**BS-Chemistry Semester-V (3RD YEAR)**

**Course Instructor: DR. Maqsood Ahmed**

**Course Title: PHYSICAL CHEMISTRY**

**Code: CHEM-271**

**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, wave functions and Born interpretation of wave functions, probability density, eigen functions and eigen values, Hamiltonian operator, Schrödinger wave equation, wave functions 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:**

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).
5. Coulson C. A., Vanlence, Oxford University Press (1980).
6. Keeler. J. and Wothers, P., Chemical Structure and Reactivity: An Integrated Approach, 1 st ed., Oxford University Press, (2008).
7. Helpern, A. M., Experimental Physical Chemistry: A Laboratory Textbook

2nd ed., Prentice Hall, (1997).

1. Garland, C. W., Nibler, J. W. and Shoemaker, D., P., Experiments in Physical Chemistry, 8th ed., McGraw-Hill, (2003).
2. Born, Max., Atomic Physics, 8th ed., Blackie & Son Ltd., (1969).
3. Atkins, P., Jones, L., Chemical Principles: The Quest for Insight, 5 th ed., W. H. Freeman, New York, (2010).
4. 11. James, A. M., Prichard, F. E., Practical Physical Chemistry, 3 rd ed., Longman Group Limited, New York, (1974).
5. Smith, M. B., March’s Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 7th ed., John-Wiley & Sons, Inc., (2013).
6. Ansari, F. L., Qureshi, R. and Qureshi, M. L., Electrocyclic Reactions: From Fundamentals to Research, Wiley-VCH, Germany, (1999).
7. Kürti, L. and Czakó. B., Strategic Applications of Named Reactions in Organic Synthesis: Back ground and Detailed Mechanisms, Elsevier Inc., (2005).