

Course No: IGCHM17C101

Title: Chemistry-I (04 + 02 Credits)

Max. Marks: 90

Duration: 64+ 64 Contact hours

Continuous Assessment: 30

End Term: 60

Unit – I Atomic Structure and Periodic Properties (16 Contact hours)

1. Atomic Structure: Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of Ψ and Ψ^2 , quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d, orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rule, Electronic configurations of the elements, effective nuclear charge.
2. Periodic Properties: Atomic and ionic radii, ionization energy, electron affinity and electronegativity applications in predicting and explaining the chemical behaviour.

Unit – II Chemical Bonding: (16 Contact hours)

1. Covalent Bond – Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, valence shell electron pair repulsion (VSEPR) theory to NH_3 , H_3O^+ , SF_4 , ClF_3 , ICl_2 and H_2O , MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro-negativity difference.
2. Ionic Solids – Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rule, Metallic bond-free electron, valence bond and band theories.

Unit – III Fundamentals of Organic Chemistry**(16 Contact hours)**

Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reactive Intermediates: Carbocations, Carbanions and free radicals. Aromaticity: Benzenoids and Nonbenenoids, Hückel's rule.

1. Types of organic reactions and mechanism e.g. substitution, elimination, addition, condensation, rearrangement reactions, radical and pericyclic reactions with examples.
2. Cycloalkanes – Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings

Unit – IV Aliphatic Hydrocarbons**(16 Contact hours)**

1. Alkanes: Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation.
2. Alkenes: Preparation: Dehydration of alcohol and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (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.
3. Alkynes: Preparation: Acetylene from CaC₂ and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO₄, ozonolysis and oxidation with hot alk. KMnO₄.

Unit V: Lab Course-I**(32 Contact hours)**

Qualitative Analysis of Inorganic Mixtures (excluding interfering radicals)

Unit VI: Lab Course-II**(32 Contact hours)**

Preliminary investigations and qualitative analysis of solid organic compounds with functional group detection.

Books Recommended:

1. Principles of physical chemistry, Puri, Sharma, Pathanai; Vishal Publishing Co.; 47th edition edition (2016)
2. Principles of Inorganic Chemistry, L.R. Sharma , K.C. Kalia and B.R. Puri; Milestone Publishers & Distributors/ Vishal Publishing Co.; 33rd edition edition (2016)
3. Lee, J. D. Concise Inorganic Chemistry, 5thedn. (Chapman & Hall, 2002).
4. Organic Chemistry, Solomons and Frhyle; Wiley India Pvt Ltd; Eighth edition (2006)
5. Carey, F. A., Sundberg, R. J. Advanced Organic Chemistry, 4th edn., (Plenum Publishers, 2001).
6. Atkins, P., Paula, J. de. Elements of Physical Chemistry, 4th edn. (Oxford University Press, 2005).
7. Clayden, J., Greeves, N., Warren, S., Wothers, P. Organic Chemistry (Oxford University Press, 2008).
8. Vogel Qualitative Inorganic Analysis, G. Svehla; Pearson Education 7Th Edition (2002)
9. Elementary Practical Organic Chemistry: Qualitative Organic Analysis Part 2, A. I. Vogel; Pearson India; 2nd edition (2010)
10. Textbook of Practical Organic Chemistry; Vogel, A.I.; Tatchell, A.R; Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.; 5th ed.; Prentice-Hall; 1996.
11. Practical Organic Chemistry; Mann, F.G. & Saunders, B.C.; Orient-Longman; 1960.
12. Laboratory Manual in Organic Chemistry; R.K. Bansal; Wiley Eastern.
13. Experimental Organic Chemistry;; P.R. Singh, D.S. Gupta and K.S. Barpal; Vol I & II Tata McGraw Hill.
14. Advanced Practical Organic Chemistry; N. K. Vishnoi; Vikas Publishing House Pvt Ltd; 1996.