FACULTY OF SCIENCE
M.Sc. II Semester Examination, May/June 2012
CHEMISTRY
Paper – III : Physical Chemistry

Time : 3 Hours] [Max. Marks : 80

Note: Answer all questions.

SECTION – A
(Short Answer Type)

1. a) Derive Gibbs-Duhem equation.
   b) Define the terms (i) activity and (ii) activity coefficient of a non ideal solution.

2. a) What are fast reactions ? Give two examples.
   b) Differentiate fluorescence and phosphorescence with suitable examples.

3. a) Solve the Schrodinger wave equation for a particle in one dimensional box.
   b) What is spherical harmonics ? Define the terms (i) Atomic orbital (ii) Molecular orbital.

4. a) Write the expression for Curie-Weiss Law and explain terms in it.
   b) How are the superconductors classified based on critical magnetic field ?

SECTION – B
(Essay Type Questions)

5. a) How does chemical potential of a component vary with temperature and pressure ? Derive the equations.
   b) Derive an expression for the elevation of boiling point of a solution.

   OR

   c) State and explain Henry’s law for ideally dilute solutions.
   d) Discuss the standard state conventions for nonideal solutions.

(This paper contains 2 pages)
6. a) In a certain photochemical reaction, 0.08 millimoles of a product is formed due to absorption of 271 J. of energy. If the wavelength of light used is 440 nm, calculate the quantum yield of the reaction.

b) Explain the principle of flash photolysis.

OR

c) Explain the photophysical kinetics of unimolecular reactions.

d) Derive the expressions for fluorescence and phosphorescence quantum yields.

7. a) Explain the electronic spectra of conjugated molecules from the concept of particle in one dimensional box.

b) What are radial distribution functions? Draw the plots of $R_{1,0}(r)$ vs $r$ and $R_{2,1}(r)$ vs $r$ plots.

OR

c) Construct the wavefunction for $H_2^+$ ion according to M.O. theory and discuss about its energy and stability.

d) Explain the principle of variation method and apply it to Hydrogen atom.

8. a) Explain the classification of materials based on conductivity using band structure of solids.

b) Explain the phase diagram of Y – Ba – Cu – O system.

OR

c) Explain the BCS theory of superconductors.

d) Explain the defective Pyrovskite structure of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$.