

M.Sc.(Chemistry) (CBCS Pattern) Semester-I
PSCCHT03 - Paper-III : Physical Chemistry

P. Pages : 2

Time : Three Hours



GUG/W/24/11185

Max. Marks : 80

- Notes : 1. All questions are compulsory and carry equal marks.
2. Use of log table and calculators is permitted.

1. a) Set up the Schrodinger wave equation for a simple harmonic oscillator and solve it for energy eigen values. **8**
- b) Determine which of the following functions are the eigen functions of the operator d^2 / dx^2 **8**
- i) $\sin 3x$ ii) kx^2
iii) $\cos kx$ iv) $\exp(-ax^2)$

OR

- c) What are the Postulates of quantum mechanics. **4**
- d) Derive the expression for the energy of rigid rotor by using Schrodinger wave equation. **4**
- e) What are normalized and orthogonal wave functions. **4**
- f) Explain the degeneracy of energy levels by using case of particle in three dimensional box. **4**
2. a) What is fugacity? Describe experimental method for the determination of fugacity. **8**
- b) Derive any two Maxwell relations and give an application of one of them. **8**

OR

- c) Explain Partial molar free energy. **4**
- d) Derive Gibbs Duhem margules equation. **4**
- e) What is the residual entropy? Explain with example. **4**
- f) Derive thermodynamic equation of state. **4**
3. a) What is three component system? Explain it by taking an example of three partially miscible liquids. **8**
- b) Discuss the first and second order phase transitions and lambda line observed in liquid Helium system. **8**

OR

- c) Explain the thermodynamic derivation of phase rule. 4
- d) Define: 4
- i) Transition point ii) Invariant system
- iii) Congruent melting point iv) Degrees of freedom.
- e) Explain phase diagram of one component system of carbon. 4
- f) Explain two components system in which the two components form a compound with congruent melting points. 4
4. a) Discuss the Kinetics of the following photochemical reaction 8
- $$2\text{HI} \xrightarrow{h\nu} \text{H}_2 + \text{I}_2$$
- b) Explain Collision theory of bimolecular reaction. What are the limitations of this theory? 8
- OR**
- c) Explain transition state theory of reaction rates. 4
- d) Derive Michaelis-Menten equation 4
- e) Write a short note on. 4
- i) Photosensitization ii) Quenching
- f) Write a short note on acid-base enzyme catalyzed reaction. 4
5. a) Write quantum mechanical operator for 2
- i) Total energy (H)
- ii) X-component of momentum (P_X)
- b) Write the equation of quantized rotational energy of rigid rotor. 2
- c) State third law of thermodynamics. 2
- d) Write Gibb's Duhem equation. 2
- e) Explain reduced phase rule. 2
- f) Define: Phase of a system. 2
- g) Explain the term quantum yield. 2
- h) Write two examples of enzyme catalyzed reactions. 2
