SEMESTER-III
(Valid from session 2019-20 onwards)

M 3 CHE 01-CT 09
Advanced Spectroscopic Techniques

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Ultra-violet and Visible spectroscopy

Various electronic transitions, Beer-lambert law, effect of solvent on electronic transitions, UV spectra of carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Woodward-Feiser rules for conjugated dienes and carbonyl compounds, UV spectra of benzene and its derivatives, applications of UV spectroscopy.

IR Spectroscopy

Normal modes of vibration, Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds), factors affecting the band positions, brief idea of FT-IR.

UNIT II

Nuclear Magnetic Resonance Spectroscopy: General introduction and definition, chemical shift, spin-spin interaction, shielding mechanism, mechanism of measurement, chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto), chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (second order spectra), virtual coupling. Stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with dihedral angle. Simplification of complex

spectra-nuclear magnetic double resonance, contact shift reagents, solvent effects. Fourier transform technique, nuclear Overhauser effect (NOE). Resonance of other nuclei-^{19}F, ^{31}P.

UNIT III

Carbon-13 NMR Spectroscopy: General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), coupling constants.

Two dimension NMR Spectroscopy - COSY, NOESY, DEPT, INEPT, APT, INADEQUATE, HMBC, HMQC techniques.

Electron Spin Resonance Spectroscopy: Basic principles, Instrumentation, zero field splitting and Kramer's degeneracy, Isotropic and anisotropic hyperfine coupling, spin-orbit coupling and significance of g-tensors, factors affecting 'g' value, applications to transition metal complexes (having one unpaired electron) including biological systems and inorganic free radicals such as PH_4, F_2 and $[BH_3]$.

UNIT IV

Mass Spectrometry: Introduction, ion production - EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak, McLafferty rearrangement. Retro Diel-Alder reaction, Nitrogen rule. High resolution mass spectrometery. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

UNIT V

X-ray Diffraction: Bragg condition, -Miller indices, Laue method, Bragg method, Debye-Scherer method of X-ray structural analysis of crystals, index reflections identification of unit cells from systematic absences in diffraction pattern. structure factor and its relation to intensity and electron density, Ramchandran diagram.

Electron Diffraction: Scattering intensity vs. scattering angle, Wierl equation, measurement technique, 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.

Books Recommended:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Company.

2. Structural Methods in Inorganic Chemistry, E. A. V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS

3. Infrared and Raman Spectra: Inorganic and Coordination Compounds, K. Nakamoto, Wiley.

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

5. Transition Metal Chemistry edi R.L. Carlin vol. 3, Dekker

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

7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Norwood.

8. Practical NMR Spectroscopy, M.L. Martin, J.J. Delpeuch and G.J. Martin, Heyden.

9. Spectrometric Identification of Organic Compounds, R. M. Silverstein, G. C. Bassler and T. C. Morrill, John Wiley

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

11. Application of Spectroscopy of Organic Compounds, J. R. Dyer, Prentice Hall.

12. Spectroscopic Methods in Organic Chemistry, D. H. Williams, I. Fleming, Tata McGraw-Hill.

13. Modern Spectroscopy, J.M. Hollas, John Wiley.

14. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L. Ho, Wiley Interscience.

15. NMR, NQR, EPR and Msssbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.

16. Physical Methods in Chemistry, R.S. Drago, Saunders College.

17. Chemical Applications of Group Theory, F. A. Cotton.

18. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill.

19. Basic Principles of Spectroscopy, R. Chang, McGraw Hill.

20. Theory and Applications of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH-Oxford.

21. Introduction to Photoelectron Spectroscopy, P. K. Ghosh, John Wiley.

22. Introduction to Magnetic Resonance, A Carrington and A.D. Maclachalan, Harper & Row.

SEMESTER-III
M 3 CHE 02-CT 10
Bioinorganic, Bioorganic and Biophysical Chemistry

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT I

Metal Ions in Biological Systems

Essential and trace metals. Na/K^+ Pump, Role of metals ions in biological processes.

Electron transfer in biological systems: Structure and functions of electron transfer proteins: Cytochromes and iron sulphur proteins.

Photosynthetic pigments: Photosynthesis, Chlorophyll molecule, Photosystem-I and Photosystem-II.

UNIT II

Transport and Storage of Dioxygen: Heme proteins and oxygen uptake : structure and function of hemoglobin and myoglobin. Nonheme dioxygen carrier: Structure and function of hemocyanins and hemerythrin. model synthetic complexes of iron, cobalt and copper.

UNIT III

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

UNIT IV

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 V

Bioenergetics: Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP, muscular contraction and energy generation in mechanochemical system.

Cell Membrane and Transport of Ions: Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

Books recommended:

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

2. Understanding Enzymes, Trevor Palmer, Prentice Hall.

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

4. Enzyme Mechanisms Ed, M. I. Page and A. Williams, Royal Society of Chemistry.

5. Fundamentals of Enzymology, N.C. Price and L. Stevens, Oxford University Press.

6. Immobilized Enzymes: An Introduction and Applications in Biotechnology, Michael D. Trevan, John Wiley.

7. Enzymatic Reaction Mechanisms, C. Walsh, W. H. Freeman.

8. Enzyme Structure and Mechanism, A Fersht, W.H. Freeman.

9. Biochemistry: The Chemical Reactions of Living Cells, D. E. Metzler, Academic Press. Principles of Biochemistry, A. L. Lehninger, Worth Publishers.

10. Biochemistry, L.Stryer, W.H.Freeman.

11. Biochemistry, J. David Rawn, Neil Patterson.

12. Biochemistry, Voet and Voet, John Wiley.

13. Supramolecular and Bioinorganic Chemistry, Rekha Dashora and A. K. Goswami, Pragati Prakashan.

14. Outlines of Biochemistry, E. E. Conn and P. K. Stumpf, John Wiley.

15. Macromolecules: Structure and Function, F. Wold, Prentice Hall.

16. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.

17. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.

18. Inorganic Biochemistry volume I and II. ed. G.L. Eichhorn, Elsevier.

19 .Progress in Inorganic Chemistry, Volume 18 and 38 ed. J.J. Lippard, Wiley.

SEMESTER-III
M 3 CHE 03-ET01 A

Modern aspects of inorganic Chemistry

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Isomerism of Coordination Compounds: Isomerism's and stereochemistry, Classification of isomers. Study of constitutional and configurational isomerism. Optical activity of coordination compounds, symmetry requirements for optical activity, study of ORD, circular dichroism, cotton effect with special reference to complexes of Cr, Co, Ni and Pt.

UNIT-II

Magnetochemistry

Magnetic susceptibility and basic derivation of diamagnetic susceptibility, pascal constant and its utility, Curie law and Curie-Weiss law, antiferromagnetism and ferromagnetism. Types of antiferromagnetism, antiferro magnetic exchange pathway :

Direct –metal- metal interaction and Indirect-atom exchange i.e. super exchange mechanism.

UNIT-III

Inorganic Photochemistry- Ligand field excited state, charge transfer excited state, ligand to metal, metal to ligand, charge transfer to solvent, tetra ligand state, metal to metal state, the xi state and DOSENCO state.

Photochemical reactions of coordination compounds- Chromium (III) complex, Cobalt (III) complexes, Radium (III) complexes, complex of transition elements.

UNIT-IV

Solid state Chemistry Molecular orbital theory of solids, electrical properties, insulators and semiconductors, super conductors, Schotty and Frenkel defects, Intermetallic, interstitial and non stoichiometric compounds, defects and non stoichiometry, electrical conductivity, Spinel structure, perovskite and related phases Chervrel phases, Atom and ion diffusion, mechanism of diffusion.

UNIT-V

Smart materials

Ceramics, alloys, gels and polymers. Piezoelectric materials, electrostrictive and magnetostrictive materials, rheological, thermoresponve, pH sensitive halochromic materials, electrochromic materials and smart gels.

Books Recommended :

1. Principle and Applications of Organotransition Metal Chemsitry, J.P. Coliman, L.S Hegsdus, J.R. Norton and R.G. Finke, University Science Books.

2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree, John Wiley.

3. Metallo-Organic Chemistry, A.J. Pearson, Wiley

4. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books

5. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lipparad and J.S Valentine, University, Science Books

6. Inorganic Biochemistry Volume I and II. Ed G.L. Eichhorn, Elsevier

7. Progress in Inorganic Chemistry, Volume 18 and 38 Ed. J.J. Lipparad, Wiley

SEMESTER III
M 3 CHE 04-ET02 A
Advanced Bio-inorganic chemistry

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Fundamentals of inorganic biochemistry, geo-chemical effects on life systems essential and non-essential elements in bio-systems, Role of alkali/alkaline earth metals in bio-systems. Role of 3d block elements and non-metals in bio-systems.

UNIT –II

Role of metal ions in oxygen carriers and synthetic oxygen carriers. Designing of chelating agents and metal chelates as medicines. Fixation of dinitrogen biologically and abiologically, biotransformation of nonmetallic inorganic compounds.

UNIT-III

Environmental bioinorganic chemistry: Metal ions as probes for locating active sites. Anti-oxidants. Metal ions as antioxidants, metal ion enhancing catalytic activity of enzymes (Biocatalysts). Inhibitions as competitive and non-competitive metals and metalloproteins. Metal complexes of polynucleotides, nucleosides and nucleic acids (DNA & RNA) Template temperature, stability of DNA.

UNIT-IV

Role of metal ions in replication and transcription process of nucleic acids, Biochemistry of dioxygen, bioinorganic chips and biosensors. Biochemistry of calcium as hormonal messenger, muscle contraction blood clotting neurotransmitter, calcification reclaiming of barren land.

UNIT-V

Metals in the regulation of biochemical events. transport and storage of metal ions in vivo. Metal complexes as probes of structure and reactivity with metal substitution. Fundamentals of Toxicity and Detoxification, Nuclear medicines.

Books Recommended:

1. Supramolecular and Bioinorganic chemistry, Rekha Dashora and A. K. Goswami, Pragati Prakashan.

SEMESTER-III
M 3 CHE 03-ET01 B
Modern Interfaces of Organic Chemistry

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Selective organic name reactions: Hoffmann-Loffer-Fretag reaction, chichibabin reaction, Sharpless, asymmetric epoxidation, Barton reaction, ene reactions, Stork enamine reaction, Aldol, Perkin, Stobbe, Dieckmann, Condensation, Michael addition, Mannich reaction, Sonagashira coupling, Heck reaction, Suzuki – Miyaura coupling, Stille coupling, Negishi reaction, Kumada coupling, Hiyama coupling, Ring closure metathesis.

UNIT-II

Disconnection approach: Elementary idea of disconnection, an introduction to synthons, synthetic equivalents, functional group one and two group C-x & C-C disconnection). Interconversions, Chemoselectivity, Diels-Alder reaction, 1,3-and 1,5 difunctionalised compounds, α, β-unsaturated carbonyl compounds, Michael reaction, Robinson annelation.

Protecting group: Principle of protection of hydroxy, amine and carbonyl groups

UNIT-III

Oxidation: Introduction, different oxidative processes, hydrocarbons (alkenes aromatic rings, activated and inactivated saturated C - H groups), alcohols, diols aldehydes, ketones, ketals and carboxylic acids, singlet oxygen, ruthenium tetroxide and Tl (III) nitrate as oxidizing agent, Provost reaction, Wacker's process Barbier-Wieland degradation

UNIT-IV

Reduction: Introduction, different reductive processes, hydrocarbons (cyclo alkanes, alkenes, conjugated system, alkynes and aromatic rings), carbonyl compounds, nitro, azo and oxime

compounds, hydrogenolysis, reductions using Wilkinson's catalyst, Meerwein –Pondrof - Verley reduction.

UNIT-V

Applications of the following in the organic synthesis: Phase transfer catalysts, polymer supported reagents, Biocatalysts, microwave and ultrasound induced reactions.

Reagents containing phosphorous, Silicon and Boron in organic synthesis: Preparation, properties, applications and mechanistic details.

Books Recommended:

1. Modern Synthetic Reactions, H.O. House, W.A Benjamin

2. Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge Univ. Press.

3. Principles of Organic Synthesis, R.O.C Norman and J.M. Coxon, Blackie Academic & Professional

4. Advanced Organic Chemistry, F.A Carey and R.J. Sundberg.

5. The Disconnection Approach- An art of organic synthesis, Suresh Ameta and P. B. Punjabi, Sadguru Publications, Udaipur.

6. Organic Synthesis-Concept, Methods and Starting Materials, J. Fuhmop and G. Penzillin

7. Guide Book to Organic Synthesis, R.K. Mackie & D.M. Smith, ELBS.

8. Organic Synthesis, V.K. Ahuwalia and Renu Agarwal, Narosa

9. Synthesis, Approaches in Organic Chemistry, R.K. Bansal, Narosa

10. Advanced Organic Chemistry -Reactions, Mechanism and Structure, Jerry March, John Wiley.

SEMESTER III
M 3 CHE 04-ET02 B
Chemistry of Heterocyclic Compounds

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Nomenclature of heterocycles: Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic, fused and bridged heterocyclic.

Aromatic heterocycles: General Chemical behaviour of aromatic heterocyclic, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in 1H-NMR spectra. Empirical resonance energy, delocalization energy, Dewar resonance energy and diamagnetic susceptibility exaltations).

UNIT-II

Small ring heterocycles: Three membered heterocycles with one and two heteroatoms synthetic methods, physical, spectroscopic and chemical properties of aziridines, oxiranes, Thiiranes, diaziridines, diazirines, oxaziridines. Four membered heterocyclic compounds synthetic methods, physical, spectroscopic and chemical properties of azetines, azetidines, oxetanes, thietanes and their carbonyl derivatives.

UNIT-III

Five Membered Heterocycles: Synthetic methods, physical and chemical properties of pyrroles, furanes, thiophenes, Pyrazoles, Imidazoles, Oxazoles, Thiazoles.

Benzo-fused five membered heterocycles: Synthetic methods, physical and chemical properties of benzopyrroles, benzofuranes and benzothiophenes.

UNIT-IV

Six-membered heterocycles: Synthetic methods, physical and chemical properties of pyrilium salts, pyrones, quinolizinium salts, pyridazines, pyrimidines, pyrazines, acridines and phenanthridines, diazines and triazines.

Seven and large membered heterocycles: Synthetic methods, physical and chemical properties of azepines, oxepines, thiepines and diazepins.

UNIT-V

Meso-ionic heterocycles: Synthetic methods, properties of 1,3-oxazolium-4-olates, 1,3-oxathiolium-4-olates, 1,3-diazolium-4-olates, 1, 2, 3,-oxadiazolium-5-olates and 1, 2-diathiolium-4-olates.

Books Recommended-

1. Heterocyclic Chemistry, R.R Gupta, M. Kumar and V. Gupta, Springer Verlag.

2. The Chemsitry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.

3. Heterocyclic Chemistry, R. K. Bansal, New Age International Publishers.

4. Heterocyclic Chemistry, J.A Joule, K. Mills and G.F. Smith Chapman and Hall

5. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical

6. An Introduction to the Hetrocyclic Compounds, R. M. Acheson, John Wiley.

7. Comprehensive Heterocyclic Chemistry, A.R Kartritzky and C.W Rees.

8. Stereoselective Synthesis: A Practical Approach, M. Nogradi

SEMESTER-III
M 3 CHE 03-ET01 C
Chemical Kinetics

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Methods for determining rate of reaction, reaction mechanism and rate law.

Principles of reactivity: Significance of entropy, enthalpy and Gibb's free energy, Arrhenius equation, uses of activation parameters, nature of activation barrier in chemical reaction

UNIT II

Structure effect on rate: Linear free energy relationship, Hammett equation, substitution constants, theories of substituent effect, interpretation of σ values and reaction constant ρ, deviation from Hammett equation, the Taft model, σ_I and σ_R scales, steric acceleration, molecular measurements of steric effect upon rates.

UNIT-III

Solvation and solvent effect on rate: Factors affecting reaction rate in solution, effect of solvation on reaction rate, solvent effect on ion - ion, ion – dipole and dipole – dipole reactions, and preliminary idea about diffusion - controlled reactions.

UNIT-IV

Electron transfer processes in solution: Inner-sphere, outer sphere, bridged transition states, Marcus theory and its modifications, one equivalents and two equivalent exchange reactions, reactions of solvated electron with metal ions.

Kinetic isotope effect: Theory of isotope effects, primary and secondary kinetic effect, heavy atom isotope effect, tunneling effect, solvent isotope effect.

UNIT-V

Reaction on surfaces: Adsorption isotherm, structure of solid surface and adsorbed layers, mechanism of surface reactions, unimolecular and bimolecular surface reactions, transition state theory of surface reactions, surface chemistry in industrial processes.

Gas phase reaction: Hydrogen-oxygen reaction, combustion of hydrocarbons decomposition of N_2O_5 and acetaldehyde, Gold, Finger- Lettort –Niclause rule and inhibition mechanism.

Books Recommended:

1. Surface activity and Detergency, K. Durham, Ed. Mc Millan.

2. Emulsion and Foams, S. Berkman and G. Egloff, Reinhold.

3. Surface Chemistry, J. B. Bikeman, Academic

4. Chemical Kinetics, K. J. Laidler

5. Chemical Kinetics and Mechanism, A. A Frost and R.G. Pearson

SEMESTER-III
M 3 CHE 04-ET02 C
Nuclear and Radiochemistry

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT I

Stability of the nucleus, Mass Energy relationship for nuclear reactions, Properties of nucleus, Nuclear Models (The shell model, the liquid drop model, the Fermi gas model, the collective model and the optical model) , Contribution of the discovery of artificial radioactivity in the field of heavy element chemistry.

UNIT II

Nuclear reactions**:** Specific nuclear reactions, photonuclear reactions and thermonuclear reactions, Interaction of radiation with matter; passage of neutrons through matter;

UNIT III

Measurement of Radiation: Counting techniques, Radiation Detectors Gas ionization detectors- Principle, ion chamber- proportional counter, G M counter Scintillation Detector- Principle, features, Inorganic and organic Scintillators, Solid state detectors, Accelerators: Cyclotron and Vande Graff.

UNIT IV

Nuclear Power Reactor: Basic features, materials and design, Breeder reactor, safety features of reactants, reproduction factor, reactor power life, critical size reactor, reactor waste management.

UNIT V

Radiochemical principles and uses of tracers: Reaction mechanism, structure determination, Surface area of a powder, Neutron activation analysis, Isotope dilution analysis, radiometric titration, Applications in chemical investigations and synthesis in physiochemical analysis, in age determination and in prospecting of natural resources .

Books Suggested:

1. Source Book of atomic Energy, Glasstone, East West Edition

2. Essentials of Nuclear chemistry, H. J. Arniker

3. Introduction to Nuclear Science, M. W. Sarton, West East Edition

4. Theory of Nuclear Structure, M. K. Pal, East West Edition

SEMESTER-III
M 3 CHE 03-ET01 D
Fundamentals of Analytical Chemistry

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Basic tools and operations of analytical chemistry- Role of analytical chemistry, types of analysis, analysis methods, classical and instrumental, selecting an analytical method, laboratory operations and practices , Analytical balance, volumetric glass wares, calibration of glassware, sample dissolution and decomposition , selecting and handling of reagents, preparation of solution of analytic. Laboratory safety measurements.

UNIT-II

Data Handling in analytical chemistry: Accuracy and precision, central value and its measurement, errors, determinant and indeterminant errors. Standard derivation. Reporting analytical data, Statistical evaluation of data significant figure and its rounding off. Test of significance, rejecting of a result Q-test.

UNIT-III

Use of spreadsheets in analytical chemistry: Spreadsheets and their use, control charts, Statistics for small data sets, linear least square method, plotting right standard straight line, correction coefficient and coefficient of determination. Use of spreadsheet for plotting calibration, --- slops and intercepts and coefficient of determination LINSET for additional statics.

UNIT-IV

Environmental sampling and qualitative analysis: Getting a meaningful sample, air sample collection and qualitative analysis, water sample collection and qualitative analysis, soil sample sediment sample. Sample preparation for trace organic contaminated land sites, EPA (Environmental protection agencies)- methods and performance based analysis.

UNIT-V

Thermal methods of analysis- Thermometric titration, thermogravimatric analysis, Activation analysis.

SEMESTER-III
M 3 CHE 04-ET02 D
Modern analytical methods

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Electrochemical methods of analysis: Electrochemical reduction and oxidation, electrode materials, cathode materials, Polarisable and non Polarisable electrodes. Theory of electrochemical oxidations and reductions possible path for electroreduction reactions, Conductometry and high frequency titrations

UNIT- II

Refractometric and interferometric: Principle of refractometric, perameters influencing refrection, significance of critical angle during measurement, refractometer, Qualitative and quantitative analysis

Interferometer: Principle and application

UNIT- III

Chemiluminiscence, Atomic fluorescence and ionization spectroscopy- luminescence, Chemiluminiscence, measurement of Chemiluminiscence quantitative analysis thermoluminescence titrations, chemiluminiscence of liquids, electro Chemiluminiscence,

Atomic fluorescence principle and applications instruments for Atomic fluorescence, ionization spectroscopy, laser enhanced ionization spectroscopy.

UNIT-IV

Flame photometry: Basic Principles, experimental techniques, schematic diagram and its applications in analytic work with special reference to alkali and alkaline earth metals

Atomic Absorption Spectroscopy: Basic principles and applications

UNIT – V

Flow Injection analysis: Characteristics of physical parameters of a flow injection analysis system, Single line FIA spectrometric determination of chloride, three line FIA spectrometric determination of phosphate.

Books recommended:

1. Vogels textbook of quantitative analysis, sixth edition, Pearson education.

2. Analytical chemistry, 7^{th} edition by Skoog, West and Holler, Harcourt college publishers

3. Quantitative chemical Analysis, Eighth edition by Daniel C. Harris, Publish by Clany Marshall

SEMESTER-III

M 3 CHE 05-CP05 (Core practical-5) **Credits 4; Time 8h**

M.M. 80 marks (External)
20 marks (Internal)

1. Inorganic preparation (minimum -10)

I. $Na[Cr(NH_3)_2(SCN)_4]$

II. $Mn(acac)_3$

III. $K_3[Fe(C_2O_4)_3]$

IV. Prussian Blue, Turnbull's Blue.

V. $Co[(NH_3)_6][NO_2]_6$

VI. Cis-$[Co(trien)(NO_2)_2]Cl.H_2O$

VII. $Hg[Co(SCN)_4]$

VIII. $[Co(Py)_2Cl_2]$

IX. $[Ni(NH_3)_6]Cl_2$

X. $Ni\ (dmg)_2$

XI. $[Cu(NH_3)_4]SO_4.H_2O$

XII. $VO(acac)_2$ $TiO(C_9H_8NO)_2.{}_2H_2O$

XIII. Cis-$K[Cr(C_2O_4)_2(H_2O)_2]$

2. Spectral problems- (Minimum -15)

Identification of organic and inorganic compounds by the analysis of their spectral data (UV, NMR, IR and Mass)

3. Titrimetric estimation of drugs: (minimum 3)

Paracetamol, Ascorbic acid, Aspirin, Sulpha drugs, Benzocaine etc.

SEMESTER-III

M 3 CHE 06-EP01 A **Credits 4; Time 8 h**

(Inorganic Chemistry)

M.M. 80 marks (External)
20 marks (Internal)

1. Quantitative analysis I (Minimum-5)

Volumetric determination of two components (binary) mixture containing any two of the following;

I. Copper and Zinc

II. Tin and Lead

III. Lead and Cadmium

IV. Tin and Cadmium

V. Chromium and Iron

VI. Calcium and Magnesium, etc.

2. Quantitative analysis II (minimum-4)

Volumetric determination of ores and alloys such as dolomite, pyrolusite, marble solder, brass, Zinc Sludge etc.

3. Spectrophotometry II (minimum-4)

I. Study of Complex formation by Jobs, Mole ratio and slope ratio method

II. Stability constant by Bjerrum's method.

III. Stability constant by Turner-Anderson method

4. Chromatographic separations

I. Cadmium and zinc

II. Zinc and magnesium

III. Thin layer chromatography; Separation of nickel, manganese, cobalt and zinc,

a. Determinations of R_f values.

IV. Separation and identification of the sugars present in the given mixture of

a. glucose, fructose and sucrose by the paper chromatography and determination of R_f values

5. Magnetochemistry (one exercise) -

I. Determination of magnetic susceptibility and moment by Gouy's method.

SEMESTER-III
M 3 CHE 06-EP01 B **Credits 4; Time 8h**
(Organic Chemistry)

M.M. 80 marks (External)
20 marks (Internal)

1. Qualitative Analysis (Minimum-5)

Separation, Purification and identification of compounds in a ternary mixture of three organic compounds (three solids or two solids one liquid), Separation by ether, $NaHCO_3$, dil NaOH, Preparation of their suitable derivatives wherever possible

2. Organic Synthesis (Minimum-3)

The exercise should illustrate the use of organic reagents and may involve purification of the products by chromatoghraphic technique

I. Photochemical Reaction

II. Benzophenone- Benzpinacol- Benzpinacolone

III. Beckmann Rearrangement-

Benzopheone- Benzophenone Oxime- Benzanilide- Benzoic Acid

Acetophenone- Acetophenone Oxime- Acetanilide- (p- Nitroacetanilide or p-Bromoacetanilide)

IV. Hoffmann and Sandmeyer Reaction

Phthalic anhydride- Phthalimide- Anthranilic acid- o-Chlorobenzoic acid

Benzillic Acid Rearrangement Benzoin- Benzil- Benzilic Acid

3. Spectrophotometric Estimation (Minimum-4)

I. Amino Acids

II. Proteins

III. Carbohydrates

IV. Cholesterol

V. Ascorbic Acid

VI. Aspirin

VII. Caffeine

SEMESTER-III
M 3 CHE 06-EP01 C **Credits 4; Time 8 h**
(Physical Chemistry)

M.M. 80 marks (External)
20 marks (Internal)

1.Chemical Kinetics

I. Study the reaction between potassium persulphate and potassium iodide and find out:

i) Order of reaction ii) Energy if activation iii)Effect of ionic strength.

II. Study the kinetics of reaction between glycolic acid and cerric ammonium sulphate and find out i) Order of reaction with respect to cerric ammonium sulphate ii) Order of reaction with respect to glycolic acid iii) Effect of Temperature iv) Effect of ionic strength.

III. Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide (the kinetics of an iodine clock reaction.)

IV. Study the kinetics of reaction between cerric ammonium nitrate and primary alcohol.

V. Find out order for the saponification reaction using unequal concentration of reactants.

2. Potentiometry

I. Determination of the valency of mercurous ions potentiometrically

II. Determine the strength of strong and weak acids in a given mixture using a potentiometer/pH meter

III. Determination of the dissociation constant of acetic acid in DMSO, DMF, acetone and dioxane by titrating it with KOH.

IV. Determination of the dissociation constant of monobasic or dibasic acid.

V. Determine the dissociation constant of acetic acid potentiometrically.

VI. Titrate a mixture of strong acid (hydrochloric acid) and dibasic acid (oxalic acid) versus sodium hydroxide.

VII. Titrate a solution of Mohr's salt against potassium permanganate/potassium dichromate potentiometrically.

VIII. Titrate potentiometrically solutions of mixture of KCl + KBr + KI and determine the composition of each component

IX. Determination of the formation constant of copper - ammonia complex and stoichiometry of the complex potentiometrically

X. Determination of activity and activity coefficient of electrolytes

Semester III

M 3 CHE 06-EP01 D **Credits 4; Time 8h**

(Analytical chemistry)

M.M. 80 marks (External)
20 marks (Internal)

1. Estimation of Ca, Na and K by Flame photometry

2. Separation of amino acids by ion exchange and chromatographic method

3. Analysis of oils and fats and determine saponification value and iodine values

4. Determination of fats, protein and solid in milk

5. Polarimetric estimation of sugar

6. Analysis of HCl extract of fusion with Na_2CO_3 for Al, Fe, Ca, Mg, P and K

7. Analysis of fertilizers

8. Estimation of lead and tin in solder or bismuth, cadmium and lead in low melting alloys such as Woods metal using EDTA (Volumetrically)

9. Analysis of German silver (copper, zinc and nickel).

Books recommended:

1. Experiments in chemistry by D.V. Jahagirdar, Himalaya Publishing House

2. Instrumental Methods of Chemical Analysis B. K. Sharma