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SUBJECT CODE NO: -BB-2309
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. (CBCGS)(Pattern 2022) T.Y SEM V
Examination November / December 2025
Physics-XVH Classical and Quantum Mechanics

[Time: 1:30 Hours]

[Max. Marks: 40]

Please check whether you have got the right question paper.

N. B

1) All questions are compulsory.

2) Draw neat diagram and give equations whenever necessary.

Given $h = 6.62 \times 10^{-34} \text{ J-s}$ $c = 3 \times 10^8 \text{ m/s}$ $\hbar = 1.055 \times 10^{-34} \text{ J-s}$ $m = 9.1 \times 10^{-31} \text{ kg}$ $k = 1.38 \times 10^{-23} \text{ J/K}$ **Q1 Solve any one****10**

- a. State D'Alembert's principle and hence derive Langrange's equation of motion from it.
- b. Discuss group velocity and phase velocity in details.

Q2 Solve any one**10**

- a. Derive an equation of Plank's radiation Law and Hence derive Wein's Law from it.
- b. Derive the equation of energy of "Particle in one dimensional box" by using Schrodinger's wave equation.

Q3

- a. Derive the equation of simple pendulum from Langrange's equation of motion.

05

- b. Calculate the wavelength of photon of energy $5 \times 10^{-19} \text{ J}$.

05**OR**

- a. What is the thresh hold wavelength for tungsten surface whose work function is 4.5 eV.

05

- b. Write a short note on operators in quantum mechanics.

05**Q4 Multiple choice questions.****10**

- 1) Which equation represents Langrangian of a system

a) $L=T+L$

b) $L=T-V$

c) $L=1/2 m \dot{\theta}^2$

d) $L=mgh$

- 2) Which of the following best describe the concept of constraints in mechanics?
- Condition that limit the motion of a system
 - Force acting on a system
 - Energy transformation
 - Measurement of velocity
- 3) According to Einstein's equation for the photo electric effect, what determines the kinetic energy of emitted electrons?
- Wavelength of light
 - Frequency of light
 - Intensity of light
 - Colour of light
- 4) What does Wein's displacement law relates to?
- Energy distribution of black body distribution
 - Maximum wavelength emitted by a black body
 - Minimum energy required for electron emission
 - Maximum frequency of a black body
- 5) The De-Broglie's wavelength can be expressed in terms of energy as
- $\lambda = h/E$
 - $\lambda = h/mv$
 - $\lambda = \frac{h}{\sqrt{mE}}$
 - $\lambda = \frac{h}{\sqrt{2mE}}$
- 6) Davission-Germer experiment demonstrated
- The wave nature of light
 - The wave nature of electron
 - The particle nature of photon
 - The uncertainty principle
- 7) The Time-independent Schrodinger's equation is given by
- $H\psi = E\psi$
 - $i\hbar \frac{\partial \psi}{\partial t} = E\psi$
 - $\frac{\partial^2 \psi}{\partial x^2} + k^2\psi = 0$
 - None of the above
- 8) For a particle in one dimensional box, the boundary conditions required
- $\psi(0) = \psi(L) = 0$
 - $\psi(0) = \psi(L) = 1$
 - ψ must be constant
 - None of the above
- 9) A particle of mass $m=1\text{ kg}$, is confined in a one dimensional box of length $L=1\text{ m}$. What is energy of first excited state
- $3.28 \times 10^{-67}\text{ J}$
 - $1.34 \times 10^{-67}\text{ J}$
 - $2.19 \times 10^{-67}\text{ J}$
 - $6.63 \times 10^{-67}\text{ J}$
- 10) A block of mass 10 kg is moving with an acceleration of 2 m/s^2 . According to D'Alembert's principle what is inertial force acting on block
- -10 N
 - -30 N
 - -20 N
 - -40 N

