

K.V.R GOVERNMENT COLLEGE FOR WOMEN (A), KURNOOL

I YEAR SYLLABUS

SEMESTER – I

Course I (Inorganic & Physical Chemistry)

60 hrs. (4h/w)

INORGANIC CHEMISTRY

24 h

UNIT –I

Chemistry of p-block elements

8h

Group 13: Preparation & structure of Diborane, Borazine

Group 14: Preparation, classification and uses of silicones

Group 15: Preparation & structures of Phosphonitrilic halides $\{(\text{PNCl}_2)_n\}$ where $n=3, 4$

Group 16: Oxides and Oxoacids of Sulphur (structures only)

Group 17: Pseudohalogens, Structures of Interhalogen compounds.

UNIT-II

1. Chemistry of d-block elements:

6h

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

2. Chemistry of f-block elements:

6h

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

3. Theories of bonding in metals:

4h

Valence bond theory and Free electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

PHYSICAL CHEMISTRY

36h

UNIT-III

Solidstate

10h

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-IV

1. Gaseous state

6h

van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Law of corresponding states. Joule- Thomson effect. Inversion temperature.

2. Liquid state

4h

Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

UNIT-V

Solutions, Ionic equilibrium & dilute solutions

1. Solutions

6h

Azeotropes-HCl-H₂O system and ethanol-water system. Partially miscible liquids-phenol-water system. Critical solution temperature (CST), Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

2. Ionic equilibrium

3h

Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.

3. Dilute solutions

7h

Colligative properties- RLVP, Osmotic pressure, Elevation in boiling point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile solute using osmotic pressure, Elevation in boiling point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

List of Reference Books

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Advanced physical chemistry by Bahl and Tuli
6. Inorganic Chemistry by J.E. Huheey
7. Basic Inorganic Chemistry by Cotton and Wilkinson
8. A textbook of qualitative inorganic analysis by A.I. Vogel
9. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press

10thEd(2014).

10. Castellan, G.W.PhysicalChemistry4thEd.Narosa (2004).

11. Mortimer,R. G.PhysicalChemistry3rdEd. Elsevier:NOIDA,UP(2009).

12. Barrow,G.M.PhysicalChemistry

LABORATORY COURSE -I

30hrs (2 h / w)

Practical-I Analysis of SALT MIXTURE

(At the end of Semester-I)

Qualitative inorganic analysis (Minimum of Six mixtures should be analysed)

50 M

Analysis of SALT MIXTURE

50 M

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

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SEMESTER – II

Course II – (Organic & General Chemistry)

60 hrs (4h/w)

ORGANIC CHEMISTRY

36h

UNIT-I

Recapitulation of Basics of Organic Chemistry

Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes)

12h

General methods of preparation of alkanes- Wurtz and WurtzFittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane).General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT-II

Carbon-Carbon pi Bonds(Alkenes and Alkynes)

12h

General methods of preparation ,physical and chemical properties. Mechanism of E1,E2,E1cbreactions,Saytzeff and Hoffmann eliminations,Electrophilic Additions ,mechanism(Markownikoff /Antimarkownikoff addition) with suitableexamples,,synandanti-addition;addition of H₂,X₂,HX.oxymercuration- demercuration, hydroboration-oxidation, ozonolysis ,hydroxylation, Diels Alderreaction,1,2- and1,4- addition reactions in conjugated dienes.

Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds,Alkylation of terminal alkynes.

UNIT-III

Benzene and its reactivity

12h

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropyliumcation)

Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO₂ and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups

(ii) Halogens

(Explanation by taking minimum of one example from each type)

GENERAL CHEMISTRY

24 h

UNIT-IV

1. Surface chemistry and chemical bonding

Surface chemistry

6h

Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

2. Chemical Bonding

6h

Valence bond theory, hybridization, VB theory as applied to ClF_3 , $\text{Ni}(\text{CO})_4$, Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2 , O_2 , CO and NO).

3. HSAB

2h

Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

UNIT-V

Stereochemistry of carbon compounds

10h

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation.

Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

D,L, R,S and E,Z- configuration with examples.

Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)

List of Reference Books

Theory:

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
5. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

Practical:

1. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
2. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).
3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

Additional Resources:

1. Solomons, T. W. G.; Fryhle, C. B. & Snyder, S. A. Organic Chemistry, 12th Edition, Wiley. Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.
2. Clayden, J.; Greeves, N. & Warren, S. Organic Chemistry, Oxford.
3. Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, New Age International.
4. Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

LABORATORY COURSE-II

30hrs (2 h / w)

Practical-II Volumetric Analysis

(At the end of Semester-II)

Volumetric analysis

50 M

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using KMnO_4 with oxalic acid as primary standard.
3. Determination of Cu (II) using $\text{Na}_2\text{S}_2\text{O}_3$ with $\text{K}_2\text{Cr}_2\text{O}_7$ as primary standard.
4. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4

