



K23U 2374

Reg. No. : .....

Name : .....

**V Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/  
Improvement) Examination, November 2023  
(2019 – 2021 Admissions)  
CORE COURSE IN PHYSICS  
5B06 PHY : Quantum Mechanics**

Time : 3 Hours

Max. Marks : 40

**PART – A**

(Short answer questions. Answer **all** questions. **Each** carries **1** mark.) **(6×1=6)**

1. What is pair production ?
2. Discuss the Bohr's correspondence principle.
3. Write down the energy-time uncertainty principle and explain the terms involved.
4. What does the amplitude of the de Broglie wave represent ?
5. Explain the term degeneracy of eigen states.
6. What is Pauli's exclusion principle ?

**PART – B**

(Short essay questions. Answer **any 6** questions. **Each** carries **2** marks.) **(6×2=12)**

7. Draw the spectrum of a blackbody for two different temperatures. Explain Wien's displacement law.
8. Using a suitable schematic, explain the Bragg's law.
9. Discuss the assumptions of Thomson's model. Explain the failures of this model.
10. What do you mean by a wavepacket ? Explain the terms phase and group velocities.
11. Discuss the schematic and the results of the Davisson-Germer experiment.

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12. Explain the concept of normalizing a wave function.
13. Using a suitable figure, explain qualitatively the phenomenon of quantum mechanical tunneling.
14. Explain normal Zeeman effect.

## PART – C

(Problems. Answer **any 4** questions. **Each** carries **3** marks.) **(4×3=12)**

15. X-rays of wavelength 0.24 nm are Compton-scattered and the scattered beam is observed at an angle 60 degree relative to the incident beam. Determine (a) the wavelength of the scattered X-rays and (b) energy of the scattered X-rays.
16. Calculate the two longest wavelengths of the Balmer series of triply ionized beryllium ( $Z = 4$ ).
17. Calculate the de Broglie wavelength of an electron having a kinetic energy 1000 eV.
18. A particle is confined to a box of width  $40\text{\AA}$ . Determine the probability that the particle is found in an interval of  $4\text{\AA}$  at the centre of the box. Assume that the particle is in its lowest energy state.
19. What are the possible z components of the angular momentum vector  $L$  which represents the orbital angular momentum of a state with orbital angular momentum quantum number  $l=2$  ? What is the length of the angular momentum vector ?
20. What are the possible values of the total angular momentum quantum number under LS coupling of two atomic electrons whose orbital quantum numbers are  $l_1 = 1$  and  $l_2 = 2$  ?

## PART – D

(Long essay. Answer **any 2** questions. **Each** carries **5** marks.) **(2×5=10)**

21. List the experimental results of photoelectric effect. Give Einstein's explanations for the same.
  22. Explain Franck-Hertz experiment. Discuss the result of the experiment.
  23. Setup the time-independent Schrödinger equation for a particle moving in a potential in one dimension.
  24. Explain the fine structure splitting in hydrogen.
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