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SUBJECT CODE NO: - BB-2393**FACULTY OF SCIENCE AND TECHNOLOGY****B.Sc. (CBCGS)(Pattern 2022) T.Y SEM V****Examination November / December 2024****Physics-XVII Classical and Quantum Mechanics****[Time:1:30 Hours]****[Max. Marks:40]**

N. B

Please check whether you have got the right question paper.

- 1) All questions are compulsory.
 - 2) All questions Carry equal marks.
 - 3) Draw neat diagram & give equations whenever necessary.
 - 4) Figures to the right indicate full marks.
 - 5) Use of logarithmic table & non-programmable calculator is allowed.
- $h = 6.62 \times 10^{-34} \text{ J-s}$, $c = 3 \times 10^8 \text{ m/s}$, $t = 1.055 \times 10^{-34} \text{ J-s}$
 $m = 9.1 \times 10^{-31} \text{ Kg}$, $k = 1.38 \times 10^{-23} \text{ J/K}$

Q.1 Answer the following questions (Any one)

- | | |
|---|----|
| A. Obtain Lagrange's equation from D' Alembert's principle. | 10 |
| B. Describe Davisson & Germer experiment for normal & oblique incidence to establish wave nature of the electron. | 10 |

Q.2 Answer the following questions (Any one)

- | | |
|---|----|
| A. What is Compton Effect? Derive an expression for change in wavelength ($\Delta\lambda$). | 10 |
| B. Obtain time independent Schrodinger's equation in steady state form. | 10 |

Q.3

- | | |
|--|---|
| A. Obtain the equation of simple pendulum using Lagrange's formulation. | 5 |
| B. A microscope using photons, is employed to locate an electron in an atom to within a distance of $0.3 \text{ \AA}$. What is the uncertainty in the momentum of the electron located in this way? | 5 |

OR

- | | |
|--|---|
| A. Write a note on Failure of classical Mechanics. | 5 |
| B. Find the temperature at which the average energy of the molecules of Perfect gas would be equal to the lowest energy of the electron confined in a box of each side $2 \text{ \AA}$. | 5 |

Q.4 Multiple choice questions

1. Which of the following is not a type of constraint in classical mechanics?
 - A. Holonomic
 - B. Non-holonomic
 - C. Scleronomic
 - D. Gravitational
2. D' Alembert's principal is used to convert a dynamic problem into which of the following?
 - A. Static problem
 - B. Quantum problem
 - C. Thermal Problem
 - D. chemical Problem
3. Which of the following phenomenon could not be explained by classical mechanics?
 - A- Black body radiation
 - B. Motion of planets
 - C. Projectile Motion
 - D. Simple Harmonic motion
4. What was the key assumption in Planck's theory regarding energy emission?
 - A. Energy is continuous
 - B. Energy is quantized
 - C. Energy is infinite
 - D. Energy is only thermal
5. According to de-Broglie's hypothesis, matter can exhibit properties of
 - A. Only waves
 - B. Both particles & waves
 - C. Neither particles nor waves
 - D. Neither particles & wave
6. The phase velocity of a wave is defined as _____.
 - A. The velocity of the wave's energy
 - B. The speed at which the phase of wave Propagates
 - C. The speed of the particle
 - D. The average speed of the particles.
7. The wave function (ψ) of a moving Particles provides information about ____
 - A. The exact position of the particle
 - B. The probability density of finding the Particle
 - C. The velocity of the particle
 - D. The mass of the particle.
8. In quantum mechanics, observables are represented by, _____.
 - A. Scalars
 - B. vectors
 - C. Operators
 - D. Matrices



9. A force $F = 10 \text{ N}$ is applied to a system a distance of $x = 2\text{m}$ from the Pivot. If the system undergoes virtual displacement, what is the virtual work?

A. 5 J B. 10 J
C. 15 J D. 20 J

10. Using Wien's law, if the peak wavelength of radiation from a black body is 400nm. What is the temperature of the black body? (Wien's constant)

A. 5230 k
C. 6950 K

B. 7230 K
D. 8025 k

