

# Swami Ramanand Teerth Marathwada University, Nanded



## SYLLABUS B. SC. THIRD YEAR (CHEMISTRY) SEMESTER PATTERN

IN FORCE FROM JUNE - 2011

**B. Sc. First Year (Semester-I)  
Chemistry**

<b>Paper No.</b>	<b>Course No.</b>	<b>Course</b>	<b>Periods/week</b>	<b>Total Periods</b>	<b>Marks</b>
I	CH-101	Inorganic Chemistry	2	30	32
II	CH-102	Organic Chemistry	2	30	34
III	CH-103	Physical Chemistry	2	30	34

**B. Sc. First Year (Semester-II)  
Chemistry**

<b>Paper No.</b>	<b>Course No.</b>	<b>Course</b>	<b>Periods/week</b>	<b>Total Periods</b>	<b>Marks</b>
IV	CH-104	Inorganic Chemistry	2	30	32
V	CH-105	Organic Chemistry	2	30	34
VI	CH-106	Physical Chemistry	2	30	34
VII	CH-107	Laboratory Course-I	4	120	100

**B. SC. Second Year (Semester-III)  
Chemistry**

<b>Paper No.</b>	<b>Course No.</b>	<b>Course</b>	<b>Periods / week</b>	<b>Total Periods</b>	<b>Marks</b>
VIII	CH-201	Inorganic Chemistry	2	30	32
IX	CH-202	Organic Chemistry	2	30	34
X	CH-203	Physical Chemistry	2	30	34

**B. SC. Second Year (Semester-IV)  
Chemistry**

<b>Paper No.</b>	<b>Course No.</b>	<b>Course</b>	<b>Periods / week</b>	<b>Total Periods</b>	<b>Marks</b>
XI	CH-204	Inorganic Chemistry	2	30	32
XII	CH-205	Organic Chemistry	2	30	34
XIII	CH-206	Physical Chemistry	2	30	34
XIV	CH-207	Laboratory Course-II	4	120	50
XV	CH-208	Laboratory Course-III	4	120	50

**B. SC. Third Year (Semester-V)  
Chemistry**

Paper No.	Course No.	Course	Periods / week	Total Periods	Marks
XVI	CH-301	Inorganic Chemistry	2	30	32
XVII	CH-302	Organic Chemistry	2	30	34
XVIII	CH-303	Physical Chemistry	2	30	34

**B. Sc. Third Year (Semester-VI)  
Chemistry**

Paper No.	Course No.	Course	Periods / week	Total Periods	Marks
XIX	CH-304	Inorganic Chemistry	2	30	32
XX	CH-305	Organic Chemistry	2	30	34
XXI	CH-306	Physical Chemistry	2	30	34
XXII	CH-307	Laboratory Course-IV	4	120	50
XXIII	CH-308	Laboratory Course-V	4	120	50

**B. Sc. Chemistry Degree Marks**

Class	Theory Marks	Practical Marks	Total Marks
B. Sc. F. Y.	200	100	300
B. Sc. S. Y.	200	100	300
B. Sc. T. Y.	200	100	300
<b>Total</b>	<b>600</b>	<b>300</b>	<b>900</b>

**B. Sc. Third Year, Semester-V**  
**Paper – XVI [CH-301]**  
**Inorganic Chemistry**

**Periods: 30**

**Marks: 32**

**Unit:-I**

**1.1 Coordination chemistry (Part-I) 10**

- a) Introduction: addition or molecular compound, double salt, coordination compound. Comparison of double salt and coordination compound.
- b) Terminology: complex ion, central metal atom, ligand, types of ligand, coordination number and coordination sphere.
- c) Nomenclature: Rules of nomenclature of coordination compound, and its applications to nomenclature of simple and bridging complex compounds.
- d) Werner's theory of coordination compound, postulates, applications with reference to  $\text{CoCl}_3 \cdot 6\text{NH}_3$ ,  $\text{CoCl}_3 \cdot 5\text{NH}_3$ ,  $\text{CoCl}_3 \cdot 4\text{NH}_3$ ,  $\text{CoCl}_3 \cdot 3\text{NH}_3$ .
- e) Chelating agents and its classification, difference between metal complex and metal chelate complex.
- f) Isomerism: Structural isomerism, ionization, hydrate, linkage, coordination isomerism, geometrical isomerism, optical isomerism in 4 and 6 coordination complex.
- g) E. A. N. of metal complexes.

**Unit-II**

**2.1 Chemistry of inner transition elements (Part-I) 08**

- a) Introduction; definition of inner transition elements, Lanthanides: Position in periodic table.
- b) Electronic configuration of lanthanides; oxidation state; magnetic moment; color.
- c) Separation of lanthanides by ion exchange method.
- d) Lanthanide contraction, cause and consequences.
- e) Absorption spectra of lanthanides. Lanthanides act as shift reagents.

**Unit-III**

**3.1 Theory of gravimetric analysis 06**

- a) Introduction; definition of gravimetric analysis.
- b) Steps involved in gravimetric analysis;
- c) Precipitation, types of precipitates, factors affecting the precipitation such as temperature, pH and complex.
- d) Purity of the precipitate: Post precipitation, co precipitation and fractional precipitation.
- e) Condition for the completion of precipitation.
- f) Digestion of precipitate, filtration, washing, drying, ignition, and weighing along with conversion factor.

**Unit-IV**

**4.1 Metal carbonyls 06**

- a) Definition, types 1) Mononuclear carbonyl, characteristics and examples; 2) Polynuclear carbonyl, characteristics and examples.
- b) Preparation properties and structure of Nickel tetra carbonyl.
- c) Nature of metal carbon bond in metal carbonyl and their evidences.
- d) Structure of  $\text{Fe}_2(\text{CO})_9$ ,  $\text{Fe}_3(\text{CO})_{12}$ ,  $\text{Ir}_4(\text{CO})_{12}$ ,  $\text{Co}_2(\text{CO})_8$ .

**B. Sc. III Year**  
**Paper – XVII [CH-302] Semester-V**  
**Organic Chemistry**

**Periods: 30**

**Marks: 34**

**UNIT-I**

**1.1 Synthetic Drugs and Dyes: 08P**

**A] Synthetic Drugs:**

- a) Introduction.
- b) Definition: i) Pharmacy ii) Pharmacology iii) Chemotherapy iv) Metabolites and anti-metabolites v) Bacteria vi) Gram positive and Gram negative.
- c) Classification on the basis of:  
(1) Chemotherapeutics: (Antimalerials, Antiseptic, Antibacterial, Antibiotics, Antifungal.)  
(2) Functional: (Analgesics, Antipyretics, Sedatives, Anaesthetics)
- d) Synthesis and Uses:  
i) Sulphanilamide from acetanilide.  
ii) Sulphadiazine from 2-aminopyrimidine.  
iii) Chloroquine from 4,7-dichloroquinoline and N,N-diethyl,1,4-pentanediamine.  
iv) Aspirin from Salicylic acid.  
v) Paracetamol from phenol.

**B] Synthetic Dyes:**

- a) Introduction, Theories of colour and chemical constitution [Witt's and Armstrong(Quinonoid) Theories]
- b) Classification of dyes on the basis of structure.
- c) Synthesis of dyes and their applications:  
i) Methyl Orange.  
ii) Phenolphthalein.  
iii) Fluorescein.  
iv) Congo red.

**UNIT:-II**

**2.1 Alkaloids: 05P**

- a) Introduction, Occurrences, general properties.
- b) General methods for determination of structure of alkaloids.
- c) Constitution of Ephedrine.
- d) Synthesis of i) Nicotine from nicotinonitrile, ii) Papaverine from 1, 2-diacetyl benzene iii) Piperonal from catechol.

**2.2 Vitamins: 04P**

- a) Introduction.
- b) Classification.
- c) Occurrence, structure, and deficiency diseases of Fat soluble vitamins. A, D, E  
K and Water soluble vitamins B<sub>1</sub>, B<sub>2</sub>, B<sub>6</sub>, B<sub>12</sub>.

**Unit-III**

**3.1 Amino Acids and Proteins 08P**

**A] Amino Acids:**

- a) Introduction, Classification (acidic, basic, neutral).
- b) Acid-base behavior, Zwitter-ion formation.
- c) Preparation of  $\alpha$ -amino acids, i)  $\alpha$ -halogenated acids, ii) Gabriel phthalimide synthesis iii) Strecker's synthesis.

d) Reactions due to i)  $\text{NH}_2$  ii)  $\text{COOH}$  iii)  $\text{NH}_2$  and  $\text{COOH}$  group.

**B] Proteins**

a) Introduction, Classification, Structure of proteins (primary and secondary)

b) Properties of proteins.

c) Importance of proteins.

**3.2 Organic Reagents:**

**05P**

Synthetic applications of following reagents

a) Selenium dioxide ( $\text{SeO}_2$ ).

b) Lead tetraacetate ( $(\text{CH}_3\text{COO})_4\text{Pb}$ ).

c) Osmium tetroxide ( $\text{OsO}_4$ )

d) Lithium aluminiumhydride ( $\text{LiAlH}_4$ )

e) Sodium borohydride ( $\text{NaBH}_4$ )

**B. Sc. Third Year, Semester-V**  
**Paper-XVIII (CH-303)**  
**Physical chemistry**

**Periods: 30**

**Marks: 34**

**Unit -I**

**1.1 Spectroscopy: 14P**

- a) Introduction, Electromagnetic radiation and characteristics, Region of the spectrum. Width and intensity of spectral lines. Factors affecting width and intensity of spectral lines. Brief introduction to molecular spectra.
- b) **Rotational Spectra:**  
Classification of molecules, Rotational spectra of diatomic molecules: Rigid rotator model; moment of inertia; energy levels of rigid rotator, selection rules; spacing between spectral lines of diatomic rigid rotator, isotope effect, qualitative description of non rigid rotator. Numericals on bond length.
- c) **Vibrational Spectra:**  
Infrared spectrum, Simple Harmonic oscillator model, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies. Numericals on force constant.
- d) **Raman Spectra:**  
Concept of polarizability. Classical and quantum theory of Raman scattering. Rotational Raman spectrum of a diatomic molecule, Rotation-vibration Raman spectrum, selection rules. Experimental Raman spectroscopy.
- e) **Electromagnetic spectra:**  
Concept of potential energy curve, Frank-Condon principle, types of electronic transitions.

**Unit-II**

**2.1 Chemical kinetics 08P**

- a) Introduction, Third order reaction with equal concentration of all reactants, their characteristics.
- b) Kinetics of complex reactions: i) Opposing reaction ii) Consecutive reaction iii) Chain reaction.
- c) Kinetics of photochemical reactions: 1. Hydrogen-chlorine reaction.  
2. Decomposition of HI. 3. Dimerization of Anthracene

**Unit III:**

**3.1 Distribution Law 08P**

- a) Introduction, Nernst distribution law, solubility and distribution law, Limitation of distribution law.
- b) Association and dissociation of solute in solvent.
- c) Henry's law.
- d) Determination of equilibrium constant from distribution coefficient.
- e) Extraction with solvent.
- f) Liquid-liquid chromatography.
- g) Applications of distribution law.
- i) Numerical on Nernst distribution law.

**B. Sc. Third Year, Semester-VI**  
**Paper – XIX [CH-304]**  
**Inorganic Chemistry**

Periods: 30

Marks: 32

**Unit-I**

**1.1 Coordination theory (Part-II) 10**

- a) Valence bond theory of coordination compounds: Postulates, inner orbital and outer orbital complexes of coordination number 4 and 6. Limitations of VBT.
- b) Crystal field theory: Shape of d-orbital's, postulates, splitting of d-orbital in octahedral complexes, tetrahedral complexes, tetragonal and square planar complex.  
Definition of CFSE, calculations of CFSE for octahedral and tetrahedral complexes.
- c) Factors affecting  $10 Dq$  or magnitude of crystal field splitting : Nature of ligand, oxidation state of metal ion, size of d orbital, geometry of complexes.
- d) Applications of CFT.
- e) John teller effect in octahedral complexes of  $Cu^{++}$ .
- f) Limitations of CFT.

**Unit-II**

**2.1 Chemistry of inner transition elements (Part-II) 04**

- a) Actinides: Position in periodic table.
- b) Electronic configuration and oxidation state of actinides.
- c) Chemistry of uranium: occurrence; extraction from pitchblend by acid digestion process, properties and uses.
- d) Compounds of Uranium: i) Uranyl nitrate, ii) Uranyl acetate  
Preparation, properties and uses.

**Unit-III**

**3.1 Non-Aqueous Solvents 08**

Introduction

Water as a universal solvent

Classification of solvents

General properties of solvents such as dipole moments, dielectric constant, Troutons constant, electrical conductance, viscosity, autoionisation.

**Liquid Ammonia as a non-aqueous solvent:**

Physical data of liquid ammonia.

Chemical reactions in liquid ammonia: Autoionisation, Acid-base, Precipitation, Complex formation, Ammonolysis, Redox, Ammonation, Solubility effect in liquid ammonia.

Advantages and disadvantages of liquid ammonia as a solvent.

Solution of alkali metals in liquid ammonia.

**Unit-IV**

**4.1 Corrosion and Passivity 08**

**A) Corrosion:** Introduction.

Types of corrosion. Theories of corrosion: Electrochemical theory

Method of prevention of corrosion

**B) Passivity:** Introduction

Theories of passivity: a) Gaseous film b) Physical theories, c) Oxide layer theory. Applications of passivity

Electrochemical passivity. Mechanical Passivity.

**Reference books:-**

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia.
2. Inorganic Chemistry by Gurudeep Raj Chatwal.
3. Advanced inorganic chemistry vol. II by Satyaprakash, Tuli, Basu and Madan.
4. Inorganic Chemistry by Huheey, Keiter and Keiter.
5. Concise Inorganic Chemistry by J. D. Lee.
6. A text book of Practical Chemistry for B. Sc. By V. V. Nadkarny, A. N. Kothare and Y. V. Lawande.
7. Advanced practical inorganic Chemistry by O. P. Agarwal.

**B. Sc. III Year**  
**Paper – XX CH-305 Semester-VI**  
**Organic Chemistry**

Periods: 30

Marks: 34

**UNIT:-I**

- 1.1 Ultra-Violet Spectroscopy: 04P**
- a) Introduction.
  - b) Electromagnetic radiation.
  - c) Units used in spectroscopy: a) Wave length b) Wave number c) Frequency.
  - d) Beer-Lambert law and Molar absorption.
  - e) Types of electronic transitions.
  - f) Concept of chromophore and auxochrome, Bathochromic, Hypsochromic, Hyperchromic, Hypochromic shift.
  - g) Differentiate spectral characteristics between conjugated dienes and enones and calculate  $\lambda_{\max}$  (maximum absorption) for it.
- 1.2 Infra-Red spectroscopy: 04P**
- a) Molecular Vibration, Hooke's law.
  - b) Measurement of IR Spectrum, Finger print region, Functional group region.
  - c) Interpretation of IR spectra of simple organic compounds.  
(a) Ethane (b) Ethene (c) Ethyne (d) Benzene (e) 1-Propanol (f) 2-Propanol  
(g) t-Butyl alcohol (h) Phenol. (i) Acetone (j) Acetophenone (k) Acetaldehyde  
(l) Benzaldehyde (m) Benzoic acid (n) Methyl benzoate (o) Phenyl cyanide
- 1.3 PMR Spectroscopy: 04P**
- a) Introduction.
  - b) Principles of NMR Spectroscopy.
  - c) Orientation of hydrogen nucleus.
  - d) Precessional motion of nucleus.
  - e) Shielded proton in acetylene.
  - f) Deshielded protons in benzene.
  - g) Number of signals (equivalent and non-equivalent protons) in following compounds: a) Acetone (b) Cyclobutane (c) Methanol (d) Ethyl benzene (e) Ethyl amine (f) Mesitylene (g) Diethyl ether.
  - h) Chemical Shift.
  - i) Spin-spin coupling, coupling constant.
  - j) Interpretation of PMR spectra of simple organic molecules such as Ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, Toluene, acetophenone, ethylamine, acetic acid, benzoic acid.
- 1.4 Problems based on UV, IR, and PMR simple organic compounds using spectroscopic technique. 05P**

**Unit-II**

- 2.1. Aromatic Carboxylic Acids: 06P**  
Introduction and Classification of aromatic carboxylic acids.
- A) Benzoic Acid.**
- i) Preparations from: a) phenyl cyanide; b) toluene.
  - ii) Reactions of benzoic acids.  
a) Acyl-halide formation, b) Reduction, c) Decarboxylation, d) Nitration.
- B) Anthranilic Acid:**
- i) Preparations from: a) from phthalimide, b) from O-nitro toluene.
  - ii) Reactions of anthranilic acid.

a) Action of heat, b) Nitrous acid, c) Acetic anhydride, d) Acetylation

**C) Salicylic Acid:**

i) Preparations by: a) Kolbe's method, b) Reimer-Tieman reaction.

ii) Reactions of Salicylic acid.

a) bromination, b) nitration, c) decarboxylation, d) Reaction with Zn-dust.

**D) Phthalic Acid:**

i) Preparations from: a) From O-Xylene, b) From Naphthalene.

ii) Reactions of Phthalic acid.

a) Action of heat, b) Action of  $\text{PCl}_5$ , c) Action of ethanol.

**2.2 Aromatic Sulphonic acid: 04P**

A) Introduction and Nomenclature.

B) Preparation of Sulphonic acid from Benzene with mechanism.

C) Chemical properties: a) Salt formation, b) Formation of sulphonyl chloride, c) Formation of Sulphonic esters and amides, d) Replacement of sulphonic group by phenolic group, e) Replacement of sulphonic group by cyano, f) Replacement of sulphonic group by Hydrogen, g) Replacement of sulphonic group by  $-\text{NH}_2$  group.

**2.3 Pesticides: 03P**

a) Introduction, Classification.

b) Synthesis and Uses of i) DDT, ii) BHC, iii) Methoxychlor, iv) 2,4-D, v) Baygon (from 2-isopropyl phenol)

**Reference books:**

1. Synthetic drugs by Gurudeep and Chatwal.
2. Synthetic dyes by Gurudeep and Chatwal.
3. Organic Chemistry by S. M. Kapoor. vol. II and III.
4. Organic Chemistry by Morrison and Boyd.
5. T. B. of organic chemistry by Arun Bahl and B. S. Bahl.
6. Synthetic organic chemistry by O. P. Agrawal.
7. T. B. Organic chemistry by P. L. Soni and H. M. Chawla.
8. Organic chemistry by M. K. Jain.
9. Organic chemistry by Tewari Mehrotra.
10. Organic chemistry by Soloman.
11. Organic chemistry by Carey.

**B. Sc. Third Year, Semester-VI**  
**Paper-XXI (CH-306)**  
**Physical chemistry**

**Periods: 30**

**Marks: 34**

**Unit-I**

**1.1 Electrochemistry** **12P**

- a) Introduction to electrochemistry, concept of electrode potential, single electrode potential and standard electrode potential, oxidation and reduction potential.
- b) Electrochemical cells: Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.
- c) EMF of cell, measurement of EMF.
- d) Reference electrodes, indicator electrodes, calomel electrode.
- e) Relation between EMF and  $\Delta G$ ,  $\Delta H$  and  $\Delta S$ .
- f) Nernst equation, application of Nernst equation to oxidation half cell and reduction half cell.
- g) Electrolyte concentration cell: Concentration cell with transport and Concentration cell without transport.
- h) Application of EMF measurement in determination of pH by using a) Quinhydrone electrode and b) glass electrode.
- i) Potentiometric titrations.
- j) Numerical on Nernst equation, concentration cell,  $\Delta G$ ,  $\Delta H$  and  $\Delta S$ .

**Unit-II:**

**2.1. Thermodynamics:** **12P**

- a) Introduction
- b) Work Function and Free Energy Function: Helmholtz function (A) or work function, change of A at constant temperature, Gibb's free energy (G) or free energy function, relation between G and A, change of G at constant temperature, variation of work function with temperature and volume, variation of free energy function with temperature and pressure. The Gibb's-Helmholtz equation.
- c) The Nernst heat theorem. Third law of thermodynamics.
- d) Thermodynamics of open system: partial molar properties; concept of chemical potential, partial molar free energy. Gibb's-Duhem equation. Variation of chemical potential with temperature and pressure. Chemical potential in case of a system of ideal gases.
- e) Vant-Hoff's isotherm. Vant-Hoff's reaction isochore. Integrated form of Vant-Hoff's equation.
- f) Clapeyron equation. Clausius- Clapeyron equation and its applications.
- g) Thermodynamic derivation of law of mass action. Relation between  $\Delta G^\circ$  and  $K_p$ .
- h) Numericals on Vant-Hoff's isotherm and Integrated form of Vant-Hoff's equation.

**Unit-III**

**3.1 Surface Chemistry** **06P**

- a) Introduction: Adsorption, mechanism of adsorption, factors affecting adsorption, difference between adsorption and absorption.
- b) Types of adsorption: Physical adsorption and chemical adsorption.
- c) Adsorption of gas by solid.
- d) Types of adsorption isotherm: i) Freundlich adsorption isotherm, ii) Langmuir adsorption isotherm, (Derivation).

**Reference Books:**

1. Physical Chemistry by G. M. Barrow (Tata Mc-Graw Hill publishing Co., Ltd.)
2. Elements of Physical Chemistry by S. Glasstone & D. Lewis (D. van nostrand co. inc.)
3. Physical Chemistry by W. J. Moore (Orient Longman).
4. Principles of Physical Chemistry by S. H. Maron and C. F. Prutton.
5. University General Chemistry by C. N. R. Rao (Mc-Millan).
6. Elements of Physical Chemistry by P. W. Atkins. (Oxford University Press).
7. Physical Chemistry by R. A. Alberty (Wiley Eastern Ltd.).
8. Physical Chemistry through problems by S. K. Dogra, D. Dogra(Wiley Eastern Ltd)
9. Principles of Physical Chemistry by Puri, Sharma and Pathania (Vishal Publication Jalandher, Delhi)
10. Physical Chemistry by A. J. Mee. ELBS & Heinemann Educational Books Ltd.
11. Essentials of Physical Chemistry by Arun Bhal, B. S. Bahl and G. D. Tuli. (S. Chand )
12. Chemical Kinetics by K. J. Laidler (Tata Mc-Graw Hill Publishing Co. Ltd).
13. Text Book of Physical Chemistry by Soni-Dharmarha.
14. A Text Book Physical Chemistry by S. Glasstone, (Mac Millan.)
15. Advanced Physical Chemistry by D.N.Bajpai. (S.Chand)
16. Advanced Physical Chemistry by Gurdeep Raj. (Goel publishing house, Meerut).

**B. Sc. Third Year**  
**Paper-XXII (CH-307)**  
**Organic and Inorganic Chemistry**

**Periods: 120**

**Marks: 50**

**Note: At least sixteen experiments should be taken.**

**1. Only demonstration.**

- i) Column Chromatography.
  - a. Separation of fluorescein methylene blue.
  - b. Separation of leaf pigment from spinach leaves.

**2. Qualitative analysis :(any seven)**

Separation of organic binary mixture and analysis of each compound with preparation of one derivative.

Acids: Salicylic acid, cinnamic acid, phthalic acid, benzoic acid.

Phenols:  $\beta$ -Naphthol.  $\alpha$ -naphthol.

Base:- p-nitroaniline, m-nitroaniline, p-toluidine.

Neutral: Urea, glucose, m-dinitrobenzene, Anthracene, Naphthalene.

**3. Synthesis of organic compounds, with determining its physical constant and % yield. (Reactions to be carried out in molar quantities and suggest its possible mechanism) (Any five)**

- 1) Preparation of 2,4,6-tribromoaniline from aniline.
- 2) Preparation of p-nitroacetanilide from acetanilide.
- 3) Preparation of benzoate from phenol /  $\beta$ -Naphthol.
- 4) Preparation of p-nitroaniline from p-nitroacetanilide.
- 5) Preparation of m-nitroaniline from m-dinitrobenzene.
- 6) Preparation of fluorescein from phthalic anhydride.
- 7) Preparation of phenolphthalein from phthalic anhydride.
- 8) Preparation of benzoic acid from toluene.
- 9) Preparation of pyrimidone from ethyl acetoacetate and urea.
- 10) Preparation of pyrazolone from ethyl acetoacetate and Phenylhydrazine.

**Inorganic Section**

- 1. Gravimetric estimation of Iron as  $\text{Fe}_2\text{O}_3$ .
- 2. Gravimetric estimation of Sulphate as  $\text{BaSO}_4$ .
- 3. Gravimetric estimation of Nickel as  $\text{Ni}(\text{DMG})_2$ .
- 4. Gravimetric estimation of Aluminium as  $\text{Al}(\text{Oxinate})_3$ .

**B. Sc. Third Year**  
**Paper-XXIII, [CH-308]**  
**Laboratory Course-V**  
**Physical and Inorganic Chemistry**

**Periods: 120**

**Marks: 50**

**Note: At least sixteen experiments should be taken.**

**Instrumental**

1. Determine the normality and strength of oxalic acid conductometrically using standard solution of strong base (NaOH / KOH).
2. Determine the concentration of KCl solution by titrating it with standard solution of AgNO<sub>3</sub> conductometrically.
3. Determine the equivalent conductance of a strong electrolyte at several concentration and hence verify the Onsager's equation.
4. Determine the normality and strength of acids in mixture [strong acid (HCl / HNO<sub>3</sub>) and weak acid (CH<sub>3</sub>COOH / HCOOH)] potentiometrically using standard solution of strong base (NaOH / KOH).
5. Determine the dissociation constant a weak acid (CH<sub>3</sub>COOH / HCOOH) potentiometrically using standard solution of strong base (NaOH / KOH).
6. Determination of empirical formula of a complex between Fe<sup>3+</sup> and 5-sulphosalicylic acid by Jobs method colorimetrically.
7. Determination of dissociation constant of an organic acid (CH<sub>3</sub>COOH) using various buffers (CH<sub>3</sub>COOH + CH<sub>3</sub>COONa) pH metrically.
8. To study inversion of cane sugar by polarimetrically.

**Non-Instrumental**

1. Determine the rate constant of the reaction between potassium per sulphate and potassium iodide having equal concentrations of reacting species (a = b).
2. Determine energy of activation of hydrolysis of an ester by acid / base.
3. Investigate the reaction between bromic acid and hydroiodic acid.
4. Determine molecular weight of non volatile solute by Rast method / Beckmann's freezing point method.
5. Determine enthalpy change of neutralization of a strong acid by a strong base.
6. Determine interfacial tension between immiscible liquids, benzene and water by stalagmometer.
7. Determine molecular weight of a polymer by viscosity measurement.
8. Separation of mixture of o- & p-nitro anilines on an alumina column.

**Inorganic Section:**

1. Preparation of complexes and estimation of metal ion.
  - a) [Cu(NH<sub>3</sub>)<sub>4</sub>]SO<sub>4</sub>
  - b) [Ni(NH<sub>3</sub>)<sub>6</sub>]SO<sub>4</sub>
  - c) CoCl<sub>3</sub>. 4NH<sub>3</sub>
  - d) Sodium trioxalato ferrate.
  - e) Co[Hg(SCN)<sub>4</sub>].

**Reference Books:**

1. Experimental Physical Chemistry by A. Findlay. Longman.
2. Advanced Practical Physical Chemistry by J.B. Yadav.
3. Experiments in Physical Chemistry by R. C. Das and B. Behra. Tata Mc Graw Hill.
4. Advanced experimental Chemistry Vol. I. Physical by J. N. Gurtu and R. Kapoor. S. Chand & Co.
5. Experiments in Physical Chemistry by J. C. Ghosh, Bharati Bhavan.
6. Practical book of Physical Chemistry – by Nadkarni Kothari & Lawande. Bombay Popular Prakashan.
7. Systematic Experimental Physical Chemistry – by S. W. Rajbhoj, Chondhekar. Anjali Publication.
8. Practical Physical Chemistry – by B. D. Khosala & V. C. Garg. R. Chand & Sons.
9. Experiments in Chemistry by D. V. Jagirdar.
10. Practical Chemistry, Physical – Inorganic – Organic and Viva – voce by Balwant Rai Satija. Allied Publishers Pvt. Ltd.
11. College Practical Chemistry by H. N. Patel, S. R. Jakali, H. P. Subhedar, Miss. S. P. Turakhia, Himalaya Publishing House, Mumbai.
12. College Practical Chemistry by Patel, Jakali, Mohandas, Israney, Turakhia, Himalaya Publishing Housing, Mumbai.

**FACULTY OF SCIENCE**  
**PRACTICAL EXAMINATION**  
B. Sc. (Third Year) CH-307  
(Organic & Inorganic Chemistry) Paper-XXII

**Time: 6 Hr**

**CHEMISTRY**

**Marks: 50**

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*N. B.:*

- (i) *Use of logarithmic table and Non-programmable calculator is allowed.*
- (ii) *No candidate is allowed to appear for practical examination without certified record book.*
- (iii) *Obtain the signature of examiner on your observations and readings.*

<b>Q. 1</b>	Viva-voce & Certified Laboratory Journal	05
<b>Q. 2</b>	a) Determine the type of given binary mixture and Separation of organic binary mixture.	05
	b) Analyze the one organic compound qualitatively and find out the nature, detection of elements, functional group, physical constant and derivative.	15
<b>Q. 3</b>	a) Starting from _____ prepare the pure sample of _____ and mention yield and physical constant of prepared sample.	10
	b) Procedure and mechanism.	03
	c) Calculate Percentage (%) Yield.	02
<b>Q. 4</b>	a) Estimate the amount of _____ as _____ by gravimetrically.	12
	b) Procedure	03

**FACULTY OF SCIENCE**  
**PRACTICAL EXAMINATION**  
B. Sc. (Third Year) CH-308  
(Physical & Inorganic Chemistry) Paper-XXIII

**Time: 6 Hr**

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**Marks: 50**

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**Q. 1** Viva-voce & Certified Laboratory Journal 05

**Q. 2** Determine the normality and strength of oxalic acid conductometrically using standard solution of strong base (NaOH / KOH). 15

OR

Determine the concentration of KCl solution by titrating it with standard solution of AgNO<sub>3</sub> conductometrically.

OR

Determine the equivalent conductance of a strong electrolyte at several concentration and hence verify the Onsager's equation.

OR

Determine the normality and strength of acids in mixture [strong acid (HCl / HNO<sub>3</sub>) and weak acid (CH<sub>3</sub>COOH / HCOOH)] potentiometrically using standard solution of strong base (NaOH / KOH).

OR

Determine the dissociation constant a weak acid (CH<sub>3</sub>COOH / HCOOH) potentiometrically using standard solution of strong base (NaOH / KOH).

OR

Determination of empirical formula of a complex between Fe<sup>3+</sup> and 5-sulphosalicylic acid by Jobs method colorimetrically.

OR

Determination of dissociation constant of an organic acid (CH<sub>3</sub>COOH) using various buffers (CH<sub>3</sub>COOH + CH<sub>3</sub>COONa) pH metrically.

OR

To study inversion of cane sugar by polarimetrically.

**Q. 3** Determine the rate constant of the reaction between potassium per sulphate and potassium iodide having equal concentrations of reacting species (a = b). 15

OR

Determine energy of activation of hydrolysis of an ester by acid / base.

OR

Investigate the reaction between bromic acid and hydroiodic acid.

OR

Determine molecular weight of non volatile solute by Rast method / Beckmann's freezing point method.

OR

Determine enthalpy change of neutralization of a strong acid by a strong base.

OR

Determine interfacial tension between immiscible liquids, benzene and water by stalagmometer.

OR

Determine molecular weight of a polymer by viscosity measurement.

OR

Separation of mixture of o- & p-nitro anilines on an alumina column.

**Q. 4** Preparation of .....complex. Estimate the amount of metal ion ..... volumetrically.

- |                |    |
|----------------|----|
| a) Procedure   | 03 |
| b) Preparation | 04 |
| c) Estimation  | 08 |