Total No. of Questions: 07

B.Sc. (CS) (Sem. – 4)

QUANTUM MECHANICS

Subject Code: BCS-404

M Code: 72320

Date of Examination : 20-12-2022

Time: 3 Hrs.

INSTRUCTIONS TO CANDIDATES:

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

SECTION-A

- 1. Write briefly:
 - a) Explain the meaning of well behaved waved function.
 - b) What is the momentum of an electron if its de-Broglie wavelength is $2A^{0}$?
 - c) Why wave function and its first order space derivative must be continuous everywhere?
 - d) Explain the Superposition principle.
 - e) Can electron exist in the nucleus? Comment.
 - f) What is Auger effect? Can an Auger electron be emitted when a metal is bombarded with visible light?
 - g) What are various possible motions in a molecule?
 - h) Discuss the orthogonality condition of wave functions.
 - i) How do you explain zero point energy of harmonic oscillator?
 - j) State Ehrenfest theorem.

Total No. of Pages: 02

Roll No.

Max. Marks: 60

SECTION-B

- 2. a) What do you understand by de-Broglie waves? Show that de-Broglie wave length λ is given as h/mv. (7)
 - b) What is the difference between light waves and matter waves? (3)
- 3. a) A particle is described by a wave function

$$\psi(x) = \left(\frac{2}{a}\right)^{1/2} \operatorname{Sin}(kx)e^{-iEt/\hbar} - \left(\frac{a}{2}\right) < x < \left(\frac{a}{2}\right)$$

$$\psi(x) = 0$$
 elsewhere

Find the expectation value of the momentum.

- b) What is meant by normalization of a wave function? Discuss. (2)
- 4. a) Explain Heinsberg's uncertainty principle. Prove that $\Delta x \Delta p \ge \hbar/2$, where terms has their usual meanings. (6) b) What is Gaussian wave packet? Discuss its properties in detail. (4) 5. a) Derive one dimensional time dependent Schrödinger wave equation for free particle. (8) b) Is the Schrödinger equation valid for relativistic particles? (2) 6. a) What are two types of X-ray spectra? Explain the mechanism of production of continuous X- ray spectra. (5) b) Describe the general characteristic of electron spectra of diatomic molecules. (5) 7. a) Outline the main feature of Raman spectrum. How is it explained on the basis of quantum theory? (6)
 - b) Explain with necessary theory the rotational spectra of diatomic molecules. (4)

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

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