University of Pune
F.Y.B.Sc. Chemistry Syllabus

Paper I (Physical and Inorganic Chemistry)

Section – I (Physical Chemistry)

First Term

1. Chemical Mathematics — 10 Lectures
2. Gaseous and liquid State — 08 Lectures
3. Chemical Thermodynamics — 06 Lectures

Second Term

1. Atomic Structure — 12 Lectures
2. Colloids — 06 Lectures
3. Catalysis — 06 Lectures.

Section – II (Inorganic Chemistry)

First Term

1. Chemistry of Hydrogen — (04)
2. Hydrogen bonding — (02)
3. Stoichiometry — (06)

Second Term

1. Chemical bonding and structure — (06)
2. Concept of Hybridisation — (06)

PAPER – I : PHYSICAL & INORGANIC CHEMISTRY

FIRST TERM – SECTION I

PHYSICAL CHEMISTRY.

1. Chemical Mathematics:- (10 Lectures)

a. Logarithm:- Rules of logarithm, Characteristic and mantissa, Change of sign and base, Problems based on pH and pOH.

b. Graphical representation of equations: Rules for drawing graph co-ordinates etc., Equation of straight line, slope and intercept, plotting the graph from the data of chemical properties and problems.

c. Derivative:- Rules of differentiation and partial differentiation, Algebraic, logarithmic and exponential functions and problems.

d. Integration:- Rules of integration, Algebraic and exponential functions and problems.

2. Gaseous and Liquids State: - (08 Lectures)

Ideal and non- ideal gases, deviation of gases from ideal behavior, compressibility factor (Z), van der Waal's equation of state and its application to explain deviation of gases.

Critical constant of gas in terms of van der Waal's constant, Experimental determination of Pc, Tc and Vc, Reduced equation of state, Law of corresponding state. Measurable physical properties of liquid such as vapour pressure, Surface tension and viscosity and their experimental determination (One method of each).

3. Chemical Thermodynamics: - (06 Lectures)

Second law of thermodynamics, Carnot cycle, mechanical efficiency, Entropy changes for system and surroundings for reversible and irreversible processes, Entropy changes for an ideal gas in isothermal, isobaric and isochoric changes, Entropy Changes in chemical reactions. Entropy changes accompanying fusion.

Aims and Objectives:

1. Chemical Mathematics: -

   After studying this chapter, students should be able to

   - Define logarithm.
   - State all rules of logarithms.
   - Convert negative mantissa into positive (i.e. convert natural to logarithm and logarithm to natural)
   - Calculate pH and pOH.
   - Plot the given data on graph paper.
   - Identify the co-ordinates of any points on a graph.
   - Plot the graph and find slope and intercept.
   - Express the equation of the straight line or convert and first order rate constant (K) in the form of straight line.
   - Select a proper scale and plot a graph when chemical data are given and find the slope and intercept.
   - State the rules of derivative.
   - Solve the problems based on differentiation of a function with power, addition subtraction, logarithmic function etc.
   - State rules of integration.
   - Problems based on: integration related to chemical data.

2. **Gaseous State: - After studying this chapter, student should be able to-**

   - Explain ideal and non- ideal behaviors of (real) gas on the basis of PV against P relationship.
   - Deviation of gases from Ideal behaviors.
   - Define compressibility factor ‘Z’ and Boyle temp.
   - Faulty assumption of kinetic gas theory.
   - Derive van der Waal’s gas equation.
   - Physical significance of van der Waal’s gas constant ‘a’ and ‘b’.
   - Critical constants of gases.

- The principle of corresponding states.
- State and explain the measurable properties of gases such as vapour pressure, surface tension and viscosity.
- Experimental determination vapoure pressure by Isoteniscopic method.
- Experimental determination of relative viscosity of a liquid by Ostwald's viscometer.
- Experimental determination of surface tension by capillary rise method.

3. **Chemical Thermodynamics: - After studying this chapter, student should be able to –**
   - Limitation of first law/ Necessity to study second law of thermodynamics.
   - Cyclic process such as Carnot's cycle.
   - Operation of Carnot's cycle to determine thermodynamic efficiency.
   - Statement of second law based on thermodynamic efficiency.
   - Entropy of a system.
   - Mathematical definition of entropy (i.e.$\Delta S = q_{rev}/T$)
   - Entropy changes for system and surroundings for reversible and irreversible process.
   - Entropy changes for an ideal gas in isothermal, isobaric and isochoric process.
   - Entropy changes in chemical reaction.

Reference Books :-First term.

1. Mathematical preparation for physical Chemistry By F. Daniel, Mc. Graw Hill publication.
2. University General Chemistry. By C.N. R. Rao Mc. Millan Publication.
3. Principles of Physical Chemistry. By Maron and Pruton 4^{th} Ed. Oxford and IBH publication.
4. Physical Chemistry. By G.M. Barrow.

PAPER – I: PHYSICAL & INORGANIC CHEMISTRY

FIRST TERM – SECTION II

INORGANIC CHEMISTRY.

1. Chemistry of hydrogen (04)

Position of hydrogen in periodic table, isotopes of Hydrogen, properties of Isotopes, heavy water, its preparation and application (Ref 1 & 2)

Aims and Objectives:

Student should know

i) Element hydrogen its electronic configuration

ii) Probable Position in periodic table

iii) detail discussion regarding its position.
(Resemblance with alkali metals, halogen and carbon groups)

iv) Definition of isotopes.

v) Three isotopes of hydrogen

vi) Properties of hydrogen

vii) Meaning of heavy water, its preparation & applications.

2. Hydrogen bonding (02)

Types of hydrogen, bonding, effect of hydrogen boding on physical properties of substances like.

a) Physical State b) MP & BP c) Solubility d) Viscosity (Ref. 3)

Text Books (for Chapter 1 & 2)

1) Concise Inorganic Chemistry By J.D. Lee, Chapman & Hall 5th Ed. (1996) (Page No. 240 – 247)

2) Advanced Inorganic Chemistry by Satya Prakash Tuli, Basu & Madan 6th edn. (page 301 – 303, 311-318, 319-322)

3) A new guide to Modern Valency Theory by G.I. Brown (Pages 142 – 149, 154 – 160)

Aims and Objectives:

Student should know

i) Definition

ii) Types : intramolecular and intermolecular hydrogen bonding with examples.

iii) Effect of hydrogen bonding on following physical properties with explanation m.p, b.p., Physical State, Solubility & Viscosity.

3. Stoichiometry (06)

i) Mole concept, Determination of mole wt. By gram molecular volume relationship, problems based on mole concept (Ref. 1 & 2)

ii) Methods of expressing concentrations, strength, Normality, Molarity & Molality, ppm.

iii) Standardization of solutios, primary and secondary standard substances.

iv) Preparation of standard solution of acids and bases, problems related to acid base titrations only (Ref. 2 & 3)

Aims and Objectives:

Student should know

1) Normality, Molarity, Normal Solution, Molar Solution, Equivalent Weight, PPM and Related Problems.
2) Mole Concept.
3) GMV relationship student should able to solve problems based on GMV relationship.
4) Standard Solution, Primary and Secondary Standard Substances and standardization of solution, related problems.

References:

1) College Chemistry by Linus Paulling (Page 165 to 171)
2) Calculation of Analytical Chemistry by Hamilton, Simpson &Ellis 7^{th} Edn. (Pages 154 – 199)
3) Quantitative Inorganic Analysis by A.I Vogal. (Page 257-262)
4) Analytical Chemistry by G.D. Christian relevant pages.

PAPER – I : PHYSICAL & INORGANIC CHEMISTRY

SECOND TERM – SECTION I

PHYSICAL CHEMISTRY.

1. Atomic structure: (12)

Historical Development, Daltons atomic theory, Limitation of Daltons atomic theory, Electron, its discovery and properties. e/m ratio of electron by Thomson's method

Charge on electron by Millikens oil drop method, Proton- its discovery and properties, 'Thomson's Atomic model and its drawbacks. Rutherford's alpha particles scattering experiments, Rutherford's atomic model and its drawbacks. Prouty's hypothesis, Moseley experiment and its importance. The Neutron – its discovery and properties, atomic spectra. Ritz – combination principle, Bohr's model of hydrogen atom, postulates, derivation for its radius and energy. Application of Bohr's theory, spectra and ionization potential of hydrogen, Limitations of Bohr's theory, spectra and ionization potential of hydrogen, Limitations of Bohr's theory, Quantum number, Pauling's Exclusion principle, Hund's principles of maximum multiplicity and Aufbau's principle.

2. Colloids:

(6)

Preparation, purification, Optical properties, Tyndall effect, shape and size, stability, solvation, interaction between, colloids, solution, emulsions and gels.

3. Catalysis: (6)

Catalyst and catalysis, positive and negative catalysis, Type of catalysis, Characteristics of catalytic reactions, promoters, Catalytic poisoning*, Theories of catalysis, Active centre on catalyst surface, Adsorption theory and catalytic activity, Acid – Base catalysis, Enzyme catalysis, Mechanism of enzyme catalysis, characteristics of enzyme catalysis, application of catalysis in industries.

*Autocatalysis, negative catalysis, Activation energy and catalysis.

Aims and Objectives:-

Second Term:-

1. Atomic structure:- After studying this chapter, student should be able to-

- Explain the Dalton's atomic theory.
- Explain the production, properties of cathode ray and discovery of electron.
- Interpret the e/m ratio of electron by Thomson's experiment.
- Explain charge 'e' on electron, Milliken's oil drop method.
- Explain Rutherford's alpha scattering experiment.
- Interpret the observation of alpha scattering experiment.
- Explain the Rutherford model on the basis of experiment.
- Criticize the Rutherford's model on its success and failure.
- Explain the Moseley's experiment.
- Explain the variation of the square root frequency of X – rays emitted with atomic numbers.
- Explain Prout's theory and its limitations.
- Moseley's equation and significance of the term 'a' and 'k'.
- State the conclusion of Moseley's work.
- Explain line spectrum of an atom, band spectrum of molecule, the absorption and emission spectra.
- Explain the prediction of the existence of neutron – by Rutherford and its discovery by Chadwick.
- State the Ritz combination principle and relate the spectrum in light of this principle.
- Discuss the origin of Lyman, Balmar, Paschen, Bracket and Pfund series of hydrogen atom.
- State and explain assumptions of Bohr's theory.
- Derive the expression for energy of an electron in an orbit and radius of Bohr's orbit.
- Solve the numerical problems involving radius, energy and velocity of electron in an orbit.

- Evaluate Bohr's theory w.r.t. merits and demerits.
- Explain the quantum numbers.
- Identify the quantum numbers of any given electron in an atom.

2. Colloids : - After studying this Chapter, student should be able to-

- What are colloids?
- General properties of colloids.
- Preparation of colloids.
- Properties of suspensions namely – a) Physical b) Colligative c) Optical d) Kinetic and e) electrical.
- Optical properties of sols.
- Tyndall effect
- Shape and size of colloids.
- Stability of colloids.
- Colloidal dispersion or emulsion.
- Gel etc.

3. Catalysis :- After studying this chapter, student should be able to

- To know the meaning of terms catalyst, catalysis, positive catalysis and negative catalysis.
- Explain homogenous and heterogeneous catalysis with examples.
- To know different characteristics of catalytic reactions.
- To know the promoters and explain promotion action
- Explain catalytic poisoning.
- to understand enzyme catalysis and its characteristics.
- Explain auto and negative catalysis.

Reference Books For second term.

1. University General Chemistry. By C.N. R. Rao. Mc Millan Publication.
2. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
3. Physical Chemistry. By G.M. Barrow.

PAPER – I: PHYSICAL & INORGANIC CHEMISTRY

SECOND TERM – SECTION II

INORGANIC CHEMISTRY.

I) Chemical bonding and structure. (6)

i) Attainment of stable configuration.

ii) types of bonds a) ionic, b) covalent c) Coordinate d) metallic (Ref.1)

iii) Types of overlap, formulation of σ and π bonds S – S overlap, P-P overlap, p-d overlap with suitable examples (Ref.1)

iv) Theories of bonding, Valence bond theory a) Hitler London theory and b) Pauling Slater theory (Ref. 1)

Aims and Objectives:

Student should know

1) Electronic Configuration
2) Attainment of electronic configuration
3) Definition of different types of bonds with example (Ionic, Covalent, Coordinate and metallic bonds)
4) Formation of bond, need of bond formation.
5) Overlapping of atomic orbital to form σ and π bond with example.
6) Meaning and Difference between σ and π bonds
7) Different types of overlaps viz s-s, s-p, p-p and p-d overlap with example.
8) Different theories of bonding.
    a. Valence bond Theory.
    b. Hitler – London Theory
    c. Pauling – Slater Theory.

References:

i) Concise Inorganic Chemistry by J.D. Lee 5th Edn. (page No. 30 to 36, 90 – 96)

ii) A new guide to modern valency theory by G.I. Brown (Pages 106, 114, 165 – 168)

II) Concept of hybridization (06)

i) Definition, need of hybridization, steps involved in Hybridization, Explanation of covalency of atoms in the molecules on the basis of hybridization, types of hybridization involving S, P orbitals and S, P, d, orbitals (Ref. 1, 2 & 3)

Applications of hybridization concept, geometries of molecules like BeF_2 CH_4, BF_3, $SiCl_4$, PCI_5, IF_7, SF_6, $[Ni\ (CN)_4\ ]^{2-}$ (Ref. 1,2 & 3)

ii) VSEPR theory

Assumptions, need of theory, application of the theory to explain geometry of irregular molecules like H_2O, NH_3, $TiCl_4$, ClF_3, ICl_2, BrF_3, BrF_5, OF_2

Aims and Objectives:

Student should know

1) Definition of hybridization
2) Types of hybridization viz sp, sp^2, sp^3 , dsp^2, dsp^3 , d^2sp^3 , d^3sp^3 with examples.
3) VSEPR Theory: Assumptions and applications of this theory with examples.

References:

1) Consise Inorganic Chemistry by J.D. Lee 5^{th} edn. (Page 30-36, 72-96
2) Basic Inorganic Chemistry by Cotton & Wilkison.
3) Inorganic Chemistry – Principles of structure and reactivity by J.E. Huheey, E.A. Keiter, R.L. Keiter, U.k. Medhi, 1^{st} impression (2006) person Education Publishers (Pages 117 – 170) and (171-190)
4) New guide to modern valence Theory By G.I. Brown (Pages 106-114, 165-168).

UNIVERSITY OF PUNE

F.Y. B.Sc. (Chemistry Syllabus)

PAPER – II (Organic & Inorganic Chemistry)

Revised syllabus from Academic year – 2008 - 2009

Section – I Organic Chemistry.

(First term)

1. Introduction to organic Chemistry. (02)
2. Structure and Bonding in Organic Molecules. (08)
3. Isomerism in Organic Compounds (Part I) (10)
4. Chemistry of Alkanes. (04)

(Second Terms)

1. Alkanes, Dienes, Alkanes. (06)
2. Halogen derivatives of Alkanes (04)
3. Alcohols & Ethers (06)
4. Benzene & its Reactions. (05)
5. Phenols. (03)

Section – II Inorganic Chemistry.

(First Term)

1. Modern Periodic table and electronic configurations of elements (08)
2. Oxidation and Reduction (04)

(Second Term)

1. Chemistry of ‘S’ block elements (08)
2. Chemistry of Noble gases (04)

F.Y.B.Sc. Chemistry Revised Syllabus.
Paper II (Organic & Inorganic Chemistry)
Section I – Organic Chemistry
(First Terms)

Chapter (I) Introduction to Organic Chemistry. (02)

Development of organic chemistry, unique Properties of organic compounds, Sources of organic compounds, applications of organic compounds.

Ref 1 : 1 to 12

Chapter (II) Structure & Bonding in organic Molecules (08)

2.1 Covalent bond, Hybridization in organic molecules (sp^3, sp^2 , sp), bond length, bond angles, bond energies, localized & delocalized chemical bond, vander Waal's interactions, Inter & Intra molecular forces & their effects on physical properties.

2.2 Structural effects like inductive, Resonance, Hyper conjugation, steric effect, Hydrogen bounding.

Ref : - 2, Sec. 1.8 to 1.22, pages – 45 to 72.

Ref : 3 : Sec. 1.2 to 1.6 , Pages – 4 to 26

Chapter (III) Isomerism in organic compounds (Part I) (10)

3.1 Concept of isomerism, type, (Structural chain, position, functional group)

3.2 Representation of organic, Molecules – zig- zag structures, projection formulae – (Saw horse (Andiron), Newman, Fisher & Dotted – wedge)

3.3 Conformational isomerism in alkanes, free rotation about carbon- carbon single bond, conformation of ethane, propane n, butane , relative stability of different conformations.

3.4 Optical isomers – Isomer number & tetrahedral carbon atom chirality, optical isomerism with one asymmetric carbon atom, Polarimeter, Specific rotation, Enantiomerism R & S Nomenclature.

3.5 Geometrical isomerism – Definition, conditions for geometrical isomerism, cis-trans & E-Z nomenclature, physical & chemical properties of geometrical isomerism.

Ref. 2 Sec. 4.1 to 4.11, 4.13 to 4.16, Pages – 161 to 179, sec. 8.7 , pages 315 to 318.

Chapter (IV) Chemistry of Alkanes:- (04)

Classification, higher alkanes Homologous Series, Nomenclature, Physical properties, laboratory methods, of preparation, Industrial methods of preparations, Reactions of alkanes, Combustion, pyrolysis, cracking, Analysis of alkanes.

Ref. 2. Sec, 3.1, 3.6 to 3.15, 3.18, 3.34, Pages. – 113, 114, 122 to 135, 138, 139, 158.

F.Y.B.Sc.

Paper – II – Organic & Inorganic Chemistry.

First Term (Section – II) : - (Inorganic Chemistry)

1) Modern Periodic table and electronic configurations of elements (8)

i) Electronic Configuration of Elements, Aufbau principle, Hund's rule of Maximum multiplicity, (n+1) rules, shapes of s, p, and d orbital, Paulis exclusion Principle, Heisenberg's uncertainty principle and problems based on uncertainty in velocity and position (Ref. – 1)

ii) Periodic table Types of elements: inert gases, representative elements, transition and inner transition elements, Blocks in periodic table S, p, d & f blocks.

Nomenclature of super heavy elements periodic law periodicity in properties throughout the periodic table (Only general trends in each block.)

a) Size and atoms of ions.
b) Ionisation energy
c) Electron affinity
d) Electro negativity.

iii) Shielding effect and shielding constant, Slater's rule to calculate shielding constant, numerical Problems bases on shielding constant.

References:

1) Consicse Inorganic Chemistry by J.D. Lee, Chaman and Hall, 5^{th} edn. (1996) (Pages 17 to 24).
2) Theoretical Inorganic Chemistry by Day & Selbin.
3) Chemistry by Raymond Chang (pages 292 – 314)
4) Concepts, Models of inorganic chemistry by B. Douglas & D. Mc. Daniels, J. Alexander, Mohan wiley & sons 3^{rd} Edn (2007) Relevant Pages.

Aims & Objectives:

Student Should know

1. Mendeleeve's periodic Table concept of atomic weight and atomic number for the construction of periodic table.
2. Modern periodic law and periodic table.
3. Aufbau principle, Hund's rule of maximum multiplicity, (n+ 1) rule, Paulis exclusion principles: Application of this rule to write the electronic configuration of elements.
4. Heisenberg uncertainty Principle/ Problems on uncertainly Princilple.
5. Classification of elements depending on entries of Valency electrons viz s, p, d & f block elements.
6. Different types of elements viz representative elements, transition elements, inner transition elements inert gases.
7. Super heavy elements and their IUPAC nomenclature.
8. Trends in following properties.
    a. Atomic & Ionic Size.
    b. Ionization energy
    c. Electro negativity
    d. Electron affinity
9. Shielding effect and shielding constant.
10. Slater rule.
11. Numerical Problems based on shielding effect.

2. Oxidation & Reduction (04)

i) Introduction, definition of related terms like oxidation, reduction, oxidizing agent and reducing agent (ref. 1)

ii) Balancing of redox reaction using ion electron method and oxidation number method (ref. 1)

iii) Rules to find oxidation number,

iv) Problems based on equivalent weight of oxidant and reductants (ref. 2)

Ref : 1 College Chemistry by Linus Pauling (Pages 338 – 349)

2. Calculations of Analytical Chemistry by Hamilton, Simpson & Ellis 7th Edn. Relevant Pages.

Aims & Objectives:

Student should know

i) Oxidation, reduction, reactions, oxidizing agent (Oxidant) reducing agent (reductant), redox reaction.

ii) Oxidation number, rules to find oxidation number, calculation of oxidation number.

iii) Balancing redox reaction using ion electron method.

iv) Calculation of equivalent weight of oxidant & Reductant.

(Second Term)

F.Y.B.Sc. Paper II – Section I (Organic Chemistry)

Chapter (I) Alkenes, Dienes & Alkynes:- (06)

1.1 Alkenes:- Introduction, higher alkenes, Nomenclature, physical properties, preparations, Reactions of alkenes, Analysis of Alkenes.

Ref. 2 Sec. 8.7 to 8.9, 8.11 to 8.13, Sec. 9.1, 9.2, 9.27.

Pages 309, 318 to 321, 323 to 329, 353 to 359, 396 to 398.

1.2 Dienes : Structure & Properties, Conjugated dienes, Reactions of dienes, analysis of dienes.

Ref. 2. Sec – 11.17, 11.19, 11.21, 11.22, 11.26

Pages: - 445, 446 to 448, 450 to 452, 457, 458.

1.3 Alkynes:- Introduction , Nomenclature, Physical properties, preparation, Reactions & analysis of alkynes.

Ref. 2 . Sec - 12-1, 12-3 to 12.7 , 12-14, Pages–461,464 to 469, 476.

Chapter 2 : Halogen derivatives of Alkanes. (04)

Introduction & Classification of Halogen derivatives, Structure of alkyl halides, classification, Nomenclature, physical properties, preparation, reactions, analysis of alkyl halides.

Ref. 2 Sec. 5-4 to 5-6, 6-24, Pages:- 204 to 208, 247.

Chapter 3 :- Alcohols & Ethers (06)

3.1 Alcohols :- Introduction, physical properties, Reactions of alcohols, industrial sources of ethyl alcohol, proof, spirit, denatured spirit, absolute alcohol, analysis of alcohols.

Ref : 2, Sec 6-2 to 6-9 to 6-11 , 6-22, Pages: 250 to 255, 257 to 263, 279, 280

3.2 Ethers :- Introduction, Nomenclature, Physical Properteis, industrial sources, Laboratory Preparations, Williamson's Synthesis, Diazomethane Method Reactions of ethers.

Ref. 2. Sec. – 6.16 to 6.21, Pages – 273 to 279.

Chapter 4 : Benzene & its Reactions (05)

Structure of benzene, Kekule structure, stability of benzene, Reactions of benzene, aromatic character, Huckel rule, Nomenclature of benzene derivatives, sulphonation, halogenation, Friedal – Crafts reactions of benzene.

Ref. 2 Sec.- 14.1 to 14.4, 14.10, 14.11,Pages – 529 to 534, 540 to 545.

Chapter 5: Phenols:- (03)

Structure, classification, Physical properties, Nomenclature, Preparation of phenols, industrial source, Laboratory methods, Reactions of Phenols Nitration, Sulphonation, Halogenation, nitrosation, carbonation (Kolbe synthesis,) Reimer – Tiemann reaction & analysis. of phenols.

Ref. 2 Sec – 24.1 to 24.4, 14.10, 24.7, 24.8, 24.10 to 24.16.

Pages – 925 to 930, 934 to 938, 941 to 948.

List of Reference Books

Ref. 1 Organic Chemistry by Clayden, Oxford uni.press.

Ref. 2 Organic Chemistry by Morrison & Boyd, 6th Edition.

Ref. 3 A guide book to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition.

Learning Objectives

After studying F.Y.B.Sc. Organic chemistry, the student should be able to –

a. Appreciate the historical development of Organic chemistry its versatility in all walks of life and its potential to meet the needs of challenges of tomorrow.
b. Understand the fundamental concepts, which govern the structure, bonding, properties and reactivities of organic molecules such as covalent character, hybradization, bond angles bond energies, bond angles, bond polartities, shapers of molecules.
c. Name the organic compounds for mono functional group when structure is given or vice versa (Common and IUPAC Names)
d. Predict the conversion of one functional group into other functional group involving one or more number of steps...
e. Converting the given compound into other compound containing more or less number of carbon atoms.
f. Know the characteristic reactions of each functional group which can be used identify and distinguish that compound from other compounds.
g. Predict the possible products when reactants are given. In case there are more than one possible products, identify the major and minor products.
h. Suggest the possible reagents to bring about the given conversion.
i. Apply Huckel's rule to different organic compounds to find out aromatic / non aromatic characters.
j. Distinguish between alcohols and phenols.
k. Explain methods of preparation, chemical reactions and uses of phenols.

F.Y.B.Sc.

Paper – II- Organic And Inorganic Chemistry.

Second Term (Section – II) : Inorganic Chemistry

1) Chemistry S. Blocks Elements. (8)

Position of elements in periodic Table, Electronic configuration, Periodic trends in Properties viz. size of atom, ion, oxidation state, ionization potential, & reactivity.

Anomalous behavior of Li, Be Diagonal relationship between Li & Mg. Industrial biological and Agricultural applications of these elements & their Compounds, Crown ethers, Separation of these elements using Crown ethers. Solution of these metals in liquor NH_3

Text Book:-

Concise inorganic Chemistry by J.D. Lee, Chapman & Hall 5^{th} Edn.

(1996) (Page No. 273, 281, 302, 308, 325, 326, 329, 335 and 353)

Aims and Objectives :-

Student Should Know:

i) Meaning of S-block elements, alkali metals and alkaline earth metals.

ii) Position of S- block elements in periodic table.

iii) Alkali metals and alkaline earth metals, their electronic configuration, Occurrence, trends in periodic properties including atomic and ionic size, oxidation state, ionization Potential, electro negativity and reactivity.

iv) Anomalous behavior of Lithium and beryllium.

v) Diagonal relationship between lithium and magnesium beryllium and aluminum.

vi) Biological, Industrial & agricultural applications of alkali and alkaline earth metals.

vii) Crown ethers.

viii) Separation of alkali metals using crown ethers.

ix) Solution of alkali metals in liquor ammonia.

2 Chemistry of Noble Gases. (4)

1) Position of these elements in periodic table, Electronic configuration.
2) Chemical Properties of Noble Gases.
3) Chemistry of xenon structure and bonding in xenon compounds.
   XeF_2, XeF_4, XeO_6, XeO_4, XeO_2F_2, $[XeO_6]^{-4}$, $XeOF_4$.

Aims and Objectives:

Students should Know:-

i) Meaning of noble gases.
ii) Position of these elements in periodic table.
iii) Electronic configuration of these elements.
iv) Chemical properties of noble gases.
v) Chemistry of Xenon.
vi) Structure and bonding in following compounds:-
   XeF_2, XeF_4, XeF_6 XeO_2, XeO_4, $[XeO_6]$-4 , $XeOF_4$, XeO_2F_2

Ref Books:-

1) Concise Inorganic Chemistry by J.D. Lee Chapman and hall 5th edn. (1996) pages (635 – 647)
2) Concepts and Models of Inorganic Chemistry by B. Douglas & D. Mc. Daniels Alexander Mohan Wiley & sons 3rd Edn. (2007) Relevant pages.
3) Inorganic Chemistry Principles of structure & reactivity
   By James Huheey, Keiter, Medhi (Pearson Education)
   Pages 342-348.

UNIVERSITY OF PUNE

F.Y. B.Sc. CHEMISTRY PRACTICAL SYLLABUS

A: PHYSICAL CHEMISTRY PRACTICALS (ANY FIVE)

1. Determination of molecular weight of given volatile organic liquid by using ideal gas equation.
2. Determination of Viscosity of liquid by Oswald's viscometer.
3. Determination of viscosity of two pure liquids A and B hence find the composition of the two liquids.
4. To determine the surface tension of a given liquid by capillary rises method.
5. Heat of solution of KNO_3/ NH_4Cl.
6. To determine the gas constant R an expression of it in different units by Eudiometric method.
7. Kinetics of hydrolysis of ester in presence of HCl.

Reference Books:-

1. Experiments in general chemistry by C.N.R. Rao and Agrawal East West Press.
2. Experiments in Physical Chemistry by R.C. Das and Behere Tata Mc Graw Hill.
3. Experimental physical Chemistry by F. Daniel and others (International Student Edition)
4. Systematic Experimental Physical Chemistry by S.W. Rajbhoj and Dr. T.K. Chodhekar, Anjali Publication Aurangabad.

B) INORGANIC CHEMISTRY PRACTICALS

1. Volumetric analysis (Only two)

i) Acid-base titration using two burettes of (on micro scale)

ii) Standardization of $KMnO_4$ and estimation of Fe (II) Volumetrically.

iii) Determination of Hardness of water from given sample by E.D.T.A. method.

2. Gravimetric analysis – (any one)

i) Determination of water of crystallization of given salt. $BaCl_2$ $2H_2O$, $Mg.SO_4$, $7H_2O$.

ii) Determination of Percentage Purity of given Salt.
(Na_2CO_3, $NaHCO_3$)

3. Inorganic Qualitative analysis . (Four Mixtures to be analyzed, without phosphate and Borate)

Reference Book :- Inorganic Qualitative Analysis by Vogel.

C) ORGANIC CHEMISTRY PRACTICALS.

1) Purification of Organic Compounds
   1) Crystallization 2) Sublimation 3) Distillation.

2) Recording of M.P. & B.P. – (Confirmation by Mixed M.P.)

3) Characteristic Reactions of following functional groups.

A) Alcohols – 1) Sodium metal test 2) Lucas Reagent test
3) Iodoform test 4) Esterification
5) Action of $K_2Cr_2O_7$

B) Alkenes – 1) $KMnO_4$(Alkaline) 2) Bromine in CCl_4

C) Aldehydes and Ketones.
1) 2., 4-DNP test 2) Semi carobazone 3) Iodoform
4) Tollen's Reagent 5) Fehling's solution 6) Schiff's Reagent

D) Acids 1) $NaHCO_3$ 2) Esterfication 3) $AgNO_3$ test.

E) Phenols 1) NaOH 2) $FeCl_3$ 3) Bromine.

F) Amines. i) HCl test ii) Diazotization test iii) Carbylamine test
iv) Hinsberg test.

G) Amides i) NaOH test (Evolution of NH_3)

H) Esters i) Hydrolysis (Depolarization of Phenolphthalein

I) Aromatic system
i) Sooty flame test ii) Br_2 in CCI_4 iii) $KmnO_4$ test.

4) **Analysis of given Organic Compounds**

i) Type Determination.

ii) Recording of physical constants.

iii) Determination of functional groups.

5) Estimations:- i) Phenol / Aniline / Acetone.

List of compounds for analysis is attached.

Acid: Benzoic, Salicylic, Oxalic, Acetic, Succinic, Cinnamic, phthalic, P-nitrobenzoic.

Phenols: α – naphthol , β - naphthol, Resorcinol, Phenol, O – nitrophenol, P- nitorphenol , m-nitrophenol, p – cresol.

Bases – Aniline isopropyl amine, n – butyllamine, p – Toludine, o- nitroaniline, m-nitroaniline, p-nitroaniline, methylamine, **Dimethyl amine, diphylamine.**

Neutrals:- Acetamide, Urea, Thiourea, Acetanilide, Ethyl acetate, Methyl acetate, Ethyl benzote, methyl salicylate, Nitrobenzene, m – dinitorbenzene, Anisole, Methyl alcohol, n- propylalcohol, Isopropropyl alcohol, n-butyl alcohol, Benzyl alcohol, isoamyl alcohol, Naphthalene, Anthracene, Bi-phenyl, Cyclohexene, chlorobenzene, Bromobenzene, chloroform, Glucose, Benzaldehyde, Acetone, ehtylmethyl ketone, benzophenone, Acetophenone.

Reference Book:- Organic Chemistry by Vogel.

Pattern for F.Y.B.Sc. Practical Examination

1. Physical Experiment Or Inorganic Volumetric / Organic Volumetric.	}	35 marks.
2. Inorganic Qualitative Analysis Or. a. Organic Qualitative Analysis b. Purification of Organic Compounds/ Detection of Functional group.	}	35 Marks
3. Oral		10 marks
4. Internal marks for Journal & Oral.		20 marks.

Note:-

1. At the time of Practical examination in a batch 50 % Students must be given Physical Experiments.
2. For detections of Functional Groups two different compounds must be given.
3. For Organic Qualitative Analysis 20 marks & for purifications/ functional group 15 marks.
4. For Volumetric Analysis Students must prepare standard solutions.
5. No external printed material or practical book/ text book is allowed during the practical examination.