

Reg. No. :

Name :

Fifth Semester B.Sc. Degree Examination, December 2023

First Degree Programme under CBCSS

Physics

Core Course V

PY 1541 : QUANTUM MECHANICS

(2018 Admission onwards)

Time : 3 Hours

Max. Marks : 80

SECTION - A

Answer **all** questions; each question carries 1 mark.

1. What is photoelectric effect?
2. State Planck's quantum theory.
3. Give expression for fine structure constant α .
4. Define threshold frequency.
5. Write the de-Broglie relation.
6. Define phase velocity.
7. Write the operator corresponding to energy.
8. Define zero point energy.
9. Give the condition for two functions to be orthogonal.
10. What is Hilbert's space?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight**; each question carries **2** marks.

11. State and explain Einstein's photoelectric equation.
12. Explain how uncertainty principle accounts for the natural line width of spectral lines.
13. Prove the non-existence of electrons in the nucleus on the basis of uncertainty principle.
14. Outline the various admissibility conditions on the wavefunction of a system.
15. Define a Hermitian operator and name its two properties.
16. Distinguish between co-ordinate representation and momentum representation.
17. Derive time independent shrodinger equation for a linear harmonic oscillator.
18. Write the operators corresponding to angular momentum components.
19. What are linear operators?
20. Outline the probability interpretation of the wavefunction.
21. Write the equation of continuity for probability current density.
22. What is the difference between Einstein's and Debye's theory of specific heat?

(8 × 2 = 16 Marks)

SECTION – C

Answer any **six**; each carries **4** marks.

23. X-ray with wavelength $1\text{\AA}$ are scattered from a carbon block. The scattered radiation is viewed at 90° to the incident beam. What is the compton shift.
24. Calculate the photoelectric work function for sodium metal given that the threshold wavelength is $6800\text{\AA}$ and $h = 6.625 \times 10^{-34}\text{ Js}$.
25. What is the de-Broglie wavelength of an electron which has been accelerated from rest through a potential difference of 100 V ?