United International **University**

School of Science and Engineering

Mid Term Examination; Year 2021; Trimester: Summer
Course: PHY 105/2105; Title: Physics; Sec: A-F
Full Marks: 20; Time: 1 Hour 15 Minutes

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

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

1.	(a) The displacement of a Simple Harmonic Motion (SHM) is $y = A\omega cos(-\omega t - \delta - \frac{\pi}{2})$. Find the velocity and draw the displacement and velocity graph.	2	CO1
	(b) The solution of spring mass dampers Damped Harmonic Motion equation can be represented as $x = x_m e^{-\gamma t} cos(\omega_d t + \phi)$. Rewrite the case for (i) damping amplitude, (ii) damping frequency, and (iii) damping energy.	1	CO1
	(c) Draw the phase difference of two waves, when $\delta = -\frac{\pi}{4}$.	1	CO1
2.	(a) An object undergoing SHM traces a parabola taking 0.25 s to travel from one point of minimum velocity to the next point of maximum velocity. The distance between those points is 36 cm. Calculate the (i) period, (ii) frequency, (iii) amplitude of the motion, and (iv) instantaneous velocity when particle is displaced at 18 cm.	3	CO3
	(b) A body of mass 25 gm executes SHM such that its velocity at mean position is 1 m/s and acceleration at one extremity is 1.57 m/s^2. Calculate (i) amplitude, (ii) time period of oscillation, (iii) total energy, and (iv) instantaneous velocity at t=28.7 s.	2	CO3
	(c) The equation of a travelling wave is $y = 10 \sin \pi(10t - \frac{\pi}{6}x)$**.** Calculate the (i) amplitude of vibrating particle, (ii) wave velocity, (iii) wave length, and (iv) frequency of oscillating particle.	2	CO3
3.	(a) A condenser of capacity 10 μF, an inductance of 0.2 mH and a resistance of 600 Ω are joined in series. (i) Which type of oscillation it is? (ii) What is the damping frequency, if any? and (iii) What is its resonant frequency, if any? (iv) What is its life time?	3	CO3
	(b) A series-connected circuit with R = 4 Ω and L = 25 mH is connected with a capacitor which is run by a FHM V=V_m sin$(\omega t + 45^0)$. (i) Calculate the value of C that will produce a quality factor of 50; (ii) Find ω_1, ω_2, and B; and (iii) Determine the power dissipated at $\omega = \omega_0$. Take V_m = 100 V.	2	CO3
4.	Suppose, the instantaneous displacement of a SHM is $x = a\omega^3 \sin(\omega t + 65°)$. Determine the total energy of the SHM and also draw an appropriate graph showing total energy.	4	CO2
5.	If you have inductor, capacitor and resistor, then draw a circuit comprising all. Obtain (i) a differential equation for that circuit; (ii) also resonant frequency and damping frequency; (iii) time period and life cycle of this circuit; (iv) the dead bit condition of that circuit; (v) Can it be possible to design a new circuit which exhibits a SHM from that? If done, draw; and (vi) What is the dissimilarity between two circuits?	4	CO2

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