United International University

School of Science and Engineering

Mid Term Examination; Year 2021; Trimester: Fall
Course: PHY 105/2105; Title: Physics; Sec: A-D
Full Marks: 30; Time: 1 Hour 45 Minutes

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

1.	(a) Why does amplitude of Simple Harmonic Motion gradually decrease and finally die out? Draw some damping oscillating systems.	2	CO1
	(b) Graphically show the variation of Potential Energy, Kinetic Energy and Total Energy versus displacement curve for Simple harmonic motion (SHM).	2	CO1
	(c) Write down the differential equation of DHM and find a condition to convert it to SHM, and also draw the displacement vs time graph for DHM for $\omega/\gamma = 5$, $\omega/\gamma = 0.5$.	2	CO1
2.	(a) A 0.7 kg block on a spring is pulled a maximum distance of 30 cm from its equilibrium position. The subsequent oscillations are measured to have a period of 0.80 s. At what position (or positions) is the speed of the block 150 cm/s?	2.5	CO3
	(b) For the simple harmonic oscillation where k = 0.5 N/m, A = 0.5 m, x = -0.5 m cos (0.5t), and v = (0.25 m/s) sin (0.5t), determine (i) the total energy, (ii) the kinetic and potential energies as a function of time, (iii) the velocity when the mass is 0.5 m from equilibrium and (iv) maximum velocity.	2.5	CO3
	(c) A 0.25 kg body undergoes simple harmonic motion of amplitude 8.5 cm and 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? and the (iii) maximum acceleration.	3	CO3
3.	(a) For the damped oscillator of m = 250 gm, k = 85 N/m, and b =70 gm/s. (i) Which damping condition maintains the oscillator? (ii) What is time period of oscillation?	2.5	CO3
	(b) In a spring mass system, the block has a mass of 1.50 kg and the spring constant is 8.00 N/s and b = 230 g/s. The block is pulled down 12.0 cm and released. What is the amplitude of the damped oscillations at the end of 20 cycles?	2.5	CO3
	(c) Find whether the discharge of capacitor through the following inductive series circuit is oscillatory or not. Given, C = 0.1μF, L = 5mh, R=300 Ω. (i) If Oscillatory, find the frequency of damping oscillation? (ii) What is frequency f, if any? and (iii) Life time, if any?	3	CO3
4.	(a) Suppose, the instantaneous displacement of a SHM is $x = a\sin(\omega t + 45°)$. Determine the total energy of the SHM and also draw an appropriate graph showing total energy.	4	CO2
	(b) Suppose, you have inductor, capacitor and resistor, then draw a circuit comprising all. Obtain (i) a differential equation for that circuit; (ii) conditions for over damping, critical damping and oscillatory behavior; (iii) frequency of oscillations; (iv) What is the dissimilarity between LC and RLC circuits?	4	CO2
5.	(a) Suppose, equation of displacement of a body executes SHM is expressed as $x(t) = A\cos(\omega_o t + \phi)$. Now find out the phase difference between (i) acceleration and displacement, (ii) velocity and displacement, (iii) draw appropriate figure, if necessary.	4	CO2
	(b) Derive differential equation for Simple pendulum. Find out expression for frequency of oscillation.	4	CO2

CO1: Define different physical quantities with examples. CO2: Derive/Show/Find out the various equations of SHM, DHM, wave motion, etc. CO3: Evaluate different numerical problems based on the basic characteristics of SHM, DHM, wave equation, etc.