

8th November, 11:30 AM– 12:30 PM

Course Code: NS (1001)	Course Name: Applied Physics
Instructor Names: Mr. Javaid Qureshi , Ms. Rabia Tabassum , Mr. M. Rahim , Mr. Waqar Ahmed	
Student Roll No:	Section :

Instructions:

- Attempt all questions.
- Return the question paper with your answer sheet.
- Read each question completely before answering it. There are **3 questions and 2 pages**.
- All the answers must be solved according to the sequence given in the question paper.

Time: 60 minutes.

Max Marks: 30 points

Question 1: Oscillations

CLO - 5

[10]

- a. An oscillator consists of a block attached to a spring ($k = 400 \text{ N/m}$). At some time, t , the position (measured from the system's equilibrium location), velocity, and acceleration of the block are $x = 0.2 \text{ m}$, $v = -15.5 \text{ m/s}$, and $a = -145 \text{ m/s}^2$. Calculate (i) the frequency of oscillation, (ii) the mass of the block
[4]
- b. In a mass-spring system placed horizontally, the mass has a kinetic energy of 3 J and the spring has an elastic potential energy of 2 J when the block is at $x = 2.0 \text{ cm}$. (i) What is the kinetic energy when the block is at $x = 0$? What is the elastic potential energy when the block is at (ii) $x = -2.0 \text{ cm}$ and (c) $x = -xm$?
[2]
- a. For a damped oscillator, $m = 260 \text{ g}$, $k = 84 \text{ N/m}$, and $b = 75 \text{ g/s}$. (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?
[4]

Question 2: Wave Motion

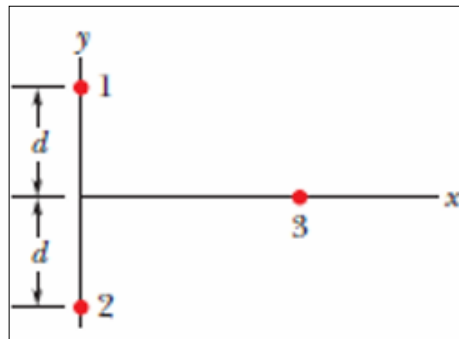
CLO - 6

[10]

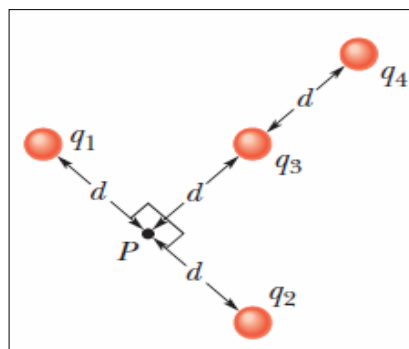
- a. The linear density of a string is $1.6 \times 10^{-4} \text{ kg/m}$. A transverse wave on the string is described by the equation $y = (0.021 \text{ m}) \sin[(2.0 \text{ m}^{-1})x + (30 \text{ s}^{-1})t]$. What are (i) the wave speed and (ii) the transverse velocity, and (iii) the transverse acceleration?
[4]
- b. What phase difference between two identical traveling waves, moving in the same direction along a stretched string, results in the combined wave having an amplitude 1.5 times that of the common amplitude of the two combining waves?
[3]
- c. Discuss the motion of water particles and type of water waves.(not more than 5 lines)
[3]

Question 3: Electric Force and Field**CLO - 7****[10]**

- a. Initially, sphere A has a charge of $=50e$ and sphere B has a charge of $= -20e$. The spheres are made of conducting material and are identical in size. If the spheres then touch, what is the resulting charge on sphere A ? [2]
- b. In Fig-1 particles 1 and 2 of charges $q_1=q_2 = +3.2 \times 10^{-19}\text{C}$ are on a y axis at distance $d = 17\text{cm}$ from the origin. Particle 3 of charge $q_3 = 6.4 \times 10^{-19}\text{C}$ is moved gradually the x axis from $x = 0$ to $x = +5\text{m}$. At what values of x will the magnitude of the electrostatic force on the third particle be (i) Minimum and (ii) Maximum? What are the (iii) minimum and (iv) maximum magnitudes? [4]

**Fig -1**

- c. In Fig-2., the four particles are fixed in place and have charges $q_1 = q_2 = 5e$, $q_3 = 3e$, and $q_4 = 12e$. Distance $d = 5.0\text{ mm}$. What is the magnitude of the net electric field at point P due to the particles? ($e = 1.6 \times 10^{-19}\text{C}$, $k = 9 \times 10^9$) [4]

**Fig-2**

Good Luck 😊