S.V. National Institute of Technology, Surat

B.Tech. I - SEMESTER I (Div- G to K)

AM – 104: Engineering Mechanics

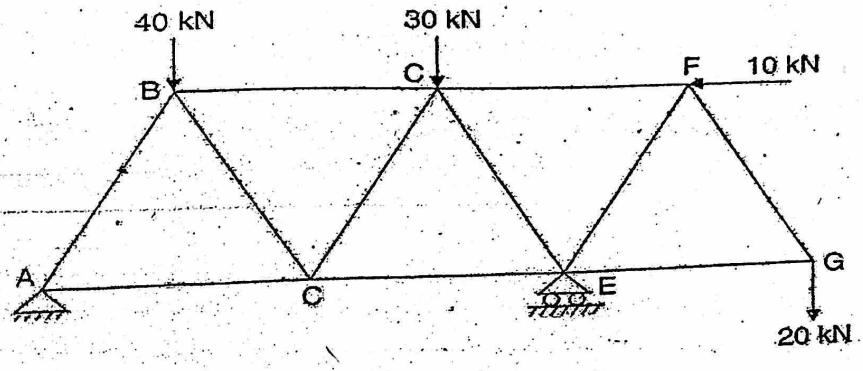
END SEMESTER EXAMINATION- 2019

Time: 8.30 to 11.30 am | **05/12/2019** | **Marks: 100**

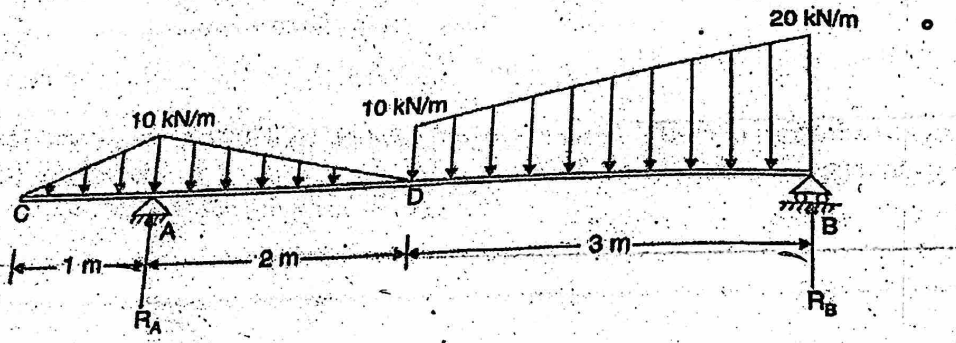
Instructions:

(i) *Figures to the right indicate full marks for the question.*
(ii) *Make use of sketches/diagrams wherever possible.*
(iii) *Assume missing data suitably and mention the same clearly.*

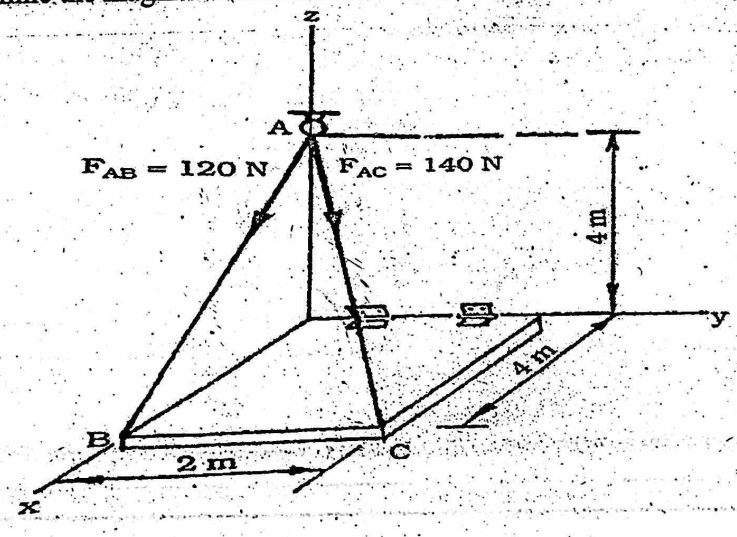
Q1. (CO-1) Analyse the truss shown in figure below. All members are 3 m long. [10]



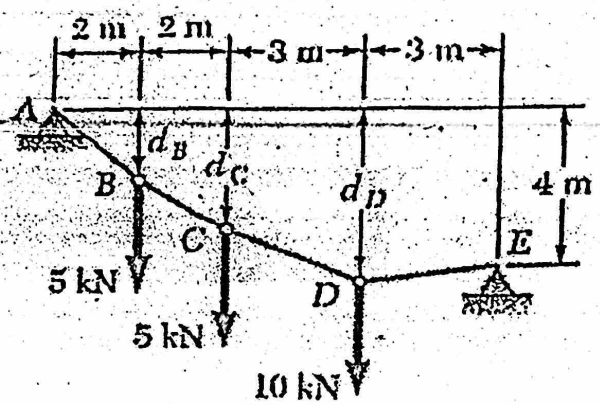
Q2. A) (CO-1) Find the reactions developed at supports A and B of the loaded beam shown in figure. [05]



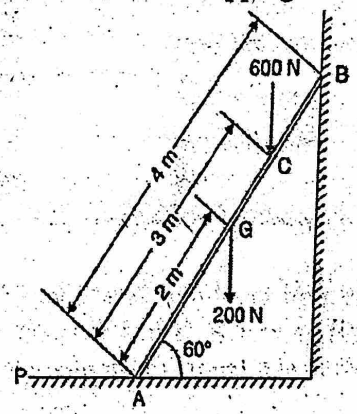
B) Two cables exert forces F_{AB} = 120 N and F_{AC} = 140 N on the ring at A as shown in figure. Determine the magnitude and directions of the resultant force acting at A. [05]



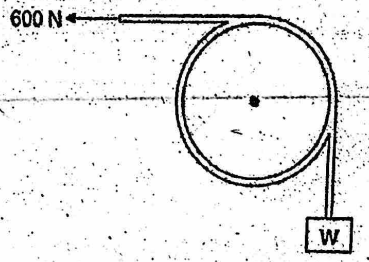
Q3. (CO-1) Determine (a) distance d_c for which portion DE of the cable is horizontal, (b) the corresponding reactions at A and E.



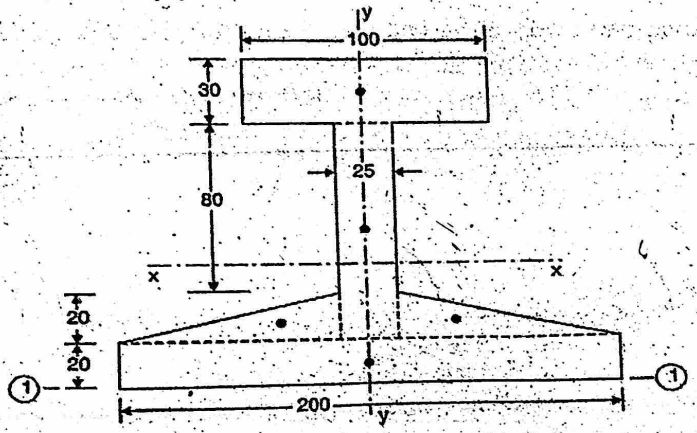
Q4. A) (CO-2) A ladder of length 4 m, weighing 200 N is placed against a vertical wall as shown in figure below. The coefficient friction between the wall and the ladder is 0.2 and that between the floor and the ladder is 0.3. In addition to self weight, the ladder has to support a man weighing 600 N at a distance of 3 m from A. Calculate the minimum horizontal force to be applied a A to prevent slipping. [06]



B) A rope making $1\frac{1}{4}$ turns around a stationary horizontal drum is used to support a weight W. If the coefficient of friction is 0.3, what range of weight can be supported by exerting a 600N force at the other end of the rope? [04]

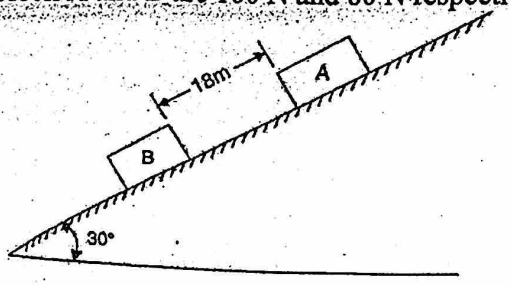


Q5. (CO-3) Determine the moment of inertia of the built-up section shown in figure below, about its centroidal axes x-x and y-y . [10]

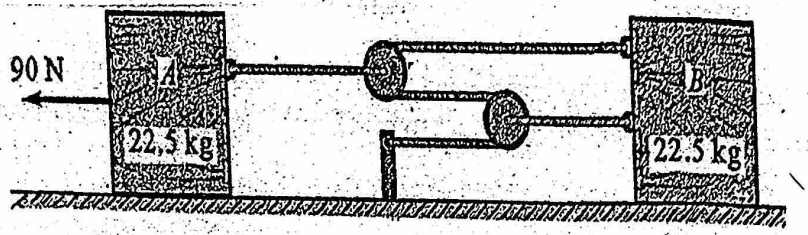


Q6. (CO-4) **Attempt any two:** [10]

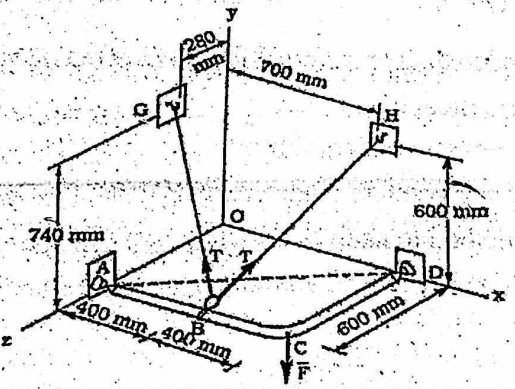
A) Two blocks A and B released from rest on a 30^0 inclines, when they are 18-m-apart. The coefficient of friction under the upper block A is 0.2 and that under the lower block B is 0.4 as shown in figure below. In what time block A reaches the block B? After they touch and move as a single unit, what will be the contact force between them? Weights of the block A and B are 100 N and 80 N respectively.



B) A system shwon in figure is at rest initially. Neglecting friction determine velocity of block A after it has moved 2.7 m when pulled by a force of 90 N. [10]

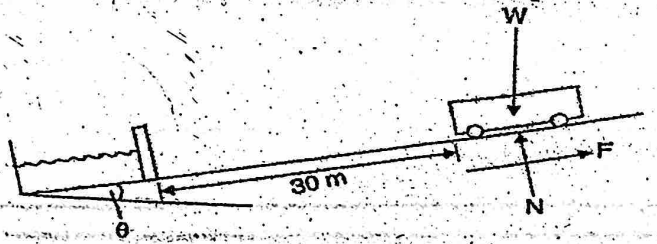


(C) A Frame ACD is hinged at A and D and supported by a cable which passes through a ring at B and is attached t hooks at G and H. Knowing that the tension in the cable is 1125 N, determine the moment about the diagonal AD of the force exerted on the frame by portion BH of cable. [10]



Q7. (CO)-5) **Attempt any two:** [10]

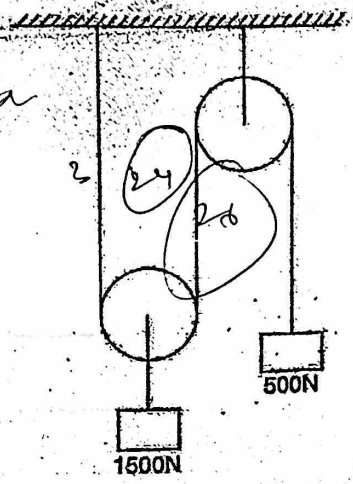
A) A wagon weighing 500 kN starts from rest runs 30 m down one percent grade and strikes the bumper post. If the rolling resistance of the track is 5 N/kN, find the velocity of the wagon when it strikes the post. If the bumper spring which compresses 1 mm for every 15 kN determine by how much this spring will be compressed.



b) Determine the tension in the strings and the velocity of 1500 N block shown in figure, 5 seconds after starting from [10]

- Rest
- Starting with a downward velocity of 3 m/sec.

Assume pulleys as weightless and frictionless.



c) A pile hammer, weighing 15 kN drops from a height of 600 mm on a pile of 7.5 kN. How deep does a single blow of hammer drive the pile if the resistance of the ground to pile is 140 kN? [10]

(CO- 6) [10]

Q8.1) Explain pappus guldinus theorem.
2) Explain varignon's theorem.
3) Define vibration and enlist its type.
4) What is equation of simple harmonic motion? Also write the equation and circular frequency.
5) What do you understand by external force of internal force?
6) Define second moment of the area.
7) Write down the equation of equilibrium.
8) Explain determinate truss and indeterminate truss.
9) Which are the method to analyze the truss.
10) Explain Damped & undamped vibration.

****