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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

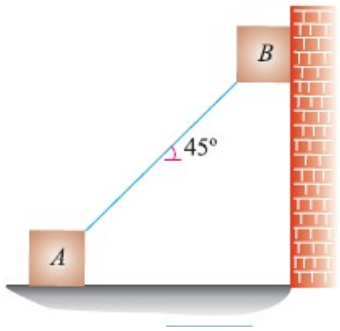
End Semester Examination, December 2017

Program: B.Tech | **Semester – I**
Subject (Course): Engineering Mechanics | **Max. Marks : 100**
Course Code : MECH 1002 | **Duration : 3 Hrs**
No. of page/s: 06

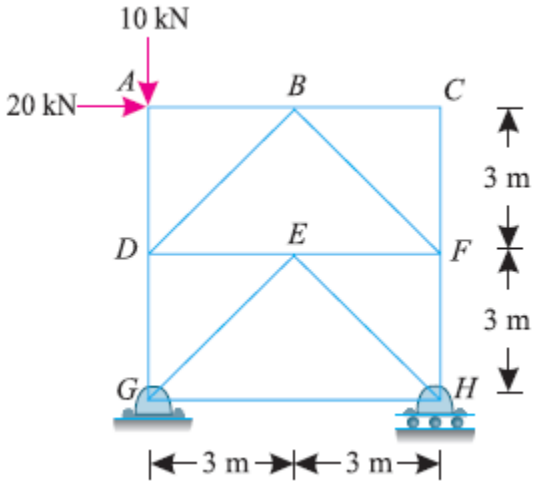
Note: Attempt all the questions. There is internal choice in section B and section C. Assume suitable data if missing.

Section 'A' (5x4=20 marks)

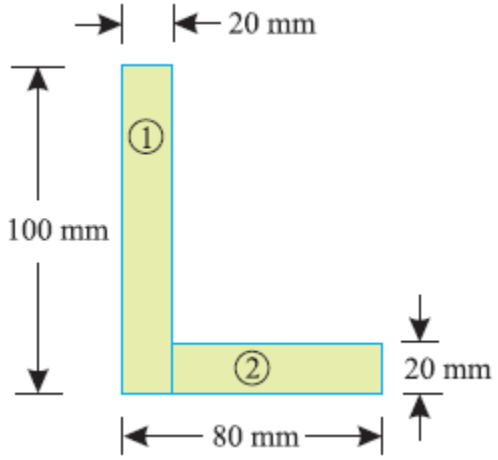
1. Find the magnitude of the two forces, such that if they act at right angles, their resultant is 10 N, but if they Act at 60°, their resultant is 13 N.
2. Two identical blocks of weight W are supported by a rod inclined at 45° with the horizontal as shown in figure. If both the blocks are in limiting equilibrium. Draw the free body diagram of the system.



3. Show that the frame shown in figure is perfect frame.

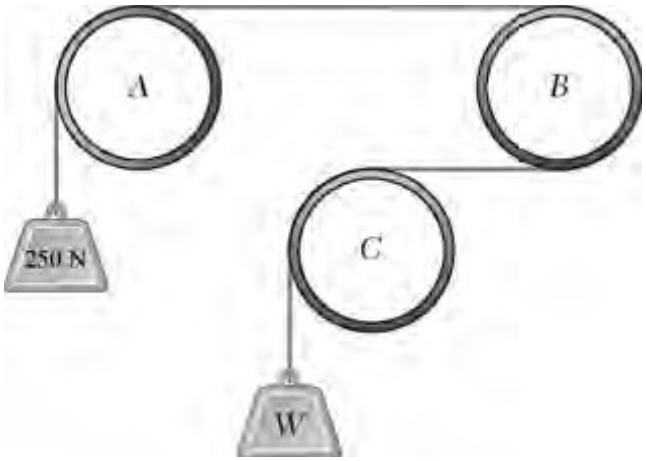


4. The equation of motion of a particle moving in a straight line is given by: $s = 18t + 3t^2 - 2t^3$ where (s) is in meters and (t) in seconds. Find: (1) Velocity and acceleration at start and (2) time, when the particle reaches its maximum velocity
5. Find the centroid of an unequal angle section 100 mm × 80 mm × 20 mm.

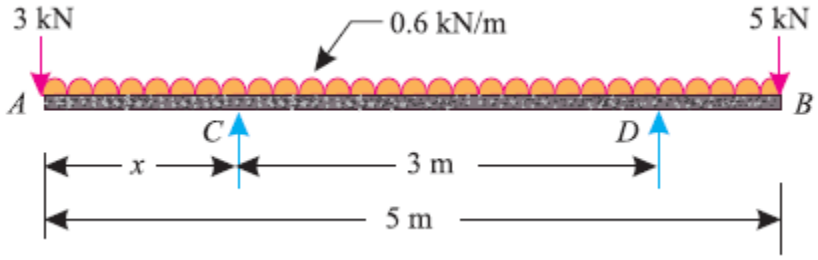


Section 'B' (5x12=60 marks)

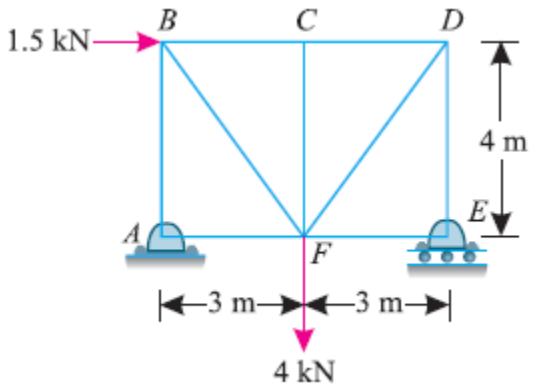
6. A cable is placed around three similar parallel pipes as shown below. Knowing that the coefficients of friction are μ_s =0.25, determine the smallest weight *W* for which equilibrium is maintained.



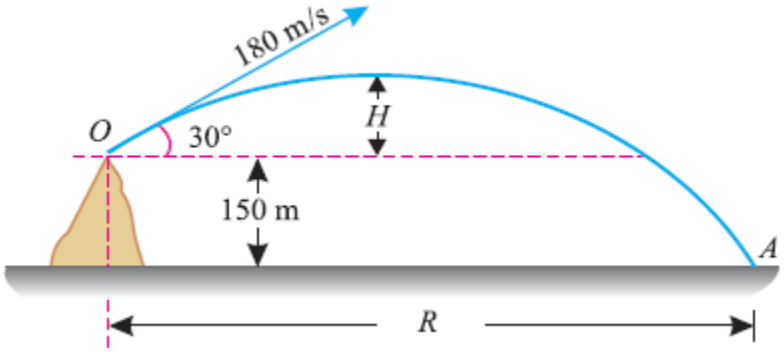
7. A beam AB 5 m long, supported on two intermediate supports 3 m apart, carries a uniformly distributed load of 0.6 kN/m. The beam also carries two concentrated loads of 3 kN at left hand end A, and 5 kN at the right hand end B as shown in figure. Determine the location of the two supports, so that both the reactions are equal.



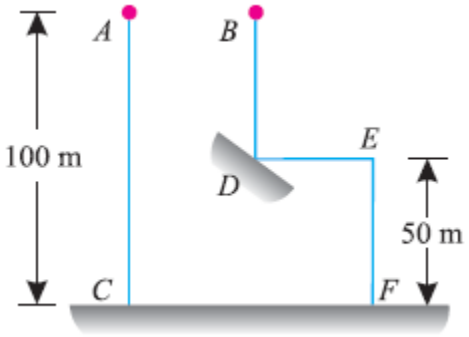
8. Find the forces in all the members of truss in magnitude and direction.



9. A projectile fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance find :
   a. The greatest elevation above the ground reached by the projectile; and
   b. Horizontal distance from the gun to the point, where the projectile strikes the ground



10. Two particles A and B are dropped simultaneously from rest two points both 100 m above the ground. Particle A falls on the ground, while the particle B in its mid path, hits a fixed plane inclined to the horizontal as shown in the figure. As a result of this impact, the direction of its velocity becomes horizontal. Compare the times of fall of the particles A and B to reach the ground.

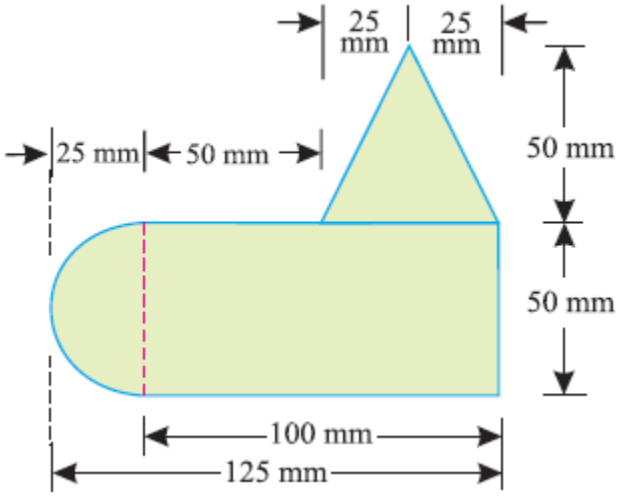


OR

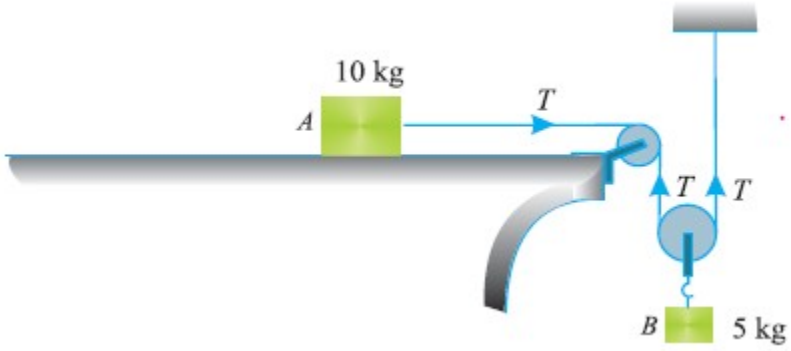
A stone is dropped from the top of a tower 60 m high. Another stone is projected upwards at the same time from the foot of the tower, and meets the first stone at a height of 18 m. Find the velocity with which the second stone is projected upwards.

Section 'C' (2x20=40 marks)

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



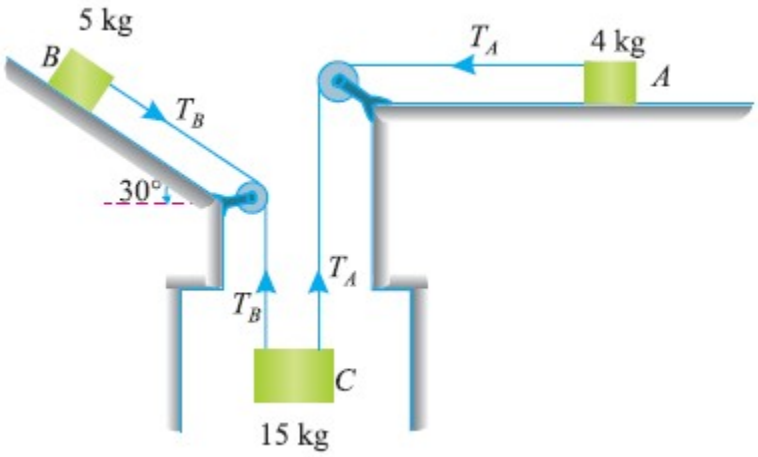
12. A block of wood A of mass 10 kg is held on a rough horizontal table. An elastic string connected to the block passes over a smooth pulley at the end of the table and then under a second smooth pulley carrying a body B of mass 5 kg as shown in figure.



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.

OR

A system of bodies A,B and C in figure is released from rest. Find:
(i) Acceleration of the masses
(ii) Tension in the two strings.
Take coefficient of friction for the contact surfaces of bodies A and B as 0.4.


5 kg
B
T_B
30°
T_B
T_A
T_A
4 kg
A
C
15 kg