Swami Ramanand Teerth Marathwada University, Nanded

B. O. S. IN CHEMISTRY

B. SC. SECOND YEAR (CHEMISTRY) REVISED SYLLABUS

IN FORCE FROM JUNE - 2009

B. Sc. Second Year
Chemistry

Paper	Course No.	Course	Periods/week	Total Periods	Marks
V	CH-201	Inorganic Chemistry	2	54	65
VI	CH-202	Organic Chemistry	2	54	70
VII	CH-203	Physical Chemistry	2	54	65
VIII	CH-204	Laboratory Course-I	4	120	100
IX	CH-205	Laboratory Course-II	4	120	100

B. Sc. Second Year (Theory) Course Structure
Paper-V, Inorganic Chemistry (CH-201)

Time: 2½ Hrs. **Marks: 65**

Unit	Topic	Title	Periods	Marks
I	1.1	Theory of Qualitative analysis	10	12
	1.2	Chemistry of Non-transition elements-Part-I	10	12
II	2.1	Chemistry of Non-transition elements-Part-II	09	10
	2.2	Chemistry of Non-transition elements-Part-III	09	11
III	3.1	Chemistry of Transition series elements	08	10
	3.2	Nuclear Chemistry	08	10
		Grand Total	**54**	**65**

B. Sc. Second Year (Theory) Course Structure
Paper-VI, Organic Chemistry (CH-202)

Time: 2½ Hrs. **Marks: 70**

Unit	Topic	Title	Periods	Marks
I	1.1	Aromatic Carbonyl Compounds	12	15
	1.2	Polymers	06	09
II	2.1	Carbohydrates	10	13
	2.2	Stereochemistry	08	10
III	3.1	Organic compounds of nitrogen	10	13
	3.2	Heterocyclic compounds	08	10
		Grand Total	**54**	**70**

B. Sc. Second Year (Theory) Course Structure
Paper-VII, Physical Chemistry (CH-203)

Time: 2½ Hrs. **Marks: 65**

Unit	Topic	Title	Periods	Marks
I	1.1	Atomic Structure and Wave Mechanics	07	09
	1.2	Thermodynamics	10	13
II	2.1	Chemical Kinetics	10	10
	2.2	Phase equilibrium	10	12
III	3.1	Electrochemistry	10	12
	3.2	Photochemistry	07	09
		Grand Total	**54**	**65**

Note:

1. Question number one should be on Unit-I syllabus.
2. Question number two should be on Unit-II syllabus.
3. Question number three should be on Unit-III syllabus.
4. Question number four should be on all units syllabus.
5. Multiple choice Questions should be from each topics to be covered.
6. ± 3 marks adjustment in given weightage should be allowed.

B. Sc. Second Year
Paper-V, [CH-201]
Inorganic Chemistry

Marks: 65 **Periods: 54**

Unit:-I

1.1 Theory of Qualitative analysis **10**

a) **Introduction:** Definition of qualitative analysis, macro, micro and semimicro qualitative analysis, radicals, acidic and basic radicals.

b) Role of sodium carbonate extract in qualitative analysis.

c) Interfering radicals. Removal of interfering radicals such as oxalate, borate, fluoride and phosphate.

d) Use of solubility product, common ion effect and complex ion formation in the analysis of basic radicals:
- i) Separation of II_A and II_B.
- ii) Separation of II and III_B.
- iii) Separation of III_A and III_B.
- iv) Separation of Zn^{++} and Mn^{++}.
- v) Separation of Co^{++} and Ni^{++}
- vi) Separation of Fe^{+++} and Al^{+++}.
- vii) Separation of Cu^{++} and Cd^{++}.

e) Use of reagents in qualitative analysis.
- i) ammonium chloride
- ii) Yellow ammonium sulphide.
- iii) Dimethylglyoxime for Nickel.
- iv) 1,10-Phenonthroline for Iron.

1.2 Chemistry of Non-transition elements-Part-I **10**

a) Complexes of alkali metals, the **'wrap around'** complexes.

b) **Boranes:** Definition, classification and nomenclature. Preparation, Structure and bonding of diborane with evidences.

c) **Carboranes:** Definition of Closo and Nido carboranes. Preparation and structure of dicarboclosododecaboranes.

d) **Borazine:** Preparation, structure and bonding. Similarities between borazine and benzene.

Unit:-II

2.1 Chemistry of Non-transition elements-Part-II **10**

a) Silicates: Definition, Basic Unit of silicate and classification on the basis of basic unit.

b) Zeolite: Definition, preparation, classification and uses. Ultramarine.

c) Carbide: Definition, preparation, properties and structure of different types of carbide.

2.2 Chemistry of Non-transition elements-Part-III

a) Inter-halogen compounds:
- i) Definition, preparation and structure of XY, XY_3, XY_5, and XY_7 types of inter-halogen compounds.
- ii) Pseudo-halogen: Definition and only examples.
- iii) Inter-halogen are more reactive than halogen.

b) Fluorocarbon: Definition and uses of fluorocarbon (Freons as CFCs).

d) Fullerence (C-60).

Unit-III

3.1 Chemistry of Transition series elements: 08

- **a)** Introduction and position.
- **b)** Electronic configuration of First transition elements.
- **c)** Properties: atomic size, oxidation state, tendency to form complex compound, colour and catalytic.
- **d)** Magnetic properties: Para magnetism, diamagnetism, magnetic susceptibility and magnetic moment of ions (Numerical).
- **e)** Electronic configuration of second and third transition series elements.

3.2 Nuclear Chemistry 08

- **a)** Introduction, composition of nucleus and nuclear size.
- **b)** Classification of nuclides: Isotopes, isobars and isotones.
- **c)** Nuclear Stability: Odd and even number of protons and neutrons, N/Z ratio, magic number, packing fractions (Numerical), Mass defect (Numerical), Nuclear binding energy (Numerical) and mean nuclear binding energy (Numerical).
- **d)** Release of nuclear energy:
  - i) Nuclear fission reaction, Nuclear fuels and plutonium bomb.
  - ii) Nuclear fusion reaction, the energy of sun, hydrogen bomb. Calculation of Q value of nuclear reaction.
- **e)** Definition of radioactivity, group displacement law, $\square^{+}$ emission and K-capture.
- **f)** Application of radioisotopes

Reference books:-

1. Principles of Inorganic Chemistry by Puri, Sharma and Kaliya.
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. Nuclear Chemistry by Arnikar.
6. Concise Inorganic Chemistry by J. D. Lee.
7. Vogel's Qualitative Inorganic Analysis (Seventh Eddition).
8. A text book of Practical Chemistry for B. Sc. By V. V. Nadkarny, A. N. Kothare and Y. V. Lawande.
9. Advanced practical inorganic Chemistry by O. P. Agarwal.

B. Sc. Second Year
Paper-VI, [CH-202]
Organic Chemistry

Marks: 70 **Periods: 54**

Unit:-I

1.1 Aromatic Carbonyl Compounds: **12**

a) Introduction, formation, and structure of carbonyl group.

b) Synthesis of benzaldehyde:
1) Gattermann synthesis; 2) Gattermann Koch synthesis

c) Synthesis of acetophenone:
1) From Benzene ; 2) From 1-Phenylethanol

d) Physical properties of benzaldehyde and acetophenone.

e) Reactions:
i) Addition of (a) Hydrogen cyanide (b) Sodium bisulphate to Benzaldehyde and Acetophenones.
ii) Condensation with (a) Ammonia (b) Methanamine (c) Hydroxylamine (d) Hydrazine (e) Phenyl hydrazine (f) Acetyl hydrazine (semicarbazide) to Benzaldehyde and Acetophenones.

f) Name Reactions (with mechanism).
1) Aldol Condensation (simple and crossed)
2) Perkin Condensation
3) Benzoin condensation
4) Cannizaro reaction
5) Mannich reaction

g) Oxidation of acetophenones by using 1) Chromic acid and 2) Per-acids (Baeyer-Villiger reaction)

h) Reduction of acetophenones by using
1) $LiAlH_4$ and $NaBH_4$
2) Aluminium isopropoxide (MPV)
3) Clemmensen reduction method

1.2 Polymers. **06**

a) Introduction, and classification (natural, semisynthetic and synthetic)

b) Types of polymerization reactions
i) Addition (chain growth) polymerization Free-radical polymerization reaction, Cationic polymerization reaction, Anionic polymerization reaction.
ii) Condensation (step growth) polymerization reaction: Nylon-6, Nylon-66.

c) Synthesis and uses of:
i) Teflon
ii) Polystyrene
iii) Polyurethanes
iv) Polyvinylchloride
v) Bakelite formation (phenol formaldehyde resin)
vi) Buna rubber (Buna-N and Buna-S)

Unit:-II

2.1 Carbohydrates: **10**

a) Introduction

b) Classification and nomenclature

c) Reactions of Monosaccharides:

i) Mutarotation with mechanism

ii) Epimerization

iii) Ether formation

iv) Osazone formation of glucose and fructose (with mechanism)

v) Reduction of glucose and fructose

vi) Oxidation of glucose and fructose

vii) Glycoside formation

d) Interconversion:

i) Glucose to Fructose

ii) Fructose to Glucose

iii) Glucose to Mannose

iv) Glucose to Arabinose (Ruff degradation)

v) Arabinose to Glucose (Kiliani synthesis)

e) Furanose and Pyranose structure of glucose

f) Pyranose ring structure determination

g) Fermentation of sucrose (general procedure and reaction).

2.2 Stereochemistry: **08**

a) Introduction

b) Concept and types of isomerism

i) Structural and stereoisomerism

ii) Types of Structural isomerism

(Chain, position, functional, metamerism, tautomerism)

iii) Types of stereoisomerism isomerism

(Conformational and configurational)

c) Optical isomerism: (Enantiomerism)

i) Concept of asymmetric carbon atom, chiral centre

ii) Concept of diastereoisomers

iii) Dextro and Laevo forms, Racemic mixture, Racemic modification, Resolution (concept and methods), Walden inversion, retention.

d) Element of symmetry (plane, centre and axis of symmetry)

Nomenclature:

i) Priority Sequence rule

ii) Cis-trans and E and Z system of nomenclature of geometrical isomers

iii) D and L / R and S erythro-threo nomenclature.

(D and L in - glyceric acid, lactic acid, glucose and fructose)

(R and S in – (1) Bromo-chloro-iodomethane, (2) Chloro-iodomethane sulphonic acid, (3) 2-bromobutane, (4) Glyceraldehydes, (5) Lactic acid, (6) glyceric acid, (7) 1-bromo,1-chloroethanol.

Unit:-III

3.1 Organic compounds of nitrogen **10**

a) **Aliphatic nitro compounds**:

i) Introduction and nomenclature

ii) Preparation of (a) Nitro methane from sodium chloroacetate;

(b) Nitro hexane from n- hexane

b) Aliphatic amino compounds:

i) Introduction and classification

ii) Preparation of aliphatic amines

a) Methanamine by Hoffmanns bromide method (with mechanism)

b) Methanamine by Gabriels phthalimide method

iii) Properties.

iv) Basicity of amines, effect of substituent on basicity, formation of quaternary ammonium salt, Hoffmanns β elimination reaction.

c) Urea

i) Synthesis of urea by a) Wohler's method (b) from CO_2

ii) Reactions:

a) Action of heat b) nitrous acid

c) Hydrolysis d) thionyl chloride

e) Formaldehyde f) hydrazine

g) Acetyl chloride h) salt formation.

d) Aromatic nitro compounds:

i) Introduction

ii) Types of nitrating agents:

a) Conc.HNO_3

b) Nitrating mixture (Conc.HNO_3 + Conc.H_2SO_4)

c) Fuming HNO_3

d) Acetyl nitrate.

iii) Nitration of benzene at different temperature.

iv) Chemical properties of nitro benzene

a) Nitration

b) Reduction in different medium.

i) Acidic

ii) Alkaline

iii) Neutral

iv) Electrolytic

v) Nucleophilic substitution (nitro benzene to o-nitro and p- Nitrophenol)

vi) Importance of nitro benzene.

e) Aromatic nitro compounds:-

i) Introduction, classification.

ii) Preparation of aniline from: a) nitrobenzene b) chlorobenzene

iii) Reactions:

a) Carbylamine reaction

b) Salt formation

c) Acetylation

d) Reaction with benzaldehyde

e) Acetophenone.

f) Diazonium salts:

i) Introduction, preparation of Benzene Diazonium chloride.

ii) Structure of Diazonium salts.

iii) Reactions involving removal of diazo group (-N_2X)

a) Hydrogen b) Halogen c) Cyano group

d) Hydroxyl group e) Alkoxy group

iv) Reactions involving retention of diazo group (coupling reaction)

a) Coupling with aniline

b) Coupling with phenol.

3.2 Heterocyclic compounds **08**

a) i) Introduction, classification.

B) ii) Nomenclature and Numbering in monocyclic and fused heterocyclic compounds.

c) iii) Aromaticity of Oxole, Azole, Thiole, and Azine.

d) iv) Molecular orbital picture and resonance structure of Oxole, Azole, Thiole, and Azine.

e) Study of heterocyclic compounds:

A] Oxole: (furan)

i) Synthesis from:

a) Fiest Benary method.

b) Mucic acid.

ii) Properties: physical and chemical. Like Electrophilic Substitution reaction. (Sulphonation, nitration, with mechanism) and reactions with n-butyl lithium, benzyne and reduction.

C) Azole: (pyrrole).

i) Synthesis from: **a)** Succinamide; **b)** Oxole (furan).

ii) Properties: physical and chemical. Like Electrophilic Substitution reaction.(bromination with mechanism) and reactions with carbene, ring expansion and reduction.

C) Thiole : (Thiophene)

i) Synthesis from:

a) n-butane

b) Acetylene.

ii) Properties: physical and chemical. Like Electrophilic Substitution reaction.(nitration with mechanism) and reactions with chlorination, chloromethylation and reduction.

D) **Azine :(Pyridine)**

i) Synthesis from:

a) Acetylene

b) Pentamethylenediamine hydrochloride.

ii) Properties: physical and chemical. Like Nucleophilic Substitution reaction. (Amination with mechanism) and reactions with acetylation, bromination, oxidation and reduction.

Reference books:-

1. Organic chemistry: by: - Morrison and Boyd, Print ice hall.
2. Organic chemistry: by: - L.G.Wade. Print ice hall.
3. Organic chemistry: Vol^{m} I, II, III. By: - S.M.Mukharji, S.P.Sing, and R.P.Kapoor.
4. Fundamental of organic chemistry: by:- Solomon. John willey.
5. A Text book of organic chemistry: by:- Bahl and Bahl.
6. A Text book of organic chemistry: by:- P.l.Soni.
7. A Text book of organic chemistry: by:- Tewari Mehrotra.
8. Stereochemistry: by:- P.S.Kalsi.
9. Organic chemistry: by:- I.L.Finar.

B. Sc. Second Year
Paper-VII, [CH-203]
Physical Chemistry

Marks: 65 **Periods: 54**

Unit I:

1.1 Atomic Structure and Wave Mechanics **07P**

a) Planck's quantum theory of radiation.
b) Photoelectric effect, explanation on the basis of quantum theory, Numerical problems.
c) Compton Effect.
d) de-Broglie hypothesis: derivation of de-Broglie equation, Numerical problems.
e) Davisson-Germer experiment.
f) Heisenberg's uncertainty principle: Statement, explanation, Numerical problems.
g) Schrodinger wave equation: Derivation in time independent form and Hamiltonian operator form. Physical significance of wave function. Application of Schrodinger wave equation to particle in one dimensional box. Numerical problems.

1.2 Thermodynamics **10P**

a) Introduction to thermodynamic terms and basic concepts, First law of thermodynamics, Internal energy and enthalpy.
b) Heat capacity, molar heat capacity, molar heat capacity at constant pressure and volume, relation between Cp and Cv.
c) Joule's law. Joule-Thomson effect. Joule-Thomson coefficient and inversion temperature.
d) Thermochemistry: Heat of reaction, standard heat of reaction, effect of temperature on heat of reaction (Kirchhoff's equation), numerical problems. Heat of formation, heat of combustion, heat of neutralization, heat of solution, heat of ionization, heat of vaporization, heat of transition. Hess's law of constant heat summation, application and numerical problems. Bond energy, factors affecting bond energy (bond polarity and bond length), and numerical problems.
e) Need for second law thermodynamics, different statements of second law of thermodynamics. Carnot's cycle and its efficiency. Carnot's theorem, numerical problems.
f) Concept of entropy: Introduction, Definition, Mathematical Expression, Unit. Entropy as a state function. Entropy changes for reversible and irreversible processes in isolated systems. Entropy change in Physical transformations: (i) Fusion of a solid. (ii) Vaporization of a liquid. (iii) Transition from one crystalline form to another. Entropy changes for an ideal gas as a function of V and T and as a function of P and T. Entropy changes of an ideal gas in different processes. Physical significance of entropy. Numerical problems.

Unit II

2.1 Chemical Kinetics **10P**

a) Introduction: Rate of reaction, Definition and units of rate constant, Factors affecting rate of reaction, Order and Molecularity of reaction.

b) Zero order reaction: Rate expression and Characteristics.

c) First order reaction: Rate expression, Characteristics of first order reaction.

d) Pseudounimolecular reactions such as, (i) Hydrolysis of methyl acetate in presence of acid, (ii) Decomposition of hydrogen peroxide (KMnO4 method).

e) Second order reaction: Derivation of rate constant for equal and unequal concentrations of the reactants. Characteristics of second order reaction. Examples: (I) Saponification of ethyl acetate, (ii) Reaction between $K_2S_2O_8$ and KI.

f) Methods of determination of order of reaction. Numerical problems.

g) Effect of temperature on reaction rates: Temperature coefficient, activation energy, Arrhenius equation. Numerical problems.

h) Theories of reaction rates: Collision theory of bimolecular gaseous reactions activated complex theory of bimolecular reactions. Numerical problems.

2.2 Phase equilibrium **10P**

a) Statement and explanation of the terms-phase, component and degree of freedom.

b) Derivation of Gibb's phase rule.

c) Phase equilibria of one component system: Water system, Sulphur system and Co_2 system.

d) Phase equilibria of two component system: Pb-Ag system, desilverisation of lead, Ferric Chloride-water system and Na_2SO_4-H_2O system.

e) Partially miscible liquids: phenol-water, triethylamine-water, nicotine water systems. Critical solution temperature, upper critical solution temperature, lowers critical solution temperature. Effect of impurities on critical solution temperature.

f) Three component systems: Formation of one pair of partially miscible liquids, formation of two pair of partially miscible liquids, formation of three pair of partially miscible liquids.

g) Numerical problems.

Unit III

3.1 Electrochemistry **10P**

a) Introduction, Conduction of electricity, Types of conductors: electronic and electrolytic.

b) Conductance of electrolytes: Conductance, Specific resistance, Specific conductance, Equivalent conductance, Molecular conductance and their units. Numerical problems.

c) Variation of conductance, specific and equivalent conductance with concentration (effect of dilution), Equivalent conductance at infinite dilution.

d) Measurement of conductance by Wheatstone bridge, conductivity cell, Cell constant and its determination. Numerical problems.

e) Strong and weak electrolyte. Arrhenius theory of electrolytic dissociation and its limitation. Debye-Huckel theory of strong electrolytes. Debye-Huckel Onsager's equation, relaxation effect and electrophoretic effect.

f) Migration of ions, Transport number, Determination of transport number by Hittorf's method, Factors influencing transport number: Nature of electrolyte, Concentration, Temperature, Complex formation, Degree of hydration. Numerical problems.

g) Kohlrausch law, Applications of Kohlrausch law: (i) Determination of equivalent conductance at infinite dilution of weak electrolytes. (ii) Determination of degree of dissociation. (iii) Determination of solubility of sparingly soluble salts. (v) Determination of absolute ionic mobility. (vi) Determination of ionic product of water. Numerical problems.

h) Advantages of conductometric titration. Conductometric acid-base titrations: (i) Strong acid against strong base. (ii) Strong acid against weak base. (iii) Weak acid against strong base. (iv) Weak acid against weak base. Precipitation titration.

i) Numerical problems.

3.1 Photochemistry **07P**

a) Introduction to photochemistry, types of chemical reaction, difference between thermal and photochemical processes.

b) Lambert-Beer Law: Light absorption by solution, molar extinction coefficient, transmittance, absorbance, optical density.

c) Laws of photochemistry, Grothus- Drapper law, Stark-Einstein law.

d) Quantum yield, experimental determination of quantum yield. Reasons for high and low quantum yield, Numerical problems.

e) Jablonski diagram with various Processes occurring in the excited state. Qualitative description of Fluorescence, phosphorescence, non-radiative processes (internal Conversion, inter- system crossing).Photosensitized reactions.

f) Kinetics of hydrogen-chlorine reaction. Kinetics of photochemical decomposition of HI. Kinetics of dimerization Anthracene reaction.

g) Numerical problems.

Reference Books:

1. Physical Chemistry by G. M. Barrow (Tata Mc-Graw Hill publishing Co., Ltd.)
2. Elements of Physical Chemistry by S. Glasstone and 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. (Oxford & IBH Publishing Co.)
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 Jallandher,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. Second Year
Paper-VIII, [CH-204]
Laboratory Course-I

Marks: 100 **Periods: 120**

Organic Chemistry:

1. Only demonstration
   i) Determination of R_f values of O, M and P-nitro aniline.
   ii) Separation of benzene and water by distillation method.
2. Qualitative analysis:-
   i) Identification of following organic compounds.
   a) Acids: Benzoic acid, phthalic acid, salicylic acid, cinnamic acid.
   b) Base: P-nitroaniline, aniline, P-toludiene.
   c) Phenols: phenol, α-naphthol, β-naphthol.
   d) Neutral: Naphthalene, Anthracene, acetanilic acid, Nitrobenzene, M-dinitrobenzene.
3. Quantitative analysis (estimation)
   i) Estimation of glycine by Sorenson's method
   ii) Estimation of formaldehyde.
   iii) Estimation of glucose
   iv) Estimation of phenol.
   v) Estimation of amide.
   vi) Estimation of cinnamic acid.

Inorganic Chemistry:

1. Identification of two acidic and two basic radicals with one interfering radical such as oxalate, borate, fluoride and phosphate by semi-micro qualitatively.
   (At least eight mixture of salt must be practisized).

B. Sc. Second Year
Paper-IX, [CH-205]
Laboratory Course-II

Marks: 100 **Periods: 120**

Physical Chemistry

Instrumental

1. Determine the normality and strength of strong acid (HCl /H_2SO_4/HNO_3) conductometrically using standard solution of strong base (NaOH/KOH).
2. Determine the normality and strength of weak acid (CH_3COOH/HCOOH) conductometrically using standard solution of strong base (NaOH/KOH).
3. To determine the solubility of a sparingly soluble salts ($BaSO_4$/$PbSO_4$/AgCl) conductometrically at room temperature.
4. Determine the normality and strength of strong acid (HCl /H_2SO_4/HNO_3) potentiometrically using standard solution of strong base (NaOH/KOH).
5. To determine formal redox potential of Fe^{+++}/Fe^{++} and Ce^{3+}/Ce^{4+} system potentiometrically.
6. Verification of Lamberts-Beer's law using $KMnO_4$/$NiSO_4$ / $K_2Cr_2O_7$ / $CoSO_4$ colorimetrically and determine concentration of unknown solution.
7. To determine amount of Cu^{++}/ Ni^{++} ion in given sample solution titrating it against std. EDTA solution colorimetrically
8. To determine stability constant of silver-ammonia complex potentiometrically.

Non-Instumental

1. To study the effect of addition of electrolyte (KCl / NaCl) on solubility of weak acid at room temperature.
2. To determine energy of activation of reaction between KI-$K_2S_2O_8$.
3. To construct the phase diagram of a two component system diphenyl amine-benzophenone /aniline –hexane/ aniline –water/ triethylammine –water.
4. To determine viscosity of given liquid using Ubbelhode viscometre .
5. To determine surface tension of given liquid by capillary rise method/differential capillary rise method.
6. Determine the solubility of benzoic acid in water at different temperature and hence its heat of solution.
7. To study the effect of solute (NaCl /succinic acid) on the CST of phenol- water system and hence determine amount of solute in given sample phenol –water composition.
8. To determine the enthalpy of neutralization of weak acid/weak base against strong base/strong acid and determination of enthalpy ionization of weak acid/ weak base.

Inorganic Chemistry

Separation and estimation of binary mixtures by volumetric method:

1. $Cu^{++} + Zn^{++}$
2. $Ba^{++} + Ca^{++}$
3. $Mn^{++} + Zn^{++}$
4. $Fe^{++} + Al^{+++}$

Reference Books:

1. Experimental Physical Chemistry by A. Findlay. Longman.
2. Advanced Practical Physical Chemistry by J.B. Yadav. (Goel Publishing house, Meerut).
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 Chemisty – 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.