NEP-13 / 01MSCCH03 - Paper-III : Physical Chemistry-I

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Notes :   1.   All questions are compulsory and carry equal marks as indicated.

1. a) i)   Prove that eigen values of a Hermitian operators are real. **8**

      ii)   What are the postulates of quantum mechanics?

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

<div align="center">OR</div>

  c)   Which of the following function is eigen functions of the operator (d/dx). **4**
    i) e^{ikx}
    ii) $\cos kx$
    iii)   K
    iv)   KX

  d)   Describe the properties of well behaved wave function. **4**

  e)   Explain one dimensional simple harmonic oscillator. **4**

  f)   Write application of Schrodinger wave equation for 3-dimensional box. **4**

2. a)   Derive Maxwell relations and give an application of one of them . **8**

  b)   What is meant by chemical potential? How does chemical potential vary with temperature and pressure? Derive the Gibbs Duhem equation. **8**

<div align="center">OR</div>

  c)   Derive condition of exactness of pfaff differential equation. **4**
Show that $dF = \dfrac{-RT}{P^2} dP + \dfrac{R}{P} dT$ is an exact differential.

  d)   What is Fugacity? How fugacity can be determined? **4**

  e)   What is the Residual entropy and explain it with example. **4**

  f)   Starting form Gibb's Duhem equation, obtain Gibb's Duhem Margules equation. **4**

3. a)   Explain phase diagram of two components system in which the two components form a compound with incongruent melting points. **8**

  b)   Describe the first and second order phase transitions and Lambda line observed in liquid Helium system. **8**

<div align="center">OR</div>

	c)	Explain the phase diagram of carbon system.	**4**
	d)	What is phase rule? Explain degree of freedom by taking example of any system.	**4**
	e)	Explain the following.	**4**
		i) Transition point.	
		ii) Congruent melting point.	
		iii) Invariant system.	
		iv) Degrees of freedom.	
	f)	Discuss the phase diagram of three component system with suitable example.	**4**
4.	a)	Explain transition state theory. Write application of transition state theory.	**8**
	b)	Discuss the kinetics of photochemical hydrogen-bromine reaction.	**8**

OR

	c)	Derive an expression for the rate constant on the basis of collision theory for bimolecular reaction.	**4**
	d)	What is meant by the energy of Activation? Explain how energy of activation is determined with the help of the Arrhenius Equation?	**4**
	e)	What is quantum yield? Give the reasons of high and low quantum yield.	**4**
	f)	Derive Michaelis Menten equation.	**4**
5.	a)	What is tunneling effect?	**2**
	b)	What is normalized and orthogonal wave function?	**2**
	c)	Define intensive and extensive properties.	**2**
	d)	Explain third law of thermodynamics in brief.	**2**
	e)	What is reduced phase rule.	**2**
	f)	Define the terms: i) Phase ii) Component.	**2**
	g)	Explain photosensitizer?	**2**
	h)	Explain the effect of pH on enzyme catalyzed reaction.	**2**

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