

12. Syllabus of Courses

Semester-I

CHE-101-T: Fundamentals of Chemistry-I

Course type: Major (Theory)

No. of Credits: 2

Course Outcomes

After the completion of this course, student will be able to-

CO1: recall the fundamental concepts of the mole concept, atomic structure, organic chemistry, catalysis, and surface chemistry.

CO2: explain the principles of chemical stoichiometry, Hund's rule, Aufbau principle and catalysis.

CO3: utilize the knowledge of the mole concept, atomic structure, factors affecting the reactivity of organic compounds, and surface chemistry.

CO4: apply the principles of the mole concept, atomic structure, organic reactivity, catalysis, and surface chemistry to solve the problems.

CO5: evaluate the solutions based on their concentration, and organic structures based on their reactivity and surface chemistry.

CO6: propose solutions to problems related to organic chemistry reactions, catalysis mechanisms, and atomic structure concepts, and apply them to real-world scenarios.

Course Content

Chapter 1: Essentials of Analytical Chemistry

[08 hours]

What is analytical Chemistry, the analytical perspectives, Common analytical problems. Importance in various fields. Some important units of measurements-SI units, distinction between mass and weight, mole, millimole and Calculations, Solution and their concentrations- Molar, Normal and Molar concentrations, percent Concentration, part per million, part per billion, part per thousand, density and specific gravity of solutions, problems. Empirical and Molecular Formulas, Stoichiometric Calculations, Problems. Introduction to errors, limitations of analytical methods, classifications of errors, accuracy, precision, minimization of errors, significant figures and computation.

Chapter 2: Atomic Structure

[07 hours]

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Sommerfield modification. Quantum numbers, introduction to the concept of atomic orbitals; shapes, radial and angular probability diagrams of s, p and d orbitals (qualitative idea). Many electron atoms and ions: Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitations. Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals. Quantum Mechanics: Wave particle duality, de Broglie hypothesis, and the uncertainty principle.

Chapter 3: Essentials of organic chemistry

[09 hours]

Organic Compounds: Classification and Nomenclature, Structure and reactivity of organic molecules, Structural effects- Inductive Effect, Resonance Effect, Hyperconjugation Effect, Steric Effect, Hydrogen bonding and Tautomerism. Comparative study of strength of acids and bases based on Inductive and Resonance effect. HSAB principle, Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles, Types of organic reactions, Reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Aromaticity: Huckel's rule and Benzenoids.

Chapter 4: Catalysis and Surface chemistry

[06 hours]

Catalysis, Types of catalyst and catalysis, specificity and selectivity, mechanism of catalyzed reactions at solid surfaces (diffusion theory of catalysis). Introduction to surface Chemistry - some basic terms related to surface Chemistry adsorption, adsorption materials, factors affecting adsorption, characteristics of adsorption, types of adsorption, classification of adsorption isotherms, Langmuir adsorption isotherm, Freundlich's adsorption isotherm, application of adsorption, problems

References

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2. Fundamentals of Analytical Chemistry- Skoog, west, Holler, Crouch, 9th Ed. Brooks / Cole, 2014/2004.
3. Basic Concept of Analytical Chemistry- S. M. Khopkar.
4. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons, 2014.

5. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
6. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi 1988.
4. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
7. Kalsi P. S. Organic Reactions and Their Mechanisms, New Age International (P) Limited Publishers, 2001
8. J. D. Lee. Concise Inorganic Chemistry, 5th Ed. Blackwell Science
9. CNR Rao. University general Chemistry, an introduction to chemical science, Macmillan.
10. Brian W. Pfennig. Principles of Inorganic Chemistry, 2015 John Wiley & Sons.
11. Essential of Physical Chemistry, Bahl and Tuli (S. Chand).
12. Principles of Physical Chemistry by Puri, Sharma, Pathania.
13. Physical Chemistry, Singh, N.B., et al. Volume 2, New Age International Ltd, 2000
14. Physical Chemistry by, R. A. Alberty, Wiley Eastern Ltd.
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