# CLUSTER UNIVERSITY SRINAGAR

## CHEMISTRY
## Semester - I
## (Credits: Theory-4, Practicals-2)

## THEORY

**Unit I *Atomic Structure*:**

Dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure.

Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation).

**Periodicity of Elements:**

Detailed discussion of the following properties of the elements, with reference to s and p-block.

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

(b) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

(c) Electron gain enthalpy, trends of electron gain enthalpy.

(d) Electronegativity, Pauling's/ Mullikan's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

**Unit II *Chemical Bonding and Molecular Structure***

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds.

Polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.

MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO+. Comparison of VB and MO approaches.

**Unit III Fundamentals of Organic Chemistry**

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications;

Nucleophlicity and basicity; Reactive Intermediates: Carbocations, Carbanions, Carbenes, Benzynes, Nitrenes and free radicals.

**Stereochemistry**

Conformations with respect to butane and cyclohexane. Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. Concept of chirality (up to two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for up to two C=C systems).

**Unit IV; Aliphatic Hydrocarbons**

**Alkanes**: Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.

**Alkenes**: Preparation: Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes by Partial catalytic hydrogenation and trans-alkenes by Birch reduction. Reactions: cis-addition (alk. KMnO4) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation. **Alkynes**: (Case Acetylene) conversion into higher alkynes; addition of bromine and ozonolysis and oxidation with KMnO4.

**Aromatic hydrocarbons Reactions**: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes.

Reference Books:


1. Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry:
5. Principles of Structure and Reactivity, Pearson Education India, 2006.
6. Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
7. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
8. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
9. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000.
10. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
11. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
12. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.


**PRACTICALS**

**Section A:** Inorganic Chemistry Qualitative Analysis: To identify the given Inorganic mixture containing two acidic and two basic radicals (excluding insoluble and interfering radicals) by Macro Scale Analysis (06 known and 06 unknown mixtures)

**Section B:** Organic Chemistry 1. Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements) 2. Functional group analysis of –COOH, -OH, Phenol, carbonyl group , amines, nitro,

Reference Books:

1) Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2) Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3) Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook
4) of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
5) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.