrhenius activation parameters. Study of ionic strength effect on persulfate-iodide reaction.

8. Kinetics of B-Z reaction; Kinetics of modified B-Z reaction

9. Investigate the Autocatalytic reaction between potassium permanganate and oxalic acid.

10. Determination of PKa value of a weak acid by chemical kinetic method(formate-iodine reaction)

Potentiometry and Conductometry:

11. Transport number by potentiometry.

12. Hydrolysis constant by aniline-hydrochloride by potentiometry and conductometry

13. pKa of weak acids by potentiometry and conductometry.

14. Complexation between Hg^{2+} and I^- conductometrically.

ANALYTICAL CHEMISTRY SPECIALIZATION

CH-402: Paper XIV (Special I-Analytical Chemistry)

60h (4h/week) 15h/unit 80 Marks

Unit-I: Radioanalytical Chemistry-II **15h**

Preparation of some commonly used radioisotopes, Use of radioactive isotopes in analytical and physico-chemical problems, Industrial applications, Neutron sources, Neutron Activation Analysis, Isotope Dilution Analysis, Radiometric titrations (Principle, Instrumentation, applications, merits and demerits), Radiochromatography, Carbon dating, Numericals based on above.

Unit-II: Optical methods of analysis-IV **15h**

Inductively coupled plasma-atomic emission spectroscopy: Principle, atomization and excitation. Plasma source and sample introduction. Instrumentation. Comparison of ICP-AES with AAS. Applications.

X-ray fluorescence spectroscopy*:* Principle. Instrumentation: wavelength and energy dispersive devices. Sources and detectors. Comparison between wavelength and energy dispersive techniques. Sample preparation for XRF. Matrix effects in XRF. Applications in qualitative and quantitative analysis.

Particle induced X-ray emission (PIXE): Basic principle, Instrumentation and applications.

Electron microscopy: Principle, instrumentation and applications of scanning electron microscopy (SEM) and transmission electron microscopy (TEM)

Unit-III: Electrochemical methods of analysis-III **15h**

Ion selective electrodes: Theory of membrane potential. Types of ion-selective electrodes. Construction of solid state electrodes, liquid membrane electrodes, glass membrane electrodes and enzyme electrodes, Selectivity coefficients, Glass electrodes with special reference to H^+, Na^+ and K^+ ions. Applications of ISE in analysis of environmentally important anions like F^-, Cl^-, Br^-, I^-, NO_3^- and CN^-. Advantages of ISE.

Coulometry: Principle. Coulometry at constant potential and constant current. Instrumentation. Applications and advantages of coulometric titrations.

Electrochemical microscopy: Introduction to scanning probe microscopy (SPM), scanning tunneling microscopy (STM), atomic force microscopy (AFM) and scanning electrochemical microscopy (SECM).

Unit-IV:Thermal methods of analysis **15h**

Introduction to different thermal methods, Thermogravimetry (TG and DTG), Static thermogravimetry, quasistatic thermogravimetry and dynamic thermogravimetry, Instrumentation-Balances, X-Y recorder, Stanton-Redcroft TG-750, Thermogram, Factors affecting thermogram, Applications of thermogravimetry, Differential Thermal Analysis (DTA)-Theories, DTA curves, Factors affecting DTA curve, Applications of DTA, simultaneous determination in thermal analysis, Differential Scanning Calorimetry (DSC)- Introduction, Instrumentation, DSC curves, factors affecting DSC curves, applications, Thermogravimetric titration-Theory, Instrumentation and applications.

CH-403: Paper XV (Special II-Analytical Chemistry)

60h (4h/week) 15h/ unit 80 Marks

Unit-I: Pharmaceutical and clinical analysis **15h**

Requirements of a quality control laboratory for pharmaceutical units, a general idea about following classes of drugs and their analysis-

a. Antibiotics-Chloroamphenol, ampicilline, terramycine

b. Vitamins-Thymine hydrochloride (Vitamin-B1) Riboflavin (Vitamin-B2), Ascorbic acid (Vitamin-C)

c. Sulpha drugs- sulphaguanidine, sulphapyrazine, sulphanilamide

d. Narcotics and dangerous drugs- screening by GC and TLC and spectrophotometric measurements.

Composition of blood, sample collection for blood and urine, clinical analysis, Immuno Assay-RIA, Setting up of RIA and applications, Fluorescence Immunoassay, Enzyme immunoassay, Blood gas analyzer, Trace elements in the body.

Unit-II: Soil analysis and coal analysis **15h**

Soil analysis- Classification and composition, pH and conductivity, analysis of constitutents such as nitrogen, phosphorous, potassium and microconstitutents.

Coal analysis- Proximate analysis (moisture content, ash content, volatile matter, fixed carbon). Ultimate analysis (carbon, hydrogen, sulphur, nitrogen, oxygen content). Combustion of carbonaceous fuel- Flue gas. Calorific value and its units.

Unit-III: Corrosion and corrosion analysis **15h**

Definition, draw backs and theories of corrosion-dry and wet corrosion, Different types of corrosion-Pit, Soil, chemical and electrochemical, intergrannular, waterline, microbial corrosion, measurement of corrosion by different methods, factors affecting corrosion, passivity, galvanic series, protection against corrosion, design and material selection.

Unit-IV: Automation in analytical chemistry **15h**

Automation in the laboratory, Principle of automation, automated instruments, classification, continuous analyzer, automatic instruments, semiautomatic instruments GeMSAEC Analyzer, Flow Injection Analysis (FIA), Dispersion coefficient, Factors affecting Peak Height, microprocessor based instruments, Numericals based on above.

***Hyphenated techniques*:** Introduction to GC-MS, LC-MS, ICP-MS and MS-MS (Tandem) spectrometry.

CH-405: Practical-VII (Analytical Chemistry Special)

9 h /week Marks: 80

A. Organoanalytical chemistry

1. Estimation of sulphur, nitrogen, phosphorous, chlorine in organic compound.
2. Estimation of phenol.
3. Estimation of aniline.

B. Separation techniques

Ion exchange

1. Separation and estimation of zinc and magnesium/cadmium in a mixture on anion exchanger.
2. Separation and estimation of chloride and iodide in a mixture on anion exchanger.
3. Determination of total cation concentration in water.

Solvent extraction

1. Estimation of Copper using Na-DDC.
2. Estimation of Iron using 8-hydroxyquinoline.
3. Estimation of Nickel using DMG.
4. Estimation of Cobalt using 8-hydroxyquinoline.
5. Estimation of Nickel by synergistic extraction with 1,10-phenanthroline and dithizone.

Paper chromatography

1. Separation and estimation of copper and nickel in a mixture.
2. Separation and estimation of cobalt and nickel in a mixture.

Thin layer chromatography

Separation and estimation of bromophenol blue, congo red and phenol red in a mixture.

C. Water analysis

Mineral analysis: Ttemperature, pH, conductivity, turbidity, solids, alkalinity, chloride, fluoride, sulphate, hardness

Demand analysis: DO, COD

Heavy metals: Fe, Cd and Pb

D. Demonstrations

1. Gas chromatography
2. HPLC

List of books:

1. Essentials of Nuclear Chemistry: H. J. Arnikar (Willey Eastern Ltd)

2. Substoichiometry in Radioanalytical Chemistry: J. Ruzicka and J Stary (Pergamon Press)
3. Thermal analysis: Blazek (translated by J. F. Tyson, Van Nostrand)
4. Instrumental Methods of Analysis: Willard, Meriit and Dean(Van Nostrand)
5. Instrumental Methods of Analysis: G. Chatwal and S. Anand (Himalaya Publishing House)
6. Vogel's Text Book of Quantitative inorganic Analysis: Bassett, Denney, Jeffery and Mendham (ELBS)
7. Advanced Analytical Chemistry: Meites and Thomas (McGraw-Hill)
8. Atomic Absorption Spectroscopy: Robinson (Marcel Dekker)
9. Instrumental Methods of chemical Analysis: Braun (Tata McGraw-Hill)
10. Radiochemistry: A. N. Nesmeyanov (Mir Publications)
11. Analysis of Water: Rodier
12. Ion selective electrods: Koryta (Cambridge University Press)
13. Instrumentation in analytical chemistry: Borman (American Chemical Society)
14. Industrial Chemistry: Arora and Singh (Anmol Publications)
15. Diffraction Methods: John Wormald (Clarendon Press)
16. Electroanalytical Chemistry: Bard (Dekker)
17. Analytical Chemistry by Open Learning (Wiley)
18. An Introduction to Electron Diffraction: Beeston (North Holand Publishing Co.)
19. Material Science and Engineering: V. Raghavan (Printice-Hall of India)
20. Practical Physical Chemistry: J. B. Yadav (Goel Publishing House)

CH-404: Paper XVI (Elective- Applied Analytical Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Water treatment **15h**

Hardness of water and types of hardness. Problems due to hardness. Removal of hardness by lime-soda process, Zeolite process and synthetic ion-exchange resins. Principle, instrumentation and comparison of these three processes. Numericals based on hardness removal. Desalination of sea-water.

Unit-II: Polymer chemistry and Glass analysis **15h**

***Polymer chemistry**:* Definition, classification, co-polymers, conducting polymers, determination of molecular weight, acid value, saponification value, iodine value and hydroxyl groups of polymers., TGA and DTA studies of polymers, LDC polymers. Rubbers, elastomers, silicones.

Glasses: Introduction. Physical and chemical properties. Composition of ordinary glass and special glasses. Determination of silicon, calcium, magnesium, aluminium, chloride, sulphur, barium, arsenic, antimony, chromium, cobalt, copper, iron, manganese, nickel, titanium in glasses.

Unit-III: Cosmetic technology and leather analysis **15h**

Importance of quality control in cosmetic preparations, stability testing of various cosmetic products, Study of rheological properties of semi-solid preparations, evaluation of active ingredients in finished products like shampoos, hair dyes, toothpaste, talcum powder, lip sticks, sun screen preparations.

Analysis of leather: Determination of moisture, acid, free sulphur, total ash, chromic oxide in leather, tensile strength and stretch of leather.

Unit-IV: Explosives and propellants **15h**

Classification of explosives, characteristics of TNB, TNT, RDX, dynamite, lead azide, ammonium nitrate, ammonium picrate. Pyrotechniques.

Analysis of explosives and propellants: Heat of explosion, moisture determination by Karl-Fisher reagent, vacuum oven drying and non-aqueous titration. Stability by different methods. Total volatiles. Qualitative tests for explosives. Colorimetric methods for nitro-compounds. Mechanical tests for explosives.

CH-404: Paper XVI (Elective- Nuclear Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Radiation Chemistry, Radiolysis **15h**

Measurement of dose. Dosimetric terms and units (Roentgen, REM, Rad, Gray, Sievert), inter conversions, calculation of absorbed dose-various types of dosimeters, chemical dosimeters (Fricke and Ceric sulphate), experimental methods, TLD badges, Radiolysis-definition, process, Radiolysis of water and aqueous solutions, hydrated electron,

Effect of radiation on biological substances, genetic effects, radiation effects on organic compounds (Halides-carboxylic acids), polymers, nitrates and solid thermoluminescence.

Unit-II: Hot Atom Chemistry and Radiochemistry **15h**

Recoil energy and calculations, Szilard Chalmers effects, Kinetics, primary and secondary retention-effect of various factors on retention and its uses, Mossbauer effect- principle, instrumentation and chemical applications,

Unit-III: Radioanalytical techniques **15h**

Neutron sources, Neutron activation analysis, principle, methodology and application for trace analysis, Isotope dilution analysis-principle and application, Isotopic exchange reaction, mechanism and application in use of radioisotopes and tracers, radioactive dating based on carbon-14 and lead isotopes.

Unit-IV: Radiopharmaceuticals **15h**

Radioimmunoassay (RIA), discovery, principle, set up of RIA, Principle of Immunoradiometric assay (IRMA), principle and set up, Radiopharmaceuticlas, classification of products, preparations, quality control aspects, ^{99}Mo-^{99m}Tc generator, Cylotron based products, PRT studies, Therapeutic applicatyions , Radiotherapy

CH-404: Paper XVI (Elective- Environmental Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit-I: Water Pollution **15h**

Pollutants- Types of pollutants, sources of water pollution, sampling, preservation and storage of water sample, physico –chemical, organoleptic and chemical analysis of water, electro-analytical, optical (UC-visible spectrophotometry, AAS, flame photometry, XRF, ICPAES), chromatographic (GC and HPLC) and neutron activation methods of analysis of Co, Ni, Cu, Fe, Mn, Zn, Cd, Pb, Hg, As, Cl^- ,F^-, $SO4^{--}$,PO_4^-, NO_3^-. Historical development of detergents, chemistry of soaps and detergents.

Unit-II: Air Pollution **15h**

Natural versus polluted air, air quality standards, air sampling, analysis and control of Particulates, Chemistry and analysis of SOx, NOx, CO, ozone, hydrocarbons, CFCs. Chemistry of gaseous, liquid and solid fuels-gasoline and additives, antiknock agents. Air pollution control—control of automobile emission and control measures in thermal power stations.

Unit-III: Soil Pollution **15h**

Types and sources of soil pollution, classification of soil pollutants, impact of soil pollution on air quality, Specifications for disposal of sewage and effluent on land for irrigation and ground water recharge. Methodology of waste water disposal on land in India. Impact of usage of land for solid waste disposal both municipal solid waste and industrial solid wastes (fly ash from thermal power station, lime sludge from paper and pulp industry), cause of soil erosion, effects of soil erosion, conservation of soil, control of soil pollution.

Unit-IV: Solid waste pollution **15h**

Sources, types and consequences, classification of wastes- domestic, industrial, municipal, hospital, nuclear and agricultural and their methods of disposal. Transfer and transport, Recycle, reuse, recovery, conversion of solid wastes -energy / manure. Analysis and monitoring of pesticides.

Impact of toxic chemicals on enzymes, Biochemical effects of As, Cd, Pb and Hg, their metabolism, toxicity and treatment.

CH-404: Paper XVI (Elective- Polymer Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

Unit I: Polymerization **15h**

Types of polymerization, addition-chain, free radical, ionic polymerization, step polymerization, electropolymerization, ring-opening polymerization.

Unit II: Techniques of polymerization **15h**

Techniques of polymerization-suspension, emulsion and bulk polymerization, coordination, polymerization mechanism of Ziegler Natta polymerization, stereospecific polymerization, interfacial polycondensation, mechanism of polymerization.

Unit III: Characterization of polymers **15h**

Electronic, IR and NMR spectral methods for characterization of polymers (Block and Graft)

Thermal methods-TGA, DTA, DSC, thermomechanical and X-ray diffraction study, Block and Graft copolymers, random, block, graft co-polymers, methods of copolymerization.

Unit IV: Specific polymers **15h**

A) Biomedical polymers: Contact lens, dental polymers, artificial heart, kidney and skin.

B) Inorganic polymers: Synthesis and application of silicon, phosphorous and sulphur containing polymers.

C) Coordination polymers: Synthesis and applications of coordination polymers.

CH-404: Paper XVI (Elective- Medicinal Chemistry)

60 h (4 h per week): 15 h per unit 80 Marks

UNIT-I: **15 h**

A] Drug rules and drug acts, Overview of Intellectual property right, Indian and International framework for patent protection**.**

B] Chromatographic separation techniques for drugs: TLC, Paper chromatography, GC, HPLC, LCMS. Dignostic agents: Radio Pharmaceuticals, Radiology and CT.

UNIT-II: **15 h**

A]Statastical method: For sampling and interpretation of results, Statastic in quality control, T-Test, F-Test, Validation of analytical methods as defind proceding USP Radioimmunoanalysis, Investigational drugs.

B]Anti-Viral agents: Inroduction, viral diseases, viral replication, and transformation of cells, investigation of antiviral agents,. Chemotherapy for HIV. Synhesis of: Idoexuidine,acyclovir ,amantadine and cytarabin.

C]Anti-malarial agents: Introduction, malarial parasite, and its life cycle, development of antimalarials, chemotherapy of malaria. Synthesis of: Chloroquin, primaquin, proguanil, and Quinacrine

UNIT-III: **15 h**

A) Histamines and Antihistamic agents: Introduction, histamine H1-receptor antagonists. Inhibitors of histamine release. Synthesis of: alkyl amines, phenothiazines, piperzines derivatives.

B) Antibiotics: Introduction, β-lactam antibiotics, classification, SAR and chemical degradation of penicillin, cephalosporins-classification , tetracycline antibiotics-SAR,miscellaneous antibiotics. Synthesis of ampicillin, cephradine, methacycline,chloramphenicol

UNIT-IV: **15 h**

A) Anthelminitics and antiamoebic drugs: Introduction to Helminthiasis, Anthelminitics, drugs used in cestode infection, drugs used in trematode infection, origin of antiamoebic drug, drugs used in nematode infection. Synthesis of: Clioquinol, Iodoquinol, Haloquinol, Dichlorphen, Niclosamide.

B) Anti-inflammatory drugs: Introduction, etiology of inflammatory diseases. The inflammatory response, biochemical response. Synthesis of: Phenyl butazone and its derivatives, pyrazolone derivatives, pyrole and indole acetic acid derivatives.

CH-406: Practical VIII- Project

9 h/week 80 Marks

Project is a part of practical examination. Project should be carried out by the student under the supervision of Guide/Teacher. The examination shall be conducted by External and Internal Examiners. Students are supposed to present their work either on LCD Projector / OHP or blackboard.

The division of marks will be as follows:

External examiner: 40 marks

Internal examiner (Guide/ Teacher): 40 marks

(With Internal Assessment of 20 Marks)

Note: One external examiner shall be appointed for evaluation of group of 6 students.

CH-407: Seminar-IV

2 h /week Marks: 25

Seminar of 30 minutes duration will be a part of internal assessment for 25 marks (1 credit). Seminar should be delivered by the student under the guidance of concerned teacher on the topic allotted by the teacher. The topic will be related to the syllabus. Marks will be allotted by a group of teachers.