



**T.Y. B.Sc.
CHEMISTRY**

Sr. No.	Paper No.	Paper Name	Total Marks
1	C-301	Industrial & Analytical Chemistry	75
2	C-302	Inorganic Chemistry	75
3	C-303	Organic Chemistry	75
4	C-304	Physical Chemistry	75
5	C-305	Structural Chemistry	75
6	C-306	Practical Course in Chemistry	125
TOTAL			500

T. Y. B.Sc.
Chemistry

Paper No : C - 301 Industrial & Analytical Chemistry

Total Marks: 75

Unit	Detailed Syllabus	Teaching Hours	Marks
Unit :1	<p>(A) Unit Processes, Unit Operations and Intermediate Compounds: Elementary concept of unit process and unit operation. Study of the following unit processes: Amination, Reduction, Sulphonation, Halogenation, Nitration, Alkali fusion. Brief account of following unit operations : crystallization, distillation, drying, evaporation, filtration.</p> <p>Preparation and uses of following intermediate compounds :</p> <p>Naphthionic acid, 1-2-4-acid, α-aiminoanthraquinone, 2-amino anthraquinone, Indoxyl, H-acid, R-acid, J-acid, γ-acid, G-acid, Benzidine, O-dianisidine.</p> <p>(B) Synthetic dyes: Introduction, classification of dyes, preparation and uses of the following dyes:</p> <p>Methyl violet, Eosin, Methylene blue, Alizarin–orange, Alizarin-Red, Naphthol-AS, Naphthol-ASG, Chrysophenine-G, Direct black-E, Remazole black-B, Reactive red-B, Phenolphthalein.</p>	15 Lectures	15
Unit :2	<p>(A) Synthetic drugs: Introduction, classification of drugs, preparation and uses of the following drugs: chloroquine, sulphacetamide, sulphafurazole, n-hexyl resorcinol, phenobarbitone, chlorpromazine, trimetin(Avil), chlorpropamide, chloramphenicol, analgine, chlorambucil, benadril, benzocain, dapsone, vioform</p> <p>(B) Fermentation Industry: Introduction, manufacture of industrial and absolute alcohol, acetic acid and penicillin.</p>	15 Lectures	15
Unit :3	<p>(A) Marine and fine chemicals: Introduction, magnesium chloride, magnesium sulphate, magnesium hydroxide, magnesium trisilicate, magnesium carbonate, bromine, potassium chloride from seawater or brine, manufacture of precipitated silica, sodium stearate, magnesium stearate, zinc stearate, etc.</p> <p>(B) Paper, pulp, sugar and sweetening agents: Introduction, manufacture of pulp (Kraft process only) and paper. Manufacture of cane sugar. Preparation of saccharin, sucaryl sodium (Sodium cyclamate), Dulcin (Phenethylurea).</p>	15 Lectures	15
Unit :4	<p>(A) Petroleum and petrochemicals: Introduction, refining of petroleum, cracking and reforming process, petrochemicals obtained from C_1, C_2, C_3, C_4 and aromatic hydrocarbons. Manufacture of poly ethylene, polypropylene.</p> <p>(B) Polymers (Fibers, Resins and Rubber): Introduction, types of polymerization, addition polymerization and condensation polymerization with proper illustration. Preparation of following polymers: teflon, saran, orlon, vinyone, urea formaldehyde, melamine resin, epoxy resin, Buna-s(SBR-styrene butadine rubber), Buna-n(NBR-nitrile butadine rubber), neoprene(duprene).</p>	15 Lectures	15
Unit :5	<p>(A) Qualitative and Quantitative analysis: Introduction, separation of Cl^-, Br^-, I^-; S^{2-}, SO_3^{2-}, SO_4^{2-}; NO_2^-, NO_3^-; AsO_3^{3-}, AsO_4^{3-}, PO_4^{3-}. Common ion effects with proper illustrations. Solubility product, relation between solubility</p>	15 Lectures	15



<p>product and solubility, applications of solubility product.</p> <p>(B) (i) Conductometry: Basic principle of conductometry, acid-base titration, dissociation constant of mono-basic acid, (ii) Potentiometry: Introductory information about Nernst equation, electrodes and pH scale, applications of potentiometry to acid-base and redox titrations, (iii) Colorimetry: Basic principle of colorimetry. (Beer-Lambert's law), applications of colorimetry in determining unknown concentration of the homogeneous colored solution.</p> <p>(C) Chromatography: Introduction and classification of chromatography. Partition chromatography, column, paper and thin layer chromatography, Ion exchange chromatography, Gas-liquid chromatography.</p>		
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--	--

Reference books:

1. Shrev's Chemical Process Industries,-R. Norris Shreve, J.A.Brink,Jr.; McGraw-Hill Kgakusha.
2. Industrial Chemistry,-Dr B.K.Sharma; Goel Publication house.
3. Roger's industrial chemistry,-C.C,Furnas; D.Van Nostrand compony,Inc.
4. Industrial Chemistry,-William Thornton ;John Wiley & Sons.
5. Industrial and analytical chemistry, -Dr.Mrs. Kusumben Desai, Dr. Bipin Patel ; Popular publication.
6. Udhyogoma rasayanic vishleshan,-Dr.M.N.Desai ; university book production board.
7. Basic consepts of analytical chemistry,3rd edition,-S.M.Khopkar; New Age publishers.
8. Analytical chemistry,-Dharuba charan das; PHI Pearnig P.L.
9. Audhyogic ane vaishleshik rashayanshashtra ; Popular Prakashan.
10. Text Book of Production Technology,-O.P.Khanna,M.Lal; Dhanpat Rai Publications.

T. Y. B.Sc.
Chemistry

Paper No: C – 302 Inorganic Chemistry

Total Marks: 75

Unit	Detailed Syllabus	Teaching Hours	Marks
Unit :1	<p>(A) Operators and Wave mechanics: Operator concept, linear operator, commutator operator, vector operator, Laplacian operator, Hamiltonian operator, Hermitian operator, Unitary operator, construction of Hamiltonian operator for He, He₂⁺, H₂, H₂⁺, Li, Be, B, N and C. Particle in a one-dimensional box and in a three dimensional box.</p> <p>(B) M.O. theory: Introduction. Molecular orbital energy level diagram of B₂, N₂, O₂, NO, CO and their ions.</p>	15 Lectures	15
Unit :2	<p>(A) Molecular symmetry: Explanation of symmetry elements and symmetry operations with proper illustrations such as identity, axis of rotation, plane of symmetry, point of inversion and improper axis of rotation, multiplication of symmetry operation. Multiplication table for C_{2v} and C_{3v} point groups.</p> <p>(B) Zero group elements: Nomenclature, electronic configuration and effect of electronic configuration on their properties. Explanation for bonding and structure of XeF₂, XeF₄, XeF₆, XeO₃, XeOF₄.</p>	15 Lectures	15
Unit :3	<p>(A) Metal carbonyl compounds: Classification of carbonyls, important methods for preparation of carbonyls and explanation for structure of carbonyls of Mo, W, Fe, Mn, Co, Ni and Ru with their I.R spectra.</p> <p>(B) Organometallic compounds: Introduction, Structure of Beryllium dimethyl [Be(CH₃)₃], Aluminum trimethyl [Al(CH₃)₃], Platinum tetramethyl [Pt(CH₃)₄], Zeiss salt K[PtCl₃(C₂H₄)], Ferrocene [(C₅H₅)₂Fe], dibenzenechromium [Cr(C₆H₆)₂]</p>	15 Lectures	15
Unit :4	<p>(A) Sidgwick-Powel Rules: Six Rules of Sidgwick & Powel, its extension by Nyholm and Gillespie by proper illustrations such as BeH₂, BeCl₂, BH₃, CH₄, NH₃, H₂O, ClF₃, PCl₅, SF₆ and IF₇</p> <p>(B) Hydrides and electron deficient compounds: Introduction, classification of hydrides, preparation, properties and application of different types of hydrides such as (i) salt like saline or ionic hydride (ii) molecular or co-valent hydride (iii) metallic interstitial hydride (iv) boron hydrides, structure of B₂H₆ and B₅H₉</p>	15 Lectures	15
Unit :5	<p>(A) Lanthanides and Actinides series: Different nomenclature given to these elements, their position in PT, Different methods for separation, electronic configuration and effect on physical and chemical properties, lanthanide contraction and its post effects and their properties. General outlines for actinides, their nomenclature given up to element no. 103</p> <p>(B) Non-aqueous solvents: Non-aqueous solvents and importance of study in non-aqueous media, Classification of solvents, characteristics of solvents</p>	15 Lectures	15



pertaining to water and study of the following systems (i) Protonic solvent, Liq. NH ₃ & Liq. HF (ii) Non-Protonic liq. SO ₂		
----------------------------------------------------------------------------------------------------------------------------------------------------	--	--

Reference books:

1. Basic Inorganic chemistry, -*F.A.Cotton, G.Wilkinson*; John Wiley & Sons.
2. Textbook of Inorganic Chemistry, - *P.L.Soni* ; Sultan chand & sons.
3. Modern Inorganic chemistry, -*G.D.Parkes*; Longmans, Green & Co. London.
4. Quantum chemistry, - *Iran.N.Levine* ; P H I Learning Private Ltd.
5. Aadhunic acarbanic & carbonic rasayanshashtra, -*Dr.C.G.Joshi, Pro.Y.S.Patel* ; Jyot Prakashan.
6. Aadhunic Rasayanshashtra (Acarbanic Rasayanshashtra) ; New Popular Prakashan, Surat.
7. Quantum Chemistry, -*R.K.Prasad*; New Age International Publication.
8. Modern Inorganic Chemistry, - *R.D.Madan*; S.Chand & Company Ltd.
9. Advance Inorganic chemistry, -*Gurdeepraj* ; Goel Publishing House.
10. Advance Inorganic Chemistry (Vol-1, 2, 3), -*Satyaprakash, G.D.Tuli*;

T. Y. B.Sc.
Chemistry

Paper No: C – 303 Organic Chemistry

Total Marks: 75

Unit	Detailed Syllabus	Teaching Hours	Marks
Unit :1	<p>(A) Stereochemistry: Introduction, concept of chirality (only introduction), racemisation, theory of racemisation, methods for the resolution of racemates. methods for asymmetric synthesis. Walden inversion, molecular asymmetry and optical activity of allenes, spirans and diphenyl derivatives, geometrical isomerism of the compounds containing C=C and C=N, Backmann re-arrangement, methods for determining configuration of cis-trans isomers.</p> <p>(B) Carbohydrates and Glycosides: Introduction, methylation of carbohydrates, Introduction of D- and L- configurations, mutarotation, Hudson's Lactone rule, determination of ring structure of glucose and fructose, determination of the constitution of sucrose, synthesis and analytical evidences for the structure of salicin and indican.</p>	15 Lectures	15
Unit :2	<p>(A) Alkaloids: Introduction, classification, isolation and properties of alkaloids. general methods of determination of structure of alkaloids. Synthesis and analytical evidences for the structure of hygrine, coniine, nicotine, papaverine .</p> <p>(B) Heterocycles: Introduction, Synthesis and chemistry of following Azoles : Pyrazole, Imidazole, Isoxazole, Thiazole. Synthesis and chemistry of following Azines : Pyridazine, Pyrimidine, Pyrazine.</p>	15 Lectures	15
Unit :3	<p>(A) Terpenoids (Isoprenoids): Introduction, isoprene rule and classification of terpenoids. Isolation of essential oils and terpenoids. General method of determining structure of terpenoids. Synthesis and analytical evidences for the structure of citral, menthol, α-terpineol and camphor.</p> <p>(B) Polypeptides and proteins: Introduction of polypeptides and proteins, Comparison of polypeptide and proteins. General methods for synthesis of Polypeptides by Fischer's & Bergman's method, Determination of amino acid sequence in Polypeptides and Proteins by Senger, Edman, Schlack & Kumpf's methods.</p>	15 Lectures	15
Unit :4	<p>(A) Plant Pigments: Introduction and classification. Synthesis and analytical evidences for the structure of cyanin chloride, flavone, chrysin, flavonol, quercitin, isoflavone, genistein and β-carotene. structural relationship between flavonoids.</p> <p>(B) Vitamins, steroids and hormones: Introduction, synthesis and analytical evidences for the constitution of Vitamin-C (L-ascorbic</p>	15 Lectures	15



	acid), vitamin-A (Retinol), its relation with β-carotene, introduction to steroids, adrenaline.		
Unit :5	(A) Nucleic acids: Introduction, classification, degradation of nucleic acids, synthesis and analytical evidences for the structure of Adenosine, Guanosine, Cytidine, Uridine, Thymidine. Structure of Nucleotides and Nucleic acids. Function of Nucleic acid in Protein synthesis. Difference between RNA and DNA. (B) Reactions: Principle, mechanism and synthetic applications of the following reactions: (i) Ardent-Eistert reaction (ii) Bischler-Napieralski reaction (iii) Claisen-Schmidt condensation reaction (iv) Deickmann reaction (v) Mannich reaction (vi) Pechmann reaction.	15 Lectures	15

Reference books:

1. Organic Chemistry vol-I , - *I.L.Finar* ; Longman Scientific & Technical Publication.
2. Organic Chemistry vol-II , - *I.L.Finar* ; Longman Scientific & Technical publication.
3. Organic Chemistry Reaction & Reagents , - *O.P.Agarwal* ; Goel Publishing House Meerut.
4. Principals of medicinal chemistry, - *Kadam, Mahadik* ; Bothara-Nirali Prakashan .
5. Textbook of Organic chemistry, - *P.L.Soni , H.M.Chawala* ; Sultan chand & Sons.
6. Textbook of Organic chemistry , - *Arun Bahal, B.S.Bahal* ; S-chand & Company.
7. Organic chemistry of Natural Products , - *O.P.Agarwal* ; Goel publishing house.
8. Organic chemistry of Natural Products, - *G.R.Chatwal, M.Arora*; Himalaya Pub. House
9. Reaction Mechanisam & Reagents in Organic Chem.. , - *G.R.Chatwal* ; Himalaya Pub. house.
10. Organic name reaction, - *Goutam Brahmchari* ; Narosa Publishing House Mumbai.
11. Reaction Mechanisam & Problems in organic chemistry , - *P.Chattopadhyay* ; Asian books Pvt. Ltd.



T. Y. B.Sc.
Chemistry

Paper No: C – 304 Physical Chemistry

Total Marks: 75

Unit	Detailed Syllabus	Teaching Hours	Marks
Unit :1	Thermodynamics: Equilibrium between the phases of one component. Clapeyrone equation, equilibrium between two crystalline forms, liquid vapour equilibria, Clausious-Clapeyrone equation. solid vapour equilibria, variation of equilibrium, latent heat on total pressure condition of equilibrium for the system of more than one component. Nernst's heat theorem. Third law of thermodynamics and its limitations, application of third law of thermodynamics, determination of absolute entropy of solids, calculation of free energy changes of reactions, calculation of equilibrium constants, partition function. Types of partition functions without derivation.	15 Lectures	15
Unit :2	(A) Chemical kinetics: Experimental method to study reaction kinetics, Kinetics of simultaneous reactions, side reactions, opposing reactions, consecutive reactions. Absolute or transition state theory, comparison of collision and absolute rate theories. Primary and secondary salt effects, kinetics of heterogeneous reaction and retardation reaction, numerical. (B) Adsorption: Introduction, Derivation of B.E.T equation, Gibbs adsorption equation, direct and indirect method for the verification of Gibbs-adsorption-equation.	15 Lectures	15
Unit :3	(A) EMF: Polarization, cause of polarization, explanation of polarization, remedy of polarization, decomposition voltage, measurement of decomposition potential, reversible potential and over voltage, polarography, hydrogen over voltage, influence of current density, pH, temperature, electrode surface, impurity on over voltage, measurement of over voltage, theories of over voltage. (B) Ionic equilibria: Ostwald's law of dilution, behavior of strong and weak electrolytes with reference to Ostwald's law, validity of Ostwald's law, ionic strength. Debye-Huckel-Ostwalds' inter ionic theory, Wien effect, Walden's rule, numerical.	15 Lectures	15
Unit :4	(A) Phase rule: Phase rule for three component system, graphical representation, partially miscible three liquid system-three types. System composed of two solids and a liquid-four types. (B) Nuclear chemistry: Tracer technique, nuclear fusion, nuclear fission, nuclear chain reaction reactor. Uses of nuclear energy, thermonuclear reactions on sun and stars. Detection and measurement of radio activity:	15 Lectures	15



	Such as, scintillation counter, proportional counter, Geiger- Muller counter. Accelerators: Cyclotron, Linear accelerator.		
Unit :5	<p>(A) Study of Solid substances: The study of crystals, space lattice, crystal systems, lattice plane and dimensions, Miller's indices, Bragg equation for x-ray diffraction, the determination of crystal structure by Bragg's X-ray spectrometer and powder method of P. Debye, P. Scherrer. Determination of NaCl, KCl structure, determination of Avogadro number, heat capacity of solids. Einstein theory and Debye theory of atomic heat capacity of solids. Numericals.</p> <p>(B) Study of Gaseous substances: Postulates of kinetic theory of gases, determination of kinetic equation for gases. Derivation of gaseous law from kinetic equation, derivation of PV isotherm of real gases, van der Waals equation. Critical temperature, critical pressure and critical volume, critical phenomenon and Andrew's experiment. Van der Waals equation and critical state. Molecular velocity, root mean square, average and most probable velocities, numerical.</p>	15 Lectures	15

Reference books:

1. Text book of Physical Chemistry, - *Glasstone* ; London Macmillan & Company Ltd.
2. Physical Chemistry, - *A.J.Mee* ; The English Language Book Society.
3. Physical Chemistry, - *Barrow*; McGraw Hill Book Co.
4. Principles of physical chemistry, - *Samuel H. Maron, Carl F. Pruton* ; Oxford and IBH Publishing Co.
5. Physical Chemistry, - *William F. Sheehan* ; Prentice hall of India Pvt. Ltd.
6. Physical Chemistry, - *Frank.H.Mac Dougall* ; New York The Macmillan Company.
7. Text book of Physical Chemistry, - *P.L.Soni, O.P.Dharmarha, V.N.Dash* ; Sultan Chand & Sons.
8. Advance Physical Chemistry, - *Gurdeep Raj* ; Goel Publishing House.
9. Physical Chemistry, - *Dr.R.L.Madan, G.D.Tuli* ; S.Chand Company Ltd.
10. Physical Chemistry, - *Gurtu & Gurtu* ; Pragati Prakashan.
11. Text book of Physical Chemistry, - *K.K.Sharma, L.K.Sharama* ; Vani Educational Book Ltd.
12. Text book of Physical Chemistry, - *K.L.Kapoor* ; Macmillan India Ltd.
13. Physical Chemistry, - *Ira N. Levine*; The Tata McGraw Hill.

T. Y. B.Sc.
ChemistryPaper No: C – 305 Structural Chemistry
Marks: 75**Total**

Unit	Detailed Syllabus	Teaching Hours	Marks
Unit :1	Ultraviolet and visible spectroscopy: Various spectral regions of electromagnetic spectrum in terms of frequency and wave number, Morse potential energy curve, Frank Condon principle, electronic excitation, simple chromophoric groups, conjugated systems, systems of extended conjugation, aromatic systems, Woodward, Fieser Scott rules for pre-designing of organic functional groups viz conjugated dienes, unsaturated carbonyl compounds, aromatic compounds. Visible spectra of transition metal complexes, selection rules and intensities of the transitions, spectrum for d^1 and d^9 (Ti^{+3} and Cu^{2+}) systems, Orgel diagram, hole formation, derivation of Russell-Souder's terms (spectral terms) with example.	15 Lectures	15
Unit :2	(A)(i) General introduction to spectroscopy: Spectroscopy, spectrometry and spectrum. Electromagnetic radiation, wavelength, wave numbers and frequency , electromagnetic spectrum. Regions of electromagnetic spectrum and types of molecular spectrums. Types of molecular energies- translational, rotational, vibrational and electronic. Types of molecular spectroscopy IR, microwave, UV, visible , NMR , ESR and mass. (ii) Infra Red spectroscopy : Introduction, theory of IR, number of fundamental vibrations, types of molecular vibrations, principle of IR spectroscopy, double beam infrared spectrometer, selection rules (active and forbidden vibrations), factor influencing vibrational frequencies : coupled vibrations and Fermi resonance, electronic effects, hydrogen bonding, bond angles, sampling techniques : solids, liquids and gases, finger print region, applications of IR spectroscopy. (B) Rotational spectroscopy Origin of Microwave spectroscopy, classification of molecules, linear molecule, spherical top molecules, symmetrical top molecules, prolate and oblate symmetric top molecules, asymmetric top molecules, rigid rotator model of di-atomic molecules, selection rules, derivation of rotation frequency equation, applications of rotational spectra.	15 Lectures	15
Unit :3	NMR spectroscopy: Introduction, magnetic property of a nucleus and classification of nuclei from a view point of NMR spectroscopy, principle of NMR spectroscopy with derivation of the fundamental	15 Lectures	15



	equation, interaction between a nuclear magnet and electromagnetic waves, instrumentation, number of signals, equivalent protons, position of signals, shielding and de-shielding of protons, chemical shift, Tau and Delta scales, factors affecting chemical shift, intensity of signals-peak area and proton counting, splitting of signals, spin-spin coupling and coupling constant, deuterium labeling, use of NMR spectroscopy and limitations of NMR spectroscopy, problems for determination of structures of organic compounds.		
Unit :4	(A) ESR spectroscopy: Introduction, principle, hyperfine splitting, ESR spectra of H^1 , H^2 , methyl free radical, $C_6H_6^+$ free radical, C_6H_5 (phenyl) free radical, simple applications of ESR. (B) Mass spectroscopy: Introduction, principle and instrumentation, various types of ions produced in mass spectrum, interpretation of mass spectrum, Nitrogen rule, unsaturated site, mass spectrum of paraffin hydrocarbons, Olefins, alcohols, aldehydes, carboxylic acids, amines, applications of mass spectroscopy.	15 Lectures	15
Unit :5	(A) Conformation: Introduction, fundamental postulates of tetrahedral theory, conformational analysis of alkanes, substituted alkanes, cyclohexane, monosubstituted cyclohexanes and disubstituted cyclohexanes, factors affecting stability of conformation. (B) (i) Dipole moment: Introduction, definition of dipole moment, types of polarization, induced polarization, orientation polarization and molar polarization, determination of dipole moment by various methods such as Vapour temperature method, Refraction method, Dilution method. Dipole moment of benzene, mono substituted benzene compounds and disubstituted benzene compounds. Applications of dipole moment to find out the molecular structure. (ii) Magnetic susceptibility: Definition of magnetic susceptibility, types of magnetism such as : dia magnetism, para magnetism, ferro magnetism, anti ferro magnetism. Determination of magnetic susceptibility, Goy's method, derivation of only spin magnetic moment formula, use of magnetic moment in structure determination.	15 Lectures	15

Reference books:

1. Fundamental of molecular Spectroscopy , - *C.N.Banwell* ; Tata McGraw Hill Publishing Company Ltd.. New Delhi.
2. Organic Spectroscopy (Principals & Applicaton) , - *Jagmohan* ; Narosa Publishing House.
3. Introduction to Infrared and Raman Spectroscopy , - *N.B.Colthup, L.H.Day and Stephen E. Wiberly* ; Academic Press, New York.
4. Molecular and Atomic Spectroscopy , - *R.Wilfred Sugumar* ; MJP Publishers.
5. Instrumental Analysis, - *Skoog, Holler, Nieman* ; Harcourt Collage Publishers.



6. Basic Concept of Analytical Chemistry , - *S.M.Khopkar* ; New Age International Ltd.
7. Spectroscopy (Atomic & Mole.) , - *Gurdeep Chatwal, Sham Anand* ; Himalaya Pub. House.
8. Spectroscopy , - *B.K.Sharma* ; Krishna Prakashan Media (P) Ltd.
9. Elementary Organic Spectroscopy, - *Y.R.Sharma* ; S.Chand & Company Ltd..
10. Molecular Structure & Spectroscopy , - *G.Aruldas* ; P.H.I Learning Pvt. Ltd..
11. Analytical Chemistry , - *G.L.David Krupadanam* ; Universities Press.
12. Elements of Analytical Chemistry , - *R.Gopalan, P.S.Subramanian* ; S.Chand & Sons.



T. Y. B.Sc.

Chemistry

Paper C – 306

Practical Course in Chemistry

125 Marks

UNIT	DETAILED SYLLABUS
Ex-1	GRAVIMETRIC EXERCISE : Determination in presence of interfering ions 1. Aluminum as Aluminum Oxide 2. Ferric as Ferric Oxide 3. Barium as Barium Sulphate 4. Nickel as Nickel – Dimethyl glyoxime
Ex-2	VOLUMETRIC EXERCISE BY E. D. T. A. METHOD Estimation of Bi, Cu, Mg, Fe
Ex-3	MACRO QUALITATIVE INORGANIC ANALYSIS OF MIXTURE Containing not more than six radicals including phosphate, chromate, dichromate and borate.
Ex-4	Separation and identification of organic substances from mixture of two compounds.
Ex-5	ORGANIC ESTIMATION : Amide, Amine, Phenol and Glucose (by bromination)
Ex-6	PHYSICO-CHEMICAL EXERCISE : 1. Volumetric determinations : various types of acid-base titration solubility of salts Dissociation constant of a weak acid 2. To determine the viscosity of inorganic liquids, mixtures and solutions. 3. To determine the surface tension of liquid and to calculate the parachor. 4. To determine the V. D. of volatile liquid by Victor-Moyer method. 5. To determine the optical rotation To determine the rate of inversion of cane sugar. 6. To determine the refractive index of a given liquid, mixture and solution. 7. Colorimetric analysis of iron and Nickel. 8. To determine the degree of hydrolysis and dissociation by pH measurement 9. Potentiometric determination : various types of acid-base titration Oxidation Reduction titration $Fe^{2+} - Cr_2O_7^{2-}$ 10. To determine the temperature coefficient and energy of activation of hydrolysis of methyl acetate by calculation and potassium iodide. 11. To investigate the reaction between potassium per sulphate and potassium iodide. 12. To investigate the reaction between potassium bromate and potassium iodide. 13. Paper chromatography : separation of $Cu^{2+}, Cd^{2+}, Bi^{3+}, * Fe^{3+}, Cr^{3+}, Al^{3+}$ $Ca^{2+}, Ba^{2+}, Sr^{2+}$ Amino acids Find out the R_f values of each component. 14. To determine the distribution of ammonia between water and chloroform.