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Daffodil International University

Faculty of Engineering

Final Examination, Fall 2025

Course Code: 0533-111 | Course Title: Basic Physics | Teacher's Initial: SAT, MMR
Section: A, B, C, D, E, F, G, H | Level-Term: L1-T1 | Time: 2 Hours
Full Marks: 40 | Exam Date: December 20, 2025

[Note: There are three sets of questions in total. Answer all of them. Right hand margin indicates full marks.]

Q1. (a) **Explain** transverse wave and longitudinal wave. CO-1 (C2) [2]

(b) **Explain** damping coefficient and sharpness of resonance. CO-1 (C2) [2]

Q2. (a) A person on a moving boat blows a whistle of frequency 500 Hz while heading straight toward a large cliff. He notices that the frequency of the echo coming back from the cliff is 550 Hz. If the speed of sound in air is 330 ms^{-1}, **Calculate** the speed of the boat. CO-2 (C3) [4]

(b) For the damped oscillator m = 264 g, k = 85 Nm^{-1}, and b = 80 gs^{-1}. **Calculate** after how many complete oscillation the mechanical energy will be half of the initial energy. CO-2 (C3) [4]

(c) A block has mass m = 0.72 kg and is designed to oscillate at frequency f = 10.0 Hz and with amplitude x_m = 20.0 cm. **Calculate** the block's speed as it passes through the point 7cm away from the equilibrium position and also **compute** the kinetic energy and potential energy of the system at that point. CO-2 (C3) [4]

(d) Two trains are moving directly toward each other on the same track. Train A is moving at 18 $ms^{-1}$and blows a horn of frequency 500 Hz. Train B is approaching at 22 ms^{-1}. If the speed of sound in air is 340 ms^{-1}, **Calculate** the frequency does the driver of Train B hear. CO-2 (C3) [4]

(e) **Identify** the occurrence of damped oscillations in an LCR circuit and support your explanation with the appropriate differential equation. CO-2 (C3) [4]

(f) **Explain** the shape of the Lissajous figure formed when the frequency ratio of the two oscillations is 1:1. Explain how the phase difference between the two oscillations affects the shape. CO-2 (C3) [4]

(g) **Show** that for Simple harmonic motion average potential energy and kinetic energy are half of the total mechanical energy for a complete cycle. CO-2 (C3) [4]

Q3. (a) When a simple harmonic wave is propagated through a medium, the displacement of a particle (in m) at any instant of time is given by $y(x, t) = 0.08 \sin(120\pi t - 4\pi x)$. **Calculate** the amplitude of the vibrating particle, wave velocity, wavelength, frequency, angular frequency and time period. CO-3 (C3) [4]

(b) **Show** that the distance between two successive nodes and antinodes are same in a standing wave formed on a string. CO-3 (C3) [4]