



United International University

School of Science and Engineering

Mid Term Examination; Year 2020; Trimester: Fall

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 $y = A \sin(\omega t + \frac{\pi}{2})$. Find the expression of acceleration and graphically show the displacement and acceleration vs. time. 2 CO1
(b) Two damping oscillators maintaining conditions (i) $\omega/\gamma = 5$ and (ii) $\omega/\gamma = 20$. Draw displacement vs. time graph in a single frame. 1 CO1
(c) Draw the phase difference of two waves, when they are (i) in phase and (ii) out of phase. 1 CO1
2. (a) A 0.4 kg block on a spring is pulled a maximum distance of 100 cm from its equilibrium position at $t=0$. The subsequent oscillations are measured to have a period of 0.80 s. (i) At what position (or positions) is the speed of the block 190 cm/s? (ii) What is the maximum velocity of the block? (iii) What is the maximum acceleration of the block? (iv) What is the instantaneous velocity equation? 3 CO3
(b) A hydrogen atom has a mass of 1.68×10^{-27} kg, when it attach to a certain massive molecule, it oscillate as classical oscillator with frequency of 10^{12} Hz and with amplitude of 10^{-8} cm. Calculate (i) force acting on the hydrogen atom and (ii) the maximum kinetic energy of the atom. 2 CO3
(c) An oscillating block-spring system has a total energy of 2.00 J, amplitude of 13.0 cm, and a maximum speed of 1.20 m/s. Find (i) the spring constant, (ii) the mass of the block, and (iii) the frequency of oscillation. 2 CO3
3. (a) A damped harmonic oscillator consists of a block ($m = 2.00$ kg), a spring ($k = 10.0$ N/m), and a damping force (F). Initially, it oscillates with amplitude of 25.0 cm and $\omega/\gamma = 5$. (a) What is the value of b ? (b) What is the maximum frictional force (F') acting on the block? 3 CO3
(b) A progressive wave moving along +x direction has an angular frequency of 240 rad/s and a wavelength of 185 cm. Calculate (i) the speed of the wave, (ii) frequency of oscillating particle, (iii) time period, and (iv) write the equation for the wave. 2 CO3
4. (a) Suppose the displacement of a SHM is $x = -A \sin(\omega t + \delta)$. Find out the phase difference between velocity and displacement with necessary graph. 2 CO2
(b) A spring block system is considered. Find out the relation between instantaneous acceleration and displacement. 2 CO2
5. (a) If you have inductor, capacitor and resistor, then draw a circuit comprising all. Obtain a differential equation for that circuit and also find ω . 2 CO2
(b) Suppose, a travelling wave is moving from right hand side to the left. Now establish an equation for the progressive wave. 2 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, etc.