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Total No. of Pages : 02

Total No. of Questions : 19

M.Sc. (Chemistry) (PIT) (Sem.-2)
**PHYSICAL CHEMISTRY-II(QUANTUM AND STATISTICAL
CHEMISTRY)**

Subject Code : CHL-413

M.Code : 51150

Time : 3 Hrs.

Max. Marks : 70

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains SIX questions carrying FIVE marks each and students have to attempt ALL questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

Write briefly :

- 1) Define orthonormal wave function.
- 2) Discuss Bohr's Correspondence principle with an example.
- 3) Why can't an electron exist within the nucleus?
- 4) Determine the term symbol for the ground state of Nb whose outer electronic configuration is $5s^1 4d^4$.
- 5) Write Slater determinant for the ground state of Carbon atom.
- 6) What do you mean by thermodynamic probability?
- 7) Define Ensembles with types.
- 8) What are radial probability distribution curves?
- 9) How does zero point energy relate to Heisenberg's uncertainty principle?
- 10) What do you mean by a well behaved wave function?

SECTION-B

- 11) Derive Maxwell's Boltzmann Distribution law.
- 12) Derive expression for vibrational energy of a linear harmonic oscillator.
- 13) Define Hermitian Operator. Show that the eigen functions of a hermitian operator are orthogonal.
- 14) Discuss the concept of wave particle duality. How it was established and what is its significance in daily life?
- 15) Discuss Huckel theory for 1,3-butadiene. Also evaluate charge density on atoms.
- 16) What are the commutation relations of angular momentum operators? Discuss briefly.

SECTION-C

- 17) What is a rigid rotor? Derive an expression for energy of a rigid rotor using Schrodinger wave equation.
- 18) a) How is entropy related to thermodynamic probability?
b) Compare the three different types of statistics.
- 19) Evaluate ground state energy for a Helium atom using first order perturbation theory.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.