

M.Sc. (Part-I) (Chemistry) (NEP Pattern) Semester-I
NEP-13 / 01MSCCH03 - Paper-III : Physical Chemistry-I

P. Pages : 2

Time : Three Hours



GUG/S/25/15072

Max. Marks : 80

- Notes :
1. All five questions are compulsory and carry equal marks.
 2. Draw diagram wherever necessary.
 3. Use of calculator is permitted.

1. a) i) Prove that eigen values of a Hermitian operators are real. 8
- ii) Show that e^{ax} is an eigen function of the operator $\frac{d}{dx}$ and find the corresponding eigen value.

- b) Derive an expression for the energy of a rigid rotor using the Schrodinger wave equation. 8

OR

- c) Discuss normalized and orthogonal wave function. 4
- d) What are the postulate of quantum mechanics. 4
- e) Explain one dimensional simple Harmonic oscillator. 4
- f) Explain concept of degeneracy of energy level by using the case of particle in 3-dimensional box. 4

2. a) Derive any two Maxwell relations and give an application of one of them. 8
- b) What is fugacity? Describe experimental method for the determination of fugacity. 8

OR

- c) Derive thermodynamic equation of state. 4
- d) What is residual entropy and explain it with suitable example. 4
- e) Derive Gibbs Duhem-Margules equation. 4
- f) What is mean by chemical potential? How does chemical potential vary with temperature and pressure. 4

3. a) Discuss the first and second order phase transition and lambda line observed in liquid Helium system. 8
- b) What is three component system? Explain it by taking an example of three partially miscible liquid. 8

OR

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| c) | Explain phase diagram of carbon system. | 4 |
| d) | What is phase rule? Explain degree of freedom by taking example of any system. | 4 |
| e) | Explain two component system in which the two components form a compound with congruent melting point. | 4 |
| f) | Draw and discuss phase diagram of ferric chloride-water system. | 4 |
| 4. | a) Discuss collision theory of bimolecular reaction? What are limitation of this theory. | 8 |
| | b) Discuss the kinetics of photochemical hydrogen-bromine reaction. | 8 |

OR

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| c) | What is mean by the energy of activation & explain energy of activation is determined with the help of Arrhenius equation? | 4 |
| d) | Write a note an application of photosensitizers. | 4 |
| e) | Derive Michaelis-Menten equation for enzyme catalysis. | 4 |
| f) | Write a short note on acid-base enzyme catalyzed reaction. | 4 |
| 5. | a) What is tunneling effect? | 2 |
| | b) Explain eigen function. | 2 |
| | c) Explain extensive and intensive properties. | 2 |
| | d) State third law of thermodynamic. | 2 |
| | e) Explain reduced phase rule. | 2 |
| | f) What is congruent melting point and triple point? | 2 |
| | g) Explain the term quantum yield. | 2 |
| | h) Write any two postulate transition state theory. | 2 |
