**20PHU16**

**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**BSc DEGREE EXAMINATION DECEMBER 2022**
(Fifth Semester)

Branch – **PHYSICS**

**QUANTUM MECHANICS & RELATIVITY**

Time: Three Hours Maximum: 75 Marks

**SECTION-A (10 Marks)**
Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (10 x 1 = 10)

1. Which of the following is the energy quantum of radiation?
(i) Neutron (ii) Phonon (iii) Positron (iv) Photon

2. The concept of matter wave was suggested by _____.
(i) Heisenberg (ii) De-Broglie (iii) Schrodinger (iv) Laplace

3. Identify the position-momentum uncertainty relation is _____.
(i) $\Delta E.\Delta t \geq h$ (ii) $\Delta P.\Delta x \geq h$ (iii) $\Delta J.\Delta\theta \approx h$ (iv) $\Delta P.\Delta x = 0$

4. Electron microscope is a microscope in which the object is illuminated by ____ beam.
(i) Photon (ii) Electron (iii) Proton (iv) Muon

5. Indicate the steady state form of Schrodinger wave equation is _____.
(i) Linear (ii) Quadratic (iii) Differential (iv) Derivable

6. For a particle inside a box the potential is maximum at X = _____.
(i) L (ii) 2L (iii) L/2 (iv) 3L

7. ----------transformation are replaced by the Lorentz transformation which confirms the postulate of relativity.
(i) Galilean (ii) Maxwell (iii) Planck's (iv) Newtons

8. As an object approaches the speed of light its mass becomes _____.
(i) Zero (ii) double (iii) Constant (iv) Infinite

9. Find the rest mass of Photon is _____.
(i) Positive (ii) finite (iii) infinite (iv) zero

10. The gravitational red shift has been observed in the spectral lines of stars called ____.
(i) white dwarfs (ii) Black holes
(iii) Galaxies (iv) Milky way

**SECTION - B (35 Marks)**
Answer **ALL** Questions
**ALL** Questions Carry **EQUAL** Marks (5 x 7 = 35)

11. a) List out the any five characteristics of Photons.

(OR)

b) Deduce the Einstein's photo-electric equation.

12. a) State and prove uncertainty principle and discuss its physical importance.

(OR)

b) Explain with neat sketch, the construction and working of an electron microscope.

**Cont...**

13. a) Derive the time dependent Schrodinger's wave equation.

(OR)

b) Describe the Schrodinger's equation for a linear harmonic oscillator and solve it to obtain its eigen values and eigen functions.

14. a) What is Newtonian relativity? Deduce the Galilean transformation equations.

(OR)

b) Bring out the Lorentz transformation equations.

15. a) Explain the principles of equivalence.

(OR)

b) Explain the precession of the perihelion of mercury.

## SECTION - C (30 Marks)

Answer any **THREE** Questions
**ALL** Questions Carry **EQUAL** Marks (3 x 10 = 30)

16. Discuss the Davisson and Germer's experiments for the study of electron diffraction.

17. Explain Heisenberg's uncertainty principle and illustrate it by any thought experiment.

18. Analyze the Schrodinger's wave equation for the particle in a one dimensional box.

19. Outline the Michelson-Morley experiment and explain the significance of Negative results.

20. Point out the general theory of relativity? Discuss the important conclusions derived from it.

Z-Z-Z END