D5BPH2202 **Reg. No.....**

Name: .....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2024

(Regular/Improvement/Supplementary)

PHYSICS

GPHY5B07T: QUANTUM MECHANICS

Time: 2 Hours **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 20 marks)

1. Distinguish between phase velocity and group velocity.
2. What is the significance of quantum numbers?
3. What is Bohr's correspondence principle?
4. Define a confined particle.
5. What are the two assumptions made by Planck for deriving Planck's radiation law?
6. Mention the significance of probability amplitude of matter waves.
7. What is a stationary state?
8. What is meant by normalization of wave function?
9. What is Bremsstrahlung?
10. Define Bohr magneton. Write down its expression.
11. Explain the zero-point energy of a harmonic oscillator.
12. What is meant by potential energy barrier?

SECTION B: Answer the following questions. Each carries *five* marks.
(Ceiling 30 marks)

13. Explain normal and anomalous Zeeman effect.
14. Discuss energy-time uncertainty principle. Does uncertainty exist in Classical mechanics.
15. Distinguish between angular momentum in classical mechanics and quantum mechanics.
16. Find the solutions of Schrodinger equation for a particle with constant potential energy.
17. Calculate the de-Broglie wavelength of an electron having kinetic energy 1000 eV.
18. Calculate the two longest wavelengths of the Balmer series of triply ionized Beryllium (Z = 4).
19. X-rays of wavelength 0.24 nm are Compton scattered and the scattered beam is observed at an angle of 60 degrees relative to the incident beam. Determine (a) the wavelength of the scattered X-rays and (b) energy of the scattered X-rays.

SECTION C: Answer any *one* question. Each question carries *ten* marks.

20. Write Schrodinger equation for hydrogen atom and obtain the expression for R, Θ and Φ using separation of variables.
21. Discuss Rutherford nuclear atom model. What are its defects?

(1 × 10 = 10 Marks)