

# SYLLABUS

With Effect from June 2009

THIRD YEAR B.Sc

CHEMISTRY

Krantiguru Shyamji Krishna Verma  
Kachchh University  
Mundra Road  
BHUUJ-370 001

**KSKV KUTCH UNIVERSITY : BHUJ : 370 001**

**SYLLABUS OF CHEMISTRY  
THIRD YEAR B. Sc : In force from June -2009**

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**Chemistry Paper : VI ( Structural Chemistry): Max. Marks : 60**

**UNIT I Symmetry**

**( 12 M )**

Symmetry Operations and Symmetry elements (  $C_n$ ,  $\sigma$ ,  $S_n$ ,  $i$  ), Multiplication Table  $C_{2V}$ ,  $C_{2h}$  and  $C_{3V}$  point groups,  
Classification of Schoenflies Point groups :  $C_1$ ,  $C_s$ ,  $C_i$ ,  $C_n$ ,  $C_{nh}$ ,  $C_{nv}$ ,  $D_n$ ,  $D_{nh}$ ,  $D_{nd}$ ,  $T_d$  and  $O_h$ , Matrix representation of  $C_n$ ,  $\sigma$ ,  $S_n$ ,  $i$ ,  $E$   
Symmetry and Dipole moment, Symmetry and Optical activity.

**Ref books**

- (1) Physical Chemistry by Daniels and Alberty, 4<sup>th</sup> Ed , pages 434-446
- (2) Chemical Applications of Group theory by F A Cotton , 2<sup>nd</sup> Ed, pages 14-32 , 33-38 , 45-52 , 62-73.
- (3) Introductory Quantum Chemistry : A K Chandra , 3 rd Ed , page 252-273
- (4) Chemical Bonding : An Introduction : A K Raval , KC Patel, & R D Patel :2<sup>nd</sup> Ed , Pages 149-189

**UNIT :II**

**(A) Term symbols**

**( 6 M )**

Russel Saunders Coupling and determination of Term symbols in Ground state , Pigeon hole diagram of  $p^2$  and  $d^2$  , Hund's rules, Hole formalism, Calculation of number of microstates.

**Ref books :**

- (1) Concise Inorganic Chemistry : J D Lee , 4<sup>th</sup> Ed, pages 938 to 950

**(B) Electronic Spectra of Metal Complexes :**

**( 6 M )**

Electronic Spectra of Transition metal complexes, Selection rules, Laporte Orbital Selection rules, Spin selection rule, Orgel combined energy level diagram (  $d^1 - d^9$ ,  $d^2 - d^8$  only ) and their spectra, Spectra of  $d^5$  , Jahn Teller distortions, Spectro chemical series , Vibronic coupling.

**Ref books :**

- Concise Inorganic Chemistry : J D Lee , 4<sup>th</sup> Ed, pages 951 to 967

**UNIT : III**

**(A) Mossbauer Spectroscopy :**

**( 6 M )**

Principle, Experimental technique and applications

**Ref Books:**

- (1) Physical Methods in Inorganic Chemistry: R S Drago, pages : 362 – 372
- (2) Basic principles of Spectroscopy: R Chang: page 90 – 103

(3) Fundamentals of Spectroscopy: C N Banwell, Reprint. Pages 313 – 323

**(B) IR and Raman Spectra of Inorganic molecules :** ( 6 M )

**IR Spectra :** Basic principle, Instrumentation, Applications of IR spectra in structural determination of simple diatomic and tri atomic molecules like HCl, H<sub>2</sub>O, CO<sub>2</sub> , SO<sub>2</sub> NO<sub>2</sub> and Cl<sub>2</sub>O

**Raman Spectra :** Basic , Instrumentation, Applications , Comparison of IR with Raman spectra.

**Ref Books :**

- (1) Basic Principles of Spectroscopy : R Chang , pages : 149 – 167 , 182- 185
- (2) Physical methods in Inorganic Chemistry : R S Drago
- (3) Fundamentals of Molecular spectroscopy : C N Banwell

**UNIT : IV : Spectroscopy for Organic Molecules :**

**(A) Infra Red Spectroscopy :** ( 6 M )

Introduction, Various types of vibrations, Sample preparation, Group frequencies, Applications in Structural determination including H-bond, tautomers, and geometrical isomers , Finger print region, Examples .

**(B) NMR Spectroscopy :** ( 6 M )

Principle , Equivalent and non-equivalent protons, Chemical shift and factors affecting it, Relative intensity of signals, Spin-spin coupling, Long range coupling, coupling constant, Deuterium labeling , Application including determination of Aromatic Character, Carbocation , Examples .

**UNIT : V :**

**Problems based on combined applications of UV, NMR and IR spectroscopy:**

( 12 M )

**Reference Books for Units: IV and V :**

- (1) Applications of Absorption Spectroscopy of Organic Compounds : J R Dyer
  - (2) Organic Chemistry : VI th Ed, Morrison and Boyd
  - (3) Spectro photometric Identification of Organic Compounds : R M Silverstein , G C Bassler & T C Morrill : 4 th Ed. John Wiley & Sons
  - (4) Spectroscopy of Organic Compounds : P S Kalsi : 6<sup>th</sup> Ed, New Age International  
Organic Spectroscopy : William Kemp, 2<sup>nd</sup> Ed, ELBS
  - (5) Elementary Organic Absorption Spectroscopy : Y R Sharma & O P Vig . S.Chand & company, New Delhi
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**T. Y. B. Sc : CHEMISTRY : VII (Inorganic Chemistry) M. M. : 60**

**UNIT : I : Quantum Chemistry :**

**( 12 M )**

Setting up of Operators for observables, Time – dependant Schrodinger wave equation, Elimination of Time part, Stationary states, Important theorems concerning Hermitian operators, Particle in a three dimensional box, Separation of variables, Eigen functions and Eigen values, Symmetry and degeneracy.

Electron in a ring, Rigid rotator problem, Application to rotation spectra of diatomic molecules, Schrodinger equation in spherical polar co-ordinates for hydrogen atom, Separation of variables, solution of  $\phi$  and  $\Phi$  equation, Total energy of Hydrogen atom as per the variation method and the secular equation.

**Ref. Books :**

- (1) Introductory Quantum Chemistry : A K Chandra
- (2) Quantum mechanics in Chemistry : Melvin W Hanne
- (3) Chemical Bonding : An Introduction : A K Raval , K C Patel, & R D Patel
- (4) Theoretical Inorganic Chemistry : Dey & Selbin

**UNIT : II : Chemical Bonding :**

(A) Valence Bond treatment of  $H_2$  and  $H_2^+$  ion , Comparison of VB and MO for these molecules, Molecular orbital treatment for square planar, tetrahedral complexes, Molecular orbital treatment of polyatomic molecules such as  $BeCl_2$ ,  $BeH_2$ ,  $BH_3$ ,  $CH_4$ ,  $H_2O$  and  $NH_3$  **( 6 M )**

(B) Three centered bonds in  $B_2H_6$  and structure of Boranes , MO treatment for complexes such as  $[PtCl_4]^{-2}$ ,  $[NiF_4]^{-2}$ ,  $[IrF_6]^{-4}$ ,  $[Fe(CN)_6]^{-4}$ ,  $[FeF_6]^{-3}$ ,  $[V(CN)_6]^{-3}$  Simple Huckel theory , Basic concept of pi electron approximation **( 6 M )**

**Ref. Books:**

- (1) Electron and Chemical Bonding : Harry B Grey
- (2) Valency and Molecular structure : E Cartmell and G W Fowels
- (3) Advanced Inorganic Chemistry : F A Cotton, and Wilkinson.

**UNIT : III**

**(A) Coordination Chemistry :**

**(6 M)**

Reaction Kinetics, and mechanism, Trans effect and Trans influence, its application in synthesis, Mechanism of trans effect, Lability, Inertness, Stability and instability

**(B) Kinetics and Reaction rates of Substitution :**

**( 6 M )**

Ligands field effect and reaction rates, Mechanism of substitution reaction, Substitution in Octahedral complexes, Substitution reaction in square planar complexes, Substitution in square planar Pt(II) complexes, substitution in Octahedral Co(III) complexes, [Cis-effect] Associative , Dissociative and  $SN-1$  mechanism.

**Ref Books:**

- (1) Inorganic Chemistry : James E Huheey
- (2) Mechanism of Inorganic Reactions : Basolo & Pearson

#### **UNIT : IV**

##### **(A) Metal Carbonyls : ( 4 M )**

Mono and poly nuclear metal carbonyls such as  $\text{Ni}(\text{CO})_4$ ,  $\text{Fe}(\text{CO})_5$ ,  $\text{Cr}(\text{CO})_6$ ,  $\text{Fe}_3(\text{CO})_{12}$ ,  $\text{Co}_2(\text{CO})_8$ ,  $\text{Mn}_2(\text{CO})_{10}$ ,  $\text{Ir}_4(\text{CO})_{12}$   
Metal Nitrosyl and Metal Carbonyl hydrides, Application of IR spectra in the structure determination of metal carbonyls.

##### **Ref Books :**

- (1) Advanced Inorganic Chemistry: Cotton & Wilkinson, 3<sup>rd</sup> ED, pages 683-698, 702-706, 713-715
- (2) Inorganic Chemistry: James E Huheey
- (3) Introduction to Advanced Inorganic Chemistry : Durrant & Durrant

##### **(B) Magneto Chemistry and SHAB : ( 4 M )**

Types of magnetic behaviour, Methods of determining magnetic susceptibility, Spin only formula, Correlation of  $\mu_s$  and  $\mu_{eff}$  values ; Hard –Soft Acids & Bases

##### **(C) Organometallic Compounds : ( 4 M )**

Definition, , Classification, Synthesis ( General methods), Properties and structure and application of Organo metallic compounds of Mg , Al and Be; OMC of first transition series elements.

##### **Ref Books :**

- (1) Basic Inorganic Chemistry : F A Cotton & G Wilkinson

#### **UNIT : V Industrial Chemistry :**

##### **(A) Ceramic Industries : ( 4 M )**

Classification of Ceramic products, Basic raw material in ceramic industries, fluxing agents, Glazing Porcelain

##### **(B) BIO INORGANIC CHEMISTRY : ( 5 M )**

Role of Myoglobin and Hemoglobin in biological system, cooperative effect. Metallo enzymes, Inhibition and poisoning of enzymes, Role of alkali and alkaline earth metal ions in biological systems, Sodium pump, Calcium pump, Biological junction and toxicity of some elements, Biological fixation of nitrogen.

##### **(C) Generation of Electricity from Nuclear Energy , Its merits and demerits, Hydrogen energy ( 3 M )**

**T. Y. B . Sc : CHEMISTRY : VIII (organic Chemistry) M. M. : 60****UNIT:I****(A) Stereo Chemistry :** ( 6 M )

# Molecular asymmetry of Di phenyls , Allenes and Spiranes .

# Stereo selective and stereo specific reactions : Stereo chemistry of addition of halogens to alkenes. Syn and anti addition .

**Ref :**Organic Chemistry : VI th ed , R T Morrison and R N Boyd , pages 367 - 376 .

# Concept of pro-stereoisomerism and Chiral synthesis : Cram's Rule, Prelog's Rule and assignment of configuration.

**Ref :** Stereochemistry : Configuration and Mechanism : P.S.Kalsi; Wiley Eastern Ltd.

**( B ) Name –reactions / rearrangements** ( 6 M )

Principle, Mechanism and synthetic applications of these reactions :

(1) Pinacol-pinacolone rearrangement (2) Fries Migration (3) Hofmann reaction(4) Dakin Reaction (5) Diels-Alder reaction (6) Benzil-Benzilic acid rearrangement (7) Curtius rearrangement

**UNIT:II:****(A) Nucleophilic reactions (Aliphatic):** ( 4 M )

Definition, types of reactions , discussion about SN-1 and SN-2 reaction (definition,mechanism, evidences, stereochemistry, graph etc ) , Factors affecting the course and mode of SN reactions ( Nature / structure of Substrate, nature of Nucleophile, Nature of leaving group, nature of solvent ) ,Neighboring group participation , SN-i reaction, Walden inversion.

**Ref:** Org. Chem. 3<sup>rd</sup> Ed : James B Hendrickson, Donald J Cram, George S Hammond Chapter 10, page 375 -

**(B) Elimination reactions:** ( 4 M )

Definition, classification, discussion about E-1, E-2 and E-1CB mechanism, Carbonium ion rearrangement, Orientation of double bond in elimination reactions.

**Ref :** Org. Chem. 3<sup>rd</sup> Ed : James B Hendrickson, Donald J Cram, George S Hammond

**(C) Nucleophilic Aromatic substitution:** ( 4 M )

Definition, Bimolecular displacement and its mechanism, reactivity, Orientation, Electron withdrawal by resonance, Evidence for two step mechanism, Benzyne Mechanism including structure of Benzyne and evidences.

**Ref:** Organic Chemistry: VI th ed , R T Morrison and R N Boyd , sec 26.1, 26.4 to 26.14

**UNIT: III****(A) Isoprenoids ( Terpenoids) :** ( 6 M )

Classification, general methods of determining structure of isoprenoids, Isoprene rules, Chemistry of Citral ,  $\alpha$ -Terpineol and Camphor with their synthesis , study of reactions of  $\beta$ -carotene ( No synthesis )

**Ref :** Organic Chemistry : I L FinarAR , Vol.II , 5<sup>th</sup> Ed, pages 354-358, 361-365, 369-371, 392-395.

**(B) Alkaloids :** ( 6 M )

Classification, Definition, General methods of determining structure, Structure of Coniine, Nicotine and Atropine including their synthesis.

**Ref :** Organic Chemistry : I L Finar, Vol.II, 5<sup>th</sup> Ed, pages 696-702, 713, 717-726

**UNIT : IV**

**(A) Carbohydrates :** ( 6 M )

**Disaccharides:** Structure of Maltose, Cellobiose, Lactose and Sucrose

**Ref:** Organic Chemistry: VI th ed , R T Morrison and R N Boyd , pages 1185-1192

**(B) Heterocyclic compounds:** ( 6 M )

Structure and aromaticity of Pyrrole, Furan and Thiophene, Electrophilic substitution reactions, Reactivity and Orientation, Structure of and aromatic characteristics of Pyridine, SE and SN reactions of Pyridine, Basicity of Pyridine, Synthesis and reactions of Quinoline and Isoquinoline, Synthesis of Pyrimidine, Uracil, Thymine and Cytosine.

**UNIT : V**

**(A) Synthetic Perfumes :** (5M)

Definition, Vehicle, Fixative, Odorous substances, Classification, Synthesis of (1) Methyl anthranilate (2) Phenyl alcohol (3) Linalool (4) Musk Ketone (5)  $\alpha$  and  $\beta$  -Ionones (6) Vanilline

**Ref:** Synthetic Organic Chemistry: O.P.Agarwal

**(B) Synthetic Drugs :** ( 7 M )

Chemotherapy, Brief notes on Antipyretics, Analgesics, Hypnotics, Sedatives, Anesthetics, Antimalerials, Antiseptics, Tranquilizers, Cardiovascular drugs with minimum of two examples with structural formula from each family.

Synthesis and use of (1) Sulphathiazole (2) Sulphadiazine (3) Paracetamol (4) Benzocaine (5) Para amino salicylic acid ( PAS) (6) Phenacetin (7) Antipyrine (8) Tolbutamide (9) Chloramine-T (10) n-Hexyl resorcinol.

**Ref :** (1) A text book of Pharmaceutical Chemistry –II : Dr. A V Kasture & Dr. S G Wadodkar : Nirali Prakashan (2) Organic Pharmaceutical Chemistry : Harkishan Singh & V K Kapoor : Vallabh Prakashan, Delhi

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**T. Y. B . Sc : CHEMISTRY : IX ( Physical Chemistry ) M. M. : 60**

**UNIT : I : Thermodynamics : ( 12 M )**

Zeroth law of TD, Difference between heat and temperature, Thermometric equation, Clausius-Clapeyron equation and its application, Trouton's law, Craft's equation, Colligative properties, Elevation in boiling point, Depression in freezing point, van't Hoff's isotherm, van't Hoff's isochore, Third law of TD, Chemical potential, Derivation of Law of mass action using Chemical potential

**UNIT : II : Electrochemistry : ( 12 M )**

\* Reversible cells and reversible electrodes, Electrical double charge layer and electrode potential, Nernst equation,

\*Electrodes reversible with respect to cations, Electrodes reversible with respect to anions, Metal insoluble salt electrodes, Oxidation-reduction electrodes, Reference electrodes, Hydrogen electrode, Calomel electrode, Quinhydrone electrode, Glass electrode,

\*Measurement of emf by Poggendorff's method, Weston cell, concentration cells, Types of concentration cells, Derivation of equation of emf of each concentration cell, Derivation of equation of emf of concentration cell with transference and without transference, LJP and derivation of equation of emf of LJP, Application of emf measurement in determination of solubility and solubility product of sparingly soluble salt, ionic product of water, pH, thermodynamic function of  $G, S, H, K$ , Valency of cations, transference number, Instability constant of complex ion, degree of hydrolysis of a salt,

\*Decomposition potential, its experimental determination, Application of decomposition potential, Over voltage, Types of over voltage, factors affecting over voltage, its application.

**UNIT : III:**

**(A) Chemical Kinetics : ( 4 M )**

Activated complex theory, Predictions of reaction rates, Salt effect, Primary and secondary salt effect, Heterogeneous gas reaction, Retardation reaction.

**(B) Polymer Chemistry : ( 4 M )**

Mol Wt. (  $M_n$  and  $M_w$  ), Degree of polymerization, Classification of polymers, Determination of molecular weight by osmotic pressure method, viscosity method, light scattering method, sedimentation method, Flory Huggin's theory, Dissolution of polymer and thermodynamics of polymer solution

**(C) Phase rule : ( 4 M )**

Derivation of phase rule, condensed phase rule equation, study of two components systems, Pb / Ag system, Zn / Cd system, Zeotropic and azeotropic mixtures, Phenol – water, Triethylamine-water and Nicotine-water systems, Fractional distillation and steam distillation.



**UNIT : IV****(A) Nuclear Chemistry :** ( 4 M )

Detection of isotopes, Velocity focusing mass spectrograph, ( Banbridge), Direction focusing mass spectro meter ( Dempster), Double focusing mass spectrometer ( Nier) , Separation of isotopes: Gaseous diffusion method, Thermal diffusion method, Mass spectrograph method, Laser technique, Applications of isotopes, Tracer technique, Artificial Nuclear reactions, Types of Nuclear reactions , Artificial and induced radioactivity, Energy changes in nuclear reactions, Nuclear Fission and nuclear fusion, Units used in nuclear science: Curie, Rutherford, Becquerel, Barn, Fermi, Gray , Sievert.

**(B) Molecular Spectra :** ( 4 M )

Pure rotational spectra, Vibrational - rotational spectra, Raman spectra, Electronic spectra, Morse energy curve and ortho & para Hydrogen.

**(C) Photochemistry** ( 4 M )

Laws of photochemistry, Grotthuss-Draper law, Stark-Einstein law, Quantum yield, High quantum yield , Low quantum yield, Experimental determination of quantum yield, Types of photochemical reactions, Fluorescence and Phosphorescence, Chemiluminescence Photosensitization, Flash Photolysis, Photo stationary state, Black-white and colored photography.

**UNIT: V : Industrial Chemistry :** (12 M)**(A) Desalination or Reverse osmosis****(B) Electrochemistry and pollution control****(C) Fuel cell :**

Gemini cell, Bacon cell, Electrodes and Electrolytes used in fuel cell, Classification based on temperature, Efficiency of fuel cell, Hydrocarbon fuel cell, Methanol fuel cell, Hydrazine fuel cell, Air depolarized cell, Use of porous electrodes in fuel cell, Electrochemistry of fuel cell.

**(D) Metallic corrosion :**

Types of corrosion, Electrochemical series, Differential aeration principle, Corrosion in acidic medium, Corrosion in neutral medium, Prevention of corrosion by various methods, Polarization and types of polarization, Factors affecting corrosion, Atmospheric corrosion, Effect of moisture and pollutants on corrosion rate.

**(E) Anodic/ cathodic technical reactions :**

Current efficiency, Energy efficiency, Advantages of electro-chemical methods, Electrolysis of NaCl in different conditions, Electroplating and production of metal powder, Preparation of organic compounds: Alkane, Anthraquinone, Aniline, Sorbitol, Mannitol, Preparation of Inorganic compounds :  $\text{KMnO}_4$ ,  $\text{K}_2\text{S}_2\text{O}_8$ ,  $\text{K}_3[\text{Fe}(\text{CN})_6]$ ,  $\text{H}_2\text{O}_2$  .

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**T. Y. B. Sc: CHEMISTRY: X (Analytical Chemistry) M. M. : 60****UNIT : I :****(A) Treatment of analytical data : (4 M)**

Significant figures, Accuracy, Precision, Types of errors and minimization of errors, Ways of expressing accuracy and precision, rejection of result, Test of significance ( Q. test, students t-test and F-test), Correlation coefficient.

**(B) Theory of precipitation: (4M)**

Formation of precipitates, Particle size of precipitates, Impurities in precipitates, Purification of precipitates, Precipitation from homogeneous solution, Precipitation titrimetry, Mohr's method, Volhard method , Fajan method, construction of titration curve, Factors influencing the sharpness of end point

**(C) Solvent Extraction : (4M)**

Distribution coefficient, Distribution ratio, Solvent extraction of metals, Extraction process, Separation efficiency, Choice of solvent.

**UNIT: II****(B) Redox Titrations: (6M)**

Calculation of potential at various point on the titration curve, Redox indicators, Potential requirements of oxidation reduction titrations, Multicomponent titrations, Iodometry and Iodimetry , Metal reductors.

**(C) Potentiometry : (6M)**

The scope of potentiometric titrations, Precipitation and neutralization titrations, Graphical methods including Gran's plot for selecting end point, Differential titrations, Dead stop titrations, Ion selective electrodes, Types of ion selective electrode, working and use of Calcium ion selective electrode, Principle of pH meter.

**UNIT : III****(A) Polarography : (4 M)**

Principle, Electrodes, Types of current, Half wave potential, Ilkovic equation, Method of determining concentration.

**(B) Colorimetry and Spectrophotometry : (4 M)**

Laws of absorption, Spectrophotometric instrument, Light sources, Optical system, Wavelength selector, Light sensitive devices, Accuracy and error of spectrophotometry, Analysis of mixtures.

**(C) Flame Photometry : (4 M)**

Flame emission spectroscopy, and Atomic absorption spectroscopy, Principle and comparison, Inductively coupled plasma emission spectroscopy, Burners (Total consumption burner and pre mix burners )

#### **UNIT : IV**

##### **(A) Acid – Base titrations** ( 6 M)

Titration of polyprotic acids, and mixture of acids, Titration of salts, Differential alkali titrations, Buffer solution, Buffer level, Buffer range, Buffer efficiency, Buffer capacity.

##### **(B) Complexometric titration :** ( 6 M)

Types of titrations, Different indicators, pH effect, Hydrolysis effect, Ligand effect, Masking & demasking, construction of titration curve

#### **UNIT : V**

##### **(A) Chromatography :** ( 4 M)

Adsorption chromatography, Paper chromatography, Thin Layer chromatography, Ion exchange chromatography, Gas chromatography, Instrumentation and evaluation of data, High performance liquid chromatography ( HPLC-Principle only)

##### **(B) Ion exchange resin :** ( 4 M)

Ion exchange equilibrium, Types of ion exchange resins, Ion exchange capacity, Applications of Ion exchange resins.

##### **(C) Types of Analytical methods :** ( 4 M)

Introduction, Branches of Chemistry , Analytical Chemistry, Importance of Analytical Chemistry, Classification of Analytical methods, Advantages and limitations of Chemical methods and Instrumental methods, Literature of Analytical Chemistry including Chemical abstract , Names of few reference books and Journals on Analytical Chemistry

#### **Ref Books :**

(1) Instrumental Methods of Chemical Analysis : B K Sharma : Goel Publishing House, Merrut (2) Quantitative Analysis : Day and Underwood (3) Fundamentals of Analytical Chemistry : Skoog and West (4) Analytical Chemistry : IV th Ed. Gary D Christian .

**Kachchh University , BHUJ**

**T .Y. B. Sc: PRACTICALS IN CHEMISTRY**

**(A) Organic Separation and organic spotting :**

Binary Organic Mixture , Separation of two components from the mixture . Water soluble compound included. Identification of both of the components by Lassign test, Physical & Chemical methods, determination of MP/BP and preparation of derivative of any one compound of the mixture. Minimum of eight solid mixtures and three liquid mixtures to be done.

**Chemical compounds :**

Solids : Benzoic acid , Cinnamic acid, Salicylic acid, Phthalic acid,  $\alpha$ -Naphthol,  $\beta$ -Naphthol,  $\alpha$ - Naphthyl amine, p-Toluidine, meta and para- Nitro anilines, Diphenyl amine, m-Dinitrobenzene, Acetanilide, Naphthalene, Anthracene,

Water soluble : Succinic acid, Oxalic acid, Tartaric acid, Citric acid, Urea, Thiourea, Acetamide

Liquids : Low BP : Acetone, Benzene, Chloroform, Ethyl acetate, Methyl acetate , Ethanol, Methanol, CTC

High BP : Nitrobenzene, Aniline , Chloro benzene, Bromo benzene

**Few examples of Mixtures :**

Solids : (1) Benzoic acid + Naphthalene (Type: Acid + Neutral ), (2) Salicylic acid +  $\alpha$ -Naphthol ( Acid + Phenol ) ,(3) Succinic acid + m-Dinitrobenzene ( Water soluble acid + insoluble neutral ) etc

Liquid Mix : L + L : Benzene + Aniline , Acetone + Nitrobenzene etc

S + L : Benzoic acid + Acetone , Succinic acid + Ethyl acetate etc

**(B) Organic Preparation :**

**Preparation by single stage method**

- (1) p-Bromo acetanilide from Acetanilide ( Bromination )
- (2) Tri Bromo aniline from Aniline (Bromination )
- (3) Tribromo phenol from Phenol (Bromination)
- (4) p-Nitro acetanilide from Acetanilide (Nitration )
- (5) m-Dinitrobenzene from Nitrobenzene (Nitration)
- (6) Benzoic acid from Benzaldehyde (Oxidation)

**(C) Organic Estimation :**

- (1) To find out Mol. Wt of Organic acid by titrimetry method
- (2) To find out basicity of organic acid by titrimetry method
- (3) To find out the purity of the sample of organic acid
- (4) To find out the amount of Acetone in the given solution by iodine method
- (5) To find out amount of Ethyl acetate by hydrolysis method
- (6) To find out saponification value of an oil.
- (7) To find out %age purity of Ethyl acetate by hydrolysis method

**(D) Inorganic Qualitative Analysis :**

Analysis of inorganic mixture containing six radicals only. Minimum of **12 ( Twelve )** mixtures to be done and reported in journal . Arsenic element not to be given in any form. No negative marking for wrong detection of Sodium ion .

Examples of some mixtures :

- (i)  $\text{FeCl}_3 + \text{KNO}_2 + \text{NaNO}_3$       (ii)  $\text{CuCl}_2 + \text{KI} + \text{CdCO}_3$

**(E) Inorganic Gravimetric :**

Gravimetric determination of the metal after removing one impurity metal

- (1)  $\text{BaCl}_2 + \text{FeCl}_3 + \text{HCl}$  ( Estimation of Ba as  $\text{BaSO}_4$  , after removal of Iron )
- (2)  $\text{MnCl}_2 + \text{CuCl}_2 + \text{HCl}$  ( Estimation of Mn as  $\text{Mn}_2\text{P}_2\text{O}_7$  , after removing Copper )
- (3)  $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 + \text{CuSO}_4 + \text{H}_2\text{SO}_4$  ( Estimation of Iron as  $\text{Fe}_2\text{O}_3$  )
- (4)  $\text{Al}_2(\text{SO}_4)_3 + \text{CuSO}_4 + \text{H}_2\text{SO}_4$  ( Estimation of Al as  $\text{Al}_2\text{O}_3$  , after removing Copper )
- (5) Analysis of Brass ( Cu Volumetrically and Zn gravimetrically )
- (6) Analysis of German Silver ( Cu volumetrically and Ni as Gravimetrically )

**(F) Inorganic Volumetric analysis :**

- (1) Estimation of  $\text{Fe}^{+3}$  by EDTA
- (2) Determination of  $\text{Bi}^{+3}$  by EDTA
- (3) %age purity of  $\text{H}_2\text{O}_2$  by Iodometric method
- (4) Estimation of  $\text{Cl}^{-1}$  by Silver nitrate ( Mohr's method )
- (5) Estimation of  $\text{Zn}^{+2}$  &  $\text{Cd}^{+2}$  in a mixture by Edta
- (6) Estimation of  $\text{Ca}^{+2}$  &  $\text{Mg}^{+2}$  in a mixture by Edta

**(G) Physico-Chemical exercise :**Chemical Kinetics :

- (1) To study reaction between
  - (a)  $\text{K}_2\text{S}_2\text{O}_8$  and KI (  $a = b$  )
  - (b)  $\text{HBrO}_3$  and KI (  $a = b$  ;  $a \neq b$  )
  - (c)  $\text{H}_2\text{O}_2$  and HI (  $a = b$  ;  $a \neq b$  )
- (2) To determine the energy of activation and temperature coefficient of hydrolysis of Methyl acetate or Ethyl acetate

Conductometry :

- (1) To titrate the mix of strong acid + weak acid against strong base
- (2) To titrate the mix of strong base + weak base vs strong acid

pH metry :

- (1) To titrate strong acid against strong base
- (2) To titrate a mixture of strong acid + weak acid against strong base

Potentiometry :

- (1) To titrate strong acid against strong base
- (2) To titrate  $\text{Fe}^{+2}$  against  $\text{K}_2\text{C}_2\text{O}_7$

Colorimetry :

- (1) To study Beer's law and to determine the concentration of (i)  $\text{Cu}^{+2}$  (ii)  $\text{CrO}_4^{-2}$  (iii)  $\text{Fe}^{+3}$  in unknown solution.

Distribution law :

- (1) To study the distribution of Ammonia between Water and Chloroform
- (2) To study the distribution of Ammonia between Water and Carbon tetra chloride

Thermo chemistry :

To determine the heat of solution of an organic acid ( Benzoic acid, Salicylic acid, Succinic acid )

**(H) Chromatography :**

- (1) Separation of Ind group ions
- (2) Separation of Dyes
- (3) Separation of Amino acids

**Distribution of Marks of practical work :**

<b>Organic separation and spotting :</b>	<b>25</b>
<b>Organic estimation OR Organic preparation :</b>	<b>15</b>
<b>Inorganic Mixture :</b>	<b>25</b>
<b>Inorganic Gravimetric</b>	<b>20</b>
<b>Inorganic Volumetric</b>	<b>15</b>
<b>Physico chemical exercise :</b>	<b>25</b>
<b>Chromatography :</b>	<b>05</b>
<b>Viva : ( Pertaining to practicals only )</b>	<b>10</b>
<b>Certified Journals</b>	<b>10</b>
<b>Total : ( External practical Marks )</b>	<b>150</b>

**Note : Student shall not be allowed to appear for the examination if he / she does not produce the certified journals.**

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**Kachchh University : Question Paper style****TYBSc : CHEMISTRY**

- (1) For every question paper, there shall be FIVE main questions, with internal options.
- (2) Questions are to designed in such a manner that no topic / chapter is left out untouched. Means all the chapters are to be covered.
- (3) Every main question must be of 12 marks. (MM = 60)
- (4) Questions can be of this type depending on the number of chapters:

**Q.1 (a), (b) and (c) OR Q.1 (a), (b) and (c) .**

**Q.1 (a) OR (a), (b) OR (b) etc...**

**Q.1 (a) Attempt any TWO out of three or Four**

**(b) Attempt any Two/Three out of three / four / five etc...**

**Similarly other questions are to be set.**

- (5) Proper data / constants are to be given in the paper.
- (6) Spectral data on NMR and IR are to be given in paper no. VI (Structural Chemistry).
- (7) Numerical problems are to be asked wherever necessary.

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**Ramesh Luhana  
HoD, Chemistry  
Tolani College of Arts and Science  
Adipur.  
Chairman, Chemistry  
Kachchh University  
BHUJ: Kachchh: 370 201**