

**Total No. of Questions : 07**

**B.Sc.(CS) (2013 & Onwards) (Sem.-4)**

# QUANTUM MECHANICS

**Subject Code : BCS-404**

**Paper ID : [72320]**

**Time : 3 Hrs.**

**Max. Marks : 60**

**INSTRUCTION TO CANDIDATES :**

1. **SECTION-A** is **COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. **SECTION-B** contains **SIX** questions carrying **TEN** marks nnnneach and a student has to attempt any **FOUR** questions.

## SECTION-A

**1. Answer briefly :**

- Calculate the frequency and wavelength of a photon whose energy is 75 eV.
- Calculate the de-Broglie wavelength of an electron in first Bohr orbit of hydrogen atom.
- What is an eigen function and eigen value?
- What do you understand by a wavefunction?
- State Ehrenfest theorem.
- What are orthogonal wave functions?
- What is tunnel effect?
- What is Moseley law?
- State the difference between molecular and atomic orbitals.
- What is Raman effect?

### SECTION-B

2. Define phase velocity and group velocity of a wave packet. Derive a relation between group velocity and phase velocity. Show that the particle velocity is equal to the group velocity of a wavepacket.
3. What is normalization of a wavefunction? How it is mathematically expressed? Find out the normalization factor for a wave function. Prove that normalization is independent of time.
4. Explain formation of a Gaussian wave packet. Plot graphically and explain its properties.
5. A particle of mass ' $m$ ' is confined to a one dimensional box of length ' $l$ '. Derive the expression for (i) wave function (ii) probability density of the particle. Show these on separate graphs.
6. Obtain the time independent Schrodinger equation and solve it in the case of a particle in one dimensional rectangular potential well of finite width.
7. Obtain an expression for rotational energy levels of a diatomic molecule and the frequency of rotational spectra. State clearly the selection rules. In which region of the electromagnetic spectrum do the rotational spectra of molecule lie?