

**VEER NARMAD SOUTH GUJARAT UNIVERSITY**  
**Third Year B. Sc.**  
**Syllabus In Chemistry**  
**Paper – VI (Inorganic Chemistry)**  
**(Effective from July 2008)**

70 Marks (External)	Total 60
Hrs.	
30 Marks (Internal)	Time 3 Hrs.

**UNIT - I**

**Topic – 1: Quantum mechanics [5 Hrs.]**

Postulates of Quantum mechanics, Particle in three dimensional box, particle in a ring, Schrodinger's wave equation in polar coordinates, its separation into R,  $\theta$  and  $\Phi$ .

**Topic – 2 : Molecular Symmetry [7 Hrs.]**

Introduction and importance of symmetry, symmetry elements and symmetry operations, classification of molecules into symmetry point groups. point group of simple molecules like  $\text{CO}_2$ , HCl,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$ ,  $\text{BF}_3$ ,  $[\text{PtCl}_4]^{2-}$ ,  $\text{PF}_5$ , Cis- and Trans-dichloro ethylene ( $\text{C}_2\text{H}_2\text{Cl}_2$ ), Staggered and Eclipsed-Ethane ( $\text{C}_2\text{H}_6$ ),  $\text{C}_6\text{H}_6$ ,  $\text{C}_5\text{H}_5^-$ ,  $\text{CH}_4$  and  $\text{SF}_6$ . Construction of multiplication table for  $\text{C}_{2v}$ ,  $\text{C}_{2h}$  and  $\text{C}_{3v}$  point group.

**UNIT – II**

**Topic – 1: Hybridisation [3 Hrs.]**

Bond angles in  $sp$ ,  $sp^2$  and  $sp^3$  hybrid orbital using wave function [fully mathematical calculations].

**Topic – 2: Chemical bonding [4 Hrs.]**

Existence and stability of  $\text{H}_2^+$  ion based on MOT. Full mathematical derivation of  $E_S$ ,  $E_A$ ,  $\psi_S^2$  &  $\psi_A^2$ . Bonding in diborane, tetra borane (10), penta borane (9) and dodeca borane (12) anion.

**Topic – 3: Metal Complex (Inorganic Reaction Mechanisms) [5 Hrs.]**

Reaction mechanisms of ligand substitution reaction in octahedral complexes: (i)  $\text{SN}_1$  (D-Process) (ii)  $\text{SN}_2$  (A-Process) (iii) Solvent Intervention (iv) Ion Pair formation (v) Conjugate Base formation ( $\text{SN}_1\text{CB}$ ). Solvolysis (Hydrolysis) Reactions- Acid Hydrolysis and Base Hydrolysis. Redox (Single electron transfer) reactions.

### UNIT – III

**Topic – 1: Thermodynamic and Kinetic aspects of Metal Complexes [6 Hrs.]**

A brief out-line of thermodynamic stability of metal complexes, stability constant, factors affecting stability of metal complexes, lability and inertness, factors affecting lability of metal complexes. Substitution reaction in square planar complexes, Trans effect, theories of Trans effect (i) Electrostatic Polarisation Theory (ii)  $\pi$ -Bond Theory, Uses of Trans effect.

**Topic – 2: Metal Carbonyls [5 Hrs.]**

Definition, Classification, Nature of Bonding in metal carbonyls, Structure and IR Spectra in  $\text{Ni}(\text{CO})_4$ ,  $\text{Fe}(\text{CO})_5$ ,  $\text{Fe}_2(\text{CO})_9$ ,  $\text{Mn}_2(\text{CO})_{10}$ ,  $\text{Ni}(\text{CO})_4$ .

### UNIT – IV

**Topic – 1: Corrosion and its Protection [5 Hrs.]**

Definition and Importance of corrosion, Types of corrosion, uniform, pitting, intercrystalline and stress corrosion, cracking corrosion. Electrochemical theory of corrosion. Protection methods: Coating, Inhibitors (organic, inorganic, anodic, cathodic), anodic and cathodic protection.

**Topic – 2: Bonding in Metal Complexes [7 Hrs.]**

Jahn Teller Theorem, distortion in octahedral complexes. Ligand Field Theory (MOT).  $\sigma$  – bonding in octahedral complexes. Molecular Orbital Energy Level diagram and magnetic properties for  $[\text{CoF}_6]^{3-}$ ,  $[\text{Co}(\text{NH}_3)_6]^{3+}$ ,  $[\text{FeF}_6]^{3-}$ ,  $[\text{Fe}(\text{CN})_6]^{3-}$ .  $\pi$  – bonding in octahedral complexes.

### UNIT – V

**Topic – 1: Organometallic Compounds [4 Hrs.]**

Definition, Classification, Importance of Organometallic compounds. Structure and bonding in ferrocene, dibenzene chromium, Zeise ion and gaseous dimethyl beryllium.

**Topic – 2: Nano Particles [4 Hrs.]**

Introduction, properties nano particles, semi-conductors, ceramics nano particles, catalytic aspects of nano crystals, carbon nano tubes, application of nano particles.

**Topic – 3: Environmental Pollution [5 Hrs.]**

Introduction, Types of pollution (i) Gaseous Pollution in air, Acid rain and Green house effect (ii) Water pollution, Types of water pollutants, trace element in water and their effects. Determination of DO, BOD and COD (iii) Radiation pollution-cause, effects, controls. (iv) Noise pollution, their effects and controls (v) Oil pollution and their controls.

**Reference Books:**

1. Introductory Quantum Chemistry by A.K.Chandra, Tata Mc. Graw Hill, Delhi.
2. Quantum mechanics in chemistry by M.H.Hanna.
3. Theoretical Inorganic Chemistry M.C.Day and J. Selbin, Affiliated East West Pubs. Pvt.Ltd.
4. Advanced Inorganic Chemistry by Cotton and Wilkinson John Wiley.
5. Uni. Chemistry by B.H.Mohan.
6. Structural Inorganic Chemistry by A.F.Wells.
7. Chemical Bonding-An Introduction by Rawal, Patel and Patel.
8. Basic Inorganic Chemistry by Cotton and Wilkinson.
9. A Text book of Inorganic Chemistry by P.L.Soni.
10. Introduction to Inorganic Chemistry by Durrant and Durrant.
11. Modern Coordination Chemistry by R. Lewis and R.G.Wilkinson.
12. Coordination Chemistry by D. Benerjeea.
13. General and Inorganic Chemistry Part-I & II by R. Sarkar, Books and Allied (P) Ltd., Kolkata.
14. Inorganic Chemistry-Principles of structure and reactivity by J.E.Huhhey and E.A.Keiter.
15. Application of group theory to chemistry by P.K.Bhattacharya, Himalaya Publishing House, Mumbai.
16. Quantum Rasayan, Uni.Granth Nirman Board (Gujarati).
17. Advanced Inorganic Chemistry Part-I & II by Gurdeep Raj.
18. College Inorganic Chemistry (T.Y.B.Sc.) 17<sup>th</sup> Ed., by Laxmi Devi, Patel and Dhume, Himalaya Publishing House, Mumbai.
19. Prevention of corrosion by R.M.E., Diamant, Pub. 1971, Bussiness books limited, London.
20. The corrosion and Oxidation of Metals by Evans U.R., (1961), Avnold, London.
21. Corrosion, Causes and Prevention, Speller.F., Mc Graw Hill, New York.
22. Dhatvik Ksharan, Part-I & II by M.N.Desai, Uni.Granth Nirman Board (Gujarati).
23. Corrosion and corrosion control, Uhlig H., Wiley.
24. Corrosion engenering by Fontana M.G. and Green N.D., McGraw Hill.
25. Inorganic nanotubes and Fullerene like nanoparticles by R. Tenne,  
<http://www.nature.com/nano/journal/v1/n2/nano.2006.62.html>

VEER NARMAD SOUTH GUJARAT UNIVERSITY  
 Third Year B. Sc.  
 New Syllabus In Chemistry  
**Paper – VII ( Organic Chemistry)**  
**(Effective from July 2008)**

70 Marks (External)	Total	60
Hrs.		
30 Marks (Internal)	Time	3 Hrs.

### UNIT – I

Topic –1: Reaction Mechanism 7 Hrs

(a) Different types of mechanism for esterification and hydrolysis

BAc<sup>2</sup> AAc<sup>2</sup> AAc<sup>1</sup> AAL<sup>1</sup> BBL<sup>1</sup> BAL<sup>2</sup>

(b) Mechanism of formation and hydrolysis of amides.

(c) Mechanism of hydrolysis of acid anhydrides and acid chlorides.

(d) Pyrolytic eliminations: Pyrolysis of acetates, Cope and Chugaev reaction.

Topic –2: Molecular rearrangements 5 Hrs

(a) Mechanism of rearrangements involving C to C migrations as illustrated by Wagner – Meerwein and pinacol-pinacolone rearrangements.

(b) Mechanism of rearrangements involving C to N migrations as illustrated by Hoffmann Curtius , Schmidt and Beckmann rearrangements.

### UNIT – II

Topic –1: Alkaloids: 4 Hrs

The occurrence , classification , general methods, to determine their structure , analytical and synthetic evidence to prove the structure of Nicotine and Papavarine.

Topic –2: Vitamin and Hormones: 3 Hrs

Structural determinations of Pyridoxine , Thyroxine and their synthesis . General introduction, structural determination of Riboflavin (Lactoflavin) and its synthesis.

**Topic –3:(a) Green Chemistry: 2 Hrs**

Fundamental principles of green chemistry

**- 3 (b) Catalysis: 3 Hrs**

Catalysis in Organic reaction, Nucleophilic catalysis , Acid catalysis, Base catalysis, Metal-ion catalysis. Intramolecular catalysis, Phase transfer catalysis-

(i) t-butyl ammonium hydrogen sulphate used in the synthesis of 3,4 diphenyl 7-hydroxy coumarine from 2-hydroxy 4-methoxy benzophenone

(ii) Tetra n-butyl ammonium bromide used in the synthesis of Dichloro norcarane( 2,2 dichloro bicyclo(4. 1. 0 ) heptane) from cyclohexane.

## UNIT – III

**Topic –1: Terpenoids ( Isoprenoids): 4 Hrs**

Their occurrence , classification , isoprene and special isoprene rule , general methods to determine their structure , analytical and synthetic evidences for the structure of Camphor & Citral.

**Topic –2: Synthetic dyes:(Colour and constitution electronic concepts) 3 Hrs**

Definition and difference between dyes and pigments, classification of dyes , colour and constitution –Witt's theory, synthesis and uses of Eriochrome black-T , Congo red , Crystal violet , Eosin, Indigo, Methylene blue, Caledon Jade Green and Alizarine.

**Topic –3: Synthetic polymers: 5 Hrs**

Addition or chain growth polymerisation , free radical vinyl polymerisation and Ionic vinyl polymerisation, Ziegler – Natta Polymerisation and Vinyl polymers  
Condensation or step growth Polymerization , Polyesters , Polyamides, Phenol Fomaldehyde resins, Urea, Formaldehyde resins , Epoxy resins , Natural and Synthetic rubbers( General account and no Synthesis).

## UNIT – IV

### Topic –1: Synthetic drugs : 5 Hrs

Their classification based on their pharmacological action, synthesis and uses of Amyl nitrate, Varapamil, Nalidixic acid, Ibuprofen, Pyrimethamine, Diazepam, Chloramphenicol, Lidocaine, Sulfadoxine, Chlorpropamide, Dapsone,

### Topic –2: Plant pigments : 5 Hrs

- (a) classification
- (b) Carotenoids: General, analytical and synthetic evidence for the structure of B-carotene.
- (c) General account of Anthocyanidines and flavones including structural variations, general method for determining the structures of anthocyanidines and flavones, structure and synthesis of cyanidine chloride and quercetin.

### Topic –3: Carbohydrates : 2 Hrs

Introduction to disaccharides, structure determination of maltose and lactose.

## UNIT – V

### Topic –1: Spectroscopy : 8 Hrs

(a) Infrared (IR) absorption spectroscopy terms, instrumentation molecular vibrations, Hook's law, selection rules, intensity and position of IR bands, measurement of IR spectrum finger prints region, characteristic absorption of various functional groups and interpretation of IR spectrum of simple organic compounds.

(b) Nuclear magnetic resonance (NMR) spectroscopy, proton magnetic resonance ( $^1\text{H}$  NMR) spectroscopy, Nuclear shielding and de shielding, chemical shift and molecule structure, spin-spin splitting and coupling constants, areas of signals. Interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.

### Topic –2: Poly peptides : 4 Hrs

Definition, peptide structure determination, Sangers method, Edman method, N-terminal determination, C-terminal determination by generation of amino alcohol and using digestive enzymes., End group analysis, selective hydrolysis of peptides, levels of protein structure, protein denaturation/renaturation.

## Reference Books:

- (1) Mechanism and Structure in organic chemistry-Goulde. S.
- (2) Reaction mechanism in organic chemistry by Mukhargy & Singh
- (3) Principles of reaction mechanism in organic chemistry by Dharmaraha & Chawla
- (4) Organic reaction mechanism by Bansal Tata Mac. Hill
- (5) Organic Chemistry (Vol I & II) 6 th Edn, I. L. Finar.
- (6) Organic Chemistry by Hendrickson, Cram & Hammond
- (7) Organic Chemistry by Brown R. F.
- (8) Organic Chemistry by Solomon W. Graham
- (9) Principles of Organic Synthesis- R. O. C. Norman
- (10) Basic Principles of Organic chemistry, by R. Y. Caserio, W. A. Benjamin
- (11) May's Chemistry of synthetic Drugs by Dyson.
- (12) Chemistry of drugs, Ener and Caldwell
- (13) Synthetic drugs by Tyagi and Yadav.
- (14) Chemistry of synthetic Dyes Vol. I & II by Venkatraman
- (15) Synthetic Organic Chemistry by O. P. Agarwal
- (16) Synthetic Dyes by Chatwal & Anand
- (17) Spectrometric identification of organic compounds. By Silvestein, Bassler, Monill.
- (18) Chemistry of synthetic Dyes by I. G. Vashi
- (19) Organic Chemistry by Morrison and Boyd.
- (20) Chemistry of organic Natural Product Vol. I & II by O. P. Agarwal.
- (21) Spectra and Structure by P. S. Satpanthi
- (22) Chemistry of synthetic drugs by Trivedi
- (23) Industrial Chemistry by A. R. Rao.
- (24) Green Chemistry, Environmentally Verign Reactions by V. K. Ahuwalia published by Ane books India.
- (25) Organic chemistry 3/e by Paula Yurlanis Bruice ( University of California Santa Barbak)  
published by Pearson Education (Singapore) Pvt. Ltd., Indian branch Pratapganj , Delhi.
- (26) Principles of Medicinal Chemistry Vol. I & II by S.S.Kadam, K. R. Mahadik, K. G. Bothara  
( Nirali Prakashan )
- (27) Medicinal Chemistry by Asutosh kar 4/e
- (28) Organic reactions & their mechanism by P. S. Kalsi, New age international publishers.

VEER NARMAD SOUTH GUJARAT UNIVERSITY  
 Third Year B. Sc.  
 Syllabus In Chemistry  
**Paper- VIII [Physical chemistry]**  
**(Effective from July 2008)**

70 Marks (External)	Total	60
Hrs.		
30 Marks (Internal)	Time	3 Hrs.

### Unit-I

[12Hrs.]

#### THERMODYNAMICS

Partial molal free energy(chemical potential),chemical potential in case of a system of ideal gases. Concept of fugacity, fugacity function, fugacity at low pressures, physical significance of fugacity, graphical method for determination of fugacity, fugacity in gaseous mixture, fugacity of compounds in a mixture of solution, Lewis fugacity rule, Lewis-Randall rule.

Concept of activity and activity coefficient, standard state, standard state of liquid, solid and gas, Vapour pressure method of determining activity and activity coefficient (BKS-632), Variation of activity of a gas with pressure and temperature.

The Nernst heat theorem (NHT), limitations of NHT, Proof of NHT, The third law of thermodynamics, consequence of third law of thermodynamics, Determination of absolute entropy of gases and liquids, applications of third law of thermodynamics, concept of residual entropy (K.L.Kapoor, Vol-2), Exceptions to the third law of thermodynamics, Numerical problems.

### Unit-II

[12 Hrs.]

#### ELECTROCHEMISTRY: Electrodictics

Concept of oxidation and reduction, electrochemical series (Reduction series), definition of electrode, half cell and cell, single electrode potential, sign of electrode potential, standard electrode potential (oxidation and reduction potential), electrochemical process, Galvanic cell with example of Daniel cell, EMF of a cell and its measurements, standard Weston cell, different types of reversible electrodes, determination of single electrode potential, calculation of standard emf of cell and determination of cell reaction, Standard hydrogen electrode, calomel electrode and Ag-AgCl electrode.

Thermodynamics of electrochemical cell reaction

Reaction in reversible cell and concept of thermodynamic reversibility, reversible and irreversible electrochemical cell, free energy change and electrical energy, prediction of spontaneity of cell reaction, determination of standard free energy change and equilibrium constant, temperature coefficient of emf of a cell, entropy change and enthalpy change of cell reaction.

#### Classification of electrochemical cell

Chemical and concentration cell, electrode and electrolyte concentration cell, liquid junction potential (LJP), methods for elimination of LJP, salt bridge, concentration cell with and without transference [with derivation of equation for emf of cell and LJP]

Application of measurements of emf in the determination of

- (1) Solubility product and solubility of sparingly soluble salts
- (2) Ionic product of water by galvanic cell
- (3) Transport number of ions
- (4) Equilibrium constant
- (5) pH by hydrogen, glass and quinhydrone electrodes

Numerical problems.

## Unit-III

### [A] COLLOIDAL CHEMISTRY

[6 Hrs.]

General introduction, Donnan membrane equilibrium, electrokinetic phenomena: Electrophoresis, Electroosmosis, Sedimentation potential, Streaming potential, [only qualitative aspects], electrical double layer (Stern theory) and zeta potential.

### [B] SOLUTIONS

[6Hrs.]

Definition of terms: solute, solvent and solution, composition of solution – normal solution, molar solution, molal solution, mole fraction, % solution, saturated, unsaturated and super saturated solution, solubility.

Liquid-liquid mixtures, ideal liquid mixtures, Raoult's law, non ideal or real solutions, positive and negative deviations from Raoult's law, temperature composition curves for ideal and non ideal binary solutions of miscible liquids, azeotropes, partially miscible liquids: Phenol-water systems, immiscible liquids, steam distillation.

Numerical problems.

## Unit-IV

[12 Hrs.]

### NUCLEAR CHEMISTRY

Stable and unstable isotopes, separation of isotopes by different methods, gaseous diffusion, thermal diffusion, distillation, chemical exchange methods, Bainbridge velocity focusing mass spectrograph, Dempsters direction focusing mass spectrograph, application of radio isotopes as tracers in medicines, agriculture, in studying reaction mechanism in photosynthesis and age determination by  $C^{14}$ - dating method.

Particle accelerators: linear accelerator, cyclotron and synchrocyclotron, discovery of artificial disintegration, classification of nuclear reaction- based on overall energy transformations and - particles used as projectiles, the merits and demerits of different projectiles, transuranic elements and controversial elements.

Q-value of nuclear reactions, chemical and physical atomic weight scale, mass defect and binding energy, packing fraction and its relation with the stability of the nucleus, nuclear fission, atom bomb, nuclear reactor for power generation and critical mass, stellar energy and hydrogen bomb, hazards of nuclear radiation.

Numerical problems on Q- value, binding energy, packing fraction, and energy released during nuclear reactions.

## Unit-V

[12

Hrs.]

### [A] POLYMER CHEMISTRY

[4 Hrs.]

Introduction, all types of classification, chain polymerization, step polymerization, graft and block polymers, average molecular weight of polymers ( Number average and Weight average molecular weight), experimental methods to determine molecular weight (Osmotic pressure method, Sedimentation methods, Viscosity method), Numerical problems.

### [B] PHASE EQUILIBRIA

[8 Hrs.]

Statement and meaning of the terms phase, component, degree of freedom, phase rule, phase equilibria, of one component system- water,  $CO_2$  , sulphur system, phase equilibria of two component system- simple eutectic- Zn-Cd, Pb-Ag systems, desilverisation of lead, KI- Water system, freezing mixtures.

Solid solutions: compounds with congruent melting point, (Mg-Zn) system, and incongruent melting point (NaCl-Water) system.

**REFERENCE BOOKS:**

1. Elements of physical chemistry by Glasstone and Lewis
2. Physical chemistry by G.M. Barrow
3. Physical chemistry by W. Moore
4. Physical chemistry by Atkins
5. Physical chemistry by G.K.Vemulapalli
6. Physical chemistry by B.K.Sharma
7. Physical chemistry by Gurdeep raj
8. Physical chemistry by Puri, Pathania, Sharma
9. Essential of Physical chemistry by Bahl and Bahl
10. Physical chemistry by Negi and Anand
11. Physical chemistry by K.L. Kapoor Vol 1-5.
12. Physical chemistry by Baliga,Dhavale and Zaveri Vol 1-3.
13. Physical chemistry by Dr. S. Pahari
14. Nuclear chemistry by Arnikar
15. Electro chemistry by S. Glasstone
16. Electrochemistry by B.K.Sharma
17. Modern Electrochemistry by J'om Bockris and Reddy
18. Introduction to Colloidal chemistry by K.J.Mysel
19. colloidal chemistry by B.K.Sharma
20. Polymer chemistry-an introduction by R.B. Saymour and C.E. Carraher Jr.
21. Text book of polymer science by Billmeyer F.W Jr.
22. Polymer science by V.R. Gowarikar, N.V. Vishwanathan and J. Shreedhar
23. Principles of polymer science by P.Bahadur and N.V.Sastry



paper )- Beating process. Importance of Filling, Sizing, Colouring materials in the manufacture of paper & Calendering,

## Topic-2: Fluorocarbons:

4 Hrs

Chloro-fluoro derivatives of Methane & Ethane used as Freons., Uses of Freon-12.

Manufacture of HF from Fluor-spar, Manufacture of Freon-12 from Carbon tetrachloride

using HF, Manufacture of Freon-12 from Vinylidene fluoride.

## Topic-3: Unit processes in organic synthesis:

4 Hrs

**Nitration-** Definition, Nitrating agents, Factors affecting the nitration,

Nitration of Benzene, Naphthalene,

Importance of nitration in the manufacture of –

**Artificial perfumes-** Musk xylene, Musk ketone, Musk ambrette,

**Explosives** -Trinitro phenol, Trinitro toluene, Trinitro glycerine, Ammitol.

**Amination-** Definition,

**Amination by Reduction** - Metal Acid Reduction, Sulphide Reduction.

**Amination by Ammonolysis**, e.g. Amination of Chlorobenzene, 2;4,dinitro chlorobenzene, Phenol, Naphthols.

Importance of Amination in industry in the manufacture of Sulphanilamide and Benzidine from nitrobenzene, m-Phenylene diamine from m-nitro aniline, Benzoquinone from p-nitro chlorobenzene, Sachcharin, HMDA, Anthranilic acid, Hexamethylene tetramine

**Sulphonation-** Definition, Methods of sulphonation, Sulphonating agents.

Sulphonation of Benzene with the help of  $\text{SO}_3$  gas, Synthesis of Phenol

$\text{H}_2\text{SO}_4$ , Synthesis of Sachcharin, Picric acid,  
n-hexyl resorcinol

Oleum, Synthesis of Alizarine

$\text{Cl SO}_3\text{H}$ , Synthesis of Chloramine-T,

Sulphapyridine

### Unit – III

#### Topic-1: Treatment of Analytical data : 6 Hrs

Errors, Types of errors, Determinate and indeterminate errors, constant and proportional errors.

Absolute errors, Relative errors, Meanimisation of determinates errors.

Define and explain the following terms – Accuracy, Precision, Mean, Median, Deviation, Average deviation, Standard deviation, Co-efficient of variation, Relative mean deviation, Range Rejection of result from a set of results,

2.5 d rule, 4d rule and Q-test (Problems based on above topic)

#### Topic-2: Gravimetric analysis : 6 Hrs

Factors affecting solubility of precipitate. Effect of (1) Common ion (2) Diverse ions (3) pH (4) Hydrolysis (5) Complex formation. (With numerical Problems)

The precipitation process. Nucleation growth. Von Weirman's theory of relative supersaturation. Digestion of precipitate. Factors affecting quality of precipitate. Co-precipitation and post precipitation from homogeneous solution with illustrations of Barium and Alluminium.

Thermogravimetry, general principle. Thermogram of Calcium and Magnesium oxalate – suitable drying temperature of precipitate from thermogravimetry. [ No instrument ]

### Unit - IV

#### Topic-1: Titrimetric analysis : 12 Hrs

(a) General principles of Titrimetric, primary and secondary standards and standardisation of solutions.

(b) **Acid base titration**; Calculation of pH at different stages of titration of dibasic acid with strong base, construction of titration curve, titration of carbonate mixture. Problems.

(c) **Precipitation titrations**; Titration with  $\text{AgNO}_3$ , Detection of end point using Mohr's method, Volhard's method, and adsorption indicators. Problems.

(d)**Redox titrations** : construction of titration curve for titration of Fe<sup>2+</sup> with Ce<sup>4+</sup>.

Calculation of equilibrium constants of  $\text{FeSO}_4 \rightarrow \text{KMnO}_4$ ,

Types of indicators, theory of true Redox indicators , Use of  $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$  as oxidants and Sodium arsenite and Sodium thiosulphate as reductants. Problems.

(e)**Complexometric titrations** : - EDTA titrant . Distribution of various species of EDTA as function of pH . Absolute and conditional stability constants , Derivation of factors :  $\alpha_4$  for effect of pH.,  $\beta_4$  for the effect of auxilliary complexing agent. Construction of titration curves. Theory of metallochromic indicators, Masking demasking and kinetic masking Types of EDTA titrations. Problems.

## Unit -V

Modern methods of analysis :

5Hrs

### Topic-1:Spectrophotometry:

(a) components of spectrophotometer – Sources, Grating and Prism as dispersing device, sample handling, detectors- photo tube and photomultiplier tube.

Terms involved in Beer's law ,( no derivation) causes of deviation from Beer's law. Analysis of unknown by calibration curve, standard addition method and factor method ( ratio method )- principles ( no detailed method ) for spectrophotometer determination of  $\text{Cu}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{NO}_2^{-1}$ .

Problems based on quantitative analysis.

### Topic-2: Gas chromatography :

4Hrs

Classification of chromatography –principle of GC separation –components of GC carrier gas and its selection –sample introduction-stationary phases : solid adsorbents liquid stationary phase, inert solid supports-packed and capillary. Detectors : FID and TCD, Qualitative and quantitative analysis using GC. Limitations of GC.

### Topic-3: Liquid chromatography :

3Hrs

Limitations of conventional liquid chromatography-Technique of HPLC- elementary idea about technique and layout diagram of instrument . components of instrument .

## Reference Books:

- (1) Shreve Chemical Process Industries 5 ed. George. T. Austin . Mag. Hill. Book Agency
- (2) Reigel's Industrial Chemistry Ed. By James A. Kent.
- (3) Unit Process in Organic Synthesis by D. H. Groggins.
- (4) An Introduction to Industrial Chemistry by Peter Wiseman , Applied Science Pub. Ltd. London.
- (5) Industrial Chemistry by B. K. Sharma Goel Pub.
- (6) Quantitative Analysis by R. A. Day & A. L. Underwood, 6 th ed. Pub. Prentice Hall of India Ltd.
- (7) Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed.
- (8) Analytical Chemistry ( Principles & Technique ) by Lary G. Hargis.
- (9) Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
- (10) Instrumental Methods of Analysis by B. K. Sharma

VEER NARMAD SOUTH GUJARAT UNIVERSITY  
 Third Year B. Sc.  
 New Syllabus In Chemistry  
**CAN - Petrochemicals**  
**(Effective from July 2008)**

70 Marks (External)	Total	60
Hrs.		
30 Marks (Internal)	Time	3 Hrs.

**UNIT – I**

**Topic – 1: Source of Petrochemicals: 6 Hrs.**

- (a) Natural gas: Composition, Natural gas as petrochemical feed stock.
- (b) Crude oil: Composition, physical and chemical refining processes, utilization of various fractions (oil product).

**Topic -2: Classification of petrochemicals: 6 Hrs.**

First, second and third generation petrochemicals.

Conversion processes: Catalytic cracking, Thermal cracking and pyrolysis, isomerisation, hydrogenation, dehydrocyclisation of petroleum product, alkylation, hydroalkylation, polymerization of gaseous hydrocarbons.

**UNIT – II**

**Topic – 1: 6 Hrs.**

Petrochemical obtained from C<sub>1</sub> - cut of petroleum, Manufacture and applications of methanol, synthesis gas, ammonia, HCN, formaldehyde, hexamethylene tetramine, chlorinated methanes, and carbon black (oil furnace method).

**Topic – 2: 6 Hrs.**

Petrochemicals obtained from C<sub>2</sub> - cut of petroleum (Ethylene and Acetylene).

Manufacture and industrial applications of chemicals obtained from ethylene: ethanol, acetaldehyde (Wacker-Chemie Process), ethylene oxide, ethylene glycol, ethanolamines, acrylonitrile, styrene, vinylacetate,. Manufacture and industrial applications of chemicals obtained from acetylene: Acrylic acid, acrylonitrile, vinyl chloride, vinylacetate, acetaldehyde, chloroprene, trichloroethylene, methyl vinyl ether.

**UNIT – III**

**Topic – 1:****6 Hrs.**

Petrochemicals obtained from C<sub>3</sub>- cut of petroleum.

Manufacture and industrial applications of chemicals obtained from Propylene: Isopropylalcohol, acetone (Wacker-Chemie Process), propylene oxide (Halcon Process), acrylonitrile, Glycerol and isoprene, propylene tetramer acrylic acid, n-butyraldehyde (Oxo process), methyl isobutyl ketone, acrylamide, methylmethacrylate.

**Topic – 2****6 Hrs.**

Chemicals obtained from C<sub>4</sub> and C<sub>5</sub> – cut of petroleum.

Manufacture and industrial applications of butadiene, butylalcohols, methyl tertbutyl ether (MTBE), sulfolane.

**UNIT – IV****Topic – 1: BTX aromatic:****6 Hrs.**

Recovery process of BTX, manufacture and industrial applications of benzene, toluene, xylene, naphthalene, phenol, aniline.

**Topic – 2: Miscellaneous petrochemicals:****6 Hrs.**

Definition of synthetic detergents, hard and soft detergents. Synthesis of DDBS.

List of basic petrochemical raw materials for organic dyes. List of dyes derived from these raw materials with uses. Synthesis of Fluorescein, Malachite Green, Chrysoidine and Indigo.

Definition of Explosive, list of basic raw materials for explosives and list of explosives derived from these raw materials. Synthesis of Tetryl, PETN and Dynamite.

Definition insecticides, classification of insecticides on basis of mode of action. Synthesis of Methoxychlor, Captan, Parathion, Malathion and Perthane.

**UNIT – 5****Topic – 1: Industrial Fuel:****3 Hrs.**

Natural fuel, Biofuel, synthetic fuel, Hydrogen fuel of tomorrow.

**Topic – 2:****3 Hrs.**

General account of petrochemical used as monomers in the manufacture of nylon-6, nylon -6-6, nylon- 6-10, nylon -12 and nylon -8-6 fibres. Industrial production of caprolactum by

conventional process, HMDA by acrylonitrile route, adipic acid, sebacic acid and lauryl lactum.

**Topic – 3:****3 Hrs.**

General account of petrochemicals used as monomers in the manufacture of polyester fibres. Manufacture of DMT, terephthalic acid, phthalic anhydride, maleic anhydride, 1:4-butane diol and other monomers like penta erythritol and di-isocyanates.

**Topic – 4:****3 Hrs.**

The method for the large scale production with flow diagram and uses of (i) acetoacetanilide (ii)  $\beta$ -naphthol from naphthalene (iii) Benzoic acid (iv) aspirin (v) paracetamol (vi) p-aminophenol (vii) saccharin (viii) 2,4-D acid.

**Reference Books: (New edition)**

1. Introduction to petrochemicals by Sukumar Maiti, Oxford and IBH Pubs. Co. New Delhi.
2. A text on petrochemicals by Dr. B. K. Bhaskar Rao, Khanna Pubs., New Delhi.
3. Industrial chemistry including chemical engineering by B. K. Sharma, Goel Pubs. House, Meerut.
4. Petrochemicals by S. L. Venkateswaran (colour Pubs. Pvt. Ltd., Bombay).
5. Chemicals from petroleum by A. L. Waddams (ELBS & John Murray London).
6. The chemistry of petrochemicals by Astle (Reinhold Pub. Corpo.)
7. Petrochemicals and products (Statistics Division, Petroleum Information Service, New Delhi)
8. Petrochemical Digest By M. S. Manon (Asia Publishing House, Bombay)
9. Petroleum Processing by V. P. Sukhanow, MIR Publishers, Moscow.

VEER NARMAD SOUTH GUJARAT UNIVERSITY  
Third Year B. Sc.  
New Syllabus In Chemistry  
CAN - Dyes  
**(Effective from July 2008)**

70 Marks (External)	Total	60
Hrs.		
30 Marks (Internal)	Time	3 Hrs.

### UNIT – I

**Topic –1: Dyes intermediates:** 5 Hrs  
Name and structure of Benzene, naphthalene and anthraquinone intermediates useful in the dyestuff industry, synthesis of H-acid, 4-amino-2-methoxy toluene & 1,2-diamino anthraquinone.

**Topic –2: Dyes and pigments:** 7 Hrs  
Relation between colour and chemical constitution with reference to Witt's theory, definition of dyes & pigments, difference between dyes & pigments. classification of dyes based on,  
(a) chemical constitution with illustrative example.  
(b) methods of application to fibres, synthesis of Pigment yellow G, Pigment yellow 10 G, Benzidine orange.

### UNIT – II

**Topic –1: Diazotisation and coupling :(AZO dyes)** 8 Hrs  
Definition and mechanism of diazotization, common method of diazotisation, common and special coupling components, laws of coupling reaction with phenols and amines of benzene and naphthalene series, monoazo dyes, synthesis of Direct black EW, Eriochrome black T, Orange III.

**Topic –2: Disperse Dyes:** 4 Hrs  
Definition, classification of disperse dyes with examples, application of disperse dyes, synthesis of Cellitone Scarlet B, Dispersol Blue, Golden yellow VIII.

## UNIT – III

**Topic –1: Vat dyes:** **8 Hrs**

(a) Definition and general account of vat dyes, Indigo obtained from natural source, synthesis of indigo by Heumann process and Sand mayer process. Halogen derivatives

of indigo (Brilliant Indigo – 4B, Brilliant indigo -4G, 5;5- dibromoindigo vat blue - 35 )

and sulphur analogs of indigo. Synthesis of thioindigo by anthranilic acid, halogen derivatives

of thioindigo, Indanthrene Red Violet RRN, Indanthrene Scarlet –B.

(b) Anthraquinone vat dyes : Bohn's discovery of Anthraquinone Vat dyes, classification with reference to (i) anthraquinone and (ii) anthrone derivatives- synthesis of Caledon Jade-green, Indanthrene Khaki GG , Indanthrene yellow 5 GK, Indanthrene Brilliant Scarlet –RK.

**Topic –2: Reactive dyes:** **4 Hrs**

Definition, general account of reactive dyes based on monochlorotriazinyl , dichlorotriazinyl and vinyl sulphone system. Application of reactive dyes . synthesis of Procion Brilliant red H-3B , Procion Brilliant Yellow M-6G, Remazole Black B.

## UNIT – IV

**Topic –1: Azoic dyes:** **4 Hrs**

Definition ,general account of azoic dyes, fast bases , fast salts , rapid fast colours , rapidogens and rapidazoles, synthesis of naphthol AS , Fast blue B base ( Dianisidine) , Fast Orange GGD .

**Topic –2: Fluorescent brightening agents:** **8 Hrs**

General account, classification of FBA base on chemical constitution with examples, Stilbene and Coumarin derivatives of FBA , synthesis of Tinopal BV, Blankophor -B, Blankophor-G , 3-phenyl-7 methoxy coumarin, 4 methyl –3 phenyl-7-aminocoumarin .

## UNIT – V

- Topic –1: Mordant dyes:** 4 Hrs  
Definition , classification of mordant dyes with examples, application of mordant dyes synthesis of alizarin and Mordant yellow 2 G
- Topic –2: Non-textile application of dyes:** 7 Hrs  
Food colours , cosmetic dyes , dyes for paper and printing inks , dyes for paints , dyes for leather and polishes, High tech dyes, synthesis of Amaranth , Lithol Rubine, Lithod Red, Crystal violet, Bismark brown G, and Eosin.
- Topic –3: Sulphur dyes:** 2 Hrs  
General account of sulphur dyes.(a) Sulphur Black (b) Sulphur brown (c) Sulphur red (d) Sulphur blue (e) Vat blue -43

### **Reference books:**

- (1) Synthetic organic chemistry by O.P. Agrawal
- (2) The chemistry of synthetic dyes and pigments by H. A. Lubes
- (3) chemistry of synthetic dyes VOL I to VII by K. Venkatraman
- (4) An introduction to synthetic dyes by D. W. Ranghekar & P. P. Singh
- (5) A had book of synthetic dyes and their application by C. T. Bhastana & V. H. Raichura & others
- (6) chemistry of dyes & Principles of dyeing Vol II by V. A. Shehai
- (7) chemistry of synthetic dyes by I. G. Vashi
- (8) Chemistry of dyes and pigments by K. M. Shah
- (9) Synthetic dyes by G. R. Chatwal
- (10) Synthetic dyes and pigments by E. N. Abrahart.
- (11) High tech Dyes by Smith.

VEER NARMAD SOUTH GUJARAT UNIVERSITY  
 Third Year B. Sc.  
 New Syllabus In Chemistry  
 CAN - DRUGS  
 (Effective from July 2008)

70 Marks (External)	Total	60
Hrs.		
30 Marks (Internal)	Time	3 Hrs.

## UNIT – I

Topic –1: 7 Hrs

Definition of the term ‘Drugs’, classification of drugs based on their therapeutic uses,

Explanation of the following terms:

Agonist, Antagonist, Receptors, Pharmacophore, Prodrug, Antidepressant, Anticonvulsant, Diuretics.

Brief account of the following agents giving the names and structures of two important drugs, in each case:

(i) Antifungal agents: (ii) Antiviral agents. (iii) Anticancer or cytotoxic drugs

Topic –2: Micro-organism and Diseases: 5 Hrs

Brief account of the following pathogenic microbes:

Bacteria, Fungi, Viruses, Protozoa,

Classification of bacteria based on their shape and their staining property, particularly Gram –staining and Ichn-Neelson (I.N.) staining.

Names of at least three diseases in case of each of the following types of infection and also the name of microbes responsible for the same.

(i) Respiratory tract infections

(ii) Gastro intestinal tract infections

(iii) Lymphatic System Disease

(iv) Sexually transmitted diseases .

(v) Skin and soft tissue infections

(vi) Central Nervous system infections.

Names of important drugs for each of the following diseases.

(i) Typhoid (ii) Bacillary Dysentery (iii) Pneumonia (iv) Meningitis (v) Leptospirosis  
 (vi) Cholera

## UNIT – II

- Topic –1:Antibiotic:** 6 Hrs  
 Definition , history of discovery of penicillin by Alexander Fleming , structural variations among penicillins only, structural formulae and therapeutic uses of streptomycin, Oxy tetracycline and cycloserine, synthesis of chloroamphenicol.
- Topic –2:Sulfonamides (Sulfa drugs):** 6 Hrs  
 History discovery and development of sulfa drugs , Classification  
 Synthesis and uses of : sulfadiazine, sulfacetamide, succinyl sulfathiazole, sulfapyridine.

## UNIT – III

- Topic –1:Antimalarials:** 4 Hrs  
 Plasmodia responsible for human malaria, life cycle of plasmodia and classification of antimalarials.  
 Synthesis and uses of : Chloroquine , Mefloquine , Pyrimethamine.
- Topic –2:Anaesthetics:** 4 Hrs  
 Definition of general and local anaesthetics. Names and structure of general anaesthetics , classification among local anaesthetics.  
 Synthesis and uses of : Alpha –Eucaine, Procaine, Benzocaine.
- Topic –3:Sedatives and Hypnotics:** 4 Hrs  
 Introduction, , Classification Sedatives and hypnotics . brief accounts of antianxiety drugs.  
 Synthesis and uses of: Luminal (Phenobarbital) , Diazepam , meprobamate, imipramine.

## UNIT – IV

- Topic –1:Antihistamines or antiallergenic drugs:** 4 Hrs  
 General account of histamine and antiallergenic agents , classification and structural variations among antihiallergics.  
 Synthesis and uses of : Benadryl (Diphenylhydramine), Mepyramine, Promethazine (Phenargan).
- Topic –2:Analgesic and Antipyretics:** 4 Hrs

Definition , classification and structural variations among Analgesic and antipyretics,

Synthesis and uses of : Novalgin, Phenacetine, Paracetamol(Acetaminophen)  
**Topic –3:Antiseptics and Disinfectants:** 4 Hrs  
 Introduction classification and structural variations among drugs used as antiseptics and disinfectants .  
 Synthesis and uses of : Mercurchrome (merbromine) , n-Hexylresorcinol , Dichloramine-T , Acriflavine .

## UNIT – V

**Topic –1:Antimycobacterial Agents** 4 Hrs  
 General accounts of Tuberculosis and Leprosy, Classification  
 Synthesis and uses of : Isoniazid , Dapsone, (DDS),Ethionamide.

**Topic –2:Antidiabetic or Hypoglycemic agents:** 4 Hrs  
 Role of Insulin in diabetes , Classification of oral hypoglycemic agents .Types of diabetes.  
 Synthesis and uses of : Phenformin (DBI) , Tolbutamide, (Orinase) , Chlorpropamide (Diabinese) .

**Topic –3:Coagulants and Anticoagulants :** 4 Hrs  
 Definition , Water-Fall mechanism of blood clotting, Types of anticoagulants in brief, classification of blood anticoagulants , Vitamin K group, as blood coagulants.  
 Synthesis and uses of : Warfarin , Dicoumarol, Bromindione.

### Reference Books:

- (1) Burger's Medicinal chemistry (4/e) Part I, II, III by Manfre W Wolff (Ed) –John Wiley & Sons , 1981
- (2) Principles of Medicinal chemistry by Willam O. Foye Lea and Febiger, Philadelphia, 1974
- (3) Text book of organic medicinal and pharmaceutical chemistry (7/e, 1977) by Wilson, Gisvold and Doerge-J.P Lippincott company Tokyo.
- (4) Medicinal chemistry by Ashutoshkar (1993, Wiley Eastern ltd. , New Delhi)
- (5) Medicinal Bactriology by N. C. Dey and T. RR. Dey (3/e, 1975) Allied Agency – Calcutta 700 014
- (6) Principles of Medicinal chemistry Vol. I & II by S. S. Kadam , K. R Mahadik & K.G. Bothara – Nirali prakashan.
- (7) ytæwrltf mttkPjturMt;t ytiMtætultwk hmttgKt rJt|ttlt-ztu.ylttrbtf Nttn
- (8) mttkPjturMt;t ytiMtætultwk hmttgKt rJt|ttlt- ztu. fu. yu. Xtfh yltu ztu. suu. suu. r\*tJtu'e

## VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc.

New Syllabus In Chemistry

(Effective from June 2008)

140 Marks (External)

60 Marks (Internal)

Time

21Hrs.(Uni.

Exam)

**Inorganic Chemistry Practicals****1. Inorganic Qualitative Analysis:**

Inorganic Qualitative Analysis of mixture containing **three +ve and three -ve radicals**. They may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid including Chromate and Borate.

List of Inorganic Chemicals used for Inorganic Qualitative Analysis is as follows:

CHLORIDES :  $\text{Bi}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$

BROMIDES :  $\text{Sr}^{2+}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$

IODIDE :  $\text{K}^+$

NITRATE :  $\text{Pb}^{+2}$ ,  $\text{Bi}^{+3}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$

NITRITE :  $\text{Na}^+$

SULPHITE :  $\text{Na}^+$

SULPHIDE :  $\text{Zn}^{+2}$ ,  $\text{Sb}^{+3}$

SULPHATE :  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ ,  $\text{Al}^{+3}$ ,  $\text{Fe}^{+2}$ ,  $\text{Zn}^{+2}$ ,  $\text{Mn}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$

CARBONATE:  $\text{Pb}^{+2}$ ,  $\text{Bi}^{+3}$ ,  $\text{Cu}^{+2}$ ,  $\text{Cd}^{+2}$ ,  $\text{Zn}^{+2}$ ,  $\text{Mn}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Ca}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$

PHOSPHATE :  $\text{Cu}^{+2}$ ,  $\text{Al}^{+3}$ ,  $\text{Fe}^{+3}$ ,  $\text{Zn}^{+2}$ ,  $\text{Mn}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Ni}^{+2}$ ,  $\text{Ca}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$

BORATE : Boric Acid

CHROMATE :  $\text{Na}^+$ ,  $\text{K}^+$

OXIDE :  $\text{As}^{+3}$ ,  $\text{Sb}^{+3}$

**N.B. : Candidate should perform the analysis of at least 10 (ten) mixtures.**

**2. Volumetric Exercise: ( Minimum Six )**

1. To determine the percentage purity of Potassium Acid Phthalate
2. To determine the amount of Ammonium Sulphate in the given solution
3. To determine the amount of Bismuth by EDTA
4. To determine the amount of Ferric by EDTA
5. To determine the amount of Cobalt using Xylenol Orange indicator
6. To determine the amount of Nickel with Magnesium by EDTA
7. To determine the amount of Chloride by Mohr's method OR Adsorption indicator
8. To determine the percentage purity of  $\text{NaNO}_2 / \text{KNO}_2$
9. To determine the percentage purity of Boric Acid

**3. Gravimetric Estimations:**

1. Gravimetric Estimation of  $\text{Fe}^{+2}$  as  $\text{Fe}_2\text{O}_3$  from  $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 + \text{CuSO}_4$
2. Gravimetric Estimation of  $\text{Ba}^{+2}$  as  $\text{BaSO}_4$  from  $\text{BaCl}_2 + \text{FeCl}_3$
3. Gravimetric Estimation of  $\text{Al}^{+3}$  as  $\text{Al}_2\text{O}_3$  from  $\text{Al}_2(\text{SO}_4)_3 + \text{CuSO}_4$

**4. Estimation of Alloy:**

1. Brass: (i) Gravimetric estimation of  $\text{Zn}^{+2}$  as  $\text{Zn}_2\text{P}_2\text{O}_7$   
(ii) Volumetric estimation of  $\text{Cu}^{+2}$  Iodometrically
2. German Silver : (i) Gravimetric estimation of  $\text{Ni}^{+2}$  as  $\text{Ni}(\text{DMG})_2$   
(ii) Volumetric estimation of  $\text{Cu}^{+2}$  Iodometrically

**Organic Chemistry Practicals****ORGANIC SEPARATION**

Separation of binary mixture, identification of the components and its crystallization & preparation of one derivative and its purification.

ACID – Benzoic acid, Salicylic acid, Phthalic acid, Cinnamic acid, Phenyl acetic acid,

BASE – m – Nitroaniline, p – Nitroaniline, Aniline, p – Toluidine,  
p – Chloroaniline Dimethylaniline, Diethylaniline, Diphenylamine

PHENOL – Phenol, Alpha naphthol, Beta naphthol, o – Nitro phenol,

NEUTRAL –

ALDEHYDE – Benzaldehyde

KETONE – Acetone, Methyl Ethyl ketone, Acetophenone,

ESTER – Methyl acetate, Ethylacetate,

ALCOHOL – Methanol, Ethanol

HYDROCARBON – Benzene, Toluene, Anthracene, Naphthalene, Diphenyl

NITRO HYDROCARBON – Nitro benzene, m – Dinitro benzene

HALOGENATED HYDROCARBON – Chloroform, Carbon tetrachloride,  
Chlorobenzene,

Bromobenzene, P – Dichlorobenzene

AMIDE – Benzamide,

ANILIDE – Acetanilide

**N. B. Candidate should perform the analysis of at least 10 mixtures..**

### **ORGANIC ESTIMATIONS**

Determination of percentage purity of Vitamin -C

Determination of saponification value of an oil

Determination of percentage purity of Aspirin

Determination of amount of Formaldehyde in given solution

Determination of amount of Ethyl acetate in the given solution

Determination of amount of Glycine in the given solution

**(Instead of sample weighing , solutions to be given )**

### **CHROMATOGRAPHY**

Chromatographic separation of amino acid mixture by ascending paper chromatography

Glycine + Methionine, Alanine + Methionine, Alanine + Valine

### **Physical Chemistry Practicals**

#### **Refractometer**

1. To determine the specific refractivities of the given liquids A, B, and their mixtures containing 20%, 40%, 60% and unknown liquid by volume.

#### **Surface tension (Any one)**

1. To determine by the drop volume method the surface tension of the liquids A, B and C which are successively members of the homologous series.
2. To compare the cleansing power of two detergents by measuring the surface tension of their aqueous solutions.

#### **Polarimeter**

To determine the angle of rotation of the given substance ( sugar/ glucose/ tartaric acid) using three different dilutions. Determine the concentration of given unknown solution of the same substance.

#### **Chemical kinetics (All three)**

1. To investigate the reaction between  $K_2S_2O_8$  and KI.

2. To investigate the reaction between  $\text{KBrO}_3$  and  $\text{KI}$ .
3. To investigate the reaction between  $\text{H}_2\text{O}_2$  and  $\text{KI}$ .

**pH metry (Any two)**

1. To measure the pH of different buffer solutions and to study their buffer capacity.
2. To determine the degree of ionization of  $\text{HAc}$  and  $\text{NH}_4\text{OH}$ .
3. To determine the ionization constant of  $\text{HAc}$  and  $\text{NH}_4\text{OH}$ .
4. To determine the dissociation constant of weak acid by titration of weak acid and strong base.

**Potentiometry (Any one)**

1. To determine the normality of given  $\text{HCl}$  solution using  $0.5^{\text{N}}$   $\text{NaOH}$ .
2. To determine the normality of ferrous ammonium sulphate using  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
3. To determine the solubility and solubility product of a sparingly soluble salt ( $\text{AgCl}$ ) by titration of  $\text{AgNO}_3$  and  $\text{NaCl}$ .

**Conductometric titrations ( Any two)**

1. To determine the amount of  $\text{BaCl}_2$  in the given solution using  $\text{K}_2\text{CrO}_4$  solution.
2. To determine the amount of  $\text{NaCl}$  in the given solution using  $\text{AgNO}_3$  solution.
3. To determine the amount of vanillin in given vanilla sample.
4. To determine the amount of  $\text{HCl}$  and  $\text{HAc}$  in given mixture ( $\text{HCl} + \text{HAc}$ ) solution using standard  $\text{NaOH}$  solution.

**Colourimetry (Any one)**

1. Determination of indicator constant of phenolphthalein.
2. Verify Lambert-Beer's law for  $\text{KMnO}_4$  solution.
3. Determine the  $\lambda_{\text{max}}$  and concentration of given  $\text{CuSO}_4$  in ammonia solution.

**Note:** A student should perform **minimum 12 practicals** of physical chemistry practicals during academic year.