



SANJEEV AGRAWAL GLOBAL EDUCATIONAL UNIVERSITY, BHOPAL

**Mid Semester Test-II**

**Autumn 2024-25 (Jan-2025)**

Name of Program- PhD

Course Name – DSE Physics

Course Code - PY22P104

Max. Duration: 1.5 hrs

Max. Marks: 30

**A. Objective Type Questions (ALL QUESTIONS ARE COMPULSORY) (5X1=05)**

- 1 Which of the following best describes nanotechnology?
  - a) Study of biological systems
  - b) Science of manipulating materials on an atomic or molecular scale
  - c) Theory of relativity
  - d) Study of energy conservation
- 2 Which quantum mechanical concept is associated with energy levels in nanoparticles?
  - a) Tunneling effect
  - b) Quantum confinement effect
  - c) Heisenberg's uncertainty principle
  - d) Born approximation
- 3 Which property is not typically associated with laser beams?
  - a) Directionality
  - b) High coherence
  - c) Population inversion
  - d) Low brightness
- 4 Which type of laser emission is responsible for coherence in lasers?
  - a) Spontaneous emission
  - b) Stimulated emission
  - c) Population inversion
  - d) Absorption
- 5 Which type of diode operates using quantum tunneling?
  - a) Zener diode
  - b) Schottky diode
  - c) Tunnel diode
  - d) Avalanche diode

**B. Short Answer Type Questions (Attempt any THREE) (5X3=15)**

- 6 Discuss the classification of nanostructures based on dimensions. Provide examples of each type.
- 7 Describe the concept of population inversion in lasers and its importance in laser operation.
- 8 What is coherence in lasers? Distinguish between first-order and higher-order coherence.
- 9 Write a short note on the properties and applications of MOSFETs.
- 10 Explain the difference between Zener diodes and avalanche diodes.

**C. Long Answer Type Questions (Attempt any ONE) (10X1=10)**

- 11 Derive and explain the Schrödinger equation for time-independent systems. Include its significance and applications in quantum mechanics
- 12 Explain the principles and applications of microwave devices. Discuss the operation of tunnel diodes, MIS tunnel diodes, and TEDs.

