

D 50691

(Pages : 2)

Name.....

Reg. No.....

FIFTH SEMESTER (CBCSS-UG) DEGREE EXAMINATION, NOVEMBER 2023

Physics/Applied Physics

PHY 5B 07/APH 5B 07—QUANTUM MECHANICS

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

Section A (Short Answer Type)

*Answer all questions in two or three sentences,
each correct answer carries a maximum of 2 marks.*

1. A particle confined in a box must have, a certain minimum energy called zero point energy. Comment.
2. State and explain Bragg's law.
3. Write down Einstein's photoelectric equation.
4. What are stationary states ? Explain the significance of Franck Hertz experiment.
5. Show that the eigenvalues of a Hermitian operator are real.
6. State Wien's displacement law.
7. Discuss Rutherford atom model.
8. Explain the postulates of Bohr with regard to hydrogen atom.
9. Prove the nonexistence of electron in the nucleus on the basis of uncertainty principle.
10. What is a wave packet ?
11. What is magnetic quantum number ? Explain its significance.
12. For what state of hydrogen atom, the electrons probability density distribution is spherically symmetric.

(Ceiling 20)

Section B (Paragraph /Problem type)

*Answer all questions in a paragraph of about half a page to one page,
each correct answer carries a maximum of 5 marks.*

13. State and prove correspondence principle.
14. At what wavelength does a room temperature object emit the maximum thermal radiation ? Take $T = 27^{\circ}\text{C}$. To what temperature must we heat it until its peak thermal radiation is in the red region of the spectrum (680 nm).

Turn over

15. You are using a radiometer to observe the thermal radiation from an object that is heated to maintain its temperature at 1278 K. The radiometer records radiation in a wave length interval of 10.5 nm. By changing the wavelength at which you are measuring, you set radiometer to record the most intense radiation emission from the object. What is the intensity of the emitted radiation in this interval ?
16. Explain Davisson and Germer experiment with proper diagram.
17. An eigen function of the. operator $\frac{d^2}{dx^2}$ is $\psi = e^{2x}$. Find the corresponding eigen value.
18. For an electron in a one dimensional infinite potential well of width 1 \AA , calculate the separation between the two lowest energy levels and find the frequency and wavelength of the photon corresponding to a transition between these two levels.
19. A sample of a certain element is placed in a 0.300 T magnetic field and suitably excited. How far apart are the Zeeman components of the. 450 nm spectral line of this element ?

(Ceiling 30)

Section C (Essay type)

*Answer in about two page., any one question,
the question carries 10 marks.*

20. Derive the one dimensional time dependent Schrodinger equation.
21. Write the Schrodinger equation for hydrogen atom and obtain the expression for Φ , Θ and R using separation of Variables.

(1 × 10 = 10 marks)