

B.Sc.

Chemistry Department	
Programme Outcome	Students will exhibit mastery of major topics in all chemistry disciplines. Students will use critical thinking and the scientific method to plan, conduct, record, and analyse the findings of chemical experiments, as well as gain an understanding of chemistry's impact on the environment, society, and other cultures outside of the scientific community. Students will get a solid understanding of the basics and applications of current chemical and scientific ideas, including those in Organic, Inorganic, Physical, and Analytical Chemistry. Develop skills in the safe handling of chemicals and equipment. To become familiar with various industrial processes and their applications.
Programme Specific Outcome	Chemical terminology, structure, reactivity, and function in their specialised discipline of chemistry. The experiment's design and execution should demonstrate a comprehension of acceptable laboratory practises and the proper handling of chemical waste streams, as well as highlight how Chemistry applications connect to the real world. In laboratories, use appropriate techniques for qualitative and quantitative chemical analysis. Basic equipment handling, technical skills acquisition, and correct and effective communication of scientific ideas in graphic, oral, and written form exhibit knowledge and grasp of the subject's main facts, concepts, principles, and theories; Aid in the study of environmental pollution causes and the development of innovative pollution control technologies; improve analytical and problem-solving abilities that require the use of chemical principles

Course Outcome

Semester-I

Paper-I Inorganic & Physical Chemistry

UNIT : 01 : SOLID STATE

10 h

Definition of space lattice, Unit cell, Difference between crystalline and amorphous state, types of crystals with illustrations, Law of crystallography. Steno's law and laws of symmetry, lattice planes, Miller indices, Bravais indices, type of cubic system, diagrammatic representation of cubic system and d_{100} , d_{110} , d_{111} planes, Bragg's equation (X-ray diffraction), Crystal structure of NaCl, KCl. (Numerical based on Bragg's equation and Miller indices)

Reference Books :

1. Essentials of physical chemistry by A. S. Bhal and G. D. Tuli, Pub : S. Chand
2. Advance physical chemistry by D. N. Bajpai, Pub : S. Chand
3. Numerical problems by Dogra and Dogra (for numerical)
4. A textbook of physical chemistry by A. S. Negi and S. C. Anand, Pub : New Age International (for numerical)

UNIT : 02

A. ACID – BASE THEORIES

04 h

Arrhenius theory, Lowry Bronsted theory, Lewis theory, Solvent – Solute concept of acid- base, Soft-Hard acid base and its application.

Reference Books :

1. Essentials of physical chemistry by A. S. Bahl and G. D. Tuli, Pub : S. Chand

B. Atomic Structure

06 h

Historical perspective of atomic structure; Ruatherford's atomic model, Bohr's theory and its limitation, Spectrum of Hydrogen atom (Lyman, Balmer, Paschen, Brackett & Pfund), Quantum numbers, Auf bau, Hund and Pauli exclusion principles, Penetration and shielding, Effective nuclear charge (Slater rule)

Reference Book :

1. University General Chemistry by C.N.R. Rao, Pub : McMillan
2. Principles of Physical Chemistry by Maron & Pruton, 4th edition, Pub: Oxford & IBH
3. Physical Chemistry by G. M. Barrow
4. Advance inorganic chemistry (Vol. II) by Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan; Pub. S. Chand

UNIT : 03 :

A. CHEMICAL KINETICS

06 h

Chemical kinetics and its scope, rate of reaction, factors affecting rate of reaction : temperature, concentration, pressure, solvent, light and catalyst, Molecularity of reaction, Classification of chemical reaction, Order of reaction with illustration (first order, second

order, third order, zero order, pseudo first order) reaction, : second order ($a=b$), half life and mean life.

Reference Books :

1. Essentials of physical chemistry by A. S. Bahl and G. D. Tuli, Pub : S. Chand
2. Advance physical chemistry by D. N. Bajpai, Pub : S. Chand
3. Numerical problems by D. V. S. Jain, Pub. McGraw Hill (for numerical)

B. PERIODIC PROPERTIES

04 h

Definition of atomic and ionic radii, ionisation energy, electron affinity and electron negativity, S-Block elements : Comparative study, diagonal relationship, salient features of hydrides.

Reference Books :

1. Modern inorganic chemistry by Gurdeep Raj
2. Principals of inorganic chemistry by Puri, Sharma and Kalia; Pub. Vishal publishing
3. Inorganic Chemistry by J. D. Le

Semester- I

Chemistry Practical

A) ORGANIC SPOTTING

Primary tests, Ignition test, Detection of Elements, Nature of the substance (solubility test), Functional group tests, C. T., Molecular formula, Structural formula & M. P./ B. P. of the given substance.

ACID – Benzoic, Phthalic acid, Succinic acid.

BASE – Aniline, p – Toluidine

PHENOL – Resorcinol, a Naphthol, b Naphthol

NEUTRAL –

CARBOHYDRATE – Glucose , Fructose

KETONE – Acetone, Acetophenone

ESTER – Methyl salicylate, Methylacetate

ALCOHOL – Methanol , Ethanol

HYDROCARBON – Toluene , Naphthalene

NITRO HYDROCARBON – Nitrobenzene, m-di-nitrobenzene

HALOGENATED HYDROCARBON – Carbon tetrachloride, Chlorobenzene,

AMIDE – Urea, Benzamide

ANILIDE – Acetanilide

N. B. Candidate should perform the analysis of at least 08 substances.

B) VOLUMETRIC EXERCISE

H_2SO_4	NaHCO_3	HNO_3
KMnO_4	$\text{H}_2\text{C}_2\text{O}_4$	KOH
KMnO_4	FeSO_4	$\text{K}_2\text{Cr}_2\text{O}_7$
$\text{K}_2\text{Cr}_2\text{O}_7$	$\text{Fe-NH}_4\text{-SO}_4$	KMnO_4
$\text{H}_2\text{C}_2\text{O}_4$	KMnO_4	FeSO_4

N. B. Candidate should perform at least 3 volumetric exercises.

F. Y. B.Sc. Chemistry; Semester – II
(Paper : 01 : Inorganic & Physical Chemistry)

UNIT : 01

A. CONDUCTANCE AND IONIC EQUILIBRIUM

06 h

Electrical conductance, Specific conductance, equivalent conductance, Molar conductance, Effect of dilution on concentration, Cell constant, Determination of Cell constant, Ostwald's dilution law and its limitations, Acid & Basic buffer actions (Henderson-Hasselbach equation), Buffer capacity, Numerical.

B. THERMODYNAMICS

04 h

Second law of thermodynamics (in detail), Carnot cycle and its efficiency, Entropy concept, Change of entropy for reversible isothermic, isobaric, isochoric and adiabatic processes. Entropy change for ideal gases (T & V as variables, P & T as variables), Numerical.

Reference Book :

1. Physical Chemistry by ArunBahl, B. S. Bahl and G. D. Tuli; Pub. S. Chand
2. Advance physical chemistry by D. N. Bajpai; Pub : S. Chand
3. Text book of physical chemistry by P. L. Soni, O. P. Dharma; Pub. S. Chand

UNIT : 02 :

04 h

A. BASIC PRINCIPLES OF QUALITATIVE ANALYSIS

[I] Dry Reaction : theory behind borax bead test with equation, Flame test (Theory, structure of non luminous Bunsen flame)

[II] Analysis of Cation : Application of common ion effect, solubility product constant. Complexometric reactions involved in qualitative analysis;

1. For identification [reaction between Cu(II) ion with ammonia, Fe(III) with thiocyanide, NH_4^+ with Nessler Reagent].
2. For masking [Cd^{+2} , Cu^{+2}].
3. Separation of two ions [Ag-Hg , Zn^{+2} , Mn^{+2}]

Reference Books :

1. Qualitative analysis by R. A. Day and A. L. Underwood
2. Vogel's qualitative Inorganic analysis

B. Coordination Chemistry

06 h

Shape of d-orbitals, CFT – Basic assumption, splitting of d-orbitals in Octahedral, Tetrahedral, Square planer complexes, distribution of d^x electrons in Octahedral and Tetrahedral complexes and CFSE.

Reference Book :

1. Inorganic chemistry by Wahid Malik, G. D. Tuli, R. D. Madan; Pub. S. Chand
2. Coordination Chemistry by GurdipChatwal, M. S. Yadav; Pub. Himalaya pub. house

3. Advance inorganic chemistry (Vol. II) by Satya Prakash, G. D. Tuli, S. K. Basu, R. D. Madan; Pub. S. Chand

UNIT : 03 :

[A] CHEMICAL BONDING

05 h

Definition of chemical bonds (covalent, co-ordinate covalent, ionic, metallic, H-bond, Van der Waals forces of attraction), Polarizability (Fajan's rule), Molecular Orbital theory ; LCAO method, Bonding molecular orbital, non-bonding molecular orbital, anti-bonding molecular orbital, bond order, magnetic properties and molecular orbital energy level diagram of hetero diatomic molecule : CO and NO, VSEPR theory.

Reference Book :

1. Concise Inorganic Chemistry (5th ed.) by J. D. Lee
2. Basic Inorganic Chemistry by Cotton & Wilkinson.
3. Inorganic Chemistry – Principles of structure and reactivity by J. E. Huheey, E. A. Keiter; Pub. Person Education Publishers.

[B] PHYSICAL PROPERTIES AND CHEMICAL CONSTITUTION

05 h

Classification of physical properties (additive, constitutive, colligative, additive-constitutive), Atomic volume, Molar volume and Chemical constitution, Kopp's law, Surface tension, Drop number method, Parachor, Viscosity, Determination of viscosity by Ostwald viscometer, Define : Refraction, Specific refraction, molar refraction, Numerical.

Reference Book :

1. Principles of Physical chemistry by Puri, Sharma and Madan; Pub. Vishal publishing
2. Essentials of physical chemistry by A. S. Bhal and G. D. Tuli, Pub : S. Chand
3. Advance physical chemistry by D. N. Bajpai, Pub : S. Chand

F. Y. B.Sc. Chemistry Practical syllabus 2019

Semester-II

A. INORGANIC QUALITATIVE ANALYSIS

LIST OF INORGANIC CHEMICALS

CHLORIDES : Cu^{+2} , Fe^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Na^{+} , K^{+} , NH_4^{+} .

BROMIDES : Sr^{+2} , Na^{+} , K^{+} , NH_4^{+} .

IODIDE : K^{+}

NITRATE : Pb^{+2} , Co^{+2} , Ni^{+2} , Ba^{+2} , Sr^{+2} , Na^{+} , K^{+} , NH_4^{+} .

SULPHIDE : Zn^{+2} , Sb^{+3} .

SULPHATE : Cu^{+2} , Al^{+3} , Fe^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+} .

CHROMATE : Na^{+} , K^{+}

CARBONATE : Cu^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

PHOSPHATE : Cu^{+2} , Al^{+3} , Fe^{+3} , Zn^{+2} , Mn^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

OXIDE : Sb^{+3} , Zn^{+2}

N. B. Candidate should perform the analysis of at least 8 compounds.

B. PREPARATIO OF STANDARD SOLUTION (BY STUDENTS) OF FOLLOWING.

1. 0.1 N succinic acid against NaOH
2. 0.1 N KHP against NaOH/KOH
3. 0.01 N $\text{Na}_2\text{S}_2\text{O}_3$ against I_2 solution
4. 0.1 N $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ against KMnO_4 solution
5. 0.1 N $\text{K}_2\text{Cr}_2\text{O}_7$ against $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ Or $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ solution

N. B. Candidate should perform at least 3 volumetric exercises.

F. Y. B. Sc. Semester- I Paper_II Organic Chemistry

UNIT I:(A) Alkanes and Cycloalkanes:

10 Hrs.

Alkanes : IUPAC nomenclature of branched and unbranched alkanes, Alkyl group, Classification of carbon atoms in alkanes. Isomerism in Alkanes, sources, methods of formation special reference to **Wurtz reaction, Kolbe reaction and Corey-House reaction and decarboxylation of carboxylic acids**). Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenations of alkanes: orientation, reactivity & selectivity.

(B) Cycloalkanes : Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (Cyclo propane and cyclo butane), Theory of strainless ring. The case of cyclo propane ring: banana bonds

UNIT II : Stereochemistry

10 Hrs.

- (a) Isomerism :- Optical activity , Chiral and Achiral molecules,
- (b) Optical isomerism of tartaric acid, Enantiomers, diastereomers(Threo&Erythro), Meso compounds Resolution of Racemates, inversion retention and racemization .
- (c) Geometrical Isomerism: Alkene derivative & oximes E & Z system of nomenclature.
- (d) Relative and absolute configuration, sequence rules. D & L and R & S system of nomenclature.

UNIT III (A) Heterocyclic compounds :

5 Hrs.

Nomenclature aromaticity , and synthesis properties uses and canonical structures of Pyrrol, Benzopyrrol Furan , Benzofuran, Thiophene, Benzothiophene.

(B) PolynuclearHydrocarbons :

3 Hrs.

Classification aromaticity and Industrial preparation, , properties, uses and canonical structures of Napthalene , Anthracene and Phenanthrene.

(C) Organic Qualitative Analysis

2 Hrs.

(I) Elemental Analysis (Lassaigne's Test with equation)

(II) Solubility of Organic Compound (Ref. : Vogel's qualitative organic analysis)

Chemical Methods : Solubility in NaHCO_3 , NaOH and HCl , Acid, Base and Phenol and amphoteric compounds (Sulphanilic acid and Anthranilic acid)

F. Y. B. Sc. Semester- II

Paper-II

(Organic

Chemistry)

UNIT: I: Reaction mechanism :10 Hrs.

- (a) Homolytic and Heterolytic fission free radicals carbonium ions (carbocations) and carbanions reactive intermediates carbenes , arynes and nitrenes.
- (b) Types of reagents, electrophiles nucleophiles .
- (c) Electromeric, inductive, conjugative effect.
- (d) Types of reactions : Addition, substitution, elimination, rearrangements. Addition, and Substitution with respect to electrophilic and nucleophilic reaction, SN^1 SN^2
- (e) Mechanism of (i) addition reaction to alkenes and dienes (ii) substitution in benzene Ring, nitration , sulfonation, alkylation , acylation, halogenation., cyanohydrin formation and acetal formation,
- (f) Mechanism of Perkin reaction, Benzoin Condensation and Cannizzaro's reaction

UNIT II: (A) Empirical formula, Molecular formula, and Structural formula: 4 Hrs.

Determination of empirical formula and its relation with molecular formula
determination of molecular weight of (a) Organic acid by Silver salt method and
(b) organic base by chloroplatinate method and its limitations .
Numerical example.

(B) Carbohydrates:

6 Hrs.

Modern definition of carbohydrates, classification of carbohydrates, function of Carbohydrates, optical isomers,
Diastereoisomers, enantiomers, racemates of Glucose and Fructose, Structure of Glucose and Fructose isomers, mutarotation, glucoside linkage (Pyranose and Furanose) D & L isomers of Glucose and Fructose, derivatives of Monosaccharide, step up and stepdown synthesis, Kiliani synthesis, conversion of glucose to Fructose and conversion of Fructose to glucose.

UNIT – III (A) Alkenes, dienes and alkynes : 10Hrs.

- (a) Alkenes : Nomenclature, method of preparation, properties and uses of ethylene and propylene Markovnikov's rule and Saytzeff rule, polymerization of ethylene styrene and vinyl chloride. Alkenes. Reactions: Hydroboration, Oxidation, Epoxidation, Ozonolysis, Oxymercuration, Hydroxylation, Hydrohalogenation, Dehydrohalogenations, Hydration.
- (b) Dienes : Nomenclature, classification of dienes methods of formation of Butadiene chemical reactions 1,2 and 1,4 additions, Diels – Alder reaction.
- (c) Alkynes : Nomenclature , methods of formation, chemical reactions: Hydroboration, Oxidation, metal ammonia reduction, oxidation, polymerization. Electrophilic and nucleophilic addition reactions of acetylene.

Reference Books

- (1) Organic chemistry vol.I and vol. II by I.L.Finar (Longman group)
- (2) Organic chemistry by P.L.Soni
- (3) Organic chemistry by R.T.Morrison and Boyd Prentice Hall India.
- (4) Organic chemistry by B.K. Sharma.
- (5) Organic chemistry by Bahland Bahl
- (6) Organic reaction mechanism by Mukharji and singh
- (7) Fundamentals of Organic chemistry by Soloman, John Wiely
- (7)

S.Y.B.Sc. Sem-III

Paper-III Inorganic Chemistry

[A] Chemistry of Elements of first transition elements : [5 Hrs.]

Characteristics properties of d-block elements, properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states.

[B] Electronic configuration of atom; L-S coupling: [5 Hrs.]

Introduction, L-S coupling, J-J coupling (introduction), Term symbol, Determination of microstate of P^2 , P^3 system, Term symbol of C, N, O, Ni, Ni^{2+} , Fe, Fe^{2+} , Fe^{3+} , Cr, Cr^{3+} , Co^{2+} , V , V^{3+} and Cl^- .

UNIT-II

[A] Purification of water [5 Hrs.]

Classification and composition of water (tap water, mineral water, portable water, distilled water). Different methods of purification of water for potable and industrial purposes, Soft and hard water. Desalination of sea water by reverse osmosis and electro dialysis.

[B] Paper chromatography : [5 Hrs.]

Principles of chromatography, Classification of chromatography according to mobile phase and stationary phase. Types of paper chromatography, one dimensional, two dimensional and radial paper chromatography, R_f value, Use of paper chromatography in inorganic analysis (I, IIA, IIIB, IV, and halides).

UNIT-III

Quantum Mechanics [10Hrs.]

[A] Derivation of the time independent Schrodinger equation, Wave function and probability function, Well behaved wave function, Particle in one –dimensional box and its importance.

[B] Operators (definition and derivation), Linear operators, Commutator operators, Vector operators, Laplacian operators, Hamiltonian operators, Hermitian operators. Derivation of Hamiltonian equation, Hamiltonian operators for H atom H_2^+ , He^{2+} and Li.

Reference Books:

1. Introductory Quantum Chemistry by A. K. Chandra, Tata Mc. Graw Hill Delhi.
2. Atomic Structure and Chemical Bond by Manos Chandra, Tata Mc. Graw Hill Pub. Co. Ltd.
3. Theoretical Inorganic Chemistry by M. C. Day & J. Selbin Affiliated, East West Pub. Pvt. Ltd.
4. Coordination Compounds (Studies in Modern Chemistry) S. F. A. Kettle, Nelson.
5. Inorganic Chemistry by (Principles of Structure and Reactivity) James E. Huhely, Harper International (NY).
6. Inorganic Chemistry by R. B. Heslop and P. L. Robinson Elsevier Pub. Co. NY.
7. Physical Methods Inorganic Chemistry by R. S. Drago, W.B.S. Saunders Co. London, Reinhold Pub. Co. NY.
8. Basic Concepts of Analytical Chemistry by S. M. Khopkar, Wiely Estern Ltd. New Delhi.
9. Quantitative Analysis Day & Underwood Prentice Hall of India, Pvt. Ltd.
10. Instrumental Method of Analysis B. K. Sharma, Krishna Pub. House, Merrut.
11. Principles of Inorganic Chemistry (Puri, Sharma, Kalia).
12. Enviornmental Chemistry, By S. K. Banerji. Prentice Hall India Pvt. Ltd.
13. Progressive Inorganic Chemistry, Suratkar, Thatte, Pandit, Ideal Book Service, Poona.
14. Advanced Inorganic Chemistry Vol. I & II by Gurudeep Raj, Goel Pub. House, Meerut.
15. Quantum Chemistry Ir. N. Levine, Prentice Hall.
16. Advanced Inorganic Chemistry by Cotton & Wilkinson John Wihn Wiely.
17. Introduction to Chromatography Theory and Practice by V. K. Srivastava and K. K. Srivastava - S. Chand Pub.
18. Environmental Chemistry by. A. K. De.
19. Industrial Chemistry by B. K. Sharma
20. Inorganic chemistry by Gray L. Miessler, Donald A. Tarr, 3rd addition, Pearson publication.
21. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) ltd.

S.Y.B. Sc. Semester-IV

Chemistry Paper-III Inorganic Chemistry

[A] Chemistry of Lanthanide and Actinide Elements : [10Hrs.]

(a) Lanthanide and Actinide Elements, Electronic configuration, Sources. Occurrence, Extraction by solvent and ion exchange, Properties (Spectral and Magnetic).

(b) Lanthanide contraction, Use of Lanthanide compounds. Industrial use Uranium and Plutonium, Misch metal.

UNIT-II

[A] Hydrogen Bonding : [4 Hrs.]

Theory of hydrogen bonding, classification, importance of hydrogen bonding in ice, Effect of hydrogen bonding in various fields.

[B] Metal Complexes: [6 Hrs.]

Introduction, Werner's coordination theory, CFSE, Factors affecting on CFSE, Application of CFT (Magnetic properties, Spectral properties)

Nomenclature of complexes (Nomenclature rules, Examples of Common monodentate and multidentate ligands).

UNIT-III

[A] Ion-exchange chromatography: [6Hrs.]

Synthesis and Characterization of ion exchanger, Basic requirements of ion exchange resin. Types of ion-exchange resin. Technique of ion exchange, Application of ion exchange for Separation.

[B] Non aqueous solvents : [4Hrs.]

Introduction, classification of solvents, Properties characterising of solvents, protonic non aqueous solvents (liquid ammonia, anhydrous sulphuric acid), aprotic solvents (liquid SO₂).

Reference Books:

1. Introductory Quantum Chemistry by A. K. Chandra, Tata Mc. Graw Hill Delhi.
2. Atomic Structure and Chemical Bond by Manos Chandra, Tata Mc. Graw Hill Pub. Co. Ltd.
3. Theoretical Inorganic Chemistry by M. C. Day & J. Selbin Affiliated, East West Pub. Pvt. Ltd.
4. Coordination Compounds (Studies in Modern Chemistry) S. F. A. Kettle, Nelson.
5. Inorganic Chemistry by (Principles of Structure and Reactivity) James E. Huhely, Harper International (NY).
6. Inorganic Chemistry by R. B. Heslop and P. L. Robinson Elsevier Pub. Co. NY.
7. Physical Methods Inorganic Chemistry by R. S. Drago, W.B.S. Saunders Co. London, Reinhold Pub. Co. NY.
8. Basic Concepts of Analytical Chemistry by S. M. Khopkar, Wiely Estern Ltd. New Delhi.
9. Quantitative Analysis Day & Underwood Prentice Hall of India, Pvt. Ltd.
10. Instrumental Method of Analysis B. K. Sharma, Krishna Pub. House, Merrut.
11. Principles of Inorganic Chemistry (Puri, Sharma, Kalia).
12. Enviornmental Chemistry, By S. K. Banerji. Prentice Hall India Pvt. Ltd.
13. Progressive Inorganic Chemistry, Suratkar, Thatte, Pandit, Ideal Book Service, Poona.
14. Advanced Inorganic Chemistry Vol. I & II by Gurudeep Raj, Goel Pub. House, Meerut.
15. Quantum Chemistry Ir. N. Levine, Prentice Hall.
16. Advanced Inorganic Chemistry by Cotton & Wilkinson John Wihn Wiely.
17. Introduction to Chromatography Theory and Practice by V. K. Srivastava and K. K. Srivastava - S. Chand Pub.
18. Environmental Chemistry by. A. K. De.
19. Industrial Chemistry by B. K. Sharma
20. Inorganic chemistry by Gray L. Miessler, Donald A. Tarr, 3rd addition, Pearson publication.
21. General and Inorganic chemistry (part-I & II) by R. Sarkar, Books and Allied (P) ltd.

S.Y.B. Sc.; Semester-III

Chemistry Paper-IV [Organic Chemistry]

Unit-I

[A] Organic Nitrogen compounds: [6Hrs.]

- (i) Preparation and physical properties and chemical reactions of Nitriles, Isonitriles, Carbamates, Semicarbazides and their application in organic synthesis.
- (ii) Structure and nomenclature of amines, Preparation of aryl amines, physical properties and chemical reactions. Gabriel-phthalimide reaction, Bromamide reaction.

[B] Carboxylic acid and its derivatives: [4Hrs.]

Structure and nomenclature of acid chloride, ester, amides of monocarboxylic acid; Method of formation of monocarboxylic acid derivatives and chemical reactions.

Unit-II

[A] Heterocyclic compounds: [5Hrs.]

- (i) Classification and nomenclature :
- (ii) Synthesis, Chemical properties and reactions of pyridine.
- (iii) Skraup's synthesis and Friedlander synthesis of quinoline. Electrophilic substitution reactions, Nucleophilic substitution reactions, Oxidation reaction, Reduction reactions.
- (iv) Synthesis, Reactivity and importance of Imidazole and Benzimidazole.

[B] Polycyclic aromatic Hydrocarbons: [5Hrs.]

- (i) Classification and nomenclature :
- (ii) Linear orthofused polycyclic hydrocarbons: Occurrence, synthesis of Tetracene, Pentacene and Hexacene.
- (iii) Non-linear orthofused polycyclic hydrocarbons: Occurrence, synthesis of 1,2-benzanthracene, 1,2,5,6-di benzanthracene.

(iv) Ortho-perifused polycyclic hydrocarbons: Occurance, synthesis of of Pyrene, Perylene and Coronene.

Unit-III

[A] Diazonium salts:

[6Hrs.]

(i) Mechanism of diazotisation and method of preparation of diazonium salts.

(ii) Nomenclature of diazonium salts.

(iii) Reactions of diazonium salts., Replacement reactions in which nitrogen atom is eliminated and reactions in which nitrogen atoms are retained

Application of diazonium salts. In the synthesis of aromatic compounds.

(iv) Laws of coupling , coupling agents, Definition of diazoamino and aminoazo compounds.

(v) Synthesis and uses of : Methyl orang, Methyl red, congo red and Erichrome Black-T.

[B] Use of reagents:

[4Hrs.]

Synthesis and applications of following reagents.

- (i) Anhydrous aluminium chloride
- (ii) N-bromo succinimide
- (iii) Selenium dioxide
- (iv) Lithium aluminium hydride.

Reference books:

- (1) Organic Chemistry by R.T.Morison and R.N. Boyd, Prentice Hall India.
- (2) Organic Chemistry vol-I & II by I.L.Finar.
- (3) Organic Chemistry vol-I & II by B.K.Sharma, Goel pub. House, Merrut
- (4) Reaction and reagents In Organic synthesis by O.P.Agrawal Goel pub. House, Merrut.
- (5) Organic Chemistry by S.H.Pine
- (6) Reaction Mechanism In Organic chemistry by S.M. Mukharji & S.P. Singh.
- (7) Organic Chemistry by L.G. Wade Jr. Pretice Hall.

S.Y.B. Sc.; Semester-IV

Chemistry Paper-IV [Organic Chemistry]

Unit-I

[A] NAME REACTIONS: [7Hrs.]

General nature, Reaction mechanism and applications of the following reactions:

- (1) Fridle Craft reaction
- (2) Aldol condensation
- (3) Dickmann reaction
- (4) Michael reaction
- (5) Wolf-Kishner reduction
- (6) Mannich Reaction
- (7) Reimer Tiemann reaction
- (8) Wittig reaction

[B] Elimination reaction: [3Hrs.]

Introduction, β -elimination, E1-mechanism, E2-mechanism, Stereo chemistry of elimination reactions, Elimination v/s substitution,

α -elimination, Generation of carbenes and Ketenes.

Unit-II

[A] Carbohydrates: [5Hrs.]

- (a) General introduction:
- (b) Disaccharides: Structure elucidation of maltose, lactose and sucrose
- (c) Methods of methylating sugar.

[B] Compounds containing reactive methylene group: [5Hrs.]

- (a) Malonic ester: Preparation from acetic acid and its synthetic applications (n-butyric acid, n-caproic acid, succinic acid, adipic acid, cinnamic acid and barbituric acid)
- (b) Acetoacetic ester (Ethyacetoacetate): Preparation and synthetic applications

(butanone, 1,3 and 1,4-diketone, alicyclic compound.)

(c) Keto-enol tautomerism: Factors affecting keto-enol tautomerism and its mechanism.

Unit –III

[A] Organic Sulphur compounds:

[4Hrs.]

- (a) Aliphatic sulphur : Nomenclature, General methods of preparation and reactions of mercaptans, thioethers, sulfinic acid and sulfonic acids
- (b) Aromatic Sulfonic acid: Nomenclature, General methods of preparation and uses of sulfonic acids of toluene.

[B] Electromagnetic spectrum:

[6Hrs.]

UV and visible spectroscopy, Ultraviolet absorption spectroscopy, absorption laws, (Beer-Lambert law) terminology used in UV and visible spectra, Molar absorptivity, Types of electronic transitions, effect of conjugation, concept of chromophore and Auxochrome and hypsochromic shifts UV spectra of conjugated enes and enones, effect of solvent substitution on electronic transition. Problems based on calculation of λ_{max} for conjugated dienes and unsaturated carbonyl compounds and substituted benzene derivatives using relevant rule.

Reference books:

- (1) Organic Chemistry by R.T. Morrison and R.N. Boyd, Prentice Hall India.
- (2) Organic Chemistry vol-I & II by I.L. Finar.
- (3) Organic Chemistry vol-I & II by B.K. Sharma, Goel pub. House, Meerut
- (4) Reaction and reagents In Organic synthesis by O.P. Agrawal Goel pub. House, Meerut.
- (5) Organic Chemistry by S.H. Pine
- (6) Reaction Mechanism In Organic chemistry by S.M. Mukharji & S.P. Singh.
- (7) Organic Chemistry by L.G. Wade Jr. Prentice Hall.

S.Y.B. Sc. Semester-III

Chemistry Paper-V [Physical Chemistry]

Unit-I

[A] THEORIES OF REACTION RATE

[4Hrs.]

Derivation of Arrhenius equation. Collision theory of reaction rate, Energy of activation including determination, Effect of catalysis on energy activation.

Numerical problems

[B] PHOTOCHEMISTRY

[6Hrs.]

Introduction of photochemistry, Basics of electromagnetic radiations, Photons, Thermal and photochemical laws

- (a) Grothus Draper's law
- (b) Lambert Beer's law
- (c) Einstein's law of photochemical equivalence . Quantum yield or efficiency.
Experimental determination of Quantum yields. Reasons of low and high quantum yield. Numerical problems
Primary and secondary photochemical reactions. Factors affecting quantum yield. (i.e. temperature, light intensity and inert gases).
Isomeric changes, Polymerisation, Photosensitization, Photo physical process [Fluorescence, Phosphorescence]. Hemilunescence. Factor affecting Fluorescence, Phosphorescence.

Unit-II

ELECTROLYTES OR ELECTROCHEMISTRY

[10Hrs.]

Ions in solution, formation of ion in solution metallic conductance, Electrolytic conductance, Electrolysis migration of ions, Transport number of ions and its determination by moving boundary method.

Kohlraush law of ionic conductance. Application of Kohlraush law to

- (a) Determination of degree of dissociation of weak electrolyte.
- (b) Determination of equivalent conductivity of weak electrolyte at infinite dilution
- (c) Determination of solubility and solubility product of sparingly soluble salts.
- (d) Determination of ionic product of water.

Numerical problems

Unit-III

MOLECULAR SPECTROSCOPY

[10Hrs.]

Electromagnetic radiation with wave length and energy. Radio frequency, Microwave, IR, UV-visible region,

Pure rotational spectra, Vibrational and Vibrational-Rotational spectra. Raman spectra,

Rotational spectra, calculation of bond length. Vibrational rotational spectra, Hook's law, Vibrational energy level.

Numerical Problems.

References:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to IV [Pub. Macmilan]
3. Advanced Physical chemistry by D.N.Bajpai.
4. Text book of Physical chemistry by S.C. Khetepal & Yogeshwar Sharma.
[Pub. R.Chand]
5. Physical chemistry by Puri & Sharma[S.Nagin & Co.]
6. A text book of Physical chemistry by A.S.Negi & Anand [New age International]
7. Physical chemistry by P.L.Soni & O.P.Dharmraj.
8. Physical chemistry by B.K.Sharma.
9. Essential of Physical chemistry by Bahl Tuli &Bahl.
10. Elemental Physical chemistry byGlasston & Lewis.
11. Physical chemistry by K.K.Sharma, L.K.Sharma [Vikas Publication House, New Delhi.]

S.Y.B. Sc.; Semester-IV
Chemistry Paper-V [Physical Chemistry]

Unit-I

[A] PARTITION CO-EFFICIENT

[4Hrs.]

Explanation of Nernst distribution law and its conditions for the validity.

Complications arising in distribution law:

- (a) Association of solute in one of the phases.
- (b) Dissociation of solute in one of the phases.
- (c) Dissociation of solute in both the phases.

Derivation of distribution law from kinetic consideration

Explanation of solvent extraction process.

Numerical Problems

[B] ADSORPTION

[6Hrs.]

Adsorption and absorption, Heat of adsorption, Characteristics of adsorption, Physical adsorption and chemical adsorption.

Distinction between physical adsorption and chemical adsorption,

Freundlich's adsorption isotherm, Langmuir's adsorption isotherm. Catalysis, General features of catalysis.

Heterogeneous catalysis, Adsorption theory of catalysis.

Unit-II

THERMODYNAMICS :

[10Hrs.]

Free energy or work function [Gibbs free energy (G) and Helmholtz free energy (A)].

Derivation of Gibbs-Helmholtz equation.

Derivation of $G = G_0 + RT \ln p$. Helmholtz equation, Relation of ΔG and equilibrium constant K_p (Van't Hoff isotherm and isochore)

Derivation of Clapeyron and Clausius-Clapeyron equation.

Application of Clapeyron-Clausius equation in the derivation of Molal elevation constant & Molal depression constant. Numerical problem

Unit-III

[A] CONDUCTOMETRIC TITRATIONS:

[5Hrs.]

Principle, Types of conductometric titrations:

- (a) Strong acid v/s strong base
- (b) Strong acid v/s weak base
- (c) Weak acid v/s strong base
- (d) Weak acid v/s weak base
- (e) Mixture of Strong acid and weak acid v/s strong base
- (f) Precipitation titration of
 - (i) BaCl_2 v/s K_2CrO_4
 - (ii) NaCl v/s AgNO_3

Advantages of conductometric titrations over indicator method

[B] IONIC EQUILIBRIA

[5Hrs.]

Relation between degree of hydrolysis, Hydrolysis constant and pH of solutions of:

- (a) Salts of weak acid v/s strong base
- (b) Salts of strong acid v/s weak base
- (c) Salts of weak acid v/s weak base

Theories of acid-base indicators. Oswald and Quinonoid theories,

Choice of indicators, Indicator exponent and useful range of pH of an indicator.

Numerical Problems

References:

1. Physical chemistry by Gurdeep Raj.
2. Physical chemistry by K.L.Kapoor vol.-I to IV [Pub. Macmillan]
3. Advanced Physical chemistry by D.N.Bajpai.
4. Text book of Physical chemistry by S.C. Khetepal & Yogeshwar Sharma. [Pub. R.Chand]
5. Physical chemistry by Puri & Sharma [S.Nagin & Co.]
6. A text book of Physical chemistry by A.S.Negi & Anand [New age International]
7. Physical chemistry by P.L.Soni & O.P.Dharmraj.
8. Physical chemistry by B.K.Sharma.
9. Essential of Physical chemistry by Bahl Tuli & Bahl.
10. Elemental Physical chemistry by Glasston & Lewis.
11. Physical chemistry by K.K.Sharma, L.K.Sharma [Vikas Publication House, New Delhi.]

S.Y.B. Sc.; Semester-III

Industrial Chemistry

Generic Elective Course

Unit-I

[10Hrs.]

[A] Synthetic fibers with flowsheet diagram:

(1) Tetrafluoroethylene, Teflon (2) Nylon-6,10 (3) DMT, Ethyleneglycol, Terylene

[B] Synthetic rubbers with flow sheet diagram:

(1) Isoprene, Polyisoprene (2) Silicone Rubber (3) Polyurethane rubber

[C] Plastics and Resins with flow sheet diagram:

(1) Urea formaldehyde resin, Bakelite (2) Vinylchloride, PVC (3) Vinylalcohol, Polyvinyl alcohol (4) Melamine and melamine resin (5) Bisphenol-A, Epoxy resin (6) Propylene, Polypropylene

Unit-II

[10Hrs.]

[A] Detergents:

(1) Propylene tetramer (2) ABS (3) LAS

[B] Explosives:

(1) RDX (2) Nitrocellulose (3) Glyceryl trinitrate (4) Trinitro phenol (5) TNT (6) Ammitol

Unit-III

[10Hrs.]

[A] Synthetic drugs:

(1) Novacaine (2) Novalgin (3) Paludrine (4) Paracetamol (5) Sulphathiazole (6) Benadryl
(Diphenyl hydramine)

[B] Synthetic dyes:

(1) 3-phenyl, 7-methoxy coumarine (2) Blankophore-B (3) Eriochrome Black-T
(4) Eosin (5) Alizarine (6) Indanthrene khaki-GG

[C] Acetylene: (1) Wulff Process (2) Sachsse Process

S.Y.B. Sc.; Semester-IV

Industrial Chemistry

Generic Elective Course

Unit-I

[10Hrs.]

[A] Inorganic Chemicals:

(1) Red Phosphorus (2) Sodium hexametaphosphate

(3) PCl_5 (4) Phosphoric acid

[B] Industrial Preparation and uses of:

(1) Potassium permanganate (2) Bleaching powder by Bachmann's method

Unit-II

[10Hrs.]

[A] Fertilizers:

Definition and classification of fertilizers, Direct and indirect fertilizers, Natural and synthetic fertilizer, Symptoms of deficiency of some elements like N, K, and P.

Industrial Preparation of: Ammonium sulphate

Hazardous effect of use of fertilizers and its preventive measures, Mixed fertilizers, Complex fertilizers, Fertilizers grades, Fertilizers ratio, Fertilizers condition, Fertilizers filter.

Unit-III

[10Hrs.]

[A] Glasses: Classification, properties and uses of glasses

[B] Non Ferrous alloys : Monel metal, Duralumin, Wood metal, Babbit metal, Phosphorus bronze, Brass, German silver

S.Y.B. Sc.; Semester-III

Chemistry Practicals

Gravimetric Estimation of

- | | |
|---|---|
| (1) Fe^{2+} as Fe_2O_3 | (Given solution of $\text{Fe-NH}_4\text{-SO}_4 + \text{H}_2\text{SO}_4$) |
| (2) Ba^{2+} as BaSO_4 | (Given solution of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O} + \text{HCl}$) |
| (3) Ni^{2+} as Ni (DMG)_2 | (Given solution of $\text{NiCl}_2 \cdot 6\text{H}_2\text{O} + \text{HCl}$) |

VOLUMETRIC EXERCISE (Any three)

- (1) To determine the amount of Nickel by EDTA.
- (2) To determine the amount of Copper by EDTA.
- (3) To determine the amount of Zinc by EDTA.
- (4) Determination of total hardness of water by EDTA.

ORGANIC SPOTTING [Minimum 8 organic substances]

ACID : Salicylic acid, Cinnamic acid, Phenyl acetic acid, Sulphanilic acid.

PHENOL: α -Naphthol, β -Naphthol, o-Nitrophenol

BASE: o-Nitroaniline, m-Nitroaniline, p-Nitroaniline, p-Toludine, p-Chloroaniline,

Diphenyl amine, Dimethylaniline, Diethylaniline

NEUTRAL:

ALDEHYDE: Glucose, Benzaldehyde

KETONE: Methyl ethyl ketone, Acetophenone

ESTER: Ethyl acetate, Butyl acetate

ALCOHOL: Ethanol, Butanol

HYDROCARBON: Anthracene, Naphthalene, Diphenyl

NITRO HYDROCARBON: m-Dinitrobenzene, Nitrobenzene

HALOGENATED HYDROCARBON: Chlorobenzene, Bromobenzene, p-Dichlorobenzene

AMIDE: Benzamide, Thiourea

ANILIDE: Acetanilide

PHYSICAL PRACTICALS:

1. pH metry: To determine the normality of weak acid pH-metrically using strong base.
[$\text{CH}_3\text{COOH} \rightarrow \text{NaOH}$]

2 Conductometric Titration:

(i) To determine the normality of strong acid conductometrically using strong base [$\text{HCl} \rightarrow \text{NaOH}$]

3 Conductometric Titration:

To determine the solubility of PbSO_4 .

4 Viscosity :

To determine the viscosity of the liquids and the % of unknown mixture 'C'.

5. Chemical kinetics- Ester hydrolysis:

To study the hydrolysis of methyl acetate at two different concentration in 0.5N HCl. [mono molecular reaction]

6 . Partition co-efficient

Minimum 3 experiments should be performed in a semester.

At least one electrical instrumental exercise should be performed per Semester.

S.Y.B. Sc.; Semester-IV

Chemistry Practicals

INORGANIC QUALITATIVE ANALYSIS: [Minimum 8 inorganic mixtures]

LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS:

CHLORIDES: Bi^{+3} , Cu^{+2} , Cd^{+2} , Fe^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} ,
 Na^{+} , K^{+} , NH_4^{+}

BROMIDES: Sr^{+2} , Na^{+} , K^{+} , NH_4^{+}

IODIDES: K^{+}

NITRITES: Na^{+} , K^{+}

NITRATES: Bi^{+3} , Pb^{+2} , Co^{+2} , Ni^{+2} , Ba^{+2} , Sr^{+2} , Na^{+} , K^{+} , NH_4^{+}

SULPHITES: Na^{+}

SULPHIDE: Zn^{+2} , Sb^{+3}

SULPHATES: Cu^{+2} , Cd^{+2} , Fe^{+2} , Al^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Zn^{+2} , Mg^{+2} , Na^{+} , K^{+} ,
 NH_4^{+}

CARBONATES: Pb^{+2} , Bi^{+3} , Cu^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} ,
 Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

PHOSPHATES: Cu^{+2} , Al^{+3} , Fe^{+3} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} ,
 Sr^{+2} , Mg^{+2} , Na^{+} , K^{+} , NH_4^{+}

Inorganic qualitative analysis of mixture containing four radicals. The mixture may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid excluding Arsenite, Arsenate, Chromates and Borate.

The following exercises should not be asked in the university examination

1. Calibration of burette 50ml., Pipette 5ml, 10ml. & 25 ml., Measuring flasks 100 ml. & 250 ml.

ORGANIC ESTIMATIONS (Any 3 estimations should be done)

1. To determine the amount of acetamide in the given solution hydrolysis by NaOH.
2. To determine the amount of phenol/ Aniline in the given solution by bromination.
3. To determine the number of -COOH group of given carboxylic acid.
4. Percentage purity of l-ascorbic acid (Vitamin-c)

*Organic Preparation: (Minimum 3 should be done)

1. Anthraquinone from Anthracene
2. m-Dinitrobenzene from Benzene
3. p-Bromoacetanilide from Acetanilide
4. Naphthalene picrate from Naphthalene.

N.B. Preparation should be submitted with sample and justification (M.P. & C.T.)

OR

*Type of water insoluble organic solid mixture (Any four type)

PHYSICAL PRACTICALS:

1. pH metry: To determine the normality of given mix acid in $\text{HAc}^- + \text{HCl}$ pH-metrically using strong base.
- 2 Conductometric Titration:
 - (i) To determine the normality of given mixture ($\text{HAc}^- + \text{HCl}$) solution by Conductometric titration with the given 0.1N NaOH solution.
- 3 Heat of solution
To determine the heat of solution of organic acid (benzoic acid, phthalic acid) by finding the solubility of the acid at two different temperature
- 4 Surface Tension:
To determine the parachor of $-\text{CH}_2$ group of liquid: (Benzene, Toluene, Xylene)
5. Adsorption:
To study the adsorption of given organic acid (Acetic acid/ oxalic acid) on animal charcoal..
6. Relative strength:
To study the relative strength of two acids H_2SO_4 and HCl .
7. pH metry: Determination of K_a of weak acid
To determination of ionisation constant of weak acid

Minimum 3 experiments should be performed in a semester.

Atleast one electrical instrumental exercise should be performed per semester.

Third Year B. Sc. Semester -V
Chemistry Paper – VI (Inorganic Chemistry)

UNIT – I

Topic –1: Quantum Mechanics: 5 Hrs

Postulates of Quantum mechanics, particles in three dimensional box, Schrodinger's wave equation in polar coordinates, its separation in to R, θ and ϕ . Discussion of solution of schrodinger equation to same model system e.g. the one dimensional harmonic oscillator

Topic –2: Boron Hydride: 5 Hrs

Boron hydride and its classification, Wade's Rule, preparation and properties and Bonding in di borane, tetra Borane (10), penta borane (9) penta borane (11) hexaborane and dodeca borane (12) anion.

UNIT – II

Topic –1: Thermodynamic and Kinetic Aspects of metal complexes: 5 Hrs

A brief out line of thermodynamic stability of metal complexes and factors affecting a stability of metal complexes. Lability and inertness, Factors affecting lability of metal complexes. Trans effect, Theories of Trans effect (i) Electrostatic Polarization Theory (ii) π -Bond Theory. labile and inert complexes on the basis of VBT and CFT.

Topic –2: Bonding in Transition Metal Complexes: 5 Hrs

Jahn Teller Theorem , Distortation in octahedral complexes. Ligand Field Theory. Molecular energy level diagram and magnetic properties for $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3-}$, $[\text{FeF}_6]^{3-}$, $[\text{Fe}(\text{CN})_6]^{3-}$. π - bonding in octahedral complexes.

UNIT – III

Topic –1: Metal Carbonyls: 5 Hrs

Definition, classification, nature of bonding in metal carbonyls, structure and IR spectra in $\text{Ni}(\text{CO})_4$, $\text{Fe}(\text{CO})_5$, $\text{Fe}_2(\text{CO})_9$, $\text{Mn}_2(\text{CO})_{10}$, $\text{Cr}(\text{CO})_6$, $\text{Co}_2(\text{CO})_8$.

Topic –2: Corrosion and its Protection: 5 Hrs

Definition and importance of corrosion, Types of corrosion: uniform, pitting, inter crystalline and stress cracking corrosion, electro-chemical theory of corrosion. Protection methods: Coating, Inhibitors (Organic, Inorganic, anodic, cathodic), anodic and cathodic protection.

Reference Books:

- (1) Introduction to quantum chemistry, by A. K. Chandra, Tata Mc.Graw Hill, Delhi.
- (2) Quantum mechanics in chemistry by M. H. Hanna
- (3) Theoretical Inorganic chemistry by Day & Selbin , Affiliated East West Publ. 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 & Patel.
- (8) Environmental Chemistry by Amritha anand and Sugumar.
- (9) Basic Inorganic Chemistry by Cotton and Wilkinson
- (10) A Text book of Inorganic Chemistry by P.L.Soni
- (11) Introduction to Inorganic Chemistry by Durrant and Durrant
- (12) Modern Co-ordination Chemistry by R. Lewis and R.G. Wilkinson.
- (13) Inorganic Chemistry- Principles of structure and reactivity by J.E. Huhhey and E.A. Keiter.
- (14) Application of Group Theory to Chemistry by P.K.Bhattacharya., Himalaya Publishing House, Mumbai.
- (15) Quantum Rasayan, University Granth Nirman Board (Gujarat).
- (16) Environmental Chemistry by A.K. De.
- (17) The corrosion and oxidation of metals by Evans U.R. (1961), Arnold, London.
- (18) Corrosion, Causes and Prevention, Speller. F.,Mc Grqw Hill,New york.
- (19) Dhatvik Ksharan, Part-I & II by M.N. Desai, Uni. Granth Nirman Board (Gujarat).
- (20) Corrosion and Corrosion Control, Uhlig H., Wiley.
- (21) Corrosion Engineering by Fontana M.G. and Green N.D., Mc Graw Hi

Third Year B. Sc. Semester -V
Chemistry Paper – VII (Organic Chemistry)

UNIT – I

(A) Reaction Mechanism:

7 Hrs

- (a) Different types of mechanism for Esterification and Hydrolysis: B_{AC}^2 , A_{AC}^2 , A_{AC}^1 , A_{AL}^1
- (b) Mechanism of formation and hydrolysis of amides.
- (c) Pyrolytic elimination : Cope and Chugaev reaction.
- (d) Organic Name Reaction: Knoevenagel Reaction, Reformatsky Reaction, Claisen Condensation Reaction.

(B) Aromaticity:

3 Hrs

Introduction to Aromaticity, Huckel's Rule, Aromatic Character of Arenes, Definition & Examples of Aromatic, Non-Aromatic, Anti-Aromatic Compounds (Benzenoids and Non-Benzenoids).

UNIT - II

(A) Alkaloids:

5 Hrs

The occurrence, Classification, General methods to determine their structure, Analytical and Synthetic evidence to prove the structure of Nicotine and Papavarine.

(B) Vitamins and Hormons:

5 Hrs

General Introduction, Classification, Structural determinations and Synthesis of Pyridoxine, Vitamin – C, Thyroxine and Adrenalene.

UNIT – III

(A) Synthetic Drugs:

5 Hrs

Classification, based on pharmacological action, synthesis and uses of Amylnitrate, Chloroquine, Primethamine, Sulpha Pyrimidine, Diazepam, Lidocaine, Chlorpropamide, Dapsone, Isoniazide, 5-Fluoro Uracil.

(B) Polypeptides:

5Hrs

Definition & Structures of Amino acid, Synthesis of peptide by Merry Field Method, End group analysis, N-terminal determination, Sanger's method, Edman method, C-terminal determination by generation of amino alcohol and using digestive enzymes. End group analysis, selective hydrolysis of peptides classical 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) Chemistry of synthetic Dyes by I. G. Vashi
- (18) Organic Chemistry by Morrison and Boyd.
- (19) Chemistry of organic Natural Product Vol. I & II by O. P. Agarwal.
- (20) Chemistry of synthetic drugs by Trivedi
- (21) Green Chemistry, Environmentally Vergin Reactions by V. K. Ahuwallia published by Ane books India.
- (22) Principles of Medicinal Chemistry Vol. I & II by S. S. Kadam, K. R. Mahadik, K. G. Bothara (Nirali Prakashan)
- (23) Medicinal Chemsitry By Asuthosh kar 4/e
- (24) Organic reactions & their mechanism by P. S. Kalsi, New age international publishers
- (25) Organic Name Reactions by Gautam Brahmachari, Narosa Publishing House, New Delhi.
- (26) Organic Chemistry, 8th edition by Paula Yurkanis Bruice, University of California, Santa Barbara

Third Year B. Sc. Semester -V
Chemistry Paper – VIII (Physical Chemistry)

UNIT – I

A - OPEN SYSTEM THERMODYNAMICS

5 Hrs

Partial molal free energy, (chemical potential), Derivation of Gibb's Duhem Equation, 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, Lewis fugacity rule. Activity and activity coefficient (Only concept). Standard state, Standard state of Solid, Liquid and Gas, Numerical problems.

B - THE THIRD LAW OF THERMODYNAMICS

5 Hrs

The Nernst Heat Theorem (NHT), limitations of NHT, Statement of The third law of Thermodynamics, Consequence of third law of thermodynamics, Determination of absolute entropy of gases and liquids and solid, Applications of third law of thermodynamics, Concept of residual entropy, Exceptions to the third law of thermodynamics, Numerical problems.

UNIT-II

A - BASICS OF ELECTRODICS

4 Hrs

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. Numerical problems.

B CLASIFICATION OF ELECTROCHEMICAL CELL AND THERMODYNAMICS

6 Hrs

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

Free energy change and Electrical energy, Prediction of spontaneity of cell reaction, Relation of standard free energy change with equilibrium constant, Temperature coefficient of EMF of a cell, Entropy change and Enthalpy change of cell reaction. Numerical problems.

UNIT - III

NUCLEAR CHEMISTRY

10 Hrs

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

Particle accelerators : Linear accelerator, Cyclotron, Discovery of artificial disintegration, Classification of nuclear reaction based on overall energy transformations and - particles used as projectiles, Merits and demerits of different projectiles, Numerical problems

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. KapoorVol 1-5.
12. Physical chemistry by Baliga,Dhavale and ZaveriVol 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'omBockris and Reddy

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

Chemistry Paper – IX (Industrial Chemistry)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT-I

(A) Manufacture with flowsheet & uses of

6 Hrs

Acrylonitrile (Sohio Process), Bisphenol-A, Styrene, Industrial manufacture and uses of Polyolifines: Poly ethylene (HDPE & LDPE) and Polypropylene.

(B) Fluorocarbons

4 Hrs

Nomenclature of chloro fluoro derivatives of Methane & Ethane, General methods of preparation, Properties and Uses of Fluoro carbons, Manufacture of Freon-12 from fluorspar, Manufacture of Freon-12 from Vinylidene fluoride. Pollution hazards of Fluoro carbons.

UNIT-II

Unit Processes in Organic Chemistry

10 Hrs

(A) Nitration

Definition, Nitrating agent, Reaction mechanism of Nitration. Nitration of Acetylene, Benzene, Toluene and Naphthalene.

Artificial perfumes: Musk xylene, Musk ketone, Musk ambrette.

Explosives: Trinitrophenol, Trinitrotoluene, Trinitro glycerine, Emitol.

(B) Amination

Definition, Amination by reduction: Metal - Acid reduction (strong and weak), Metal - Alkali reduction (strong and weak), Catalytic reduction, Sulphide reduction.

Amination by ammonolysis : Amination of Chlorobenzene, Phenol & Benzene sulphonic acid.

Importance of amination in industry in the manufacture of Bismark brown dye from m-Phenylene diamine, Synthetic fibre (Nylon 6,6) from HMDA, Methyl Red Indicator from Anthranilic acid, Cyclonite explosive from Hexamethylene tetramine.

(C) Sulphonation - Definition, Sulphonating agents, Mechanism of sulphonation. Sulphonation of Benzene, Toluene and Anthracene. Preparation of Phenol and Resorcinol from benzene.

Importance of Sulphonation reaction in industry in the manufacture of Saccharine, Chloramine T and Alizarine Red.

UNIT-III

Metallurgy of different metals (occurrence, extraction, properties and uses) 10 Hrs

(A) (1) Tungsten (2) Molybdenum (3) Chromium (4) Aluminium

(B) Some small scale preparation of

(1) Safety matches

(2) Naphthalene balls

- (3) Wax candles
- (4) Shoe polish
- (5) Writing/ fountain pen ink
- (6) Chalk crayons
- (7) Plaster of paris.

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, 6th ed. Pub.Prentice Hall of India ltd.
7. Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

Chemistry Paper – X (Analytical Chemistry)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT-I

(A)INTRODUCTION TO ANALYTICAL CHEMISTRY:

03Hrs

Chemical and Instrumental Analysis (advantages and disadvantages) Overview of methods used in Quantitative analysis (classification of classical and instrumental analysis), Factors affecting the choice of analytical methods (in brief), Step in quantitative analysis (Flow diagram), Analytical methods on the basis of Sample size (in brief), Sampling methods..Sampling in different physical states

(B)TREATMENT OF ANALYTICAL DATA

Significant figures and rules of computation.

07 Hrs

Error Definition, Types of errors: Determinates errors, indeterminate errors, constant and proportional errors. Define and explain the following terms – Accuracy and Precision, mean, median, deviation, average deviation, standard deviation, variance, coefficient of variation, relative mean deviation, range, absolute errors, relative errors. Minimization of determinates errors, Normal error curve. Rejection of result from a set of results, 2.5 d rule, 4.0 d rule and Q-test. (Problems based on above topics)

UNIT-II

GRAVIMETRIC ANALYSIS :

10 Hrs

Factors affecting solubility of precipitates. (1) Common ion (2) Diverse ions (3) pH (4) Hydrolysis (5) Complex formation (With Numerical problems) The precipitation process,. Nucleation growth. Von Weimarn's theory of relative super saturation . Digestion of precipitates Factor affecting quality of precipitate: Co-precipitation and post precipitation Precipitation from homogeneous solution with illustration of Barium and Aluminum. Thermogravimetry, general principle,

General applications of TGA : Determination of purity and thermal stability of primary and secondary standards, determination of correct drying temperature, determination of curie point, automatic determination of mixtures, analysis of alloys, Specific application in analysis of (1) CaC_2O_4 , H_2O (2) MgC_2O_4 , $2\text{H}_2\text{O}$ [No instrumentation] (3) mixture of carbonates

UNIT-III

10 Hrs

TITRIMETRIC ANALYSIS :

General classification of titrimetric methods.

(A) ACID BASE TITRATION :

05 Hrs

Different terms for titrant, titrand, analyte, end point and equivalence

point. Theory of acid base indicators. Indicator range. Selection of proper indicators Calculation of pH at different stages of titrations of monobasic and dibasic acid with strong base Construction of titration curve, Titration of carbonate mixture and amino acids. Problems

(B) COMPLEXOMETRIC TITRATIONS:

EDTA titration, Absolute and conditional stability constant, Distribution of various species of EDTA as function of pH. Absolute and conditional stability constants. Derivation of factors : α_4 for effect of pH, β_4 for the effect of auxiliary complexing agent. Construction of Titration curves: Theory of metallochromic indicators, Masking, Demasking and kinetic masking. Types of EDTA titrations. Problems

05 Hrs

Reference Books:

- 1 Quantitative Analysis by R. A. Day & A. L. Underwood, 6 th ed. Pub. Prentice Hall of India ltd.
- 2 Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed.
- 3 Analytical Chemistry (Principles & Technique) by Lary G. Hargis.
- 4 Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
- 5 Holler F.J.Instrumental Methods of Analysis by B. K. Sharma
- 6 Instrumental analysis by R.D.Braun Mc Graw Hill.
- 7 Analytical ChemistryGary Christian
- 8 Instrumental methods of chemical analysis Dr.H.Kaur. Pragati prakashan Meerut.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

Chemistry Paper – XI (General Chemistry)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT - I

IR spectroscopy

10 Hrs.

IR absorption spectroscopy: Terms, Instrumentation, Molecular vibrations, Hook's law, Selection rules, Intensity and position of IR bands. Measurement of IR spectrum, Finger print region, Characteristics absorption of various functional groups. Application of IR spectra. Factors influencing IR vibrational frequency.

UNIT- II

[A] LABORATORY HYGENE AND SAFETY

03 Hrs.

1. Handling of chemicals [Carcinogenic chemical, Toxic and poisonous chemicals], List of Hazardous chemicals.
2. General procedure for avoiding accidents [Apron, Safety goggles, Gloves pipetting process]
3. First aid technique [Organic substance in skin, Acid on clothing, Burns in eyes, Inhalation of toxic vapors etc...]
4. Color codes and symbols for safety in chemical plants (i) classification of color codes and symbols (ii) color codes for gas cylinders and (iii) color codes for pipelines.

Reference Books:

- Industrial safety management, by L.M. Desmukh, Tata Mc Graw Hill, New Delhi, 2006
- Industrial safety, Health & Environment management, Sunil S. Rao, R.K. Jain. Khanna Publishers, New Delhi, 2006

[B] CHEMISTRY OF COSMETICS & PERFUMES

07 Hrs.

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

Reference Books:

1. E. Stocchi: *Industrial Chemistry*, Vol -I, Ellis Horwood Ltd. UK.
2. P.C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
3. Sharma, B.K. & Gaur, H. *Industrial Chemistry*, Goel Publishing House, Meerut (1996).

UNIT- III

10 Hrs.

Definitions of terms: Solute, Solvent, and Solution Composition of solution- normal solution, molar solution, molal solution, mole fraction,% solution, saturated, unsaturated and

supersaturated solution and solubility. Effect of temp. on various units of concentration. Interconversion of one unit into another unit. Preparation of solutions of some primary standard substances (e.g. Oxalic acid, succinic acid, KHP, $K_2Cr_2O_7$, As_2O_3)

Standardisation of the following solution using primary standard solutions/ standardised solution.

1. NaOH/KOH
2. I_2 solution
3. $KMnO_4$
4. Acids
5. $Na_2S_2O_3$ solution.

Reference books:

1. Quantitative analysis by R.A. Day and A.L. Underwood
2. Elements of Analytical Chemistry by R. Gopalan ; P.S.Subramanian and K. Rengarajan
3. Elementary Organic Spectroscopy by Y.L.Sharma
4. Organic Spectroscopy by B.K.Sharma
5. Environmental Chemistry by H.Kaur.
6. <http://www.fssi.gov.in/Portals/0/pdf/Final-test-manual-part-II>
7. Vogel's qualitative inorganic analysis.
8. Vogel's qualitative organic analysis.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

General elective subject (Petrochemicals)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT – I

Topic-1: Source of Petrochemicals:

4 Hrs

(a) Natural gas: Composition, Natural gas as Petrochemical feed stock.

(a) Crude oil: Composition, Distillation and Refining, Utilization of various fractions (oil product)

Topic-2: Classification of Petrochemicals:

6 Hrs

First, Second and Third generation petrochemicals.

Conversion process: Cracking reforming, Isomerisation, Hydrogenation, Alkylation and Hydrodealkylation, Dehydrocyclisation of petroleum products, Polymerization of gaseous hydrocarbons.

UNIT – II

Topic-1:

5 Hrs

Petrochemicals obtained from C1 cut of petroleum manufacture and application of Methanol, Synthesis gas, Ammonia, HCN, Formaldehyde, Hexamethylene tetramine, Chlorinated methanes, Perchloro ethylene.

Topic-2:

5 Hrs

Synthesis and uses of H-acid, J-acid, Neville Winther's acid, DASDA, Procion Red dye, Cellitone scarlet-B, Indanthrene Khakhi GG, Blankophor B, Sulphamylon, Chloramphenicol

UNIT – III

Topic-1:

7 Hrs

Petrochemicals obtained from C2 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, Vinyl acetate. Manufacture and industrial applications of chemicals obtained from Acetylene, Acrylic acid, Acrylonitrile, Vinylchloride, Vinylacetate, Acetaldehyde, Chloroprene, Trichloroethylene, Methyl vinyl ether.

Topic-2:

3 Hrs

Industrial Fuels: Natural fuels, Synthetic fuels, Hydrogen- Fuel of tomorrow, Fuel for rocket (Hydrazine)

Reference Books:

- (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) Chemicals from petroleum by A. L. Wadams (ELBS and John Murray London)
- (4) Petrochemicals by S. L. Venkatewarn (Colour pubs. Pvt. Ltd. Bombay)

- (5) Petrochemicals digest by MGK Manon (Asia Publishing house Bombay)
- (6) Hand book of industrial chemicals Vol-I by K. M. Shah (Multi tech publishing co. 15 Yogesh, Hingwala lane, Ghatkoper (E) Bombay-400077)
- (7) Industrial chemistry including chemical engineering by B. K. Sharma, Goel pubs house, Meerut.
- (8) Hand Book of Synthetic Dyes and Pigments (Vol. II) By K. M. Shah, Multi-tech Publishing Co.
- (9) Synthetic dyes by G. R. Chatwal, Himalaya Publishers.
- (10) Synthetic Drugs by G. R. Chatwal, Himalaya Publishers.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -V

General elective subject (Dyes)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

Topic –1: Dyes intermediates:

4 Hrs

Name and structure of Benzene, naphthalene and anthraquinone intermediates useful in the dyestuff industry, synthesis of 4-amino -2-methoxy toluene, 2,3- diamino anthraquinone, Chromotropic acid, Bromamine acid.

Topic –2: Diazotisation and coupling: (AZO dyes)

6 Hrs

Definition and mechanism of diazotization, common method of diazotization, 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, Orange - II, Orange – IV, Orange – III, Eriochrome Black – A.

UNIT – II

Topic –1: Disperse Dyes:

5 Hrs

Definition, classification of disperse dyes with examples, application of disperse dyes, synthesis of Cellitone Scarlet B, Dispersol Blue, Golden yellow VIII.

Topic –2: Dyes and pigments:

5 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, Benzidine orange, Pigments Orange VI.

UNIT – III

Topic –1: Vat dyes:

10 Hrs

(a) Definition and general account of vat dyes, Indigo obtained from natural source, Synthesis of Indigo by Heumann process and Sand Meyer process. Halogen derivatives of Indigo (Brilliant Indigo – 4B, Brilliant indigo -4G, 5;5- dibromoindigo vat blue -35) Synthesis of thioindigo by anthranilic acid, halogen derivatives of Thioindigo, Indanthrene Red Violet RRN.

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

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 hand 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. Semester -V

General elective subject (Drugs)

Proposed syllabus from June 2021

50 Marks (External)

20 Marks (Internal)

Total: 30 Hrs

Time: 2 Hrs. (Uni. Exam)

UNIT-I

Topic – 1: Drugs: Classifications-Terminology

05 Hrs

Definition of the term drug. Drugs obtained from plants. Different class of the drugs.

Explanation of the following terms: Agonist, Antagonist, Receptors, Pharmacophore, Pro-drug, Soft-drug, CNS depressants, CNS stimulants, Mode of action. Brief accounts of the following agents giving the name and structures of two important drugs in each case (1) Antifungal agents (2) Antiviral agents (3) Anti-cancer or Cytotoxic drugs (4) Non-Steroidal Anti-Inflammatory Drugs (NSAIDS).

Topic – 2: Micro-organism and Diseases

05 Hrs

Brief account of microbes: Bacteria, Fungi, Protozoa, Virus. Classification of the bacteria based on shape, Gram staining and Ziehl–Neelsen staining. Names of at least two diseases in case of each of the following types of infection and also the name of microbes responsible for the same: (1) Respiratory tract infections (2) Gastro intestinal tract infections (3) Urinary tract infections (4) Urethritis and sexually transmitted diseases (5) Skin and soft tissue infections (6) Cardio vascular system infections (7) Central nervous system infections. Name of important drug for each of the following diseases: (1) Typhoid (2) Dysentery (3) Pneumonia (4) Meningitis (5) Gastroenteritis (6) Actinomycosis.

UNIT-II

Topic – 1: Antibiotics

05 Hrs

Definition. History of discovery of penicillin. Structural variations in penicillin. Broad spectrum antibiotics and their therapeutic uses. Sources, Structural formula and Therapeutic uses of Streptomycin, Tetracycline, Doxycycline, Cycloserine, Chloramphenicol and Some recent antibiotics. Synthesis of Ampicillin.

Topic – 2: Sulfa drugs

05 Hrs

History of discovery and development of sulfa drugs. Structural variations among sulfonamides. Mode of action of Sulfonamides. Therapeutics uses and antimicrobials activity of sulfonamides. Synthesis and uses of Sulfadimidine, Sulfaguanidine, Sulfisoxazole (Sulfafurazole), Sulfacetamide, Succinyl sulfathiazole, Sulfanilamide, Sulfadiazine, Sulfapyridine.

UNIT-III

Topic – 1: Coagulants and Anti coagulants

05 Hrs

Definition, Fibrin-Fibrinogen, thrombin prothrombin role of calcium in blood clotting. Classification and structural variations. Blood coagulants, Vitamin K group as blood coagulants. Synthesis and uses of Warfarin, Dicoumarol, Bromindone.

Topic – 2: Analgesics

05 Hrs

Definition, classification and structural variations. Synthesis and uses of Meperidine (Pethidine), Ibuprofen, Aspirin, Meclofenamate sodium, Oxyphenbutazone, Paracetamol, Novalgin.

Reference Books:

1. May's Chemistry of synthetic Drugs by Dyson.
2. Chemistry of drugs, Ener and Caldwell.
3. Synthetic drugs by Tyagi and Yadav.
4. Synthetic Drugs by G. R. Chatwal, Himalaya Publishers.
5. The Organic Chemistry of Drug Synthesis by Daniel Lednicer & L.A.Mitscher.
6. Drugs by V.K.Ahluwalia Pub. Ane Books Pvt. Ltd.
7. Medicinal Chemistry by Balkishan Razdan, Pub. CBS Publishers.
8. Pharmaceutical Organic Chemistry by S.K.Dewan, Pub. Narosa.
9. Medicinal Chemistry - a Molecular and Biochemical Approach, by Thomas Nogrady & Donald F Weaver.
10. Pharmaceutical Organic Chemistry by Shyam Singh Pub. Himalaya Publishers.
11. Medicinal Chemistry by G Patrick. Pub. Viva Books.
12. Burger's Medicinal Chemistry & Drug Discovery. Ed. by D. J. Abraham.

VEER NARMAD SOUTH GUJARAT UNIVERSITY
Third Year B. Sc. Semester -V
Chemistry Practicals
Proposed syllabus from June 2021

1. INORGANIC QUALITATIVE ANALYSIS

LIST OF INORGANIC CHEMICALS USED FOR INORGANIC QUALITATIVE ANALYSIS

CHLORIDES- Cu^{+2} , Cd^{+2} , Fe^{+3} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Na^{+1} , K^{+1} , NH_4^{+1} .

BROMIDES- Sr^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

IODIDE – K^{+1}

NITRITE – Na^{+1} , K^{+1}

NITRATE – Co^{+2} , Ni^{+2} , Ba^{+2} , Sr^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

SULPHITE – Na^{+1}

SULPHIDE – Zn^{+2} , Sb^{+3}

SULPHATE – Cu^{+2} , Cd^{+2} , Al^{+3} , Fe^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Mg^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

CARBONATE – Cu^{+2} , Cd^{+2} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Mg^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

PHOSPHATE - Cu^{+2} , Al^{+3} , Fe^{+3} , Zn^{+2} , Mn^{+2} , Co^{+2} , Ni^{+2} , Ca^{+2} , Ba^{+2} , Sr^{+2} , Mg^{+2} , Na^{+1} , K^{+1} , NH_4^{+1}

BORATE- Boric Acid

Inorganic qualitative analysis of mixture containing six radicals. The mixture may be soluble in water or dilute hydrochloric acid or concentrated hydrochloric acid including Chromate and Borate.

N. B. Candidate should perform the analysis of at least 08 mixtures.

2.ORGANIC ESTIMATIONS

- 1.
2. Determination of saponification value of an oil
3. Determination of percentage purity of Aspirin
4. Determination of amount of Formaldehyde in given solution
5. Determination of amount of Ethyl acetate in the given solution
6. Determination of amount of Glycine in the given solution
(Instead of sample weighing , solutions to be given)

3.CHROMATOGRAPHY

Chromatographic separation of amino acid mixture by ascending paper chromatography

1. Glycine + Methionine
2. Alanine + Methionine
3. Alanine + Valine

4. PHYSICAL EXERCISE

1. To investigate rate of reaction between $K_2S_2O_8$ and KI, $a = b$, $a \neq b$.
2. To investigate rate of reaction between H_2O_2 and KI, $a = b$, $a \neq b$.
3. Polarimetry: Determination of angle of rotation of given substance using three different dilutions and determination of concentration of unknown solution. Sugar, Glucose, Tartaric acid.
4. pH metry: To measure pH of different buffer solution and to study the buffer capacity.
5. pH metry: To determine the dissociation constant of weak acid (CH_3COOH) and weak base (NH_4OH) by different dilutions.
6. Conductometry: To determine the amount of $BaCl_2$ in the given solution using K_2CrO_4 solution.
7. Conductometry: To determine the amount of $NaCl$ in the given solution using $AgNO_3$ solution.
8. Potentiometry: To determine the normality of given HCl solution using $0.5N$ $NaOH$.
9. Potentiometry: To determine the solubility and solubility product of sparingly soluble salt $AgCl$ by the titration of $AgNO_3$ and $NaCl$. **(Any SIX including one kinetic experiment should be performed.)**

Third Year B. Sc. Semester -VI

Paper-VI (Inorganic Chemistry)

UNIT - I

Topic-1: Molecular Symmetry:

10 Hrs

Introduction and importance of symmetry, Symmetry elements and Symmetry operations, Classification of molecules in to point groups. Point group of simple molecules like CO_2 , HCl , H_2O , NH_3 , BF_3 , $[\text{PtCl}_4]^{2-}$, PF_5 , C_6H_6 , C_5H_5^- , CH_4 , SF_6 , Bromo benzene ($\text{C}_6\text{H}_5\text{Br}$), Cyclobutane, Boric acid (H_3BO_3), (Cis and Trans Dicboreethylene ($\text{C}_2\text{H}_2\text{Cl}_2$), Staggered and Eclipsed Ethane (C_2H_6). Law of multiplications, Construction of multiplication table for C_{2v} , C_{3v} , C_{2h}

UNIT - II

Topic-1: Metal Complexes (Inorganic Reaction Mechanism):

6 Hrs

Reaction mechanisms of ligand substitution in octahedral complexes (i) $\text{S}_{\text{N}}1$ (ii) $\text{S}_{\text{N}}2$ Acid hydrolysis & Base hydrolysis -Redox (Single Electron Transfer) reactions, Substitution reaction without breaking M-L bond.

Topic-2: Hybridization:

4 Hrs

Bond angles in sp , sp^2 and sp^3 hybrid orbital using wave function (fully mathematical calculations).

UNIT-III

Topic-1: Organo-metallic compounds:

5 Hrs

Definition, classification, Structure and bonding in ferrocene, dibenzene chromium, Zeise ion and gaseous dimethyl beryllium, Tetramethyl lead.

Topic-2: Water Pollution:

5 Hrs

Types of water pollutants, Trace elements in water and their effects; Determination of BOD, COD, DO, Total hardness, Total dissolved solids, Ozon treatment process for wastewater.

Reference Books:

- (1) Introduction to quantum chemistry, by A. K. Chandra, Tata Mc. Graw Hill, Delhi,
- (2) Quantum mechanics in chemistry by M. H. Hanna
- (3) Theoretical Inorganic chemistry by Day & Selbin, Affiliated East West
- (4) Advanced Inorganic Chemistry by Cotton and Wilkinson, John Wiley
- (5) Uni. Chemistry by B. H. Mahan
- (6) Structural Inorganic chemistry by A. F. Wells.
- (7) Chemical Bonding- an introduction By Rawal, Patel & Patel. Sugumar.
- (8) Environmental Chemistry by Amritha Anand
- (9) Basic Inorganic Chemistry by Cotton and Wilkinson
- (10) A Text book of Inorganic Chemistry by P.L.Soni
- (11) Introduction to Inorganic Chemistry by Durrant and Durrant
- (12) Modern Co-ordination Chemistry by R. Lewis and R.G. Wilkinson.
- (13) Inorganic Chemistry- Principles of structure and reactivity by J.E. Huheey and E.A. Keiter.
- (14) Application of Group Theory to chemistry by P.K.Bhattacharya., Himalaya Pub. House, Mumbai.
- (15) Quantum Rasayan, University Granth Nirman Board (Gujarat).
- (16) Environmental Chemistry by A.K. De. U.R. (1961), Arnold, London.
- (17) The corrosion and oxidation of metals by Evans
- (18) Corrosion, Causes and Prevention, Speller. F., Mc Graw Hill, New York.
- (19) Dhatvik Ksharan, Part-I & II by M.N. Desai, Uni, Granth Nirman Board (Gujarat).
- (20) Corrosion and Corrosion Control, Uhlig H. Wiley.
- (21) Corrosion Engineering by Fontana M.G. and Green N.D., Mc Graw Hill. Publ. Pvt. Ltd.
- (22) Wiley online library.

Third Year B. Sc. Semester -VI Chemistry
Paper-VII (Organic Chemistry)

UNIT - I

Topic : 1 : MolecularRearrangements **6 Hrs**

Mechanism of rearrangements involving C to C migrations as illustrated by Wagner – Meerwein and Pinacol-Pinacolone rearrangements.

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

Topic : 2 : Catalysis and Green Chemistry **4 Hrs**

Catalysis in organic reaction, nucleophilic catalysis, Metal-ion catalysis, Intermolecular catalysis, Phase transfer catalysis. Green Chemistry : Fundamental Principle of GreenChemistry.

(ii) Green synthesis of (i) Ibuprofen (ii) Paracetamol

UNIT-II

Topic : 1 : Terpenoids (Isoprenoids) : **5 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 : SyntheticPolymers: **5 Hrs**

Basic concepts, Degree of polymerization, Classification of polymerization reaction. Mechanism of Addition or chain growth polymerization, free radical vinyl polymerisation and Ionic vinyl polymerisation, Ziegler – Natta Polymerisation and Vinyl polymers, Condensation or step growth Polymerization, Polyesters, Polyamides, Biodegradable polymers- Introduction, Classification and Application.

UNIT-III

Topic : 1 Conformational Analysis:**5 Hrs**

Conformation, Conformational analysis, Conformations of ethane, Butane and Cyclohexane. Conformational analysis of cyclohexane. Axial and equatorial Hydrogen in cyclohexane. Stability of monosubstituted cyclohexane.

Topic : 2 Synthetic dyes: (Colour and constitution electronic concepts)**5 Hrs**

Definition and difference between dyes and pigments, classification of dyes, color and constitution – Witt's theory, synthesis and uses of Crystal violet, Indigo, Alizarine, Phenolphthalein, Tetrazine, Acriflavine, Procion Brilliant. Red M-2B.

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 by Hendrickson, Cram &Hammond
- (6) Organic Chemistry by Brown R.F.
- (7) Organic Chemistry by Solomon W.Graham
- (8) Principles of Organic Synthesis- R. O. C.Norman
- (9) Basic Principles of Organic chemistry, by R. Y. Caserio, W. A.Benjamin
- (10) May's Chemistry of synthetic Drugs byDyson.
- (11) Chemistry of drugs, Ener and Caldwell
- (12) Synthetic drugs by Tyagi andYadav.
- (13) Chemistry of synthetic Dyes Vol. I & II byVenkatraman
- (14) Synthetic Organic Chemistry by O. P.Agarwal
- (15) Synthetic Dyes by Chatwal &Anand
- (16) Chemistry of synthetic Dyes by I. G.Vashi
- (17) Organic Chemistry by Morrison andBoyd.
- (18) Chemistry of organic Natural Product Vol. I & II by O. P.Agarwal.
- (19) Chemistry of synthetic drugs byTrivedi
- (20) Green Chemistry, Environmentally Vergin Reactions by V. K. Ahuwalia pub. by Ane booksIndia.

- (21) Principles of Medicinal Chemistry Vol.I & II by S.S.Kadam, K.R.Mahadik, K.G.Bothara (NiraliPrakashan)
- (22) Medicinal Chemsitry By Asuthosh kar4/e
- (23) Organic reactions & their mechanism by P. S. Kalsi, New age internationalpublishers.
- (24) Polymer Science Gowariker
- (25) Handbook of biodegradable polymer, isolation, synthetic charactrisation and application by Andras, Lendiein and adam sissom.
- (26) Stereochemistry Conformation and Mechanisam, 10th Ed. by P. S. Kalsi, New age internationalpublishers

Third Year B. Sc. Semester -VI Chemistry
Paper-VIII (Physical Chemistry)

UNIT - I

Topic : 1 : PHASE EQUILIBRIA

6 Hrs

Statement and meaning of the terms phase, component, degree of freedom, phase rule, phase equilibria, of one component system- water, CO₂ , sulphur system, phase equilibria of two component system- simple eutectic-, Pb-Ag systems, desilverisation of lead, KI- Water system, freezing mixtures. Solid solutions: compounds with congruent and incongruent melting point (Only definition and example), Three component solid-liquid systems p.no 690-691*

Topic : 2 : BINARY LIQUID MIXTURES

4 Hrs

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. Chemical Potential of Ideal and non ideal solutions, p.no 756-757* Numerical problems.

57 th edition, Principal of physical Chemistry, By Puri, Sharma, Pathania
Vishal Publishing co.

UNIT-II

Topic : 1 : APPLICATION OF ELECTRO MOTIVE FORCE

10 Hrs

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
- (6) Energy sources Ni-Cd Cell and Li- ion Cell, Lithium - Polymer Cell, Numerical problems.

UNIT-III

Topic : 1 : APPLICATIONS OF NUCLEAR CHEMISTRY

10 Hrs

Application of radio isotopes as tracers in medicines, agriculture, in studying reaction mechanism in photosynthesis and age determination by Carbon- Dating method. Geiger Muller Counter, 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.

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 Gurdeepraj
- (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 Vol1-5.
- (12) Physical chemistry by Baliga, Dhavale and Zaveri Vol1-3.
- (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 Redd

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -VI Chemistry

Paper-IX (Industrial Chemistry)

Proposed syllabus from July 2021

50 Marks (External)

Total: 30 Hrs

20 Marks (Internal)

Time: 2 Hrs. (Uni. Exam)

UNIT - I

Topic : 1 : Fermentation Industry

6 Hrs.

Definition, condition favourable for fermentation process (pH, temperature, presence of other substances, absence of preservatives, concentration). Manufacture of ethanol, citric acid, acetone and butanol, Acetic acid, Lactic acid from molasses, manufacture of penicillin-G.

Topic : 2: Pulp and Paper industry

4 Hrs

Type of pulp, Manufacture of chemical pulp by Sulphate pulp process, Sulphite pulp process, manufacture of paper (conversion of pulp into paper, beating process, importance of fillings, sizing, colouring materials in manufacture of paper and calendaring).

UNIT-II

Topic : 1 : Insecticides and Fungicides

5 Hrs.

Introduction, Inorganic insecticides, Natural and synthetic insecticides, organic insecticides, Eldrin, Dieldrin, BHC, Tetra ethyl pyrophosphate (TEPP), Introduction of Fungicides like Bordeaux mixture, Dithiocarbamates, Baygon, Termik, Zineb

Topic : 2 : Detergents:

Introduction, Principles of detergency, classification of surface active agents, Anionic detergents, Cationic detergents, Non-ionic detergents, Amphoteric detergents, Suds regulators, Builders and Additives.

UNIT-III

Topic : 1 : Sugar Industry

5 Hrs.

Introduction, Manufacture of sugar from sugarcane: Extraction of juice, Purification of juice, Concentration & crystallisation of purified juice, Refining of sugar.

Topic : 2 : Industrial manufacturing process with flow diagram & their uses**5 Hrs.**

- (1) Preparation of methanol from synthesis gas.
- (2) Preparation of Isopropanol from propylene.
- (3) Preparation of acetone from isopropanol.
- (4) Preparation of formaldehyde from methanol by oxidation dehydration process.
- (5) Acetylene from natural gas.

Reference Books:

- (1) Shreve Chemical Process Industries, 5ed., George.T. Austin. MacGraw 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 & ALUnderwood, 6th ed. Pub. Prentice Hall of India ltd.
- (7) Vogel's Text Book Inorganic Quantitative Analysis, 6th ed.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -VI Chemistry

Paper-X (Analytical Chemistry)

Proposed syllabus from July 2021

50 Marks (External)

Total: 30 Hrs

20 Marks (Internal)

Time: 2 Hrs. (Uni. Exam)

UNIT - I

SPECTROSCOPY:

10 Hrs

Types of spectrum, Process involved in interaction with matter (Fluorescence, Phosphorescence), Components of spectrophotometer-Sources, Grating and Prism as dispersing device, Sample handling, Detectors- Photo tube, Photomultiplier tube. Block diagram and working of single beam and double beam spectrophotometer. Terms involved in Beer's law (no derivation). Causes of deviation from Beer's law. Analysis of unknown by calibration curves method, standard addition method, and ratio method.

Determination of Cu^{+2} , Fe^{+3} , NO_2^{-1} , F^- using spectrophotometer. (Only principles - no detailed method), Problems based on quantitative analysis

UNIT-II

SEPARATION TECHNIQUE

6 Hrs.

Topic : 1 : Gas Chromatography:

Classification of chromatography, Principles of GC separation. Components of GC, Sample introduction system, Columns: Packed column Capillary Column (WCOT, SCOT), Carrier gas and its selection - stationary phases: Solid adsorbents, Inert supports (Selection criteria, Diatomaceous earths) and liquid stationary phases, Detectors: FID, TCD. Qualitative and quantitative analysis using GC.

Topoic : 2 : Liquid Chromatography:

4 Hrs.

Limitation of conventional liquid chromatography (no detail method). Technique of HPLC. Elementary idea about technique and layout diagrams of instrument. Components of instrument of HPLC technique, Pumps with merits and demerits, Detector: UV absorption, Refractive Index, Elementary idea of TLC.

UNIT-III

Topic : 1 : Precipitation Titrations:**5 Hrs.**

Titration involving Silver salts.

Detection of end points by Mohr's method, Volhard's method, Adsorption indicators. Construction of titration curves. Problems.

Topic : 2 : Redox Titrations:**5 Hrs.**

Formal Potential, Redox reaction: $\text{FeSO}_4\text{-KMnO}_4$, $\text{K}_2\text{Cr}_2\text{O}_7\text{-FeSO}_4$, $\text{Fe}^{+2} - \text{Ce}^{+4}$, Principle of redox indicators, Structural chemistry of indicators (Diphenyl amine, Ferroin). Construction of titration curves for titration of Fe^{2+} with Ce^{4+} .

Nernst equation and calculation of equilibrium constants for redox system, Types of indicators, Theory of true Redox indicators.

Reference Books:

- (1) Quantitative Analysis by R. A. Day & A. L. Underwood, 6th ed. Pub. Prentice Hall of India Ltd
- (2) Vogel's Text Book Inorganic Quantitative Analysis, 6th ed.
- (3) Analytical Chemistry (Principles & Technique) by Lary G. Hargis.
- (4) Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
- (5) Instrumental Methods of Analysis by B. K. Sharma
- (6) Instrumental analysis by R.D.Braun Mc Graw Hill.
- (7) Analytical Chemistry....Gary Christian
- (8) Analytical Chemistry....Day and Underwood.
- (9) Modern Analytical Chemistry by David Harvey, McGraw Hill Higher Education
- (10) College Analytical Chemistry, Mangaonkar, Teckchandani, Sathe, Ghalsasi, Jain, Himalaya Publishing House
- (11) Analytical Chemistry by Alka L. Gupta, Pragati Prakashan.
- (12) Instrumental Methods of Chemical Analysis by H. Kaur, Pragati Prakashan.

Third Year B. Sc. Semester -VI Chemistry

Paper-XI (General Chemistry)

UNIT-I

Topic : 1 : Chemistry in Consumer Protection :

10 Hrs.

Define Adulteration; Reasons of Adulteration, Types of Adulterants, Discussion Methods for detection of different adulterants in some common food items

(1) Milk

(2) Milk products: Sweet curd, Rabdi, Khoa & its product, Chhana or Paneer, Ghee, Cottage cheese, condensed milk, Khoa, Ghee, Butter

(3) Oil and Fats Oil and Fats, Mustard oil, Edible oil, Coconut oil

(4) Sweetening agents: Sugar, Pithi sugar, Honey, Jaggery, Bura sugar

(5) Food grain and their product: (Wheat, Rice, Maize, Jowar, Bajra, Chhana and Barley etc.), Maida, Wheat flour, Besan, Suji (Rawa) Dal whole and Split, pulses

(6) Spices: Whole spices, Black Pepper, Cloves, Mustard seed and Powdered spices

(7) Turmeric whole and Turmeric powder

(8) Chilli powder, Asafoetida,

(9) Miscellaneous Product: Common salt, Tea, Coffee powder,

UNIT-II

10 Hrs.

Topic : 1 : Nano particles:

Introduction of Nano particles, properties of nano particles, Semi conductors, Ceramic nano particles, Catalytic aspects of nano particles, Carbon nano tubes. Applications of Nano particles,

Topic : 2 : Environmental pollution:

Introduction types of Pollutions (1) Gaseous pollution in air, Acid rain, Green house effect and ozone depletion. (2) radiation pollution cause, effect and control, Uses of radioactive isotopes in medicine, food safety and industry (Cobalt-60, Iodine-131, Carbon-11, Carbon-14, Sodium-24, Thallium-201, Technetium-99m, Americium-241, Iridium-192, Uranium-235, Californium-252) (3) Noise pollution and their effect and control (4) Oil pollution and their control.

UNIT-III

Topic : 1 : NMR spectroscopy

10 Hrs.

Nuclear Magnetic Resonance Spectroscopy – Proton Magnetic Resonance (^1H NMR)

Spectroscopy - Nuclear Shielding and Deshielding – Chemical Shift and Molecule Structure, Spin-Spin splitting and Coupling constants - Intensities of signals – Interpretation of NMR spectra of simple organic molecule such as Ethyl bromide, Acetaldehyde, 1,1,2-tribromoethane, Ethylacetate, Toluene, Acetophenone, Nitrobenzene, Cyclopropane, Isomers of Pentane, Hexane and Dibromo propane.

Reference Books:

- (1) Quantitative analysis by R.A. Day and A.L. Underwood
- (2) Elements of Analytical Chemistry by R. Gopalan ; P.S.Subramanian and K. Rengarajan
- (3) Elementary Organic Spectroscopy by Y.L.Sharma
- (4) Organic Spectroscopy by B.K.Sharma
- (5) Environmental Chemistry by H.Kaur.
- (6) [.http://www.fssi.gov.in/Portals/0/pdf/Final-test-manual-part-II](http://www.fssi.gov.in/Portals/0/pdf/Final-test-manual-part-II)
- (7) Vogel's qualitative Inorganic analysis
- (8) Vogel's qualitative Organic analysis

VEER NARMAD SOUTH GUJARAT UNIVERSITY

Third Year B. Sc. Semester -VI Chemistry

Chemistry-Generic elective subject–Petrochemicals

Proposed syllabus from July 2021

50 Marks (External)

Total: 30 Hrs

20 Marks (Internal)

Time: 2 Hrs. (Uni. Exam)

UNIT - I

Topic : 1 : Petrochemicals obtained from C3-cut of petroleum. 6 Hrs.

Manufacture and industrial applications of chemicals obtained from Propylene: Isopropyl alcohol, Acetone (Wacker-Chemieprocess), Propyleneoxide (Halcon process), Acrylonitrile, Glycerol and Isoprene, Propylene tetramer, Acrylic acid, n-Butyraldehyde (Oxoprocess), Methyl isobutyl ketone, Methylmethacrylate.

Topic : 2 : 4 Hrs.

General account of petrochemicals used as monomers in the manufacture of polyester fibers, manufacture of DMT, Terphthalic acid, Phthalic anhydride, Maleic anhydride, 1:4 Butanediol and other monomers like Pentaerithritol and Di-isocyanates.

UNIT-II

Topic : 1 : The method for the large scale production with flow diagram and uses of: 5 Hrs.

(i) Acetoacetanilide (ii) Anthraquinone (iii) β -naphthol from naphthalene (iv) Benzoic acid (v) Aspirin (vi) Chloramphenicol (vii) Paracetamol (viii) p-Aminophenol.

Topic : 2 : Miscellaneous petrochemicals 5 Hrs.

Definition of synthetic detergents, hard and soft detergents. Synthesis of DDBS. 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 of insecticides, classification of insecticides on basis of mode of action. Synthesis of Methoxychlor, Captan, Parathion, Malathion.

UNIT-III

Topic : 1 : Chemicals obtained from C4 & C5 cut of petroleum. **4 Hrs.**

Manufacture and industrial applications of Butadiene, Butylalcohols, Methylterbutyl ether (MTBE), Cyclopentadiene, Sulpholane.

Topic : 2 : BTX aromatic : **6 Hrs.**

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

Reference Books:

- (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) Chemicals from petroleum by A.L.Wadams (ELBS and John Murray London)
- (4) Petrochemicals by S.L.Venkatewarn (Colour Pubs. Pvt. Ltd. Bombay)
- (5) Petrochemicals digest by MGK Manon (Asia Publishing house Bombay)
- (6) Hand book of industrial chemicals Vol-I by K. M. Shah (Multi tech publishing co. 15 yogesh, hingwala lane, ghatkoper (E) Bombay-400077)
- (7) Industrial chemistry including chemical engineering by B.K.Sharma, Goel Pubs. House, Meerut.
- (8) Hand Book of Synthetic Dyes and Pigments (Vol.II) By K.M.Shah, Multi-tech Publishing Co.

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Third Year B. Sc. Semester -VI Chemistry

Chemistry-Generic elective subject–Drugs

Proposed syllabus from July 2021

50 Marks (External)

Total: 30 Hrs

20 Marks (Internal)

Time: 2 Hrs. (Uni. Exam)

UNIT - I

Topic – 1: Sedatives, Hypnotics and Anticonvulsant drugs **5 Hrs.**

Definition; Introduction; Classification and Structural variations of Sedatives, Hypnotics and Anticonvulsant drugs; Synthesis and Therapeutic Uses of Luminal (Phenobarbital), Diazepam, Meprobamate, Imipramine, Veronal.

Topic – 2: Anaesthetics **5 Hrs.**

Definition; Introduction of General and Local Anaesthetics, Name and Structures of different General Anaesthetics, Classification and Structural Variation among Local Anaesthetics; Synthesis and Therapeutic Uses of Alpha-Eucaine, Benzocaine, Orthocaine, Lidocaine, Halothane.

UNIT-II

Topic – 1: Antihistamines (Anti-allergic drugs) **4 Hrs.**

Definition; Introduction; General account of Histamine and Anti-allergic drugs; Classification and Structural Variations among Antihistamines; Synthesis and Therapeutic Uses of Antergan, Benadryl (Diphenhydramine), Promethazine (Phenergan), Pyribenzamine, Chlorpheniramine.

Topic – 2: Antidiabetic Drugs (Hypoglycemic agents) **3 Hrs.**

Definition; Introduction; Hypoglycemia; Role of insulin in diabetes; Oral Hypoglycemic agents; Structural Variations among Biguanide and Sulfonylurea derivatives showing Hypoglycemic activity; Synthesis and Therapeutic Uses of Tolbutamide, Metformin.

Topic – 3: Antitubercular and Antileprotic drugs **3 Hrs.**

Definition; Introduction; General account of Tuberculosis and Leprosy; Structural Variations among Antitubercular and Antileprotic Drugs; Synthesis and Therapeutic Uses of Isoniazid, Ethambutol, Dapsone (DDS).

UNIT-III

Topic – 1: Antimalarial drugs

4 Hrs.

Definition; Introduction; Name and modes of transition of Plasmodium Parasites responsible for Malaria in Human; General Classification of Antimalarial Drugs; Synthesis and Therapeutic Uses of Chloroquine, Mefloquine, Amodiaquine (Camoquine), Primaquine.

Topic – 2: Antiseptics and Disinfectants

3 Hrs.

Definition; Introduction; Classification and Structural variations among Antiseptics and Disinfectants; Synthesis and Therapeutic Uses of Mercurochrome (Merbromin), *n*-Hexylresorcinol, Halazone, Dichloramine-T.

Topic – 3: Diuretics

3 Hrs.

Definition; Introduction; Classification and Structural Variations of Diuretics; Mercurial Diuretics and Non-Mercurial Diuretics; Synthesis and Therapeutic Uses of Sorbitol, Acetazolamide, Hydroflumethiazide.

Reference Books:

- (1) May's Chemistry of synthetic Drugs by Dyson.
- (2) Chemistry of drugs, Ener and Caldwell.
- (3) Synthetic drugs by Tyagi and Yadav.
- (4) Synthetic Drugs by G. R. Chatwal, Himalaya Publishers.
- (5) The Organic Chemistry of Drug Synthesis by Daniel Lednicer & L.A. Mitscher.
- (6) Medicinal Chemistry by V.K. Ahluwalia Pub. Ane Books Pvt. Ltd.
- (7) Medicinal Chemistry by Ashutosh Kar, New Age International Publisher.
- (8) Medicinal Chemistry by Balkishan Razdan, Pub. CBS Publishers.
- (9) Pharmaceutical Organic Chemistry by S.K. Dewan, Pub. Narosa.
- (10) Medicinal Chemistry - a Molecular and Biochemical Approach, by Thomas Nogrady & Donald F Weaver
- (11) Pharmaceutical Organic Chemistry by Shyam Singh Pub. Himalaya Publishers.
- (12) Medicinal Chemistry by G Patrick. Pub. Viva Books.
- (13) Burger's Medicinal Chemistry & Drug Discovery. Ed. by D. J. Abraham.

Third Year B. Sc. (SEM –VI)
Chemistry - Generic elective subject – DYES

UNIT – I

Topic –1: Fluorescent brightening agents:

7 Hrs

General account, classification of FBA base on chemical constitution with examples, Stillbene and Coumarin derivatives of FBA, synthesis of Tinopal BV, Blankophor-B, Blankophor-G , 3-Phenyl-7-methoxy coumarin, 4 Methyl –3 phenyl-7-amino coumarin, Brilliant Yellow, 3-Phenyl 7-Acetylamino coumarin, 4-Acetylamino-N-butyl Naphthalimide.

Topic –2: Sulphur dyes:

3 Hrs

General account of sulphur dyes. (a) Sulphur Black (b) Sulphur brown (c) Sulphur red (d) Sulphur blue (e) Vat blue -43

UNIT – II

Topic –1: Reactive dyes:

5 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, Procion Brilliant – Blue M-R, Reactive Red-B.

Topic –2: Mordant dyes:

5 Hrs

(i) Definition, classification of mordant dyes with examples, application of mordant dyes synthesis of alizarin and Mordant yellow 2 G
(ii) Heterocyclic Dyes: Introduction Azine dyes, Thiazine dyes, and Cyanine dyes. Synthesis of Safranine – T, Methylene blue, Astrazone pink-FG.

UNIT – III

Topic –1: Azoic dyes:

4 Hrs

Definition, general account of azoic dyes, fast bases, fast salts, rapid fast colors, rapidogens and rapidazole, synthesis of naphthol AS, Fast blue B base (Dianisidine), Fast Orange GGD, Naphthol ASRL, Fast Orange LG- Base.

Topic –2: Non-textile application of dyes:

6 Hrs

Food colors, Cosmetic dyes , Dyes for paper and printing inks , Dyes for paints, Dyes for leather and polishes, synthesis of Amaranth , Lithol Rubine, Lithol Red, Crystal violet, Bismark brown G, Eosin, Orange-I, Prontosil, Pyridium, Neutral Red, Mercurochrome. General account of medicinal dyes.

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 hand 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.