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(Pages : 2)

Name.....

Reg. No.....

FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Physics/Applied Physics

PHY 5B 07/APH 5B 07—QUANTUM MECHANICS

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in question paper have their usual meanings.***Section A (Short Answer Type)***Answer at least eight questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. Give an expression for the Poynting vector. What is its dimension ?
2. Write down the Compton scattering formula. Explain the terms involved.
3. Draw the schematic of the Franck-Hertz experiment indicating the parts involved.
4. Write down the Balmer formula and explain the terms involved.
5. Discuss the Bohr's correspondence principle.
6. Write down the energy-time uncertainty principle and explain the terms involved.
7. Write and explain the normalization condition of a wavefunction.
8. Explain the term degeneracy of eigen states.
9. Write down the Schrödinger equation for a free particle and give its solution.
10. Write down the form of hydrogen atom wavefunction, indicating the variables and the quantum numbers involved.
11. Explain the purpose of Stern-Gerlach experiment.
12. What is normal Zeeman effect ?

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Problem Type)*Answer at least five questions.**Each question carries 5 marks.**All questions can be attended.**Overall Ceiling 25.*

13. List the experimental results of photoelectric effect.
14. Discuss the assumptions of Thomson's model. Explain the failures of this model.
15. Calculate the two longest wavelengths of the Balmer series of triply ionized beryllium.
16. Calculate the de Broglie wavelength of an electron having a kinetic energy 1000 eV.
17. Explain the problem of quantum mechanical tunneling. Discuss an example.
18. Plot the lowest three energy levels and the corresponding probability densities of a one dimensional simple harmonic oscillator with finite potential.
19. What are the possible z components of the angular momentum vector L which represent orbital angular momentum of a state with orbital angular momentum quantum number 5? What is the length of the angular momentum vector?

 $(5 \times 5 = 25)$ **Section C (Essay Type)***Answer any one question.**The question carries 11 marks.*

20. Discuss the Davisson-Germer experiment and the results obtained.
21. Obtain the eigenfunctions and energy eigenvalues of a particle confined to a one dimensional infinite potential well.

 $(1 \times 11 = 11)$