



MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :.....

Name :.....

Fifth Semester B.Sc. Degree Examination, November 2016

First Degree Programme under CBCSS

Core Course: Physics – V

AUPY542: Quantum Mechanics

Time: 3 Hours

Max. Marks: 80

SECTION – A

Answer ALL questions in a word or one or two sentences.

1. State uncertainty principle.
2. What is Rayleigh Jeans Law ?
3. State Planks Hypothesis.
4. Define work function.
5. What is phase velocity and group velocity ?
6. What are operators ? Give four examples.
7. What is meant by Hilbert space ?
8. What is Bohr's correspondence principle ?
9. What do you meant by stationary states ?
10. What is wave packet ?

(10 × 1 = 10 Marks)

SECTION – B

Answer any EIGHT questions, not exceeding a paragraph.

11. Explain the two examples of breakdown of classical physics that demands quantum mechanics.
12. Explain spectral distribution of black body radiation.

P.T.O.

13. What are de Broglie waves and derive the expression for the wave length of an electron accelerating through a potential difference of V volt ?
14. How the diffraction of a light (or an electron) beams can be explained on the basis of the corpuscular nature of radiation and uncertainty principle ?
15. Explain in the probabilistic interpretation of wave function.
16. What do you meant by Eigen functions and Eigen values ?
17. Explain orthogonality properties of wave function.
18. Explain of photoelectric effect.
19. Compare the uncertainty in the velocities of an electron and proton confined in a 1 nm box
20. Explain Davisson Germer experiment.
21. X ray of wavelength 0.14 nm are scattered from a block of carbon. What will be the wave length of scattered X rays at (i). 180° (ii). 90° (iii). 0°
22. Explain normalization.

(8 × 2 = 16 Marks)

SECTION – C

Short essay type / Problems : Answer any SIX questions.

23. What do you meant by expectation value ?
24. Derive general uncertainty relation.
25. Explain probability current density.
26. The work function of sodium is 2.3 eV . What is the maximum wavelength of light that will cause photoelectrons to be emitted from sodium ? What will be the maximum kinetic energy of the photoelectrons be if 200 nm light falls on a sodium surface ?
27. Normalize the wave function $\psi(x) = A \sin\left(\frac{\pi x}{L}\right)$ over the domain $0 \leq x \leq L$ and calculate the expectation value of momentum.
28. Prove that $[x, px] = i\hbar$ and $[Px, Py] = 0$.
29. Write a short note on delta function well.
30. Derive Compton effect.
31. Derive the wave function for the particle confined in a cubical box of side L .

(6 × 4 = 24 Marks)

SECTION – D

*Long essay type : Answer any **TWO** questions.*

32. Derive the wave function for free particle.
33. i). Discuss the concept of Rutherford atom model. What are its limitations ?
ii). Explain Bohr postulates. Derive expression for the energy levels.
34. Derive time dependent Schrödinger equation.
35. Discuss one dimensional energy eigen values of square well potential with finite walls.

(2 × 15 = 30 Marks)
