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Mid-Term Examinations – November 2021

Programme	: B.Tech.	Semester	: Fall 2021-22
Course	: Engineering Physics	Code	: PHY1001
Faculty	: Dr. Sharad Chandra Tripathi	Slot/ Class No.	: A11+A12+A13/0001
Time	: 1 ½ hours	Max. Marks	: 50

Answer all the Questions

Q.No.	Sub. Sec.	Question Description	Marks
1		<p>A motorist traveling at a constant 15 m/s passes a school crossing where the speed limit is 10 m/s. Just as the motorist passes the school-crossing sign, a police officer on a motorcycle stopped there starts in pursuit with constant acceleration 3.0 m/s².</p> <p style="text-align: center;">(a) How much time elapses before the officer passes the motorist? At that time, (b) what is the officer's speed and (c) how far has each vehicle travelled?</p>	10
2		<p>You want to move a 500-N crate across a level floor. To start the crate moving, you have to pull with a 230-N horizontal force. Once the crate starts to move, you can keep it moving at constant velocity with only 200 N. What are the coefficients of static and kinetic friction? What is the friction force if the crate is at rest on the surface and a horizontal force of 50 N is applied to it?</p>	10
3		<p>If there is a net nonzero force on a moving object, can the total work done on the object be zero? Explain, using an example.</p>	5
4		<p>If a proton and an electron have the same kinetic energy, which has the longer de Broglie wavelength? Explain.</p>	5
5		<p>Find the first two energy levels for an electron confined to a one dimensional box 5.0×10⁻¹⁰ m across (about the diameter of an atom).</p>	5
6		<p>The wave function $\psi(x, t) = Ae^{i(k_1x - \omega_1t)} + Ae^{i(k_2x - \omega_2t)}$ is a superposition of two free-particle wave functions of the form given by $\Psi(x, t) = Ae^{i(kx - \omega t)} = Ae^{ikx}e^{-i\omega t}$. Both k₁ and k₂ are positive. Show that this wave function satisfies the Schrödinger Equation for a free particle of mass m.</p>	10
7		<p>Compare the specific surface area of spherical nanoparticles of size 80nm and 4nm</p>	5

