United International University

School of Science and Engineering

Mid Term Examination; Year 2023; Trimester: Summer
Course: PHY 2105; Title: Physics; Sec: A-H
Full Marks: 30, Time: 1 Hour 45 Minutes

Any examinee found adopting unfair means will be expelled from the trimester/program as per UIU disciplinary rules.

Questions no 1, 2, 3 are mandatory to answer. Answer anyone from question no 4 and 5.

1.	(a) Why does the amplitude of a oscillatory body decrease in Damped Harmonic Motion (DHM)?	2	CO1
	(b) Does the total energy of an oscillatory body with SHM vary with time? Explain briefly.	2	CO1
	(c) The equation of displacement of a simple harmonic oscillator is $x = Asin\left(\omega t + \frac{\pi}{6}\right)$. Graphically represent the displacement and acceleration with respect to time.	2	CO1
2.	(a) A 5 kg block is attached to a spring and the spring constant is k = 1400 N/m. The block is held a distance of 6 cm from equilibrium and released at t = 0. (i) Find the angular frequency w, the frequency f, and the period T. (ii) Write an equation for x vs. time.	2	CO3
	(b) Suppose a spring block-system moves between top and bottom point of a tall building as a moving mass. The block has mass m = 5.7×10^3 kg and is designed to oscillate at a frequency f = 50 Hz with amplitude x_m= 15 cm. Calculate: (i) the potential energy at the equilibrium point, (ii) the block speed as it passes through the equilibrium point; (iii) the maximum acceleration of the spring block-system.	3	CO3
	(c) A particle executes simple harmonic motion given by the equation $x = 3\,sin(25t - \frac{3\pi}{4})$ .Calculate the (i) displacement at t = 5 s (ii) velocity and acceleration at t = 2.5 s.	3	CO3
3.	(a) For a damped oscillator m = 580 gm, k = 240 N/m and b = 72 gm/s. The oscillator is stretched up to 8 cm from the equilibrium and released at t = 0. (i) What is the period of the motion? (ii) How long does it take for the amplitude of the damped oscillations to drop to one third of its initial value?	3	CO3
	(b) Karim want to construct a RLC circuit that produces critical damping. He have a capacitor and inductor with value, C = 0.003 mF, L = 0.0001 H respectively. (i) What is the value of resistance he must connect to make his desired circuit? (ii) If R = 800 Ω, is the circuit oscillatory? If oscillatory, find the frequency of oscillation.	2	CO3
	(c) When a simple harmonic motion is propagated through a medium, the displacement of the particle at any instant of time is given by $y = 2sin\,(t - 0.0035x)$. Calculate the (i) wave velocity, (ii) wavelength, (iii) amplitude and (iv) frequency.	3	CO3
4.	(a) For a mass spring system oscillating in simple harmonic motion, the equation of displacement is, $x = Asin(\omega t + \phi)$. Calculate the potential and kinetic energy from the equation of displacement and graphically represent the potential and kinetic energy vs displacement.	4	CO2