

R09

Code No: 09A1BS05

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B.Tech I Year Examinations, June - 2014

ENGINEERING MECHANICS

(Common to CE, ME, CHEM, MCT, MMT, AE, AME, MIE, PTE, CEE, MSNT, AGE)

Time: 3 hours

Max. Marks: 75

Answer any five questions  
All questions carry equal marks

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- 1.a) Give the classification of force system.
  - b) Forces  $P_1$ ,  $P_2$  and  $P_3$  of magnitudes 20 kN, 30 kN and 45 kN are concurrent in the space at the origin  $O(0, 0, 0)$  and are directed through the points  $A(3, 2, 4)$ ,  $B(2, 6, 5)$  and  $C(3, -3, 5)$  respectively. Determine the resultant of the system of forces.
- 2.a) State the equilibrium conditions for the coplanar (i) concurrent (ii) non-concurrent force system.
  - b) A ladder of weight 30 kg is supported at wall and floor as shown in figure 1. A man of weight 65 kg rides on a rung 8 m above floor level. Considering all contact surfaces smooth, all contact surfaces smooth, determine the reactions at  $P$  and  $Q$ .

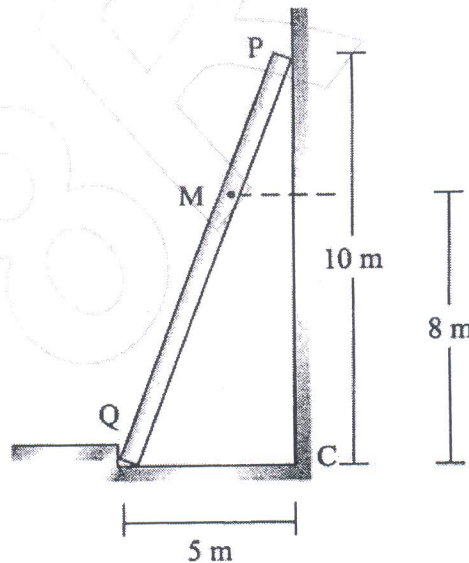


Figure: 1

- 3.a) Find the centroid of the shaded area as shown in figure 2.

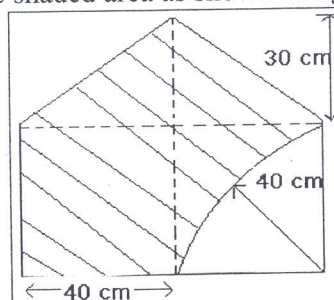


Figure: 2

- b) State Pappus theorems.

- 4.a) State and prove parallel axis theorem of area moment of inertia.  
 b) Determine the product of inertia of a rectangle of base 'a' and height 'h' about x axis and y axis by direct integration.
- 5.a) State the assumption made in the analysis of perfect frames.  
 b) Find the forces in all the members of the truss as shown in the figure 3 using method of joints.

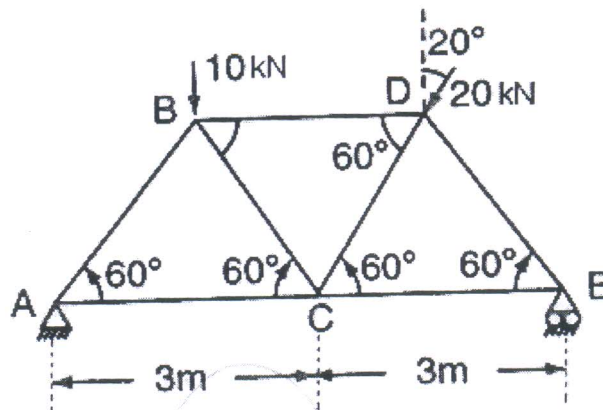


Figure: 3

6. A projectile is fired from the edge of a 100 m cliff with an initial velocity of 150 m/s at an angle of  $30^\circ$  with the horizontal. Neglecting air resistance, find  
 a) The horizontal distance from the gun to the point where the projectile strikes the ground.  
 b) The greatest elevation above the ground reached by the projectile.
7. A 60N block is released from rest on an inclined plane which is making an angle of  $30^\circ$  to the horizontal. The block starts from 'A', slides down a distance of 1.2m and strikes a spring with a stiffness of 8 kN/m. The coefficient of friction between the inclined plane and the block is 0.25. Determine:  
 a) The amount the spring gets compressed and  
 b) Distance the block will rebound up the plane from the compressed position.
- 8.a) Determine reaction at supports as shown in figure 4 using the principle of virtual work.

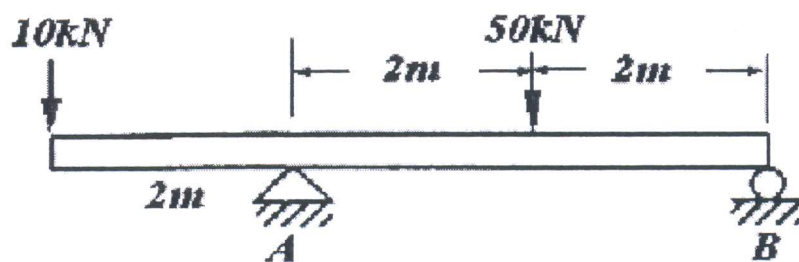


Figure: 4

- b) A weight of 100 N is raised by two frictionless pulleys of the same diameter shown in the figure 5. Determine the effort  $P$  required to hold the weight in equilibrium using the method of virtual work.

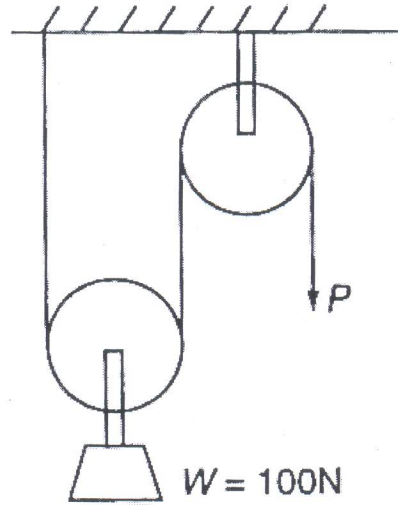


Figure: 5

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