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The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Mechanical Engineering

Study Programme	Bachelor of Science Honours in Engineering
Name of the Examination	Final Examination
Course Code and Title	**DMX3302 Engineering Mechanics**
Academic Year	2023/2024
Date	04th March 2025
Time	1330 – 1630 hrs
Duration	**03 hours**

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Six (6)** questions in **Four (4)** pages.
3. **Answer All questions.**
4. This is a Closed Book Test (CBT).
5. Answers should be in clear handwriting.

QUESTION 01 (20 marks)

The vibrations of a system are governed by the differential equation

$$2\ddot{x} + 40\dot{x} + 1800x = 0$$

with the initial conditions $x_0 = 0.001$ m and $\dot{x}_0 = 3$ m/s. Calculate or specify the following.

(a) The natural frequency, ω_n
(b) The damping ratio,
(c) Whether the system is underdamped, critically damped, or overdamped
(d) The undamped period, T
(e) Undamped frequency in Hz, f
(f) The damped natural frequency (if appropriate),
(g) The damped period (if appropriate),
(h) The logarithmic decrement (if appropriate),
(i) The amplitude of vibrations, A
(j) The phase between the response and a pure sinusoid (if appropriate),

QUESTION 02 (20 marks)

Beam AD is supported by a pin support at B and roller support at D Two point loads are applied at A and C as shown in Figure Q2.

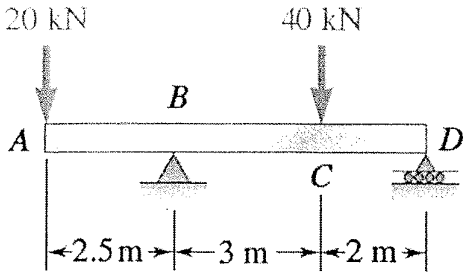


Figure Q2

a) Draw the free body diagram for beam AD.
b) Find the reactions at point B and at point D.
c) Find expressions of bending moment and shear force between AB, BC and CD.
d) Draw the bending moment and shear force diagrams for the beam AD

QUESTION 03 (15 marks)

Two disks A and B have masses $m_A = 3$ kg and $m_B = 2$ kg. Their initial velocities are $(V_A)_1 = 4$ m/s and $(V_B)_1 = 6$ m/s as shown in Figure Q3, just before they collide. If the coefficient of restitution is e = 0.5, determine the speeds of disks just after impact.

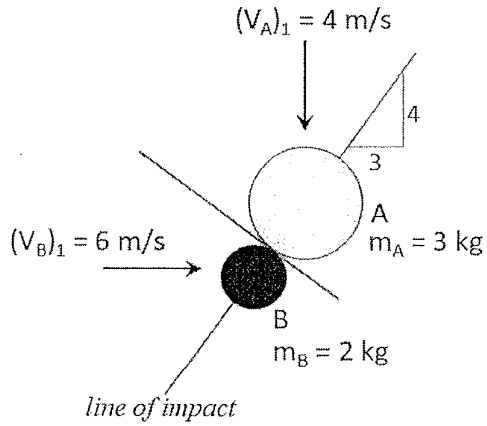


Figure Q3

QUESTION 04 (15 marks)

Three cables are used to tether (keep in position) a balloon as shown. Determine the vertical force P exerted by the balloon at A knowing that the tension in cable AD is 481 N.

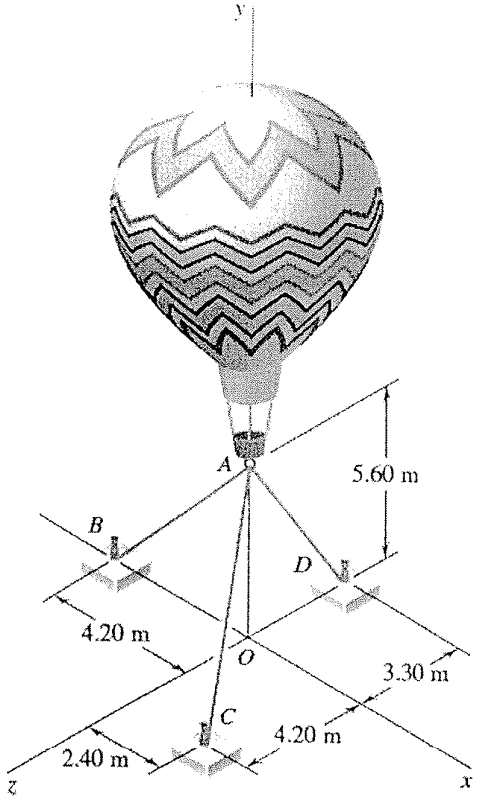


Figure Q3

QUESTION 05 (15 marks)

The 50 kg block A and the 25 kg block B are supported by an incline that is held in the position shown. Knowing that the coefficient of static friction is 0.15 between all surfaces of contact, determine thevalue of θ for which motion is impending..

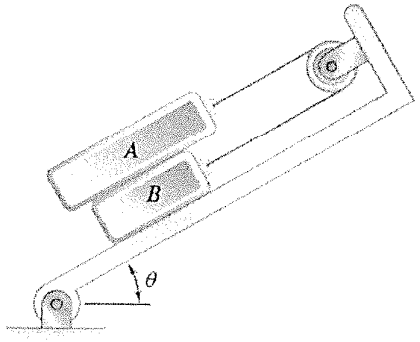


Figure Q5

QUESTION 06 (15 marks)

The uniform slender rod AC (Figure Q6)has a mass **m** and length **L**. It is hinged at point B using a pin joint and is free to rotate about point B. The rod is released from rest when $\theta = 0$ (the rod is horizontal), find the reaction force exerted on the rod by pin B when $\theta = 90°$ (the rod is vertical).

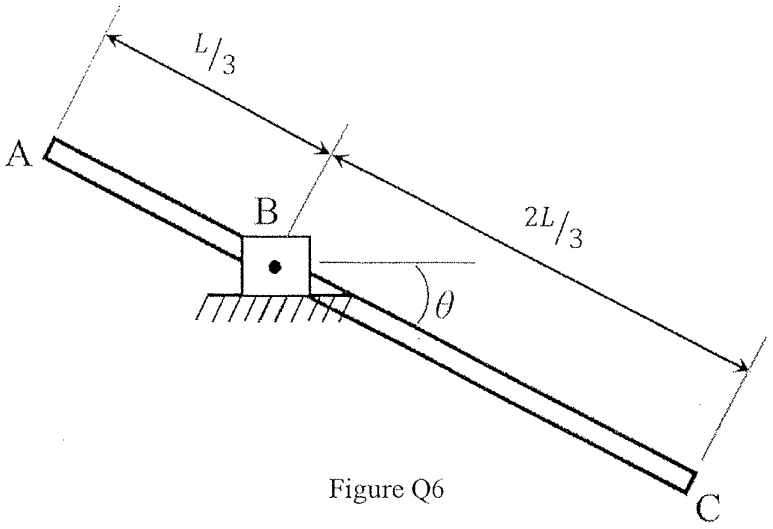


Figure Q6

End of Question Paper