



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 in graph. 2 CO1
(b) For SHM, “the acceleration is proportional to the displacement”. Justify the statement from Hook’s law. 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) What is spring constant? (ii) At what position (or positions) is the speed of the block 190 cm/s? (iii) What is the maximum velocity of the block? (iv) What is the maximum acceleration of the block? (v) 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) spring constant. 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 condenser of capacity $0.1 \mu\text{F}$, an inductance of 5 mH and a resistance of 300Ω are joined in series. Draw the circuit. Find (i) the circuit is oscillatory or not, (ii) what is the damping frequency, (iii) what is the resonant frequency of the circuit? 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 instantaneous velocity $v(t)$ of a SHM. 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.