



K22U 2329

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/  
Improvement) Examination, November 2022  
(2019 Admission Onwards)  
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.

1. Braggs law of X ray diffraction is
2. Stefan's law states that the total intensity of a blackbody radiated over all wavelengths is proportional to the \_\_\_\_\_ power of its absolute temperature.
3. Davisson Germer experiment proved the \_\_\_\_\_ nature of electrons.
4. How is group velocity of a de Broglie wave is related to the particle velocity ?
5. Write down the expressions for total energy operator in quantum mechanics.
6. The ground state energy of Hydrogen atom is (6×1=6)

## PART – B

Short essay questions. Answer **any six** questions. **Each** carries 2 marks.

7. What is ultraviolet catastrophe ?
8. State Heisenberg's uncertainty principle.
9. Why the de Broglie wave associated with a moving car is not observable ?
10. What is meant by quantum mechanical tunnelling effect ?
11. State and explain Zeeman effect.
12. What do you mean by space quantization ?
13. Represent the first three wave functions of a particle in a box graphically.
14. Discuss the importance of Stern Gerlach experiment. (6×2=12)

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## PART – C

Problems. Answer **any four** questions. **Each** carries 3 marks.

15. The photoelectrons emitted by a radiation of frequency  $3.65 \times 10^{15}$  Hz are brought to rest by a retarding potential of 10 volts. Find the threshold frequency.
16. Calculate the de Broglie wavelength of an electron having a velocity of 0.8c.
17. Find the probability that a particle in a box of L wide can be found between  $x = 0$  and  $x = L/n$  when it is in the  $n^{\text{th}}$  state.
18. Calculate the shortest and longest wavelength limits of Lyman series.  
 $R = 1.097 \times 10^7 \text{m}^{-1}$ .
19. Find the expectation value  $\langle x^2 \rangle$  of the position of the particle trapped in a box.
20. Electrons with energies of 0.400 eV are incident on a barrier 3.00 eV high and 0.100 nm wide. Find the approximate probability for these electrons to penetrate the barrier. (4×3=12)

## PART – D

Long essay questions. Answer **any two** questions. **Each** carries 5 marks.

21. What is meant by Compton Effect ? Derive an expression for Compton shift.
22. Derive time independent Schrodinger equation.
23. Solve the Schrödinger equation for a particle in a box and deduce expressions for energy eigen values and eigen functions.
24. Write down the Schrodinger equation for hydrogen atom in spherical polar coordinates and separate the variables. (2×5=10)