

Name:

Enrolment No:



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES  
End Semester Examination, December 2022

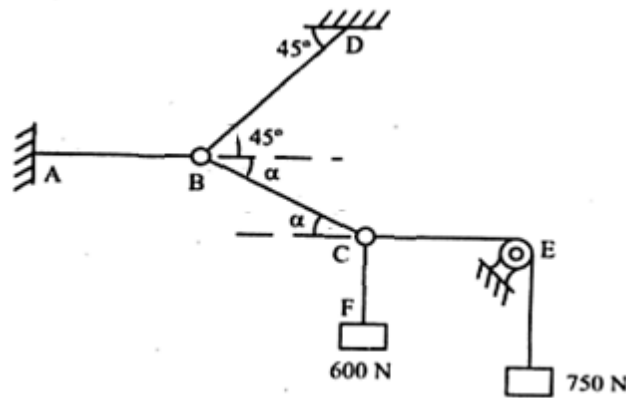
Course: Engineering Mechanics  
Programme: B.Tech ADE, Mechanical and AMNT  
Course code: MECH 2031

Semester: III  
Time: 3 hrs.  
Max. Marks: 100

Instructions: All the questions are compulsory. Assume suitable data if missing.

SECTION A  
(5Qx4M=20Marks)

Q.1 Two rings B and C are held by cables AB, BD, BC and CE as shown in the Fig. Determine the forces transmitted by cables BD and BC.



4

CO2

Q.2 Write down the assumption made in analyzing a frame.

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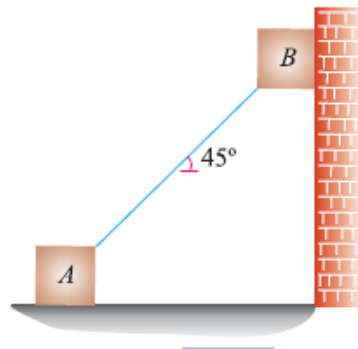
CO1

Q.3 The equation of motion of an engine is given by  $s = 2t^3 - 6t^2 - 5$ , where (s) is in metres and (t) in seconds. Calculate (a) displacement and acceleration when velocity is zero; and (b) displacement and velocity when acceleration is zero.

4

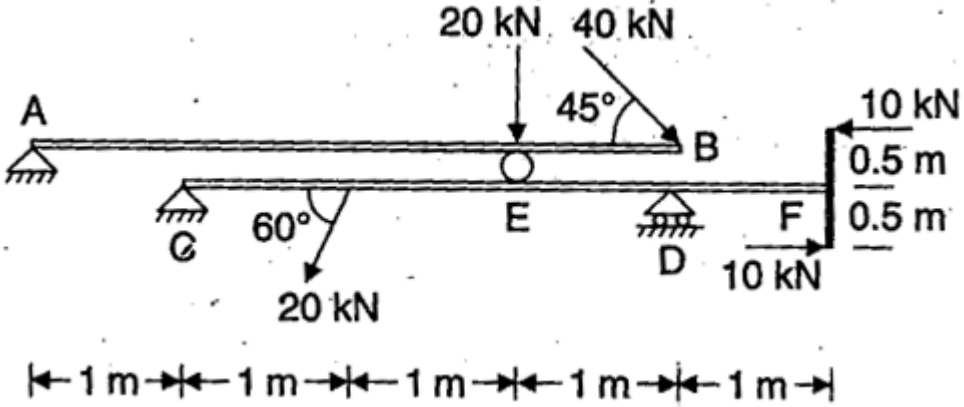
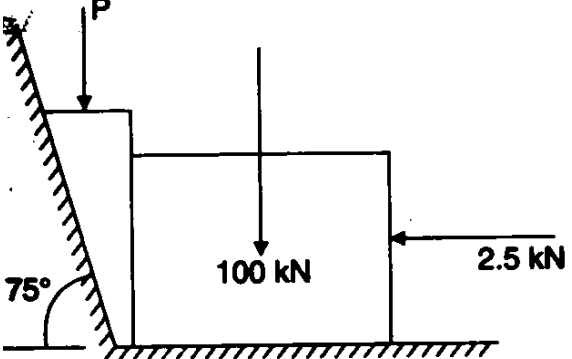
CO2

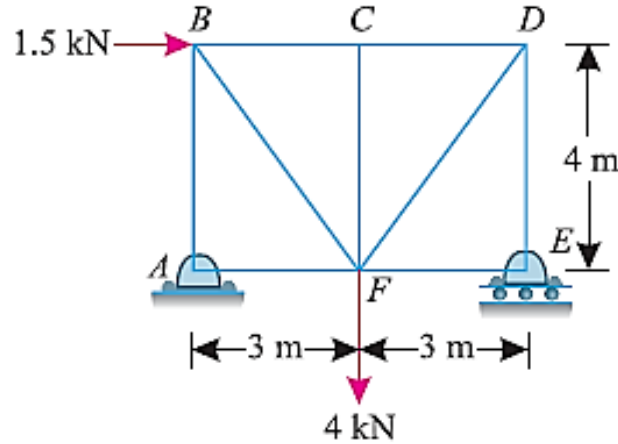
Q.4 Two identical blocks of weight W are supported by a rod inclined at  $45^\circ$  with the horizontal as shown in figure. If both the blocks are in limiting equilibrium. Draw the free body diagram of the system.



4

CO1

Q.5	Discuss the importance of study of vibration. Also, discuss the causes of vibration.	4	CO1
<b>SECTION B</b> <b>(4Qx10M= 40 Marks)</b>			
Q.6	<p>The beam AB and CF are arranged as shown. Determine the reactions at A, C and D due to the loads acting on the beam as shown.</p> 	10	CO3
Q.7	<p>Determine the force P required to start the wedge as shown. The angle of friction for all surfaces of contact is <math>15^\circ</math>.</p> 	10	CO3
Q.8	Find the forces in all the members of truss in magnitude and direction	10	CO3



Q.9 Two stations P and Q are 5.2 km apart. An automobile starts from rest from the station P and accelerates uniformly to attain a speed of 48 kmph in 30 seconds. This speed is maintained until the brakes are applied. The automobile comes to rest at the station Q with a uniform retardation of  $1 \text{ m/s}^2$ . Determine the total time required to cover the distance between these two stations.

OR

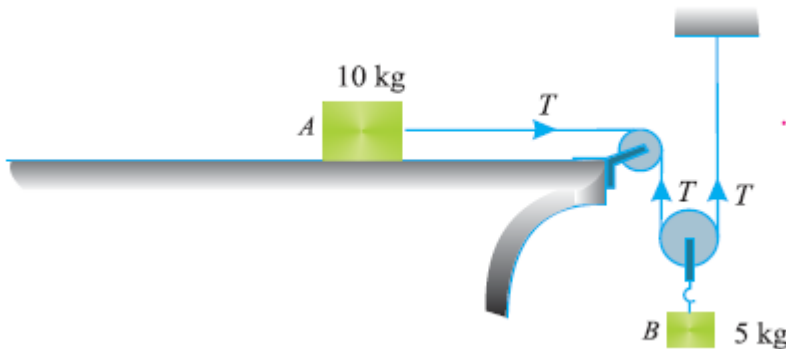
A projectile is aimed at a mark on the horizontal plane through the point of projection. It falls 20 metres short when the angle of projection is  $25^\circ$ ; while it overshoots the mark by 30 metres when the same angle is  $55^\circ$ . Find the angle of projection to hit the mark. Assume no air resistance.

10

CO2

**SECTION-C**  
**(2Qx20M=40 Marks)**

Q.10 A block of wood A of mass 10 kg is held on a rough horizontal table. An elastic string connected to the block passes over a smooth pulley at the end of the table and then under a second smooth pulley carrying a body B of mass 5 kg as shown in figure.

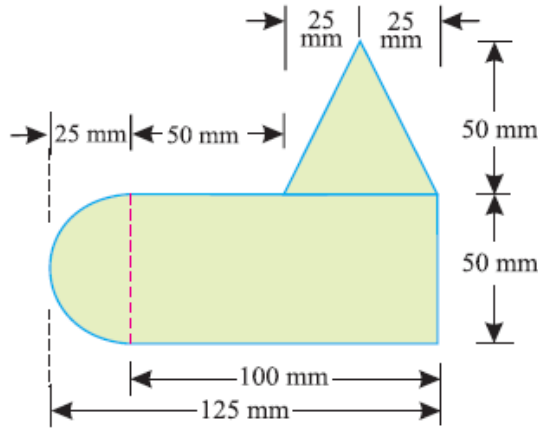


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CO3

The other end of the string is fixed to a point above the second pulley. When the 10 kg block is released, it moves with an acceleration of  $g/9$ . Determine the value of coefficient of friction between the block and the table.

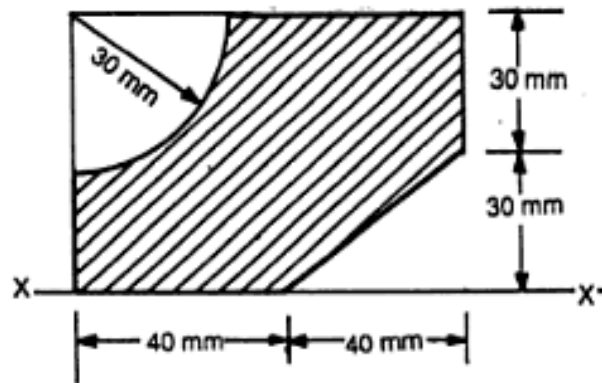
Q.11 Find the moment of inertia of the given lamina about its centroidal axes parallel to the horizontal and vertical axes.



OR

Find the moment of inertia of the shaded portion:

- (a) about the given axis X-X and;
- (b) about the centroidal axis parallel to the given X-X axis



20

CO2