SG - 167

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Seat No.	

B.Sc. (Part - III) (Semester - V) (CBSC)
Examination, January - 2023
PHYSICS
DSC - E2 : Quantum Mechanics (Paper - X)
Sub. Code: 79678

Day and Date : Wednesday, 04 - 01 - 2023 **Total Marks : 40**

Time : 2.30 p.m. to 4.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Use of scientific calculator is allowed.**
3) **Figures to the right indicate full marks.**
4) **Draw neat and labelled diagrams wherever necessary.**

Q1) Select the correct alternative: **[8]**

i) The de-Broglie hypothesis was experimentally proved by__.

a) Einstein's theory of relativity

b) Planck's constant

c) quantum mechanics

d) Davisson-Germer experiment

ii) As per de Broglie hypothesis, linear momentum (P) is____.

a) $\hbar/k$ b) $\hbar w$

c) hk d) $\hbar k$

iii) The Eigen values of parity operator are_______.

a) 0,+1 b) 0,–1

c) +1,–1 d) +1,+2

iv) The wavelength of matter wave is independent of____.

a) momentum b) mass

c) velocity d) charge

P.T.O.

v) The expectation value<x> of the position operator for a wave function $\psi(x)$ tells you what?

a) The most likely place to find the particle

b) The least likely place to find the particle

c) The position of the particle actually is

d) The average value of the position you would get if you measured in multiple times

vi) $[z, p_z]=$_____.

a) 0 b) 1

c) $i\hbar$ d) $-i\hbar$

vii) Coeficient of transmission is defined as ratio of ___ to ___ current densities.

a) incident, transmitted

b) reflected, transmitted

c) transmitted, incident

d) incident, reflected

viii) The energy spectrum of a particle in one dimensional rigid box has the nature of______.

a) infinite sequence of discrete energy levels

b) infinite sequence of equidistance energy levels

c) exponentially increasing

d) exponentially decreasing

Q2) Attempt any Two of the following **[16]**

a) Derive Schrodinger's time dependent wave equation for one dimensional motion.

b) State and explain uncertainty relation and show that electrons do not exist in the nucleus.

c) Obtain the energy eigen values and normalized wave functions for motion of a particle along x-axis in infinite potential well'

Q3) Attempt any Four of the following **[16]**

a) Show that, $[\hat{A}, [\hat{B},\hat{C}]] + [\hat{B},[\hat{C},\hat{A}]] + [\hat{C},[\hat{A},\hat{B}]] = 0$

b) Prove the relation, $[L_z, L_+] = \hbar L_+$

c) Write note on Hamiltonian operator.

d) Write note on Degenerate states of the energy levels of the particle in three-dimensional rigid box.

e) Write note on orthogonal and normalization conditions of the wave functions.

f) State the conditions that the wave function should satisfy.

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