

ESC-CE302 / ESC202 / 002 / 001 : Engineering Mechanics

P. Pages : 4

Time : Three Hours

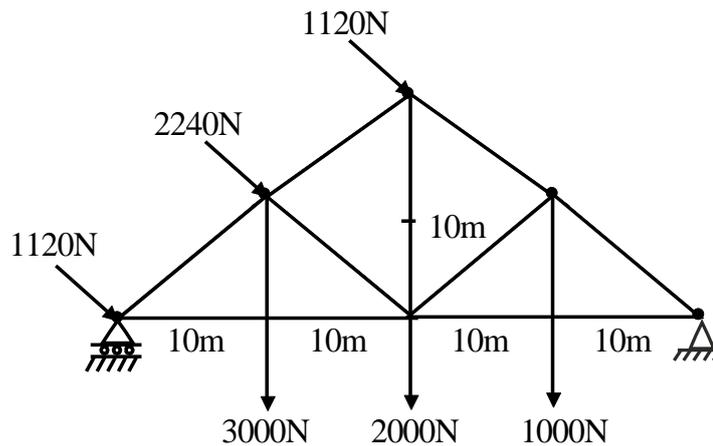


GUG/S/23/13712

Max. Marks : 80

- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Illustrate your answers wherever necessary with the help of neat sketches.
 5. Discuss the reaction, Mechanism wherever necessary.

1. a) The house roof truss shown in figure carries the given loads. The wind loads are perpendicular to the inclined members. Determine the resultant and its intersection with AB. 12



- b) Explain the principle of transmissibility with neat sketch. 4

OR

2. a) Three bars, pinned together at B and C and supported by hinges at 'A' and 'D' as shown in figure. Form a four link mechanism. Determine the value of P that will prevent motion. 8

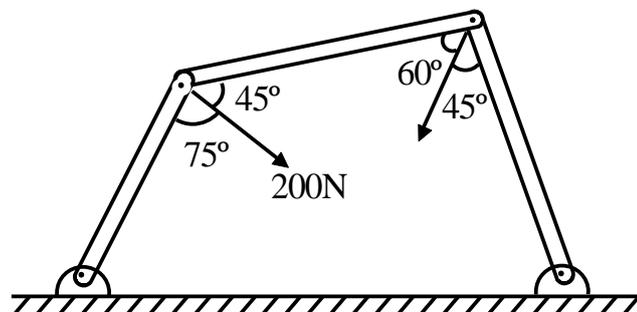
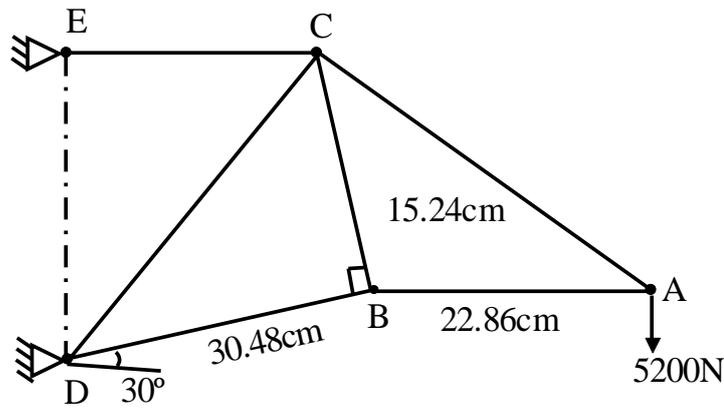


Figure 2. a

- b) State and explain resolution and composition of forces in cartesian co-ordinate system. 4

- c) State the Varignon's theorem with example. 4

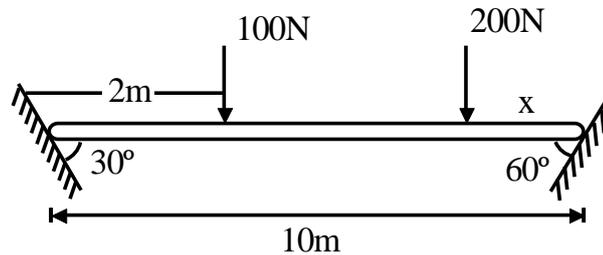
3. a) Determine the force in each member of the crane truss shown in figure. 12



- b) State the laws of dry friction. 4

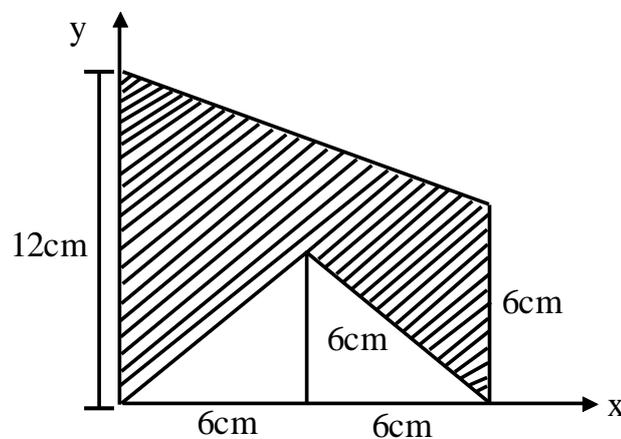
OR

4. a) A horizontal bar of 10 m long and of negligible weight rest on a rough inclined planes as shown in figure. If the angle of friction is 15° , how close to B may the 200N force be applied before motion impends? 10



- b) Define limiting friction & derive $\frac{T_2}{T_1} = e^{\mu\theta}$ for coil friction. 6

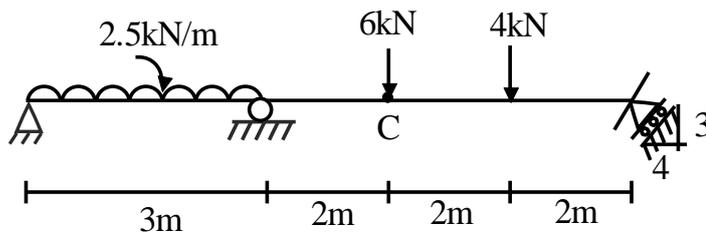
5. a) Determine the centroid of the lines that form the boundary of the shaded area shown in figure. 11



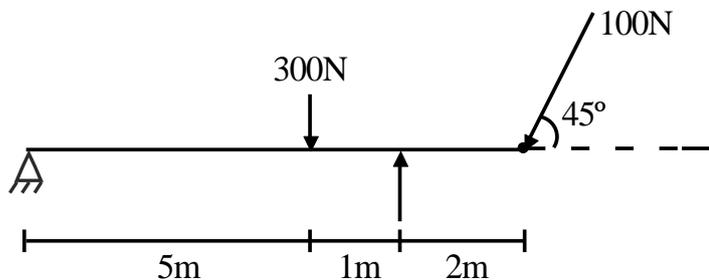
- b) State and explain perpendicular axis theorem and parallel axis theorem. 5

OR

6. a) Determine the reaction at A, B & E by using principle of virtual work. There is an internal hinge at C. 8



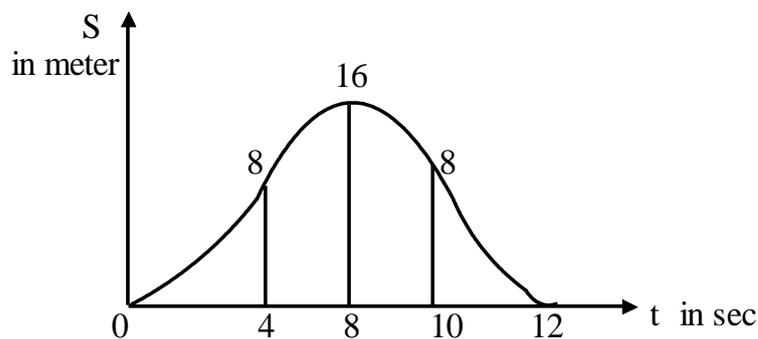
- b) Using virtual work principle, calculate the support reaction at A & B for the beam as shown in figure. 8



7. a) A ball is thrown vertically into the air at 36 m/s after 3sec, another ball is thrown vertically, what initial velocity must the second ball have to pass the ball at 30 meter from the ground. 12
- b) Explain what are the normal and tangential components of velocity & acceleration? How these component are used to calculate radius of curvature. 4

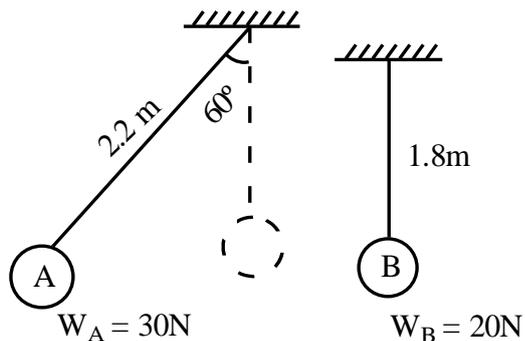
OR

8. One cycle of an s-t curve is shown in figure the curve is second degree parabola and have zero slope at $t = 0$, $t = 8$ and $t = 12$ sec.



- i) Sketch the v-t curve and a-t curve 10
- ii) Compute V_{\max} and a_{\max} . 6
9. a) Explain the terms 'elastic impact' and 'coefficient of restitution'. 4

- b) The ball A and B as shown in figure are attached to stiff rods of negligible weight. The ball A is released from rest and allow to strike the ball B. If $e = 0.6$ determine the maximum angle θ through which the ball B will swing what is the maximum and minimum tension in the attached ball 'B'. If the impact lasts per 0.02 sec find the average impact force. 12



OR

10. a) State the D'Alembert's principle. 4
- b) Determine the acceleration of each body in figure assuming the pulleys to be frictionless and of negligible weight. The incline plane is smooth. 12

