

CH-115 Fundamentals of Chemistry

Credit Hours 2-1

Pre-requisite Nil

Course Objectives

Students will acquire knowledge about the key introductory concepts of periodic law and periodicity, chemical bonding, acid-base chemistry, and properties of p-block elements as well as using this knowledge for qualitative and quantitative analysis of inorganic compounds during laboratory work.

Detailed Contents

Chemical Bonding, Types of chemical bonds including Covalent bond, Ionic bond, Coordinate covalent bond, Metallic bond, Hydrogen bonding, Vanders Waal's forces. Details of bonding theories, their advantages and limitations; Werner Theory, Valance Bond Theory, Molecular Orbital Theory, Crystal Field Theory, Valence Shell Electron Pair Repulsion Theory.

Organic: Bonding and hybridization localized and delocalized bonding, structure-aromaticity, inductive effect, dipole moment, resonance and its rules, hyper-conjugation, Cross Conjugation, Hydrogen bonding and its effects on various properties of organic compounds, Tautomerism

Thermodynamics, Fundamental concept like system, surroundings, heat, volume, pressure, work, enthalpy and entropy. Laws of thermodynamics and their applications to calculate energy change in a system. Types of reactions based on spontaneity and energy changes; Spontaneous reaction, non-spontaneous reaction, endothermic reaction, exothermic reaction. Study of reactions Kinetics and mechanisms in various chemical processes.

Course Outcome

Upon completing the Fundamentals of Chemistry course, students will gain a strong understanding of core concepts such as chemical bonding, periodicity, acid-base chemistry, and the properties of p-block elements. They will apply bonding theories and thermodynamic principles to analyze chemical reactions and molecular structures. The course also emphasizes practical lab skills, enabling students to perform qualitative and quantitative analyses of inorganic and organic compounds effectively.

Relevant Experiments:

Synthesis of organic compounds using techniques like reflux, distillation, filtration, recrystallization, and yield calculation.

Preparation of metal complexes and their spectroscopic studies by UV-Visible spectroscopy.

Determination of heat of solution by the solubility method. Determination of the heat of neutralization of an acid with a base

Recommended Books:

Atkins, P. Overton, T. Rourke, J. Weller, M. & Armstrong, F. (2010). *Inorganic Chemistry*. (5th ed.,) Oxford University Press. ISBN: 978-9-81-979229-0.

Mone, L. J. Dolter, T. O. & Gentemann, S. (2011). *Basic Concepts of Chemistry*. (8th ed.,) John-Wiley & Sons. New York. ISBN: 978-0471741541.

Clayden, J. Greeves, N. Warren, S. (2012). *Organic Chemistry*. (2nd ed.,) Oxford University Press Inc. New York. ISBN: 978-0199270293.

Cotton, F. A. & Wilkinson, G. (2007). *Advanced Inorganic Chemistry*. (6th ed.,) John-Wiley & Sons. New York. ISBN: 978-0-471-19957-1.

Miessler, G. A. Fischer, P. J. & Tarr, D. A. (2014). *Inorganic Chemistry*. (5th ed.,) Pearson Education Ltd. ISBN: 978-0321811059.

Borgnakke, C. (2024). *Fundamentals of Thermodynamics*. (11th ed.,) Wiley. ISBN: 978-1-394-21292-7.

Atkins, P. Paula, J. de. & Keeler, J. (2022). *Atkins' Physical Chemistry*. (12th ed.,) Oxford University Press. ISBN: 9780198847816.

Hill, Jr, R. H. & Finster, D. C. (2010). *Laboratory Safety for Chemistry Students*. John-Wiley & Sons. ISBN: 978-0-470-34428-6.

Svehla, G. (2009). *Vogel's Qualitative Inorganic Analysis*. (7th ed.,) Pearson Education, Ltd. ISBN: 9780582218666.

Current Literature and Reviews