BS 3rd Year

Semester-V

Course Title: PHYSICAL CHEMISTRY

Course Code: CHEM-358

Credit Hours: 3

Course Objectives:

Students will be able to understand and acquire knowledge about the principles and theoretical background of quantum chemistry, kinetics theory of gases and phase equilibrium. The knowledge gained thus can be applied to study various aspects of quantum mechanics, gas kinetic behavior and thermodynamics and phase equilibrium.

Course Contents:

Quantum Chemistry: Black body radiation, photoelectric effect, line spectra of elements, Bohr atomic model, wave and particle nature of matter, de Broglie's equation, Young's double slit experiment, Heisenberg's uncertainty principle, wavefunctions and Born interpretation of wavefunctions, probability density, eigenfunctions and eigenvalues, Hamiltonian operator, Schrödinger wave equation, wavefunctions for hydrogen-like atomic orbitals, radial distribution functions, shielding and penetration, effective nuclear charge, orbital energies, periodic trends in the properties of the elements in the periodic table.

Kinetic Theory of Gases: Equation of states, ideal and real gases, the virial equation and the van der Waals equation for real gases, critical phenomena and critical constants, probability density for molecular speeds of gas molecules, Maxwell distribution of molecular speeds, average speeds, pressure of an ideal gas, calculation of molecular speeds, binary collisions, effusion and mean free paths, Maxwell Boltzmann's law of energy distribution, method for the determination of the Avogadro's number (NA), statistical probability and entropy.

Phase Equilibrium: Gibbs phase rule, Phase diagrams of one component and two component systems, Gibbs energy and the phase diagram of a substance, location of phase boundaries, Clausius-Clapeyron equation, vapor-liquid equilibrium of binary liquid mixtures, binary phase diagrams and lever rule.

Recommended Books:

1. Silbey, R. J., Alberty, R. A., and Bawendi, M. G., Physical Chemistry, 4th ed., Jojn-Wiley & Sons, (2005).
2. McQuarrie, D. A. and Simon, J. D., Physical Chemistry – A Molecular Approach, 1st ed., University Science Books, (1997).
3. Atkins, P. and Paula, J. D., Atkin's Physical Chemistry, 9th ed., Oxford University Press, (2010). 4. Moore. W. J., Physical Chemistry, 4th ed., Longman Publisher (1972).
4. Keeler. J. and Wothers, P., Chemical Structure and Reactivity: An Integrated Approach, 1st ed., Oxford University Press, (2008).
5. Helpern, A. M., Experimental Physical Chemistry: A Laboratory Textbook 2nd ed., Prentice Hall, (1997).
6. Garland, C. W., Nibler, J. W. and Shoemaker, D., P., Experiments in Physical Chemistry, 8th ed., McGraw-Hill, (2003).
7. Atkins, P., Jones, L., Chemical Principles: The Quest for Insight, 5th ed., W. H. Freeman, New York, (2010).