



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. Bragg's 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)**

P.T.O.



PART – C

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

15. The photoelectrons emitted by a radiation of frequency 3.65×10^{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^{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)
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