

B.Sc. 4th Semester Backlog Examination (Non-CBCS)-2021

Sub: Physics

Paper: PHYG-401

(Quantum Mechanics & Mathematical Physics)

Full Marks: 20

Time: 1 hr

Answer any four of the following questions:

Q.No.1. Find the de Broglie wavelengths of (a) a 46 g golf ball with a velocity of 30 ms^{-1} , and (b) an electron with a velocity of 10^7 ms^{-1} . 5

Q.No.2. Describe Davisson-Germer experiment that confirms the wave nature of a particle. 5

Q.No.3. Give a physical interpretation for wave function in quantum mechanics. How do you normalize a wave function? 5

Q.No.4. A particle limited to the X-axis has the wave function $\Psi = ax$ between $x=0$ and $x=1$; $\Psi = 0$ elsewhere. (a) Find the probability that the particle can be found between $x=0.45$ and $x=0.55$. (b) Find the expectation value $\langle x \rangle$ of the particle's position. 2.5x2=5

Q.No.5. Find $\nabla\phi$ if (a) $\phi = \ln|r|$, (b) $\phi = \frac{1}{r}$. 2.5x2=5

Q.No.6. Prove that $\vec{\nabla} \times (\vec{\nabla} \times \vec{A}) = -\nabla^2 \vec{A} + \vec{\nabla}(\vec{\nabla} \cdot \vec{A})$ 5

Q.No.7. Solve: (a) $(x+y)^2 \frac{dy}{dx} = a^2$ 3

(b) $(1+y^2)dx + (1+x^2)dy = 0$ 2

Q.No.8. Find the general solutions of the following equations: 2.5x2=5

(a) $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 0$

(b) $(D^2 + 2D + 5)y = 0$

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