National University of Computer and Emerging Sciences

FAST School of Computing | Fall-2023 | Islamabad Campus

NS-1001: Applied Physics
BS-(AI, SE,DS)

Serial No:

2nd Sessional Exam

Total Time: 1 Hour

Total Marks: 40

Saturday, 4th November, 2023

Course Instructors

Aisha Ijaz, Dr.Tashfeen, Junaid Khan

Signature of Invigilator

Student Name | **Roll No.** | **Course Section** | **Student Signature**

DO NOT OPEN THE QUESTION BOOK OR START UNTIL INSTRUCTED.

Instructions:

1. Attempt on question paper. Attempt all of them. Read the question carefully, understand the question, and then attempt it.
2. No additional sheet will be provided for rough work. Use the back of the last page for rough work.
3. If you need more space, write on the back side of the paper and clearly mark question and part number etc.
4. After asked to commence the exam, please verify that you have Six (6) different printed pages including this title page. There are total of 04 questions.
5. Calculator sharing is strictly prohibited.
6. Use permanent ink pens only. Any part done using soft pencil will not be marked and cannot be claimed for rechecking.

	Q-1	Q-2	Q-3	Q-4	Total
Marks Obtained					
Total Marks	10	10	10	10	40

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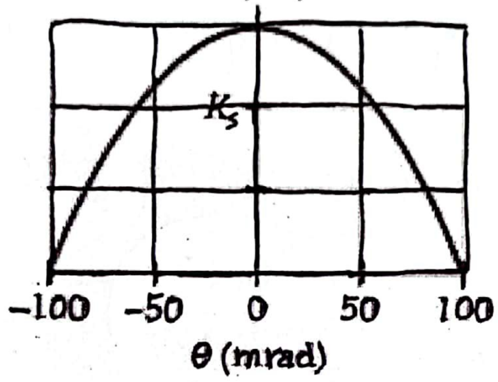
Question 1 [10 Marks]

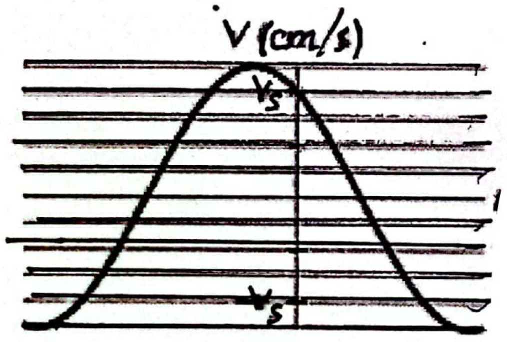
A damped harmonic oscillator consists of a block m=2kg, a spring k=10N/m, and a damping force ($F= -bv$). Initially, it oscillates with an amplitude of 25 cm because of the damping, the amplitude falls to three fourths of this initial value at the completion of four oscillations. (i) What is the value of 'b'.(ii) How much energy has been lost during these four oscillations

Question 2 [5+5]

(i). Figure shows the kinetic energy K of a simple pendulum versus its angle θ from the vertical. The vertical axis scale is set by K_s= 10mJ. The pendulum bob has mass 0.200kg. What is the length of a pendulum?



(ii). What is the phase constant ϕ for an ideal harmonic oscillator with $v(t) = -\omega x_m \sin(\omega t + \phi)$. The vertical axis scale is set by v_s= 4cm/s.



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Question 3 [10]

A warehouse worker exerts a constant horizontal force of magnitude 85N on a 40kg box that is initially at rest on the horizontal floor of the warehouse. When the box has moved a distance of 1.4m its speed is 1m/s. What is the coefficient of kinetic friction between the box and the floor?

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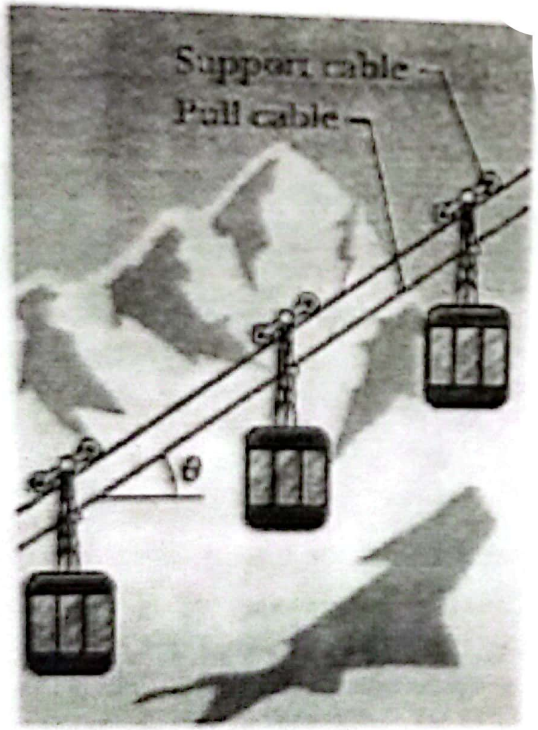
Question 4 [10]

Figure shows a section of a cable- car system. The maximum permissible mass of each car with occupants is 2800kg.The cars riding on a support cable are pulled by a second cable attached to the support tower on each car. Assume that the cables are taut and inclined at angle $\theta=35°$.What is the difference in tension between adjacent sections of pull cable if the cars are at the maximum permissible mass and are being accelerated up the incline at $0.81 m/s^2$?



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Formula Sheet

$f_k = \mu_k F_N, \quad f_{s,\max} = \mu_s F_N.$

For ideal SHO

$x = x_m \cos(\omega t + \phi)$

$$\omega = \sqrt{\frac{k}{m}} \quad \text{(angular frequency)}$$

$v = -\omega x_m \sin(\omega t + \phi)$

$a = -\omega^2 x_m \cos(\omega t + \phi)$ $\quad T = 2\pi\sqrt{\frac{m}{k}}$ (period).

$$\omega = \frac{2\pi}{T} = 2\pi f$$

$$\omega = \sqrt{\frac{k}{m}} \quad \text{(angular frequency)}$$

$$T = 2\pi\sqrt{\frac{m}{k}} \quad \text{(period).}$$

For Damped SHO

$$x(t) = x_m e^{-bt/2m} \cos(\omega' t + \phi),$$

$$\omega' = \sqrt{\frac{k}{m} - \frac{b^2}{4m^2}}.$$

$$E(t) \approx \tfrac{1}{2} k x_m^2 e^{-bt/m}.$$

Or $E(t) = E_o e^{-t/\tau}$ $\quad \tau = m/b$

................................Best Of Luck....................................