DEPARTMENT OF CHEMISTRY

V – SEMESTER

Advanced Chemistry IA

COURSE TYPE: DSE CORSE CODE:20CH501

Total Teaching hours: 60 Teaching Hours: 4 H / Week Credits: 4

Course Outcomes:

On successful completion of the course students would have;

CO1: Electronic spectra of transition metal complexes and concepts of acids and bases.

CO2: Classification, molecular orbital picture and Aromatic character of Heterocyclic Compounds and Definition, source, classification and general characteristics of alkaloids.

CO3: Classification of molecules, rotational spectra, selection rules of Microwave Spectroscopy and Simple harmonic oscillator, Hooke's law, selection rules of vibrational Spectroscopy**.**

CO4: relationships between thermal energy or heat and other forms of energy and how energy affects matter**.**

UNIT-I: Electronic spectra of transition metal complexes and Acids and Bases (15 Hours)

Electronic spectra of transition metal complexes: Russel-Sandar's coupling in defining ground states of spectrochemical series, derivation of spectroscopic ground terms (d^1 to d^{10} without J values), types of electronic transitions (d-d transitions, charge transfer transitions - MLCT and LMCT), selection rule for d-d transitions, Orgel- energy level diagram-d^1 and d^2 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Acids and Bases: Arrhenius, Bronsted-Lowry, Lux-Flood, solvent system and Lewis concepts of acids and bases. Hard and soft acids and bases (HSAB) - classification of acids and bases as hard and soft, Pearson's HSAB concept

UNIT-II: Heterocyclic Compounds, Green Chemistry, Alkaloids (15Hours)

Heterocyclic Compounds: Classification, molecular orbital picture and Aromatic character of furan, thiophene, pyrrole and pyridine, synthesis of the following compounds. i). Furan, thiohene and pyrrole from 1,4- diketones. ii) Pyridine by Hantzch synthesis. Electrophilic substitution reactions of pyrrole, furan and pyridine (chlorination and nitration), comparison of basicities of pyridine, piperidine and pyrrole.

Green Chemistry: The need for green chemistry and eco-efficiency, green methods, green products, recycling of wastes, 12 principles of green chemistry.

Alkaloids: Definition, source, classification and general characteristics, Hofmann exhaustive methylation with pyridine as an example. Isolation, constitution and confirmation by synthesis – Coniine, hygrine and nicotine.

UNIT III: Microwave Spectroscopy & Vibrational spectrum (15Hours)

Microwave Spectroscopy: Classification of molecules, rotational spectra of rigid diatomic molecules, criteria for showing the spectra, energy levels of rigid rotator, selection rules (final equations only), determination of bond length and moment of inertia of HCl molecule.

Vibrational spectrum: Simple harmonic oscillator, Hooke's law, energy level of simple harmonic oscillator model of diatomic molecule (final equations only), selection rules, zeropoint energy determination of force constant and qualitative relation between force constant and bond dissociation energies. Vibrational degrees of freedom of molecules (Linear and nonlinear).

UNIT-IV Surface Chemistry and Second law of thermodynamics (15Hours)

Second law of thermodynamics: Statement, cyclic process, Carnot's cycle, heat engine and its efficiently, Carnot's theorem, entropy and its significance, entropy change in reversible, isothermal expansion of an ideas gas, free energy, dependence of free energy on pressure and temperature, Gibb's–Helmholtz equation, Clausius-Clapeyron equation for liquid- Vapor equilibrium, Integrated form of Clausius-Clapeyron equation and its applications, problems on above, partial molal quantities, chemical potential of on ideal gas

Surface Chemistry: Adsorption, derivation of Frendlich and Langmuir's adsorption isotherms. Forms of Langmuir's adsorption isotherms at high- and low-pressure regions, BET equation (No derivation), determination of surface area using BET equation. enzyme catalysis Michaelis–Menten equation, industrial applications of catalysis.

References

1. Advance Inorganic Chemistry Vol-I and II Gurudeep Raj
2. Advance Inorganic Chemistry Satya Prakash
3. Modern Inorganic Chemistry R.D. Madan
4. Inorganic Chemistry James Huheey
5. Concise Inorganic Chemistry J.D. Lee
1. Industrial chemistry B.K. Sharma
2. Engineering Chemistry Jain and Jain
3. Reaction Mechanism P.S. Kalsi
4. Mass Spectroscopy Y.R. Sharma
5. Synthetic Organic Chemistry GurdeepChatwal
6. Organic Chemistry P.L. Soni
7. Organic syntheses Jagadamba Singh and Yadav
8. Fundamentals of Organic Synthesis (Retrosynthesis) Ratan Kumar Kar
9. Electrochemistry Glasstone
10. Physical Chemistry Atkins
11. Engineering Chemistry Jain

CHEMISTRY
V – SEMESTER
Advanced Chemistry 1 B

COURSE TYPE: DSE **COURSE CODE: 20CH502**
Total Teaching hours: 60 **Teaching Hours: 4 H / Week** **Credits: 4**

Course Outcomes:

On successful completion of the course students would have;

CO1: Understand the Nanostructures and nanomaterials and its classification and describe the experimental procedure involved in precipitation gravimetric method.
CO2: Learn the Preparation, mechanism of action and applications different reagents and classification and its synthesis of dyes.
CO3: Explain different reaction occurs at different rates, *Principles of Metallurgy* and Methods of purification of metals.
CO4: Explain the preparation, structure, properties and application of different types of polymers.

UNIT-I: Nanomaterials, Theory of gravimetric analysis and Inorganic polymers (15Hours)
Nano materials: Overview of nanostructures and nanomaterials: classification. Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture-one dimensional control. Carbon nanotubes and inorganic nanowires. Bioinorganic nanomaterials.

Theory of gravimetric analysis: Principles of gravimetric analysis- super saturation, von Weimar equation, conditions of precipitation, coprecipitation and post precipitation. Separation of precipitate from mother liquor, washing, properties of wash liquid, drying and ignition of precipitate, weighing form.

Inorganic polymers: Inorganic polymers, Types, comparison with organic polymers, silicones, phosphonitrilic halides- formation, structure and applications.

UNIT-II Reagents and Reactions and Dyes (15Hours)

Reagents and Reactions: Preparation, mechanism of action and applications DCC (Amide formation), LiAlH4 (reduction of aldehyde, carboxylic acid and ester), DDQ (Benzylic oxidation of tetralin, aromatization of tetralin), Lead Tetra Acetate (oxidation of 1,2-diols), NBS (allylic bromination), OsO4 (hydroxylation of alkenes), PCC(Pyridinium chloro chromate) in the oxidation of primary alcohols.

Dyes: Classification, requirement of a dye, colour and constitution. The synthesis of each of the following Class of dyes: Azo dyes-Congo red, Vat dyes–Indigo, Anthraquinone dyes– Alizarin Triphenyle methane dyes–Malachite green, Crystal violet, Phthalein dyes- Fluoroscein, Eosin; Synthesis of each dyes.

UNIT III: Simple collision theory of reaction rates and Industrial Metallurgy (15hours)

Simple collision theory of reaction rates: Derivation of rate constants of unimolecular (Lindemann hypothesis) and bimolecular reaction rates, limitations of collision theory. Transition state theory: Theory Comparison of transition state theory and collision theory, steric factor.

Chemical kinetics of complex reactions-first order reaction, opposing, consecutive and parallel reactions.

Industrial Metallurgy:*General Principles of Metallurgy:* Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, Kroll process, Parting process, van Arkel-de Boer process and Mond'sprocess. Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology.

UNIT IV: Retro synthesis and Properties of Polymers (15Hours)

Retrosynthesis: Introduction to retrosynthetic analysis, synthons, synthetic equivalents, functional group interconversions, one and two group C-X disconnection (definitions and examples only). Retrosynthesis of benzocaine and 4-methoxy acetophenone.

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties): Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly (vinyl chloride) and related polymers, poly (vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly (p-phenylene sulphide polypyrrole, polythiophene)].

Reference:

1. Industrial chemistry B.K. Sharma
2. Engineering Chemistry Jain and Jain
3. Reaction Mechanism P.S. Kalsi
4. Mass Spectroscopy Y.R. Sharma
5. Synthetic Organic Chemistry Gurdeep Chatwal
6. Organic Chemistry P.L. Soni
7. Organic syntheses Jagadamba Singh and Yadav
8. Fundamentals of Organic Synthesis (Retrosynthesis) Ratan Kumar Kar
9. Electrochemistry Glasstone
10. Physical Chemistry Atkins
11. Engineering Chemistry Jain

DEPARTMENT OF CHEMISTRY
V – SEMESTER

CHEMISTRY PRACTICAL V

CORSE TYPE: DSE **CORSE CODE: 20CH503**
Teaching Hours: 4 H / Week **Credits: 2**

Course Outcomes:

On successful completion of the course students would have;

CO1: Learn the experiment of condoctometric titration for different types of acids and bases.
CO2: Verify the Beer–Lambert's Law and heat of neutralization by colorimetric method and
CO3: Determination of concentration of strong acid HCl by potentiometric titration and specific rotation of glucose solution by polarimeter
CO4: Estimation of Fe+3, pH of biological fluids like milk, orange juice, citric acid, solution and sodium carbonate solution using instruments

Section A. Physical Chemistry experiments

1. Determination of the concentration of HCl by conductometric titration using the standard NaOH.
2. Determination of the concentration of CH_3COOH by conductometric titration using the standard NaOH.
3. Verification of Beer–Lambert's Law by colorimetric method and calculation of molar extension coefficient of FeCl3.
4. Determination of dissociation constant of (weak acid) acetic acid conductometrically.
5. Determination of concentration of strong acid HCl by potentiometric titration against strong solution of NaOH.
6. Determination of heat of neutralization of strong acid by strong base by water equivalent calorimetric method.
7. Determination of specific rotation of glucose solution by polarimeter.
8. Determination of solubility of sparingly soluble salt (BaSO4) Conductometrically.

Section B. Instrumental Analysis

1. Estimation of Fe+3 spectrophotometrically through phenanthroline complex.
2. Determination of pH of biological fluids like milk, orange juice, citric acid, solution and sodium carbonate solution.

Note: Only experiments in Section A are to be given in practical examination.

DEPARTMENT OF CHEMISTRY
V – SEMESTER
CHEMISTRY PRACTICAL VI

CORSE TYPE: DSE **CORSE CODE: 20CH504**

Teaching Hours: 4 H / Week **Credits: 2**

Course Outcomes:

On successful completion of the course students would have;

CO1: Understand how functional groups in a compound is responsible for its characteristic property

CO2: Learn how to prepare a derivative for particular functional groups and how to purify it.

Section A. Organic Chemistry **(40 Marks)**

Analysis of binary Organic mixture Systematic qualitative analysis of binary mixture (solid + solid and liquid +l iquid). Type of mixture to be given

a. Acid+Base: Benzoic acid+p-Nitroaniline / Cinnamicacid+m-Nitroaniline
b. Acid+ Neutral: Benzoic acid+Naphthalene / Phthalicacid+Acetanilde
c. Base+Neutral: o-Nitroaniline+Acetanilide / p-Nitroaniline+Naphthalene
d. Phenol+Neutral: 1-Naphthol+Benzamide / 2-Naphthol+Acetanilide
e. Phenol+Base: 2-Naphthol+p-Nitroaniline / 1-Naphthol+m-Nitroaniline
f. Neutral+Neutral (liquid+liquid): Acetone+Ethyl benzoate / Nitrobenzene+Acetone

Section B. Organic Chemistry

a. Fractional crystallization: Separation of mixture of naphthalene and biphenyl
b. Fractional distillation: Separation of mixture of benzene and toluene.

Note: Only experiments in Section A are to be given in practical examination. Student shall separate the mixture and analyze one compound as suggested by examiner and he has to prepare the derivative for the same.

DEPARTMENT OF CHEMISTRY

V – SEMESTER

SKILL ENHANCEMENT COURSE

Industrial Chemistry &Chemical Safety

CORSE TYPE: SEC **COURSE CODE: 20CH511**

Total Teaching hours: 30 **Teaching Hours:**2 H / Week **Credits:** 2

Course Outcomes:

On successful completion of the course students would have;

CO1: Understand the concept of Alloys, Abrasives, Glass, Cement and Fuels.

CO2: learn the handling of Chemicals with Safety measurements and recovery, recycling and reuse of laboratory chemicals.

UNIT-I. Industrial Chemistry (15 Hours)

Alloys-Significance, types of alloys (ferrous and non-ferrous alloys), preparation (fusion and electro-deposition) and their applications.

Abrasives- Classification, Mohr scale of hardness, Manufacture and application of carborundum, alundum, tungsten carbide.

Glass - physical and chemical properties of glass, raw materials, manufacture using tank furnace, annealing of glass, types, composition and uses of glasses.

Cement: Raw materials, composition of Portland cement, manufacture by rotary kiln method, mechanism of setting.

Fuels: characteristic and calorific values of fuels, advantages of gaseous fuels, Manufacture of water gas and biogas.

UNIT-II. Chemical Safety (15 Hours)

Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

References

1. Harris, D. C. Quantitative chemical analysis. 6th Ed., Freeman (2007) Chapters 3-5.
2. Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis. Cambridge Univ. Press (2001) 487 pages.
3. Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.OSU safety manual 1.01

DEPARTMENT OF CHEMISTRY
VI – SEMESTER
Advanced Chemistry II A

Course Type: DSE **Course Code:20CH601**

Total Teaching hours: 60 **Teaching Hours**: 4 H / Week **Credits**: 4

Course Outcomes:

On successful completion of the course students would have;

CO1: To understand organotransition metal complexes, 18 electron rules, Reactions of organometallic compounds and organometallic reagents.
CO2: To learn classification and properties of Carbohydrates, Vitamins and Amino acids, Peptides and Proteins.
CO3: To understand the underlying principles involved in electronic and NMR spectroscopy. Interpretation of the corresponding spectra and applications of chemical molecules. Quantum chemistry focuses on the application of quantum mechanics in physical models and experiments of chemical systems.
CO4: Understand difference between thermal and photochemical reactions Understand laws of photochemistry, Know Types of photochemical reactions and photophysical process Know about quenching and chemiluminescent.

UNIT-I Organometallic Chemistry (15 hours)

Organometallic Chemistry: Introduction, classification of organotransition metal complexes, 18 electron rule with respect to $[Fe(CO)_5]$, $[Ni(CO)_5]$, $[Mn(CO)_5]^+$ and ferrocene. Structure and bonding in metal olefins (Zeise's Salt).

Reactions of organometallic compounds: Ligand substitution, Oxidative addition, Reductive elimination and Beta-hydride elimination.

Organometallic Reagents: Applications of Organomagnesium, Organolithium, Simmons-Smith, and Gilman Reagents in organic synthesis.

UNIT-II Carbohydrates, Vitamins and Amino acids, Peptides and Proteins (15 hours)

Carbohydrates: Haworth and conformational formulae of glucose and fructose, mutarotation and its mechanism, osazone formation, Killani's synthesis, Ruff's degradation, epimers and epimerisation with respect to monosaccharides, interconversions of glucose and fructose.

Vitamins: Vitamins: Classification and importance of vitamin-A, B6, B12, C, D and E. Synthesis of Vitamin-C from D(+)-glucose, synthesis of vitamin-A by Vandropetal.

Amino acids, Peptides and Proteins: Classification, structure and stereochemistry (D and L) of amino acids, acid-base behavior, iso-electric point and electrophoresis, peptides nomenclature and structure of peptides, synthesis of a dipeptide (Bergmann synthesis), Classification of

proteins, levels of protein structure (primary, secondary and tertiary structure), protein denaturation and renaturation.

(06 hours)

UNIT-III Electronic Spectrum, Physical properties and molecular structure and Quantum Chemistry (15 hours)

Electronic Spectrum: Concept potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules, energy levels and respective transitions, Frank–Condon principle.

NMR Spectroscopy: Principle of Proton Magnetic Resonance (1H NMR) spectroscopy, nmr spectrum, chemical shift, nuclear shielding and deshielding, spin-spin coupling(n+1) rule, intensity(height) of the signal, TMS as internal standard-advantages, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, n-propyl bromide, iso propyl bromide, ethanol, acetaldehyde and benzene

Quantum Chemistry: Photoelectric effect - Einstein's photoelectric equation, wave particle duality, de- Broglie hypothesis, de-Broglie equation (derivation), experimental verification-Davisson-Germer experiment.

UNIT-IV: Photochemistry, Chemical Equilibrium, Physical properties and molecular structure (15 Hours)

Photochemistry: Photochemical reactions, laws of photochemistry – Beer's law, Lambart's Law, Beer- Lambart's Law, Grothus-Draper Law and Einstein's Law of photochemical equivalence, quantum efficiency or yield, reasons for high and low quantum efficiencies with examples, fluorescence, phosphorescence, photosensitization and chemiluminescence.

Chemical Equilibrium: Thermodynamic treatment of law of mass action, Van't Hoff reaction isotherm, between Kp, Kcand Kx. Variation of Kp and Kc with temperature & pressure. Numerical problems on equilibrium constant and degree of dissociation.
Physical properties and molecular structure: Introduction-dipole moment, induced dipole moment, measurement of dipole moment by temperature variation method and its applications.

Reference:

1. Advance Inorganic Chemistry Vol-I and II Gurudeep Raj
2. Advance Inorganic Chemistry Satya Prakash
3. Modern Inorganic Chemistry R.D. Madan
4. Inorganic Chemistry James Huheey
5. Concise Inorganic Chemistry J.D. Lee
6. Principles of Physical Chemistry by Puri, Sharma &Pathania
7. Fundamentals of molecular spectroscopy by C. N. Banwell
8. Introduction to Spectroscopy by D L Pavia
9. Organic Chemistry by I.L FinarVol 1,2
10. Organic Chemistry by Paula Bruice
11. Physical Chemistry by K L Kapoor Vol 1, 2

DEPARTMENT OF CHEMISTRY
VI – SEMESTER

Advanced Chemistry II B

Course Type: DSE **Course Code: 20CH602**

Total Teaching hours: 60**Teaching Hours:** 4 H / Week **Credits :**4

Course Outcomes:

On successful completion of the course students would have;

CO1: Understand the fundamentals of analytical chemistry and steps of a characteristic analysis. Understand the role of soil forming factors and processes in soil formation. And to understand the Knowledge of different ***manure*** and ***fertilizers*** used in different crops.

CO2: To be able to use Crystal Field Theory to understand the magnetic properties (and in simple terms the colour) of coordination compounds. Recognize how the fundamental principles of inorganic chemistry apply to bioinorganic systems.

CO3: Understand the pharmacological actions of various classes of cytotoxic and biological agents and supportive drugs used in treatment. And summaries the soap and detergent making.

CO4: Understand and explain the basic principles of qualitative inorganic analysis, Apply 18-electron rule to rationalize the stability of metal carbonyls and related species and Understand the nature of Zeise's salt and compare its synergic effect with that of carbonyls.

UNIT-I Analytical Chemistry, Soil Analysis and Fertilizer (15 Hours)

Chromatography: Principle, types, stationary and mobile phases, physical factors of separation, brief account of paper chromatography, calculation of Rf value, brief account of column chromatography and its applications.

Flame photometry: Principle, Limitations, Instrumentation, Flame photometric determination of Na and K.

Thermogravimetry: Principle and applications of thermogravimetric methods (TG and DTA).

Electrogravimetry: Principle, Instrumentation, Electro gravimetric determination of Copper.

Soil Analysis: Macro nutrients, trace metals and organic matter in soil. Determination of pH, Determination of nitrogen by alkaline permanganate method and phosphorus by Bray's and Olsen's method present in the soil.

Fertilizers: Different types of fertilizers, manufacture of the following fertilizers: Urea, ammonium nitrate, superphosphate of lime.

UNIT-II: Coordination compounds –II and Bioinorganic Chemistry (15 hours)

Coordination compounds –II: Crystal field theory(CFT) with reference to octahedral, distorted octahedral(Jahn- Tellar distortion), tetrahedral and square planar complexes, calculation of crystal field stabilization energy, factors affecting 10Dq, consequences of crystal field splitting on ionic radii of M+2 ions, enthalpy of hydration of M+2 ions, explanation of colour and magnetic properties of magnetic complexes, limitations of crystal field theory, calculation of magnetic moment using Gouy's method.

Bioinorganic Chemistry: Essential and trace elements in biological process, metalloporphyrins with respect to haemoglobin and chlorophyll (structure and function), biological role of Na, K, Fe and Zn.

(4 hours)

UNIT-III: Chemotherapy, Soaps and Detergents, Reaction Mechanism (15 Hours)

Chemotherapy: Introduction, requirement of an ideal synthetic drug, classification, synthesis and uses of the following-

Antipyretics–antipyrine, paracetamol Anaesthetics- novacaine (local) and pentothal sodium(general) Antihistamines–chlorpheniramine maleate (CPM) Antimalarials–paludrine, chloroquine Antibiotics-chloromycetin, penicillin, tetracyclin.

Para pharmaceutical reagents–Benedict's reagent, sodium citrate, Barfoed reagent.

Soaps and Detergents:

Soaps: Introduction, manufacture by modern process, cleaning action of soap. Detergents: anionic, cationic, nonionic, with suitable examples, distinction between soaps and detergents, emulsifiers, stabilizers and builders.

Reaction Mechanism

a) Beckmann rearrangement

b) Favorskii rearrangement

c) Benzidine rearrangement

d) Benzillic acid rearrangement

UNIT-IV: Terpenoids, Organometallic Chemistry, Organic Synthesis via enolates and Organic reagents in inorganic analysis. (15 hours)

Terpenoids: Introduction, classification of terpenes, Ingold's isoprene rule, constitution of citral with synthesis, synthesis of α and β ionones, synthesis of α-terpeniol.

Organometallic Chemistry: Introduction, classification of organotransition metal complexes, 18 electron rule with respect to [Fe(CO)5], [Ni(CO)5], [Mn(CO)5]+, ferrocene, structure and bonding in metal olefins (Zeise's Salt).

Organic Synthesis via enolates: Acidity of α-hydrogens, synthesis of ethyl acetoacetate (EAA) by Claisen condensation and its mechanism, synthesis of diethyl malonate, keto-enoltautomerism of EAA Synthesis of following compounds using EAA and diethyl malonate: i) ketones ii) carboxylic acids iii) heterocyclic compounds iv) dicarboxylic acids.

Organic reagents in inorganic analysis: Sensitivity, selectivity and specificity, advantages of organic reagents over inorganic reagents - Dimethyl glyoxime, 8-hydroxyquinoline (oxime).

Reference:

1. Advance Inorganic Chemistry Vol-I and II Gurudeep Raj

2. Advance Inorganic Chemistry Satya Prakash

3. Modern Inorganic Chemistry R.D. Madan

4. Inorganic Chemistry James Huheey

5. Concise Inorganic Chemistry J.D. Lee

CHEMISTRY
VI – SEMESTER
Chemistry Practical VII

Course Type: DSE **Course Code: 20CH603**

Teaching Hours: 3 H / Week **Credits:**2

Course Outcomes:

On successful completion of the course students would have;

CO1: Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

CO2: Are focus on understanding the physical properties of atoms and molecules, the way chemical reactions work, and what these properties reveal.

Section A: Inorganic Chemistry:

Gravimetric experiments: **(30 Marks)**

1. Estimation of barium as Barium sulphate.
2. Estimation of aluminium as aluminium oxide.
3. Estimation of Iron as ferric oxide.
4. Estimation of led as led sulphate.

Section B: Dissertation/Tour report/Project report
(10Marks)

The Dissertation/Tour report/Project Report should be submitted at the time of Chemistry

Practical Examination.

Student shall be assigned either dissertation /Tour report/Project report. The topics for dissertation shall be selected either from the V and VI semester theory syllabi or general topics related to chemistry. For Tour report, student shall visit an Industry or Academic/Research institutions like BARC, IISC etc.

Note: For examination: Gravimetric experiments and Dissertation/Tour report/Project work are Compulsory.

CHEMISTRY
VI – SEMESTER
Chemistry Practical VIII

Course Type: DSE **Course Code: 20PH604**

Teaching Hours: 4 H / Week **Credits:**2

Course Outcomes:

On successful completion of the course students would have;

CO1: Understand the use of instruments like conductivity meter to obtain various physicochemical parameters and also know the theory about chemical kinetics and determine the velocity constants of various reactions.

CO2: Learn to fit experimental data with theoretical models and interpret the data

Section A: Physical Chemistry (40 Marks)

1. Determination of concentration of given acids mixture (HCl+CH3COOH) conductometrically using standard NaOH.
2. Determination of percentage composition of unknown mixture of A & B liquids using Abbe's refractometer by formula method.
3. Determination of percentage composition of unknown mixture of A & B liquids using Abbe's refractometer by graphical method.
4. Verification of Beer-Lamberts Law by colorimetric method and calculation of molar extension coefficient of copper sulphate.
5. Potentiometric titration of FeSO4 against K2Cr2O7.
6. Determination of the solubility and solubility product of sparingly soluble salts (Silver halides) by potentiometrically.
7. Conductometric precipitation titration of NaCl vs AgNO3.
8. Determination of dissociation constant of weak acid (acetic acid) Potentiometrically.

Section B: Organic Preparations (Two step) (40 Marks)

1. Preparation of phthalimide from phthalic anhydride and Urea.
2. Preparation of p-bromoaniline from acetanilide.
3. Preparation of p-nitroaniline from acetanilide.
4. Preparation of Benzidine from Nitrobenzene.

CHEMISTRY
VI – SEMESTER
SKILL ENHANCEMENT COURSE
Analytical Chemistry

Course Type: SEC **Course Code: 20PH611**

Teaching Hours:2 H / Week **Total hours: 30 hrs** **Credits: 2**

Course Outcomes:

On successful completion of the course students would have;

CO1: Develop the skills in the analysis of soil, water and food adulteration.

CO2: understand the separation of mixtures of organic compounds and identification of biomolecules

UNIT-I: Analytical Chemistry **15 Hours**

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators. Determination of pH of soil samples. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. Determination of pH, acidity and alkalinity of a water samples. Determination of dissolved oxygen (DO) of a water sample.

Analysis of food products: Nutritional value of foods, idea about food processing and food preservations and adulteration. Identification of adulterants in some common food items like coffee powder, asafetida. Chili powder, turmeric powder, coriander powder and pulses, etc. Analysis of preservatives and coloring matter.

UNIT-II: Chromatography **15 Hours**

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}). To compare paint samples by TLC method

Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible.

Analysis of cosmetics: Major and minor constituents and their functional. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, subphases. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration

Suggested Applications (Any one):

a. To study the use of phenolphthalein in traps cases.
b. To analyze arson accelerants.
c. To carry out analysis of gasoline

Reference Books:

1. Willard, H.H., Merritt, L.L., Dean, J. &Settoe, F.A. Instrumental Methods of Analysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
2. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
3. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Analytical Chemistry 6thEd., Saunders College Publishing, Fort Worth (1992).
4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.
5. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
6. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
7. Freifelder, D. Physical Biochemistry 2nd Ed., W.H. Freeman and Co., N.Y. USA (1982).
8. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16 (1977).
9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
10. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.