United International University

School of Science and Engineering

Mid Term Examination; Year 2023; Trimester: Spring
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 any one from question no 4 and 5.

1.	(a) How you can differentiate progressive wave and stationary wave?	2	CO1
	(b) The equation of displacement of a simple harmonic oscillator is $x = A\cos\left(\omega t + \frac{\pi}{2}\right)$. Graphically represent the velocity and acceleration with respect to time.	2	CO1
	(c) Why do we observe simple harmonic motion (SHM) in LC circuit and damped harmonic motion (DHM) in RLC circuit?	2	CO1
2.	(a) A 0.12 kg body undergoes SHM of amplitude 8.5 cm and time period 0.20 s. (i) What is the magnitude of the maximum force acting on it? (ii) If the oscillations are produced by a spring, what is the spring constant?	2	CO3
	(b) A body of mass 300 gm is attached with a spring of spring constant 5000 dynes/cm. The body is displaced by 7 cm from its equilibrium position and released. Then the body executes SHM. Calculate the (i) frequency, (ii) angular frequency, and (iii) total energy of the mass spring system.	3	CO3
	(c) A particle executes SHM given by the equation $x = 9\sin(16t - \frac{\pi}{6})$ .Calculate (i) the maximum displacement, (ii) the maximum velocity, and (iii) the maximum acceleration.	3	CO3
3.	(a) For a damped oscillator m = 490 gm, k = 190 N/m, and b = 75 gm/s. The amplitude of the oscillator is 8 cm in initial time. (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 fourth of its initial value? and (iii) What is life time of oscillation?	3	CO3
	(b) Find whether the discharge of capacitor through the following inductive series circuit is oscillatory or not. Given, C = 0.0005 mF, L = 0.1 h, and R = 250 Ω. If oscillatory, find the frequency of oscillation.	2	CO3
	(c) When a simple harmonic wave is propagated through a medium, the displacement of the particle at any instant of time is given by $y = 4\sin\pi(250t - 0.25x)$. Calculate the (i) wave velocity, (ii) wave length, and (iii) frequency of particle of the medium.	3	CO3
4.	(a) For a mass spring system oscillating in SHM, the equation of displacement is $x = A\cos(\omega t)$. Show that, potential and kinetic energy depends on time but total energy of the system is constant.	4	CO2
	(b) Derive differential equation for LC circuits. Write down the solution of the differential equation.	4	CO2
5.	(a) Derive the differential equation of DHM for a mass-spring system. With proper conditions, graphically represent the types of damping that may be observed in the system.	4	CO2