

MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

Tirunelveli – 627012

DIRECTORATE OF DISTANCE EDUCATION AND CONTINUING EDUCATION

(Effective from the Academic Year 2014-2015 onwards)

B. Sc Chemistry

Duration of the course : 3 Years

Eligibility : +2 or equivalent

Year	Subjects
I	Part-I Tamil / Any other language except English
	Part –II English
	Part –III Major-Inorganic Chemistry Allied- Applied Chemistry Environmental Studies
II	Part-I Tamil / Any other language except English
	Part –II English
	Part –III Major I-Organic Chemistry I Major II- Physical Chemistry I Allied – Biochemistry
III	Part III Major I-Organic Chemistry II Major II- Physical Chemistry II Practical I Practical II Practical III

I Year

Major- **INORGANIC CHEMISTRY**

UNIT - I: CHEMISTRY OF d BLOCK ELEMENTS

General characteristics of d- Block elements – Group study of Titanium, Iron, Coinage and Zinc group metals. Important compounds of transition metals: Ziegler – Natta catalyst. Prussian blue, Sodium nitro prusside, Turnbull's blue, Nickel DMG complex, Wilkinson's Catalyst- KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$.

UNIT - II: CHEMISTRY OF f BLOCK ELEMENTS

General characteristics of f-block elements – comparative account of lanthanides and actinides – occurrence, oxidation states, magnetic properties, colour and spectra – separation by ion exchange and solvent extraction methods – lanthanide contraction – chemistry of thorium and uranium – occurrence, ores, extraction and uses

UNIT - III: CO-ORDINATION CHEMISTRY I

Crystal field theory - splitting of d-orbitals in octahedral and tetrahedral complexes - factors affecting the magnitude of crystal field splitting - effects of crystal field splitting - spectrochemical series - applications of CFT - magnetic properties and spectra of transition metal complexes - crystal field stabilization energy and their uses - limitations of CFT - effective atomic number - stability of complexes - step-wise and overall stability constants - factors affecting the stability of complexes - determination of stability constants.

UNIT - IV: CO-ORDINATION CHEMISTRY II

Labile and inert complexes - ligand substitution reactions in octahedral complexes: aquation, base hydrolysis and anation reactions - substitution reactions in square planar complexes - trans effect - theories of trans effect - mechanism of substitution reactions - redox reactions : inner-sphere and outer-sphere electron transfer reactions - metal carbonyls : 18 electron rule as applied to metal carbonyls - preparation, properties and structure of mono, di and

polynuclear carbonyls of Cr, Mn, Fe, Co and Ni - nature of M-L bond in metal carbonyls - metal nitrosyls.

UNIT - V: THEORY OF PRACTICALS

Qualitative Analysis: Applications of solubility product and common ion effect in the precipitation of cations – Interfering acid radicals and their elimination (oxalate, fluoride, borate, phosphate, chromate, arsenite and arsenate).

Titrimetry: Types of titrimetric reactions – acid-base, redox, Iodometric, Iodimetric, precipitation and complexometric titrations – Indicators.

Gravimetric analysis: Precipitation methods - Conditions of precipitation – co-precipitation and post precipitation - washing of precipitates.

REFERENCES :

1. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal
2. Nagin Chand and Co., Delhi, 1996.
3. P. L. Soni, Text Book of Inorganic Chemistry, 20th edition, 2001.
4. R. D Madan, Modern Inorganic Chemistry, S. Chand and company, 13th edition, 2005.
5. J.D. Lee, *Concise Inorganic Chemistry* 5th Ed., Blackwell Science Ltd.,
6. James E. Huheey, Elien A. Keiter and Richard L. Keiter, *Inorganic Chemistry : Principles Structure and Reactivity*, 4th Ed., Harper College Publisher.
7. F. Albert Cotton, Geoffrey Wilkinson, Carlos A. Marilo and Manfred Bochman, *Advanced Inorganic Chemistry*, 6th Ed., Wiley Interscience Publication.
8. Fred Basolo and Ralph G. Pearson, *Mechanisms of Inorganic Reactions : A study of metal complexes in solution*, 2nd Ed., John wiley and sons, Inc.,
9. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denny, Vogel's Text book of
10. Quantitative Chemical Analysis, 5th Edn., ELBS, 1989.
11. D.A.Skoog and D.M.West, Fundamentals of Analytical Chemistry, Holler
12. Saunders college publishing, USA. VI Ed., 1998.

Allied- **APPLIED CHEMISTRY**

Unit I : Vitamins and Drugs

Vitamins - Water soluble vitamins - Vitamin B and C - fat soluble vitamins - A, D, E & K - sources - physiological functions and deficiency symptoms.

Drugs - some important drugs - antibacterials – sulphonamide - antipyretics - aspirin - antimalarials - paludrine - antibiotics - penicillin.

Unit II : Fertilizers

Fertilizers - nitrogeous fertilizers - ammonium sulphate- urea - manufacture and action - potassium fertilizers - potassium sulphate - manufacture - phosphate fertilizers - superphosphate - manufacture. NPK-mixed fertiizers, Micronutrients and their role, biofertilizers, plant growth harmones.

Unit III : Polymer Chemistry

Definition- Monomers, Oligomers, Polymers - Classification of polymers-: Natural synthetic, linear, cross linked and network- plastics, elastomers, fibres, Homopolymers and Co-polymers

Thermoplastics- Polyethylene, polystyrene, Poly Vinyl Chloride, nylon and polyester - Thermosetting Plastics -: Phenol formaldehyde

Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.

Unit IV : Dyes

.Colour and constitution, classification of dyes according to their mode of application and chemical constitution - preparation of some important dyes - Methyl orange fluorescein, malachite green, alizarin, Bismark brown, para rosaniline - laser dyes - dyes used in electro - photography.

Unit V : Nanotechnology

Definition - size dependent properties: magnetic, electrical and optical properties - quantum dots

Synthesis of nanomaterials - bottom-up and top-down approaches - thin film deposition - chemical vapour deposition - sol gel method - chemical reduction

Fullerenes - carbon nanotubes - single walled and multi walled nano tubes – structures - carbon nanofibre

Applications of nanoscience and nanotechnology

References

- 1) M.A. Neelakantan, T. Jeyakumar, P. Thillai arasu, *Applied Chemistry*, Annai Publishers
- 2) O.P. Vermani and A.K. Narula, *Applied Chemistry*, Reprint 2008, New age international Publishers.
- 3) Dr.M. Karunithi, Dr.N. Ayyaswami, Dr.T. Ramachandran and H. Venkataraman, *Applied Chemistry*, 1st Ed., 1993, Anuradha Agencies.
- 4) K.Bagavathi sundari, *Applied Chemistry*, MJP Publishers.
- 5) Prof.D.N. Dhar, *Applied Chemistry-II*, 1st Ed., 2009, Vayu Education of India.
- 6) Introduction to Nano technology, Charles P Poole Jr. & Frank J Owens, Wiley Interscience

II Year

Major I-ORGANIC CHEMISTRY- I

UNIT I-ALIPHATIC HYDROCARBONS

ALKANES: General methods of preparation and properties. Structure of methane – sp^3 - hybridization.

ALKENES: General methods of preparation and properties. Markownikoff's rule, peroxide effect. Structure of ethene – sp^2 - hybridization.

Classification of alkenes, stability of conjugate dienes- Mechanism of 1, 2 and 1, 4-addition- Diels-Alder reaction.

ALKYNES: General methods of preparation and properties. Acidity of alkynes. Structure of acetylene – sp -hybridization.

UNIT II – HALOGEN DERIVATIVES

$SN1$ and $SN2$ mechanisms - $E1$ and $E2$ mechanisms- Hoffmann's and Saytzeff's rule- preparation, properties and uses of chloroform, carbon tetrachloride, vinyl chloride and allyl chloride- preparation and uses of carbon tetrachloride, freon and chloroform

UNIT III-ALICYCLIC COMPOUNDS

Cycloalkanes - General methods of preparation and properties. Cyclopropane, Cyclobutane preparation, properties and uses.

Relative stabilities of Cyclo alkanes – Baeyer's strain theory – Sachse - Mohr theory – Coulson and Moffitt's concept – Conformations of Cyclobutane .

Large ring compounds – synthesis and structure of civetone and muscone (structure elucidation not necessary).

UNIT-IV AROMATIC COMPOUNDS

Aromaticity: Huckel's rule – Characteristics of aromatic compounds.

Aromatic hydrocarbons- General methods of preparation and properties of benzene and its homologous. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

UNIT V - ORGANOMETALLIC COMPOUNDS AND ORGANO SULPHUR

COMPOUNDS

Preparation, structure and synthetic uses of Grignard reagent-preparation and reactions of methyl lithium, diethyl zinc, tetraethyl lead and tetramethyltin-Reformatsky reaction.

Preparation and properties and uses of thioalcohols and thioethers – sulphonal-mustard gas and sulphones

REFERENCE BOOKS

1. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry.
2. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons.
3. M.K. Jain and S. C. Sharma, Modern Organic Chemistry
4. N. Tewari, Advanced Organic Reaction Mechanism, Third Edition 2011.
5. L. Finar, Organic Chemistry Volume I, ELBS.

Major II- PHYSICAL CHEMISTRY- I

Unit - I GASEOUS AND SOLID STATE

Types of molecular velocities and their inter relations - most probable velocity, average velocity and root mean square velocity

Maxwell's distribution of molecular velocities, statement of equation and explanation (no derivation) – graphical representation

Crystalline and amorphous solids - crystal lattices - laws of crystallography .

Bragg's equation, derivation and applications -

Imperfections in a crystal - Schottky defects, Frenkel defects.

UNIT- II SOLUTIONS

Types of solutions — methods for expressing concentration – Molarity, molality, mole fraction, normality, mass fraction, parts per million Solubility of gases in liquids – Henry's law – Solutions of liquid in liquid– Binary liquid mixture - Ideal and non ideal solutions – Raoult's law. Fractional distillation –Azeotropic distillation

Unit - III PHOTO CHEMISTRY

Photochemical reactions-, primary and secondary reactions - Laws of photochemistry, Grotthus - Draper law, Stark-Einstein law - Quantum efficiency – experimental determination of quantum yield.

Qualitative description of fluorescence, phosphorescence - chemiluminescence, bioluminescence and photosensitization

Unit - IV THERMODYNAMICS-I

Statements of first law – meaning of the terms internal energy and enthalpy – relation between E and H - heat capacities at constant volume (C_v) and at constant pressure (C_p), relationship between C_p and C_v - calculation of work for the expansion of an ideal gas under reversible isothermal condition

Statement of second law of thermodynamics.

Entropy: Definition - entropy as function of T and V - entropy changes in isothermal transformation - -physical significance of entropy.

Unit - V THERMODYNAMICS-II

Free energy: Work and free energy functions – definition— -physical significance of dA and dG . - variation of G during isothermal change -Gibbs Helmholtz equation.

Van't Hoff isotherm and isochore - Clapeyron equation-Clapeyron-Clausius equation-Applications of Clapeyron-Clausius equation.Third law of thermodynamics: statement of III law statement and applications. Exception to third law- experimental verification of the law-The concept of chemical potential – variation of chemical potential with T and P- Gibbs Duhem equation.

Reference:

1. Principles of Physical chemistry-Puri,Sharma and Pathania 2004,Vishal Publishing Co., NewDelhi.
2. P.L. Soni, O.P. Dharmarha & U.N. Dash, Text book of Physical Chemistry, 22ndEdn., Sultan Chand & Sons, New Delhi
3. Essentials of Physical Chemistry –B.S.Bahl,Arun Bahl,G.D.Tuli,Reprint 2006,S.Chand & Company Ltd., New Delhi-110055.
4. Thermodynamics for students of Chemistry-Rajaram and Kuriacose
5. Thermodynamics for Chemists –Samuel Glasstone.
6. A Text book of Physical Chemistry-A.S.Negi S.C Anand 2nd Edition-2007.

Allied – **BIOCHEMISTRY**

UNIT 1: AMINO ACIDS AND PROTEINS

Amino acids- Classification and structures; essential and non-essential amino acids.

Physical properties, zwitterions, isoelectric point. Methods of synthesis of amino acids (Gabriel, Strecker, malonic acid methodologies: brief outline only). Reactions of amino acids- reaction due to amino groups, reaction due to carboxylic acid group, due to the presence of both amino and carboxylic acid groups, ninhydrin reaction.

Proteins – Introduction and classification. Protein structure- primary, secondary, tertiary and quaternary structure, Denaturation and renaturation of proteins. Separation and purification of proteins – dialysis – gel filtration - electrophoresis.

UNIT 2 : ENZYMES

Nomenclature, classification and properties-specificity, factors influencing enzyme action. Mechanism of enzyme action – Lock and Key model.

Coenzymes – cofactors – prosthetic groups of enzymes (TPP, NAD, NADP, FAD, ATP).

Their importance in enzyme action. Immobilization of enzymes. Enzyme specificity.

UNIT 3: LIPIDS

Classification - neutral lipids, Phospho lipids (lecithines, cephalins, plasmalogens) and glycolipids – importance and synthesis. Fatty acids – saturated, unsaturated fatty acids. Properties – Hydrolysis-acid number, saponification number. Auto-oxidation (Rancidity), addition reactions-Iodine value, Polenske number, Reichert-Meissl number, acetyl number. Cholesterol – biosynthesis. Bile salts derived from cholesterol. .

UNIT 4: CARBOHYDRATES

Classification – reducing and non-reducing sugars. Glucose: structure-conformation –

Stability. Carbohydrates of the cell membrane – starch, cellulose and glycogen. (Structure and utility) Metabolism: Glycolysis and its reversal; TCA cycle. Relation between glycolysis and respiration. Principles of bioenergetics, electron transport chain and oxidative phosphorylation. Gluconeogenesis, pentose phosphate pathway.

Unit 5: NUCLEIC ACIDS

Nucleosides and nucleotides – purine and pyrimidine bases. Nucleic acids Difference between DNA and RNA. Classification of RNA. Biosynthesis of DNA: Replication. Biosynthesis of mRNA: Transcription. Genetic code – mutations and mutants. DNA repair. Biosynthesis of proteins. DNA sequencing and PCR, recombinant DNA technology, DNA polymorphism.

Reference

1. Lehninger, Principles of Biochemistry, Fourth Edition, by David L. Nelson and Michael M. Cox, Worth Publishers, New York, 2005.
2. L. Veerakumari, Biochemistry, MJP publishers, Chennai, 2004.
3. Lubert Stryer, Biochemistry, W. H. Freeman and company, New York, 1975.
4. Robert L. Caret, Katherine J. Denniston, Joseph J. Topping, Principles and Applications of organic and biological chemistry, WBB publishers, USA, 1993.
5. J. L. Jain, Biochemistry, Sultan Chand and Co. 1999
6. A. Mazur and B. Harrow, Text book of biochemistry, 10th Edition, W.B. Saunders Co., Philadelphia, 1971.
7. Paula Yurkanis Bruice, Organic chemistry, 3rd Edition, Pearson Education, Inc. (Singapore), New Delhi, reprint, 2002.

III Year

Major I- **ORGANIC CHEMISTRY- II**

UNIT-I STEREOCHEMISTRY

Stereoisomerism - definition - classification into optical and geometrical isomerism. Projection Formulae - Fischer, Sawhorse and Newman projection formulae - Notation of Optical isomers -D-L notation- Cahn-Ingold-Prelog rules - R-S notations for optical isomers.

Optical isomerism - optical activity - optical and specific rotations - conditions for optical activity - asymmetric centre -- chirality - achiral molecules - meaning of (+) and (-) Elements of symmetry -. Racemisation - methods of racemisation. Resolution - methods of resolution (mechanical, seeding, biochemical and conversion to diastereoisomers) .

Optical activity in compounds not containing asymmetric carbon atoms. Biphenyls. allenes and spiranes.

Geometrical isomerism - cis-trans, and E-Z notations - Geometrical isomerism in maleic and fumaric acids - Methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration and cyclisation.

UNIT – II POLYNUCLEAR HYDROCARBONS

Isolated systems

Preparation of diphenyl, diphenyl methane, tri phenyl methane and stilbene.

Condensed system

Synthesis, reactions, structure and uses of naphthalene. Preparation and reactions of naphthols, naphthylamine and naphthaquinone.

Synthesis. Reactions, structure and uses of anthracene – Preparation and reactions of anthraquinone.

Synthesis. reactions and structure of phenanthrene.

UNIT- III HETEROCYCLIC COMPOUNDS.

Preparation, properties and uses of furan, pyrrole & thiophene - aromatic character. Synthesis and reactions of pyridine and piperidine-comparative study of basicity of pyrrole, pyridine and piperidine with amines.

Condensed five and six membered heterocyclics-preparation and reactions of indole, quinoline and isoquinoline-Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis-Electrophilic substitution reactions.

UNIT-IV ALKALOIDS AND TERPENOIDS

Alkaloids -classification- isolation- general methods of determination of structure of alkaloids-synthesis and structural elucidation of coniine, piperine and nicotine.

Terpenes- definition,classification-isolation- isoprene rule-synthesis and structural elucidation of citral, geraniol menthol and dipentene.

UNIT-V ORGANIC SPECTROSCOPY

UV spectroscopy - chromophore – auxochrome – blue shift, red shift –hypochromic shift, hyperchromic shift – applications for studying functional groups,cis-trans isomerism and nature of double bonds- Woodward-Fischer rules as applied to conjugated –enes and alpha and beta unsaturated ketones.

IR spectroscopy–characteristics of IR absorption frequencies – intermolecular and intramolecular hydrogen bonding – functional group detection.

NMR Spectroscopy - interpretation of NMR spectra of ethanol,acetaldehyde acetone, benzaldehyde and mesitylene.

REFERENCE BOOKS:

1. K.S. Tewari, N.K. Vishil, S.N. Mehotra – A text book of org. chem – 1st edition,Vikas Publishing House Pvt Ltd., 2001, New Delhi.
2. P.L. Soni, Text Book of Organic chemistry, Sultans chand, 1991, New Delhi,
3. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.
4. Gurdeep Chatwal, Reaction mechanisms and reagents in organic chemistry

5. O. P. Agarwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House, 2002.
6. Gurdeep Chatwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub. House, 2002
7. Y.R. Sharma, O.P. Vig, Elementary organic absorption spectroscopy – 1st edition, Goel Publishers, 1997, Meerut
8. R. T. Morrison And R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992.
9. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley And Sons, New York, 1992.
10. S. H. Pine, Organic Chemistry, 5th Edition, McGraw Hill International Edition, Chemistry Series, New York, 1987.

Major II- **PHYSICAL CHEMISTRY- II**

UNIT-I CHEMICAL KINETICS

Rate of reaction- -expressing reaction rates- factors influencing rate- order and molecularity of reactions- simple differential equation for first order, second order and zero order reactions. Effect of temperature on rate constant. The activation energy. -determination of Arrhenius frequency factor and energy of activation- The theory of Absolute reaction rates.

UNIT-II ELECTROCHEMISTRY

Metallic and electrolytic conductance –Definitions of specific, equivalent and molar conductances –Variation of conductance with dilution . Transport number - determination– Kohlrausch’s law –applications — conductometric titrations- Theory of strong electrolytes – Debye – Huckel – Onsager theory

Galvanic cells – Reversible and Irreversible cells – EMF and its measurement –standard Hydrogen electrode – calomel electrode –standard reduction potentials – electro chemical series –significance— potentiometric titrations.

Unit - III PHASE EQUILIBRIA

Phase rule - phase, component, degree of freedom

One-component system: Phase diagrams of Water and sulphur systems.

Two component system: (i) Simple eutectic: Lead-silver system and potassium iodide-water system.

(ii) Formation of compound with congruent melting point: Magnesium – zinc system

Unit – IV SPECTROSCOPY

Introduction - various types of molecular spectra.

UV-visible spectroscopy: types of transitions in molecules - applications

IR spectroscopy : theory - stretching and bending vibrations - important spectral regions for the characterization of functional groups - finger print region - vibrational modes of H₂O and CO₂

NMR spectroscopy: Theory of NMR, chemical shift - factors affecting chemical shift - internal standard, - NMR spectrum of ethanol.

Unit - V GROUP THEORY

Symmetry operations and symmetry elements - identity element - groups and their basic properties –Abelian and cyclic groups - classification of molecules into point groups - the

symmetry operations of a molecule form a group - C_{2v} and C_{3v} point groups - group multiplication tables

NANOCHEMISTRY

Definition - size dependent properties: magnetic, electrical and optical properties – quantum dots.

Synthesis of nanomaterials - bottom-up and top-down approaches - thin film deposition - catalytic assisted growth - chemical vapour deposition - sol gel method - chemical reduction

Fullerenes - carbon nanotubes - single walled and multi walled nano tubes – structures - carbon nanofibre - nanocomposites

Applications of nanoscience and nanotechnology

References :

1. Chemical Kinetics-K.J.Laidler, Tata McGraw Hill Publishing Company, New Delhi.
2. B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar.
3. P.L. Soni, O.P. Dharmarha & U.N. Dash, Text book of Physical Chemistry, 22nd Edn., Sultan Chand & Sons, New Delhi
4. Essentials of Physical Chemistry –B.S.Bahl, Arun Bahl, G.D.Tuli, Reprint 2006, S.Chand & Company Ltd., New Delhi-110055.
5. Physical Chemistry volumes I & II- S.Pahari, 2004, New Central Book Agency, Kolkata.
6. Physical Chemistry-G.M.Barrow, 2005, Tata McGraw Hill Publishing Company, New Delhi.
7. Physical Chemistry-G.K.Vemulapalli, 2004, Prentice Hall of India.
8. Group theory and its Chemical Applications - P.K.Bhattacharya - Himalaya publishing House.

PRACTICAL-I

INORGANIC QUALITATIVE ANALYSIS AND VOLUMETRIC ESTIMATION

Inorganic qualitative analysis

Semi micro qualitative analysis of inorganic salt mixtures containing one interfering acid radical.

1. Anions

Simple anions:

Carbonate, nitrate, sulphate, chloride and bromide.

Interfering anions:

Borate, fluoride, oxalate, phosphate and chromate.

2. Cations:

Group I : Lead

Group II : copper, cadmium, bismuth.

Group III : Aluminium

Group IV : Cobalt, nickel, manganese, zinc.

Group V : Barium, strontium, calcium

Group VI : Magnesium, ammonium.

Volumetric estimation

Acidimetry and alkalimetry

1. Estimation of oxalic acid – Std oxalic acid
2. Estimation of Na_2CO_3 – Std Na_2CO_3

Permanganometry

3. Estimation of sodium oxalate – Std oxalic acid
4. Estimation of ferrous ammonium sulphate – Std ferrous ammonium sulphate

Dichrometry

5. Estimation of ferrous iron – Std ferrous ammonium sulphate

Complexometry

6. Estimation of Zn – Std ZnSO₄
7. Estimation of Pb – Std ZnSO₄

PRACTICAL-II

ORGANIC ANALYSIS AND GRAVIMETRIC ESTIMATION

Organic analysis

Qualitative analysis of the given organic compound

- a. Test for aliphatic and aromatic nature of substances
- b. Test for saturation and unsaturation
- c. Identification of functional groups (carboxylic acids, phenols, aldehydes, esters, amines, amides and carbohydrates)
- d. Preparation of solid derivative to confirm the presence of functional group

Gravimetric Estimation

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate

PRACTICAL III

PHYSICAL CHEMISTRY EXPERIMENTS

1. Determination of molar mass of the given substance by Rast micro/macro method
2. Determination of molecular weight of the given substance by Transition temperature method
3. Study of phase equilibrium – Simple eutectic
4. Estimation of HCl by conductometric method using standard oxalic acid (to be prepared) and link NaOH
5. Estimation of Fe(II) by potentiometric method using standard ferrous ammonium sulphate (to be prepared) and link KMnO_4
6. Comparison of the strengths of acids by studying the kinetics of ester hydrolysis
7. Determination of CST of phenol-water system. Study of the effect of impurity on CST and determination of the strength of unknown