Shivaji University, Kolhapur

B.O.S. in Chemistry

B.Sc.Part – III

Revised Syllabus

To be implemented from June - 2010

INTRODUCTION

This syllabus is prepared to give the sound knowledge and understanding of chemistry to undergraduate students at last year of the B.Sc. degree course. The goal of the syllabus is to make the study of chemistry as stimulating, interesting and relevant as possible. The syllabus is prepared by keeping in mind the aim to make students capable of studying chemistry in academic and industrial courses. Also to expose the students and to develop interest in them in various fields of chemistry. The new and updated syllabus is based on disciplinary approach with vigour and depth taking care the syllabus is not heavy at the same time it is comparable to the syllabi of other universities at the same level.

The syllabus is prepared after discussions of number of faculty members of the subject and by considering the existing syllabi of B.Sc. Part-I, II & III, new syllabi of XI^{th} & XII^{th} standards, syllabi of NET and SET exams. U.G.C. model curriculum, syllabi of different entrance examination and syllabi of other Universities.

The units of the syllabus are well defined and the scope is given in detail. The periods required for units are given. The lists of reference books are given in detail.

OBJECTIVES

To enable the students-

2 To promote understanding of basic facts and concepts in Chemistry while retaining the excitement of Chemistry.

3 To make students capable of studying Chemistry in academic and Industrial courses.

4 To expose the students to various emerging new areas of Chemistry and apprise them with there prevalent in their future studies and their applications in various spheres of chemical sciences.

5 To develop problem solving skills in students.

6 To expose the students to different processes used in Industries and their applications.

7 To developed ability and to acquire the knowledge of terms, facts, concepts, processes, techniques and principles of subjects,

8 To develop ability to apply the knowledge of contents of principles of chemistry.

9 To inquire of new knowledge of chemistry and developments therein.

10 To expose and to develop interest in the fields of chemistry

11 To develop proper aptitude towards the subjects.

12 To develop the power of appreciations, the achievements in Chemistry and role in nature and society.

13 To develop skills required in chemistry such as the proper handling of apparatus and chemicals

Shivaji University, Kolhapur

B.O.S. in Chemistry

B.Sc.Part – III

Revised Syllabus

To be implemented from June - 2010

Equivalence

Equivalence in accordance with titles and contents of papers (for revised syllabus)

Sr.No.	Title of old paper	Title of new paper
1	Paper - V : Physical Chemistry	Paper - V : Physical Chemistry
2	Paper - VI: Inorganic Chemistry	Paper – VI: Inorganic Chemistry
3	Paper - VII: Organic Chemistry	Paper-VII: Organic Chemistry
4	Paper – VIII: Analytical & Industrial Chemistry	Paper- VIII: Analytical & Industrial Chemistry

A repeater candidate, if any, will be allowed to appear for practical examination as per old course up to March / April 2011 examination.

List of Laboratory Equipments:-

Apparatus & equipments.

1. Digital balance with 1 mg accuracy
2. Conductometer
3. Potentiometer
4. pH. Meter
5. Polarimeter
6. Colorimeter
7. Thermostat
8. Electric Oven
9. Suction Pump
10. Crucible Heater
11. I.R.Lamp
12. Magnetic stirrer
13. Buckner funnel
14. Water bath
15. Platinum electrode
16. Glass electrode
17. Silver, Zink, Copper electrodes
18. Conductivity cell
19. Distilled water plant.
20. Refractometer
21. Frees
22. Deep Frees
23. H_2S Apparatus

Glassware & Porcelain ware:-

1. Burette (50ml)
2. Pipette (5ml,10ml,25ml)
3. Conical flask(100ml, 250ml)
4. Beakers (100ml, 250ml, 500ml)
5. Volumetric flask (100ml, 250ml)
6. Gooch Crucible
7. Watch glass

8. Glass tubing
9. Funnel (3”)
10. Gas jar
11. Glass rod
12. Test Tubes (12x100, 5x5x8)
13. Evaporating dish
14. Crucible
15. T.L.C.Unit
16. Measuring cylinder
17. Thile’s tubes
18. Capillary tube
19. Stopper bottle
20. Thermometer ($1/10^{o}$, 360^{o}
21. Water condenser
22. Distillation flask (100ml)
23. Titration tiles.

Iron & Wooden ware:-

1. Burners
2. Tripod stand
3. Iron stand
4. wire gauze
5. Burette stand
6. Test tube stand
7. Pair of tongs
8. Test tube holder
9. Spatula
10. Copper foi

Chemicals:- All the chemicals required for experiments are mentioned in the syllabus.

Others:-
1. Filter papers (Kalpi)
2. Whatman Filter paper No. 1, 40, 41, 42.

Lab safety Precautions / Measures in Chemistry Laboratory

Part-I: Personal Precautions-

1. All personnel must wear safety Goggles at all times.
2. Must were the Lab. Aprons / Lab Jacket and proper shoes.
3. Except in emergency, an over-hurried activity is forbidden.
4. Fume cupboard must be used. Whenever necessary.
5. Eating, Drinking and Smoking in the laboratories strictly forbidden.

Part-II: Use of safety and Emergency Equipments -

1 First aid kits.

2 Sand Bucket.

3 Fire extinguishers (dry chemical and carbon dioxide extinguisher.

4 Chemical storage cabinet with proper ventilation.

5 Material safety date sheets

6 Management of Local exhaust system and fume hoods.

7 Sign. in register if using instruments.

Nature of theory question papers

N.B. The question paper should cover the entire syllabus. Marks allotted to questions should be in proportion to the lectures allotted to respective units.

Paper V to VII

Marks 100

Question No.	Details	Marks	Marks of Options
1	Multiple choose questions	20	--
2	Long answer type questions (2 out of 3)	20	10
3	Long answer type questions (2 out of 3)	20	10
4	Short answer type questions (4 out of 6)	20	10
5	Short answer type questions (4 out of 6)	20	10
Total		100	40

Paper VIII

Marks -100

Question No.	Details	Marks	Marks of Options
	Section – I **(Physical Chemistry)**		
1 (A) (B)	 Multiple choice questions. Short answer type questions (2 out of 3)	 07 10	 -- 05
2	Long answer type questions (2 out of 3)	16	08
	Section – II **(Inorganic Chemistry)**		
3 (A) (B)	 Multiple choice questions. Short answers type questions (2 out of 3)	 07 10	 -- 05
4	Long answer type questions (2 out of 3)	16	08
	Section – II **(Organic Chemistry)**		
5 (A) (B)	 Multiple Choice questions. Short answer type questions (2 out of 3)	 06 10	 -- 05
6	Long answer type questions (2 out of 3)	18	09
Total		100	40

SHIVAJI UNIVERSITY, KOLHAPUR

Revised Syllabus

(To be implemented from June, 2010)

Chemistry

B.Sc. Part – III

General Structure

Theory examination :

There will be four theory papers of 100 marks each. Their titles and distribution of marks are as follows.

Paper – V : Physical Chemistry – 100 marks

Paper – VI : Inorganic Chemistry – 100 marks

Paper – VII : Organic Chemistry – 100 marks

Paper – VIII : Analytical and Industrial Chemistry – 100 marks

The duration of each theory paper will be of 3 hours.

Practical examination :

Practical examination will be of 200 marks. The distribution of marks will be as follows :

Physical Section : 60

Inorganic Section : 65

Organic Section : 60

Project : 15

Total : 200

The duration of practical examination will be of three days – six and half hours per day.

CHEMISTRY

Revise Syllabus for B.Sc.-III

Theory

N. B. (i) Figures shown in bracket indicate the total lectures required for the respective topics.

(ii) The question paper should cover the entire syllabus. Marks allotted to questions should be in proportion to the lectures allotted to respective topics.

(iii) All topics should be dealt with S.I. units.

(iv) Industrial tour is prescribed.

(v) Use of recent editions of reference books is essential.

(vi) Use of scientific calculator (without memory) is allowed.

(vii) **Values required for spectral problems should be provided in the question paper.**

Paper V

(Physical Chemistry) 75 Lectures

Unit 1. Elementary Quantum Mechanics. [07]

1.1 Introduction

1.2 Black body radiation.

1.3 Planck's radiation law.

1.4 Photoelectric effect.

1.5 Compton effect.

1.6 De Broglie hypothesis.

1.7 The Heisenberg's uncertainty principle.

1.8 Schrodinger wave equation and its importance (no derivation). Physical interpretation of the wave function.

Unit 2. Spectroscopy. **[10]**

2.1 Introduction

2.2 Electromagnetic radiation.

2.3 Electromagnetic spectrum, Energy level diagram.

2.4 Rotational spectra of diatomic molecules : Rigid rotor model; moment of inertia (derivation not expected); energy levels of rigidrotor, selection rules; spectral intensity; distribution using population distribution (Maxwell – Boltzman distribution), determination of bond length; isotope effect.
Interaction of radiation with rotating molecule.

2.5 Vibrational spectra of diatomic molecules : Simple Harmonic oscillator model, Vibrational energies of diatomic molecules, Determination of force constant, overtones.
Interaction of radiation with vibrating molecules.

2.6 Raman spectra : Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

2.7 Numerical problems.

Unit 3. Photochemistry. **[07]**

3.1 Introduction
Difference between thermal and photochemical processes.

3.2 Laws of photochemistry : Grotthus - Draper law, Lambert's law, Lambert Beer's law (with derivation), Stark - Einstein law.

3.3 Quantum yield, Reasons for high and low quantum yield.

3.4 Photosensitized reactions – Dissociation of H_2, Photosynthesis.

3.5 Photodimerisation of anthracene, decomposition of HI and HBr.

3.6 Jablonski diagram depicting various processes occurring in the excited state : Qualitative description of fluorescence and phosphorescence.

3.7 Chemiluminescence.

3.8 Numerical problems.

Unit 4. Solutions. **[05]**

4.1 Introduction

4.2 Ideal solutions, Raoult's law, vapour pressure of ideal and non ideal solutions of miscible liquids.

4.3 Composition of liquid and vapour, vapour pressure and boiling point diagrams of miscible liquids.

Type I : Systems with intermediate total vapour pressure (Zeotropic)

Type II : Systems with a maximum in the total vapour pressure (Azeotropic).

Type III : Systems with a minimum in the total vapour pressure (Azeotropic).

Distillation of miscible liquid pairs.

4.4 Solubility of partially miscible liquids.

(i) Maximum solution temperature type : Phenol – water system.

(ii) Minimum solution temperature type : Triethyl amine – water system.

(iii) Maximum and minimum solution temperature type : Nicotine – water system. Distillation of partially miscible liquid pairs.

4.5 Vapour pressure and distillation of immiscible liquids, steam distillation.

Unit 5. Phase Equilibria. **[05]**

5.1 Introduction

5.2 Gibbs phase rule : Phase rule equation and explanation of terms involved in the equation.

5.3 Phase diagram, true and metastable equilibria.

5.4 One component systems : (i) Water system (ii) Sulphur system with explanation for polymorphism.

5.5 Two component systems: (i) Eutectic system : (Ag – Pb system); Desilverisation of lead, (ii) Freezing mixture : (KI – H_2O system), (iii) Formation of compound with congruent melting point ($FeCl_3$ – H_2O) (iv) Formation of compound with incongruent melting point (Na_2SO_4 – H_2O system).

Unit 6. Electromotive force. **[12]**

(Convention : Reduction potentials to be used)

6.1 Introduction

6.2 Thermodynamics of electrode potentials, Nernst equation for electrode and cell potentials in terms of activities.

6.3 Types of electrodes : Description in terms of construction, representation, half cell reaction and emf equation for

i) Metal – metal ion electrode.

ii) Amalgam electrode.

iii) Metal – insoluble salt electrode.

iv) Gas – electrode.

v) Oxidation – Reduction electrode.

6.4 Reversible and Irreversible cells.

i) Chemical cells without transference.

ii) Concentration cells with and without transference.

iii) Liquid – Liquid junction potential : Origin, elimination and determination.

6.5 Equilibrium constant from cell emf, Determination of the thermodynamic parameters such as ΔG, ΔH and ΔS.

6.6 Applications of emf measurements :

i) Determination of pH of solution using Hydrogen electrode.

ii) Solubility and solubility product of sparingly soluble salts (based on concentration cell).

6.7 Numerical problems.

Unit 7. Thermodynamics. [08]

7.1 Introduction

7.2 Free energy : Gibbs function (G) and Helmholtz function (A), Criteria for thermodynamic equilibrium and spontaneity.

7.3 Relation between ΔG and ΔH : Gibbs Helmholtz equation.

7.4 Phase equilibria : Clapeyron – Clausius equation.

7.5 Thermodynamic derivation of law of mass action, van't – Hoff isotherm and isochore.

7.6 Fugacity and activity concepts.

7.7 Partial molar quantities, Partial molar volume, Gibbs Duhem equation.

7.8 Numerical problems.

Unit 8. The solid state. [10]

8.1 Introduction

Space lattice, lattice sites, Lattice planes, Unit cell.

8.2 Laws of crystallography : (i) Law of constancy of interfacial angles (ii) Law of rational indices (iii) Law of crystal symmetry.

8.3 Weiss indices and Miller indices.

8.4 Cubic lattice and types of cubic lattice, planes or faces of a simple cubic system, spacing of lattice planes.

8.5 Diffraction of X-rays, Derivation of Bragg's equation.

8.6 Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation.

8.7 Numerical problems.

Unit 9. Radioactivity **[07]**

10.1 Introduction.

10.2 Detection and measurement of nuclear radiation by Scintillation and Geiger Muller counter methods.

10.3 Decay constants, half life and average life of radioactive elements.

10.4 Radioactive equilibrium and range of α - particles.

10.5 Geiger – Nuttal relation, Determination of radioactive constant (decay constant).

10.6 Numerical problems.

Unit 10. Nanotechnology **[04]**

11.1 Introduction.

11.2 Preparation of Nanomaterials.

11.3 Applications.

(References for this unit may be collected from internet.)

Reference Books : (Use recent editions)

1. Physical Chemistry by G. M. Barrow, International student Edition, Mc Graw Hill.
2. University General Chemistry by C.N.R. Rao, Macmillan.
3. Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry by P. W. Atkins, Oxford.
5. Principles of Physical Chemistry by S. H. Maron, C. H. Prutton.
6. Nuclear and Radiochemistry by Friedlander, Kennedy and Miller, John Wiley and Sons. Wiley International edition.
7. Essentials of Nuclear Chemistry by H. J. Arnikar, 4^{th} edition. Wiley Eastern.
8. Principles of Physical Chemistry by Puri, Sharma, Pathania, Shobhanlal Naginchand and Company, Jalandar.
9. Instrumental methods of chemical analysis by Chatwal and Anand, , Himalaya Publication.

10. Fundamentals of molecular spectroscopy by C. N. Banwell – Tata Mc Graw-Hill.
11. Quantum Chemistry including molecular spectroscopy by B. K. Sen, Tata Mc Graw - Hill.
12. Text Book of Physical Chemistry by S. Glasstone, Macmillan India Ltd.
13. Elements of Physical Chemistry by D. Lewis and S. Glassture (Macmillan).
14. Principles of Physical Chemistry by Maron and Lando (Amerind).
15. Electrochemistry by S. Glasstone.
16. Physical Chemistry by W. J. Moore.
17. Basic Chemical Thermodynamics by V. V. Rao (Macmillan).
18. Essential of Physical Chemistry, Bahl and Tuli (S. Chand).

*****

Paper VI

(Inorganic Chemistry) **75 Lectures**

Unit 1. Hard and Soft Acids and Bases (HSAB). [04]

1.1 Classification of acids and bases as hard and soft.

1.2 Pearson's HSAB concept.

1.3 Acid – Base strength and hardness and softness.

1.4 Application and limitations of HSAB principle.

Unit 2. Metal ligand bonding in Transition metal complexes [11]

2.1 Crystal field theory (CFT)

2.1.1 An elementary idea of crystal field theory.

2.1.2 Crystal field splitting of 'd' orbitals in octahedral, tetrahedral and square planner complexs. John – Tellar disortion.

2.1.3 Factors affecting the Crystal – field parameter.

2.1.4 High spin and low spin octahedral complexes of Co(III).

2.1.5 Crystal field stabilization energy (C.F.S.E.), calculations w.r.t. octahedral complexes.

2.1.6 Limitations of C.F.T.

2.2 Molecular orbital theory (MOT).

2.2.1 Introduction.

2.2.2 MOT of octahedral complexes with sigma bonding such as $[Ti(H_2O)_6]^{3+}$, $[Ni(NH_3)_6]^{2+}$, $[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$.

2.2.3 Merits and demerits of MOT.

2.2.4 Comparison between CFT and MOT.

Unit 3. Inorganic Polymers. [07]

3.1 Introduction.

3.2 Basic concept and definition.

3.3 Classification of polymers - Organic and Inorganic polymers.

3.4 Comparison between organic and inorganic polymers.

3.5 Polymer back bone.

3.6 Homoatomic polymer containing – (i) Phosphorus. (ii) Fluorocarbons.

3.7 Heteroatomic polymers -

(i) Silicones (ii) Phosphonitrilic compounds.

Unit 4. Metals, Semiconductors and Superconductors. [10]

4.1 Introduction.

4.2 Properties of metallic solids.

4,3 Theories of bonding in metal.

i) Free electron theory.

ii) Molecular orbital theory (Band theory).

4.4 Classification of solids as conductor, insulators and semiconductors on the

basis of band theory.

4.5 Semiconductors. Types of semiconductors - intrinsic and extrinsic semiconductors. Applications of semiconductors.

4.6 Superconductors : Ceramic superconductors - Preparation and structures of mixed oxide $YBa_2Cu_3O_{7-x}$

4.7 Applications of superconductors.

Unit 5. Lanthanides. [07]

5.1 Introduction of f-block elements.

5.2 Positions of Lanthanides in the Periodic Table.

5.3 Electronics Configurations.

5.4 Lanthanide contraction

5.5 Oxidation states.

5.6 Magnetic properties

5.7 Occurrence

5.8 Separation of lanthanides by Ion exchange method.

Unit 6. Actinides. [06]

6.1 Position in periodic table.

6.2 Electronic configuration.

6.3 Oxidation States.

6.4 General methods of preparation of Transuranic elements.

i) Neutron capture – followed by β decay.

ii) Accelerated projectile bombardment.

iii) Heavy ion bombardment.

6.5 IUPAC nomenclature of the super heavy elements with atomic number (Z) greater than 100.

Unit 7. Iron and Steel. [08]

7.1 Occurrence.

7.2 Extraction of iron by Blast furnace.

7.3 Steel : Definition and types.

7.4 Conversion of cast iron into steel by

i) Bessemer process.

ii) L.D. process.

7.5 Heat treatment on steel.

Unit 8. Nuclear Chemistry. [10]

8.1 Nuclear reaction and energetics of nuclear reactions.

8.2 Types of nuclear reactions.

i) Artificial transmutation.

ii) Artificial radioactivity.

iii) Projectile capture reaction.

iv) Projectile capture – particle emission reaction.

v) Nuclear fission.

vi) Nuclear fusion.

8.3 Use of Uranium, Thorium and Plutonium for atomic energy in nuclear reactor and atom bomb.

8.4 Applications of radioisotopes as tracers.

i) Chemical investigation – Esterification.

ii) Structural determination – Phosphorus pentachloride.

iii) Analytical Chemistry – isotopic dilution method for determination of volume of blood.

iv) Age determination – Dating by C^{14}.

Unit 9. Organometallic Chemistry. [05]

9.1 Definition, Nomenclature of organometallic compounds.

9.2 Synthesis and structural study of alkyl and aryl compounds of Li, Be and Al.

9.3 Mononuclear carbonyl and nature of bonding in simple metal carbonyls.

Unit 10. Bioinorganic Chemistry. [07]

10.1 Introduction.

10.2 Essential and trace elements in biological process.

10.3 Metalloporphyrins with special reference to haemoglobin and myoglobin.

10.4 Biological role of alkali and alkaline earth metal ions with special reference to Na^+, K^+ and Ca^{2+}

Reference Books: (Use resent edations)

1. Concise Inorganic Chemistry (ELBS, 5th Edition) – J. D. Lee.
2. Inorganic Chemistry (ELBS, 3rd Edition) D. F. Shriver, P. W. Atkins, C. H. Lang Ford, Oxford University Press, 2nd Edition.
3. Basic Inorganic Chemistry : Cotton and Wilkinson.
4. Advanced Inorganic Chemistry (4th Edn.) Cotton and Wilkinson.
5. Concepts and Models of Inorganic Chemistry : Douglas and Mc. Daniel. 3rd Edition. John Wiley publication.
6. Fundamental concepts of Inorganic Chemistry by E. S. Gilreath.
7. Structural principles in inorganic compounds. W. E. Addison.
8. T. B. of Inorganic analysis – A. I. Vogel.
9. Theoretical principles of Inorganic Chemistry – G. S. Manku.
10. Theoretical Inorganic Chemistry by Day and Selbine.
11. Co-ordination compounds SFA Kettle.
12. New guide to Modern Valence Theory by G. I. Brown.
13. Essentials of Nuclear Chemistry by H. J. Arnikar.
14. Organometallic Chemistry by R. C. Mahrotra A. Sing, Wiley Eastern Ltd. New Delhi.
15. Inorganic Chemistry by A. G. Sharpe, Addision – Wisley Longman – Inc.
16. Principles of Inorganic Chemistry by Puri, Sharma and Kalia, Vallabh Publication. Pitampur Delhi.
17. Text book of Inorganic Chemistry by K. N. Upadhyaya Vikas Publishing House – New Delhi.
18. Progress in inorganic polymer by Laport and Leigh.
19. Co-ordination compounds by Baselo and Pearson.
20. Organometallic Chemistry by P. L. Pauson.

****

Paper VII

(Organic Chemistry) 75 Lectures

Unit1. Spectroscopic Methods. [12]

I) NMR Spectroscopy.

1. Introduction
2. Proton magnetic resonance (^1H) spectroscopy (PMR).
3. Principles of PMR spectroscopy.

4. Magnetic and non-magnetic nuclei.
5. Theory of PMR spectroscopy – spinning nuclei, magnetic moment and magnetic field, processional motion of nuclei without mathematical details, nuclear resonance.
6. NMR – Instrument. Schematic diagram.
7. Shielding and deshielding.
8. Chemical shift, measurement of chemical shift, by delta scale and tau scale.
9. TMS as reference. Advantages of TMS.
10. Peak area (integration)
11. Spin – spin splitting (n + 1 rule).
12. Definition of coupling constant (J value) of first order coupling.
13. PMR spectra of ethanol, ethyl bromide, acetaldehyde, 1, 1, 2 - tribromoethane, ethyl acetate, toluene, acetophenone and benzaldehyde.
14. Problems pertaining to the structure elucidation of simple organic compounds using PMR spectroscopic data (supporting IR and UV data to be given).

II) Mass spectroscopy.

1. Introduction
2. Theory of mass spectroscopy, Mass spectrometer - schematic diagram, formation of ions by ionisation, types of ions with at least one example.
3. Applications of mass spectroscopy.
   i) Determination of molecular weight.
   ii) Determination of molecular formula.

Unit 2. Stereochemistry. [06]

2.1 Introduction.

2.2 Baeyer's strain theory.

2.3 Theory of strainless rings.

2.4 Conformation and stability of cyclohexane and monosubstituted cyclohexanes : cyclohexanol, bromocyclohexane and methyl cyclohexane.

2.5 Locking of conformation in t-butyl cyclohexane.

2.6 Stereoselective and stereospecific reactions :

i) Stereochemistry of addition of halogens to alkenes : syn and anti addition. Example – Addition of bromine to 2-butene. (mechanism not expected)

ii) Stereochemistry of elimination reaction : syn and anti elimination Example – Dehydrohalogenation of 1-bromo -1, 2 - diphenylpropane. (Mechanism not expected)

Unit 3. Name reactions. [10]

Mechanism of following reactions :

3.1 Claisen condensation

3.2 Knoevengel reaction.

3.3 Oppenur oxidation.

3.4 Meerwein Pondorf Verley reduction.

3.5 Reformatsky reaction.

3.6 Wagner – Meerwein Rearrangement.

3.7 Hofmann rearrangement reaction.

3.8 Wittig reaction.

3.9 Related problems.

Unit 4. Reagents in Organic Synthesis. [04]

4.1 Lithium Aluminium Hydride ($LiAlH_4$)

4.1.1 Preparation..

4.1.2 Applications w.r.i. reduction of acid,ketone,ester and anhydride.

4.1.3 Mechanism of reduction of carbonyl Compound..

4.2 Osmium Tetroxide (OsO_4)

4.2.1 Preparation.

4.2.2 Applications w.r.i. preparation of cis-1,2-diols and carbonyl compounds

4.3 Dicyclohexyl carbodiimide (DCC)

4.3.1 Preparation.

4.3.2 Applications w.r.t. preparation of diacyl peroxide, aryl alkyl ether and amides.

4.4 Raney Nickel.

4.4.1 Prepration.

4.4.2 Applications w.r.t. reduction of aliphatic carbon-carbon multiple bonds, reduction of Naphthalene and phenol.

Unit 5. Polynuclear hydrocarbons. [05]

5.1 Introduction.

5.2 Naphthalene – Constitution and Haworth synthesis.

5.3 Physical properties.

5.4 Chemical properties : Electrophilic substitution (Nitration, sulphonation and halogenation) reactions, oxidation and reduction.

5.5 Derivatives of Naphthalene : Methods of preparation, electrophilic substitution reactions (nitration & sulphonation), coupling reaction and uses of –

i) α - and β - Naphthol. (ii) α - and β - Naphthylamine.

Unit 6. Heterocyclic compounds. [08]

6.1 Introduction and classification.

6.2 Pyrrole.

6.2.1 Methods of synthesis :

i) From acetylene.

ii) From furan.

iii) From succinamide.

6.2.2 Physical properties.

6.2.3 Reactivity of pyrrole :

i) Basic character.

ii) Acidic character.

iii) Electrophilic substitution with general mechanism.

6.2.4 Chemical reactions :

i) Reduction.

ii) Oxidation.

iii) Nitration, sulphonation and halogenation.

iv) Friedel Craft's reaction.

v) Coupling reaction.

6.3 Pyridine.

6.3.1 Methods of synthesis.

i) From acetylene and hydrogen cyanide.

ii) From piperidine.

6.3.2 Physical properties.

6.3.3 Chemical reactions :

i) Basic character.

ii) Electrophilic substitution (Nitration, sulphonation & bromination) reactions.

iii) Nucleophilic substitution – General mechanism. Reactions with sodamide, sodium hydroxide and n-Butyl lithium.

6.4 Quinoline

6.4.1 Synthesis - Skraup's synthesis

6.4.2 Physical properties.

6.4.3 Reactions of quinoline :

i) Electrophilic substitution reactions – Nitration and sulphonation.

ii) Nucleophilic substitution reactions – Reactions with sodamide, alkylation and arylation.

iii) Reduction.

6.5 Indole.

6.5.1 Synthesis – Fischer Indole Synthesis.

6.5.2 Physical properties.

6.5.3 Chemical reactions : Elecrophilic substitution reactions (Nitration, bromination, Friedel Craft's acylation), diazo coupling, Mannich reaction, oxidation and reduction.

Unit 7. Organic synthesis via Enolates. [07]

7.1 Introduction –

7.2 Reactive methylene group.

7.3 Ethyl acetoacetate – synthesis by Claisen condensation, acidity of methylene hydrogen (salt formation), Keto-enol tautomerism, synthetic applications – Synthesis of alkyl and dialkyl derivatives, monobasic, dibasic and α- β- unsaturated acid, heterocyclic compound.

7.4 Diethyl malonate - Synthesis, acidity of methylene hydrogen (salt formation). Synthetic applications – Synthesis of alkyl and dialkyl derivatives, dibasic acid, α- β- unsaturated acid, α-amino acid and heterocyclic compound.

Unit 8. Carbohydrates. [09]

8.1 Introduction.

8.2 Classification and nomenclature.

8.3 Monosaccharide D-glucose – Open chain structure.

8.4 Chain lengthening of Aldoses – Kiliani synthesis.

8.5 Chain shortening of Aldoses – Weerman's reaction.

8.6 Interconversion of glucose and fructose.

8.7 Configuration of D-glucose from D-arabinose.

8.8 Objections against open chain structure of D-glucose.

8.9 Muta-rotation with mechanism.

8.10 Ring structure of D-glucose – Determination of size of ring by,

i) Methylation method.

ii) Periodic acid treatment method.

iii) X – ray analysis.

8.11 Disaccharides – Introduction, maltose, sucrose and lactose – Sources, structural formulae and uses.

8.12 Polysaccharides – Introduction starch, cellulose – Sources, structural formulae and uses.

Unit 9. Synthetic dyes. [06]

9.1 Introduction, chromophore, auxochrome.

9.2 Qualities of good dye.

9.3 Classification based on constitution and methods of applications.

9.4 Witt's theory – Colour and constitution.

9.5 Synthesis of Diamond black F, Orange IV, Malechite green, phenolphthalein, Alizarin and Indigo.

Unit 10. Agrochemicals. [03]

10.1 General idea of agrochemicals including pyrethroides.

10.2 Synthesis and uses of the following agrochemicals :

i) Indole-3-acetic acid.

ii) Monocrotophos.

iii) Endosulphan.

iv) Ethophan.

v) Carbaryl.

Unit 11. Pharmaceuticals. [05]

11.1 Introduction.

11.2 Qualities of ideal drug.

11.3 Methods of classification of drugs – Classification based on the therapeutical action.

11.4 Synthesis and uses of the following drugs :

i) Antimalerials – Paludrin.

ii) Antituberculars – Isoniazide and Ethambutol.

iii) C. N. S. drugs – Phenobarbitone.

iv) Antidiabetics – Tolbutamide.

v) Antiinflammatory drugs – Ibuprofen.

vi) Antibiotic – Chloromycetin.

Reference Books : (Use recent editions)

1) Organic Chemistry - Cram D. J. and Hammond G.S. McGraw Hill book Company New York.
2) Organic Chemistry - Finar I. L. The English Language Book Society, London.
3) A Guide Book to mechanism in Organic Chemistry - Peter Sykes Longman Green and Co. Ltd. London.
4) Organic Chemistry - R. T. Morrison and R. N. Boyd Prentice Hall of India private limited New Delhi..
5) Text book of organic Chemistry - Furguson L. N. D. Van Nostrand Company Indian Edition, Affiliated East West press private Ltd. New Delhi.
6) Organic Chemistry Vol. I, II and III - S. M. Mukharji, S. P. Singh, R. P. Kapoor Wiley Estern, Limited, New Delhi.
7) A text book of organic Chemistry - K. S. Tewari, S. N. Mehrotra, N. K. Vishnoi Vikas Publishing House Private Ltd. New Delhi.
8) A text book of Organic Chemistry - Arun Bahl and B. S. Bahl S. Chand and Company Ltd. 6th Edition.
9) Heterocyclic Chemistry Synthesis, Reactions and Mechanism - Raj K. Bansal Wiley Easter Ltd. New Delhi.
10) Reaction Mechanism and reagents in Organic Chemistry - G. R. Chatwal Himalaya Publishing House New Delhi.

11) Stereochemistry conformation and mechanism - P. S. Kalsi, New Age International Publishers.
12) Organic Chemistry Volume I and II - I. L. Finar ELBS with Longman.
13) Organic Chemistry Volume I and II - William Kemp ELBS with Macmillion .
14) Advanced Organic Chemistry - Jerry March Wiley Eastern Ltd.
15) Spectroscopy of Organic compounds - P. S. Kalsi.
16) Organic Chemistry - Fieser and Fieser.
17) Principles of Organic Chemistry - English and Cassidy.
18) Elementary Organic Absorption Spectroscopy - Y. R. Sharma.
19) Spectroscopy - V. M. Parikh.
20) Stereochemistry of Carbon Chemistry – Eliel.
21) Chemicals for crop improvement and pest management - Green, Hartly and West.
22) Chemistry of pesticides - K. H. Buchel (T. W.).
23) Medical Chemistry – Burger.
24) Principles of Organic Chemistry - M. K. Jain.
25) Polymer Science – V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar Willey Eastern Limited.
26) Organic Chemistry by Clayden, Greeves, Warren and Wothers Oxford press.
27) Organic Chemistry – A Comprehensive degree text and source book by Hanes Baeyers and Wolfgang Walter Albion Chemical Science Series.

*****

Paper VIII

(Analytical and Industrial Chemistry) 75 Lectures

Section I

(Physical Chemistry) 25 Lectures

Unit 1. Colorimetry. [04]

1.1 General discussion of theory of colorimetry : Lambert Beer's law (Derivation not expected), Terms used in Colorimetry, Application of Beer's law, Deviation from Beer's law.

1.2 Classification of methods of 'colour' measurement or comparison, photoelectric photometer method – single cell photo-electric colorimeter.

Unit 2. Potentiometry. **[07]**

2.1 Detail study of Quinhydrone and glass electrode and their use in determination of pH.

2.2 Potentiometric titrations : Classical and analytical methods for locating end

2.3 points, Advantages of potentiometric titrations,

i) Acid – Base titrations.

ii) Redox – titrations.

iii) Precipitation titrations.

2.4 Basic circuit of direct reading potentiometer.

Unit 3. Electroplating. **[07]**

3.1 Electrolysis, Faraday's laws, Cathode current efficiency.

3.2 Basic principles of electroplating, cleaning of articles.

3.3 Electroplating of Nickel and Chromium.

3.4 Anodising.

Unit 4. Flame Photometry. **[07]**

4.1 General principles.

4.2 Instrumentation: Block diagram, Burners: Total consumption burner, premix or laminar flow burner, Lundergarph burner, Mirrors, Slits, monochromators, filters and detectors.

4.3 Applications in qualitative and quantitative analysis.

4.4 Limitations of flame photometry.

Reference Books:

1. Text book of Quantitative Inorganic Analysis – By A. I. Vogel (ELBS and Longman 3rd Edition).

2. Instrumental methods of Chemical analysis by Willard – Merit and Dean.

3. Instrumental methods of Chemical analysis by Chatwal and Anand (Himalaya Publication).
4. Principles of electroplating and eletroforming by Blum and Hogaboom, Mac Graw - Hill Book Co. 3rd Edn.
5. Vogel's text book of Quantitative Inorganic Analysis by Basssett and Denny etc. ELBS and Longman 4th edition.

*****

Section II

(Inorganic Chemistry) 25 Lectures

Unit 5. Theory of Gravimetric Analysis. [06]

(Precipitation methods only)

5.1 Introduction.

5.2 Precipitation.

5.3 Nucleation, crystal growth, digestion.

i) Conditions of precipitation.

ii) Physical nature of precipitate.

5.4 Co-precipitation and post precipitation.

5.5 Role of organic precipitants in gravimetric analysis.

ex. 1) DMG 2) 8-hydroxy quinoline.

Unit 6. Theory of Titrimetric Analysis. [06]

6.1 Acid - Base titrations.

6.1.1 Introduction.

6.1.2 Theory of indicators w.r.t. colour change interval and Ostwald's Quinoid theory.

6.1.3 Neutralization curves and choice of indicators for the following titrations

i) Strong acid and strong base.

ii) Strong acid and weak base.

iii) Strong base and weak acid.

6.2 Complexometric titration :

6.2.1 General account.

6.2.2 Types of EDTA titrations.

6.2.3 Metalochromic indicators w.r.t. Eriochrom Black T.

Unit 7. Industrial Heavy Chemical and Chemical Toxicology. [07]

7.1 Industrial heavy chemicals

7.1.1 Physicochemical principles and manufacture of the following.

(i) Ammonia by Haber process. (ii) Sulphuric acid by contact process.

7.2 Chemical toxicology

7.2.1 Toxic Chemicals in the environment.

7.2.2 Biochemical effect of As, Cd, Pb, Hg, Ozone, PAN, Cyanides and pesticides.

Unit 8. Corrosion and Passivity. [06]

8.1 Corrosion

8.1.1 Introduction.

8.1.2 Types of corrosion.

8.1.3 Electrochemical theory of corrosion.

8.1.4 Factors affecting the corrosion.

i) Position of metal in emf series.

ii) Purity of metal.

iii) Effect of moisture.

iv) Effect of oxygen.

v) Hydrogen over voltage.

8.1.5 Methods of protection of metals from corrosion.

8.2 Passivity

8.2.1 Introduction.

8.2.2 Definition.

8.2.3 Types of passivity.

8.2.4 Oxide film theory.

8.2.5 Application of passivity.

Reference Books:

1. Vogel's text book of quantitative inorganic analysis (revise) J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.

2. Text book of quantitative Inorganic Analysis, by A. I. Vogel. (ELBS and Longman) 3rd End.
3. Chemical process Industries. R. N. Shreve, J. A. Brink (Jr.).
4. Environmental Chemistry by A. K. De (4th Edn.) New Age International Ltd. Publisher, New Delhi and Mumbai.
5. Handbook of preparative Inorganic Chemistry, Vol. I and II, Brauer, Academic Press.

*****

Section III

(Organic Chemistry) **25 lectures**

Unit 9. Soaps and detergents. [06]

9.1 Soap

i) Raw materials.
ii) Types of soaps.
iii) Manufacture of soap – Hot process.
iv) Cleansing action of soaps.

9.2 Detergents

i) Raw materials.
ii) Types of detergents – Cationic, anionic, amphoteric, neutral detertents.
iii) Preparation of teepol and deriphat.

9.3 Comparison between soaps and detergents.

Unit 10. Synthetic polymers. [05]

10.1 Introduction.

10.2 Classification:

i) According to origin, composition, method of preparation and general physical properties.
ii) Classification based upon structure.

10.3 Process of addition polymerisation - free radical polymerisation of alkenes and Dienes.

10.4 Ionic polymerisation.

10.5 Ziegler – Natta polymerisation.

10.6 Methods of preparation and uses of :

i) Polythene. ii) Polystyrene.

iii) PVC. iv) Phenol formaldehyde resin.

v) Urea formaldehyde resin. vi) Poly urethane.

10.7 Natural rubber : General idea and vulcanisation.

10.8 Synthetic rubbers : Synthesis and used of –

i) Polychloroprene. ii) Buna rubber - Buna N and Buna S.

Unit 11. Sugar Industry. [05]

11.1 Manufacture of raw cane sugar.

11.2 Refining of raw sugar.

11.3 White sugar.

11.4 By-products of sugar industry.

Unit 12. Green Chemistry. [03]

12.1 Introduction – Twelve principles of green chemistry.

12.2 Zeolites – Friedel Craft's alkylation and acylation, oxidation of benzene to phenol and benzoquinone, Reduction of benzoquinone to hydroquinone.

12.3 Biocatalytic reaction – Hydroxylation and oxidation using enzymes.

12.4 Introduction to microwave assisted reactions.

Unit 13. Chromatography. [06]

13.1 Introduction.

13.2 General principles.

13.3 Classification.

13.4 Paper chromatography.

13.5 Column chromatography.

13.6 Thin layer chromatography.

13.7 Gas chromatography

Reference Books:

1. Basic Concepts of Analytical Chemistry – S. M. Khopkar, Wiley Eastern Ltd., Bombay.
2. Industrial Chemistry - R. K. Das, Asia Publishing, Mumbai.
3. Text Book of Quantitative Organic Analysis - A. I. Vogel, Pearson Edn. Delhi.
4. Quantitative Organic Chemistry - A. I. Vogel, Pearson Edn. Delhi.
5. Hand Book of Organic Analysis - H. T. Clarke, Arnold Heinemann Pub. Delhi.
6. Advanced Organic Chemistry - B. S. Bahl and Arun Bahl, S. Chand Comp. Delhi.

7. Riegel's Handbook of Industrial Chemistry – J. A. Kent, Van. Nostrard, Londan.
8. Medical Chemistry – A. Burger, John Viley, New York.
9. Chemical Process Industries – Shreve and Brinic – Ostin, Magraw Hill, New York.
10. Analytical Chemistry- Walton.
11. Biotechnology and Applied Microbiology – Alani and Moo-Young.
12. Immobilize Biocatalysis – Joy Wleser.
13. Introduction to Polymer Chemistry – Raymond B. Seymour.
14. Advances in Green Chemistry: Chemical synthesis using MW-irradiation by R. S. Varma.
15. Green Chemistry: Environment Friendly alternatives – Rashmi Sanghi and M. M. Srivastava (Eds) (c) 2003 Narosa Publishing House, New Delhi, India.

*****

Laboratory Course

N. B. (i) Use of Digital/Analytical/Chainometric/Single pan balance is allowed.

(ii) Use of Scientific calculator (without memory) is allowed.

(iii) Use of Chart/Text book/Hand book of practical is allowed.

(iv) There will be a project having weightage of **15** marks.

Project should be in the following areas but focused on applications of Chemistry.

a) Society oriented
b) Daily use
c) Industrial based
d) Analytical based
e) ICT based

The project will be assessed by all the three examiners with equal weightage at the time of practical examinations.

The project may be completed individually or by a group of students not exceeding number three.

One copy of the project should be submitted at the time of examination. After assessment this copy will remain in the department.

Physical Chemistry

I. Non instrumental Experiments:

A. Partition Law.

1. To determine the partition coefficient of CH_3COOH between H_2O and CCl_4.

B. Chemical kinetics. (Any four)

1. The study of energy of activation of first order reaction i.e. hydrolysis of methyl acetate in presence of 0.5 N HCl / 0.5 N H_2SO_4.
2. The study of energy of activation of second order reaction i.e. reaction between $K_2S_2O_8$ and KI (Equal concentrations).
3. The study of energy of activation of second order reaction i.e. reaction between $K_2S_2O_8$ and KI (Unequal concentrations).
4. To study the hydrolysis of methyl acetate by using its two concentrations in presence of 0.5 N HCl and hence find velocity constant of the reaction.
5. To study the effect of addition of electrolyte (KCl) on the reaction between $K_2S_2O_8$ and KI (Equal concentrations).

C. Partial molar volume.

1. To determine the partial molar volume of ethyl alcohol in a mixture of ethyl alcohol and water (Any seven mixtures be given).

II. Instrumental experiments

A. Potentiometry (Any four)

1. Titration of strong acid with strong alkali.
2. Preparation of buffer solution and determination of their pH (Any five buffer solutions), - Theoretical calculation of pH values by using Henderson's equation.
3. Determination of standard electrode potential of Zn/Zn^{++}, Cu/Cu^{++}, Ag/Ag^{+} (Any two).
4. Determination of solubility and solubility product of AgCl.
5. Titration of ferrous ammonium sulphate using $K_2Cr_2O_7$ solution and to calculate redox potential of Fe^{++}, Fe^{+++} system.

B. Conductometry.

1. Titration of weak acid with strong alkali.
2. Titration of a mixture of weak acid and strong acid with strong alkali.
3. To study the effect of substituent on dissociation constant of weak acid with respect to acetic acid and monochloroacetic acid (cell constant to be given).
4. To determine the velocity constant of hydrolysis of ethyl acetate by NaOH solution by conductometric method.

C. Refractometry.

1. To determine the percentage composition of unknown mixture by (i) graphical method and (ii) by composition law (Densities of pure liquids A & B be given).
2. To determine the molar refractivity of methyl acetate, ethyl acetate, n-hexane and carbon tetrachloride and calculate the refraction equivalents of C, H and Cl atoms.

D. Colorimetry (Any Two).

1. To verify Lambert – Beer's law using $CuSO_4$ solution.
2. To estimate of Fe^{+++} ions by thiocynate method.
3. To estimate Fe^{+++} ions using salicylic acid by colorimetric titration.

E. pH – metry (Any One).

1. To determine the dissociation constant of monobasic acid (Acetic acid).
2. To determine the dissociation constant of dibasic acid (Malonic acid).

Reference Books:

1. Findlay's Practical Physical Chemistry (Longman)

2. Advanced Practical Physical Chemistry by J. B. Yadav, Goel publishing house.
3. Practical Physical Chemistry by B. D. Khosla, V. C. Garg (R. Chand and Co.)
4. Systematic experimental Physical Chemistry by Rajbhoj, Chandekar (Anjali Publicaiton)
5. Practical Physical Chemistry: Nandkumari, Kothari and Lavande.
6. Practical Physical Chemistry by Gurtu (S. Chand).
7. Text Book of Qualitative Inorganic Analysis by A. I. Vogel (ELBS Longman).

*****

Inorganic Chemistry

I Gravimetric Estimations (G).

N. B. : Any **two** experiments from G_1 to G_3 and any **one** experiment from G_4 & G_5.

G_1. Gravimetric estimation of iron as ferric oxide from the given solution containing ferrous ammonium sulphate, copper sulphate and free sulphuric acid.

G_2. Gravimetric estimation of zinc as zinc pyrophosphate from the given solution containing zinc sulphate, ferrous ammonium sulphate and free sulphuric acid.

G_3. Gravimetric estimation of barium as barium sulphate from the given solution containing barium chloride, ferric chloride and free hydrochloric acid.

G_4. Gravimetric estimation of barium as barium chromate from the given solution containing barium chloride, ferric chloride and free hydrochloride acid.

G_5. Gravimetric estimation of nickel as bis (dimethylglyoximato) nickel (II) from the given solution containing nickel sulphate, ferrous ammonium sulphate and free Sulphuric acid.

[For the gravimetric experiments, stock solution should be given in the range of 10 to 15 cm^3 and asked to dilute to 100 cm^3 (or the stock solution should be given in the range of 20 to 30 cm^3 and asked to dilute to 250 cm^3). Use 50 cm^3 of this diluted solution for estimation.]

II. Inorganic Preparations (P).

N. B. At least **six** preparations from the following with **percentage yield**:

P_1. Preparation of sodium cuprous thiosulphate.

P_2. Preparation of potassium trioxalato ferrate (III).

P_3. Preparation of potassium trioxalato aluminate (III).

P_4. Preparation of tris (ethylene diamine) nickel (II) thiosulphate.

P_5. Preparation of ammonium diamminetetrathiocynatochromate (III) (Reineck's salt).

P_6. Preparation of chlropenta-ammine cobalt (III) chloride.

P_7. Preparation of hexammine nickel (II) chloride.

P_8. Preparation of tris(thiourea) cuprous sulphate.

III) Titrimetric Estimations :

A) Percentage Purity

N. B. : Any **three** from the following.

V_1. Determination of percentage purity of ferrous ammonium sulpahte.

V_2. Determination of percentage purity of tetrammine copper (II) sulphate.

V_3. Determination of percentage purity of potassium trioxalato-aluminate(III).

V_4. Determination of percentage purity of potassium trioxalato ferrate (III).

B) Analysis of Commercial Sample.

N. B. Any **four** from the following :

V_5. Determination of percentage of magnesium in the given sample of talcum powder.

V_6. Determination of amount of aluminum in the given solution of potash alum.

V_7. Determination of titrable acidity in the given sample of milk or lassi.

V_8. Determination of percentage purity of boric acid using supplied sodium hydroxide.

(Standard succinic or oxalic acid solution to be prepared to standardise the given sodium hydroxide solution.)

C) Ion exchange method.

N. B. Any **two** from the following.

V_{10}. Determination of amount of sodium present in the given solution of common salt using cation exchange resin (By Acid Base titration).

V_{11}. Determination of amount of magnesium in the given solution containing (Mg^{2+} and Zn^{2+}) using anion exchange resin and standard solution of EDTA.

V_{12}. Determination of amount of zinc in the given solution containing (Mg^{2+} and Zn^{2+}) using anion exchange resin and standard solution of EDTA.

Reference Books:

1. A text book of quantitative Inorganic Analysis - A. I. Vogel.
2. Text book of Quantitative Inorganic Analysis - Kolthoff and Sandell.
3. Experimental Inorganic Chemistry - Palmer W. G.
4. Advanced Practical Inorganic Chemistry - Adams and Raynor.
5. Manual in Dairy Chemistry - I.C.A.R. Sub-Committee on Diary Education.
6. Chemical methods for environmental analysis - R. Ramesh and M. Anbu.

*****

Organic Chemistry

I) Qualitative analysis

Separation of binary mixture and Identification of its components. 5 g of mixture is to be given for separation.

At least 08 mixtures are to be separated & identified.

Nature : 1) Solid – Solid : 6 mixtures

2) Solid – Liquid : 1 mixtures

3) Liquid – Liquid : 1 mixtures

1) Solid – Solid Mixtures:

One mixture from each the following types should be given :

i) Acid + Phenol ii) Acid + Base

iii) Acid + Neutral iv) Phenol + Base

v) Phenol + Neutral vi) Base + Neutral

2) Solid – Liquid Mixtures

Mixture of type Neutral + Neutral Or Acid + Neutral should be given.

3) Liquid – Liquid Mixtures

Mixture of type Neutral + Neutral Or Base + Neutral should be given.

Following compounds should be used for preparation of mixtures

Acids : Benzoic acid, Phthalic acid, Salicylic acid, Cinnamic acid, Aspirin, Oxalic acid.

Phenols : α-naphthol, β-naphthol

Bases : o -nitroaniline, m-nitroaniline, p-nitroaniline, aniline, o-toluidine and N, N-dimethyl aniline.

Neutrals: Naphthalene, acetanilide, m-dintrobenzene, chloroform, carbon tetrachloride, acetone, nitrobenzene, ethyl acetate, ethyl benzoate, acetophenone, bromobenzene, urea and thiourea.

N. B. : For Solid – Liquid and Liquid – Liquid mixtures avoid detection of type of mixture. Instead the weightage is given to detection of nature and separation of mixture.

II) Quantitative analysis: (Any four)

Organic estimations:

1) Estimation of sucrose
2) Saponification value of oil.
3) Estimation of aspirin from aspirin tablets.
4) To determine the amount of acid and ester present in the given mixture of acid and ester.
5) Estimation of acid and amide from the mixture of acid and amide.

III) Organic Preparations: (Any four) with following -

24. Calculation of percentage practical yield.
25. Recrystallisation of crude product and its melting point.
26. The product **should be** confirmed by **TLC**.

1) Preparation of m-nitroaniline from m-dinitrobenzene.
2) Preparation of m-dinitrobenzene from nitrobenzene using nitrating mixture.
3) Preparation of p-bromoacetanilide from acetanilide.
4) Preparation of p-iodonitrobenzene from p-nitroaniline.
5) Preparation of benzene azo - β - naphthol.
6) Preparation of benzoic acid from toluene.

IV) Preparation of Derivatives:

During practical course, **name of the organic compound should not be given.**

1) Benzoyl derivative (of β-naphthol and aniline).
2) Picrate derivative (of anthracene and β-naphthol).
3) Anhydride derivative (of phthalic acid).
4) Oxime derivatives (of Acetone and acetophenone).
5) 2 : 4 DNP derivatives (of Acetaldehyde and acetophenone).
6) Oxalate derivative (of Urea)

Reference Books :

1. Practical Organic Chemistry by A. I. Vogel.
2. Hand book of Organic qualitative analysis by H. T. Clarke.
3. A laboratory Hand Book of Organic qualitative analysis and separation by V. S. Kulkarni. Dastane Ramchandra & Co.
4. Practical Organic Chemistry by F. G. Mann and B. C. Saunders. Low – priced Text Book. ELBS. Longman.
5. Experiments in General Chemistry by C. N. R. Rao. Affiliated East-West Press Pvt. Ltd. Delhi.
6. Advanced Practical Organic Chemistry by N. K. Vishnoi. Vikas Publishing House Private Limited.
7. Comprehensive Practical Organic Chemistry Qualitative Analysis by V. K. Ahluwalia, Sunita Dhingra. University Press. Distributor – Orient Longman Ltd.
8. Comprehensive Practical Organic Chemistry Preparation and Quantitative Analysis by V. K. Ahluwalia, Renu Aggarwal. University Press. Distributor – Orient Longmann Ltd.
9. Practical Chemistry – Physical – Inorganic – Organic and Viva – voce by Balwant Rai Satija. Allied Publishers Private Limited.
10. College Practical Chemistry by H. N. Patel, S. R. Jakali, H. P. Subhedar, Miss. S. P. Turakhia. Himalaya Publishing House, Mumbai.
11. College Practical Chemistry by Patel, Jakali, Mohandas, Israney Turakhia. Himalaya Publishing House, Mumbai.
12. Practice of thin layer chromatography by Joseph C. Touchstone, Murrell F. Dobbins. A Wiley – Interscience Publication John-Wiley & Sons.

*****

Nature of Practical Examination

1) The practical examination will be of **200** marks.
2) The duration of practical examination will be of **three days - six and half hour per day.**
3) Questions related to the practical exercise carried out by the student should be asked in viva.
4) Use of scientific calculator (without data memory) is allowed.
5) S.I. units should be used wherever possible.
6) Use of Chart / Hand book / Text book of practical is allowed.
7) A student is expected to submit a journal certified by the Head of the Department.
8) A student not be permitted to appear at the practical examination unless he/she produces a certified journal. If the journal is lost, the student should produce a certificate from the Head of the Department stating that he/she has satisfactory completed the practical work but his / her journal is lost.
9) Use of Digital / Analytical / Chainometric / Single pan balance is allowed.
10) **A student should submit one copy of project at the time of examination. Each examiner should asses the project work for Five marks and sign the same. If any student will not submit project work, he will be given Zero mark for the project.**
11) The distribution of marks for practical examination will be as follows :

A) Physical Chemistry	**60 marks**
i) Non-instrumental experiment	25 marks
ii) Instrumental experiment	25 marks
iii) Viva	05 marks
iv) Journal	05 marks
B) Inorganic Chemistry	**65 marks**
i) Gravimetric analysis	25 marks
ii) Preparation	15 marks
iii) Volumetric estimation	15 marks
iv) Viva	05 marks
v) Journal	05 marks
C) Organic Chemistry	**60 marks**
i) Mixture separation and identification of compounds	25 marks
ii) Estimation/Preparation	20 marks
iii) Derivative	05 marks
iv) Viva	05 marks
v) Journal	05 marks
D) Project	**15 marks**
Total:-	**200 marks**

@@@@@