

21/6/23

## PHYSICS - HONOURS

2023

PAPER - CC10

(Internal Assessment)

Full Marks: 10

Maximum Time: 30 minutes

Answer any 5 Questions

Each question carries 2 marks.

1. A particle of mass  $m$  and energy  $E > 0$  is in a state described by the wave function

$$\psi(x) = \frac{1}{\sqrt{2\pi}} e^{ikx}, \text{ where } k = \frac{\sqrt{2mE}}{\hbar}. \text{ Find the uncertainty in momentum of the particle.}$$

2. What is the most probable value of  $r$ , in the ground state of the hydrogen atom?[Hints: First figure out the probability that the electron would be found between  $r$  and  $r + dr$ .]3. Find the eigen value and eigen function of angular momentum operator  $\hat{L}_z = -i\hbar \frac{\partial}{\partial \phi}$ .

4. In the ground state of the harmonic oscillator, calculate the probability of finding the particle classically allowed region.

$$[\text{Use } \text{erf}(1) = \frac{2}{\sqrt{\pi}} \int_0^1 e^{-z^2} dz = 0.8427]$$

5. In case of one-electron atom calculate the two possible angle of orientations of spin vector  $S$  respect to a magnetic field  $B$  along  $Z$ -axis.6. Compute the spin angular momentum and total angular momentum of one electron system in  $^2D_{5/2}$  state.

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