

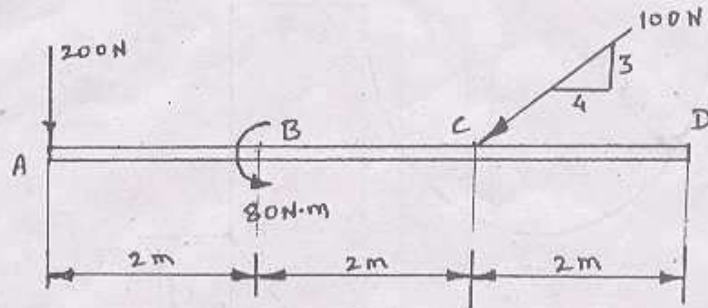
Question No. 1 is compulsory.

- (2) Attempt any four questions out of remaining six questions.
- (3) Assume suitable data if necessary and mention them clearly.
- (4) Take $g = 9.81 \text{ m/s}^2$.

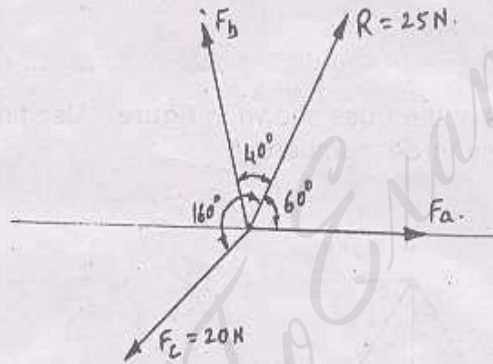
Engg. Mechanics, Dec '07, Reg. 1

1. Solve any four of following :-

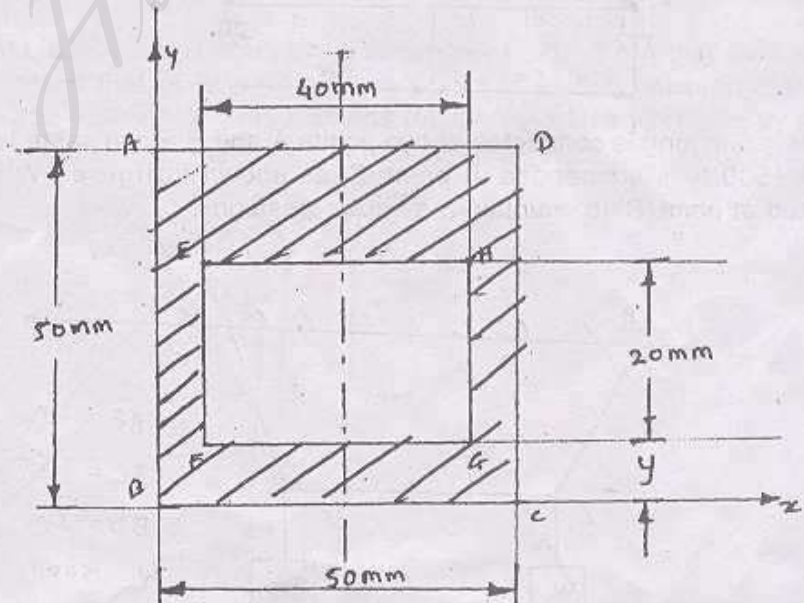
(a) Resolve a system of forces shown in figure into a force and couple at point 'A'.



(b) A force $R = 25 \text{ N}$ has components F_a , F_b and F_c as shown in figure. If $F_c = 20 \text{ N}$. Find F_a and F_b .

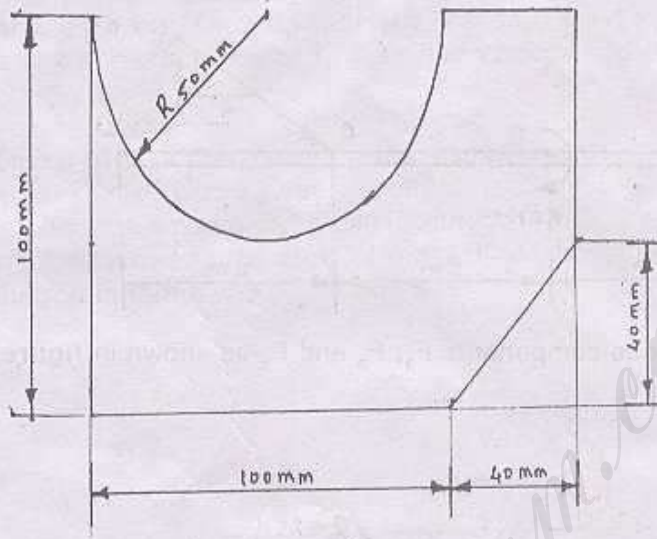


- (c) Derive an expression for the Moment of Inertia of a rectangle about its centroidal Y-axis.
- (d) State and prove Work-Energy principle.
- (e) Water leaks from the ceiling 16 m high, at the rate of 5 drops per second. Find the distance between first and second drop when the first drop has just touched the ground.
- (f) Find distance Y so that the CG of given area in figure has co-ordinates (25, 20).

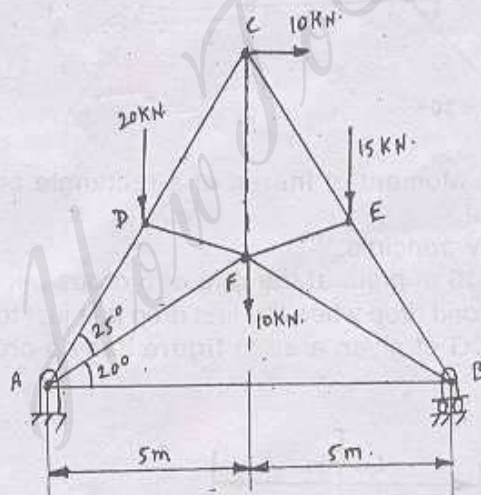


2. (a) Determine using fundamentals, the maximum height reached and the maximum distance travelled on horizontal surface by a projectile fired with velocity of 25 m/s at an angle of 40° . Derive expression for maximum height and maximum distance on horizontal surface and verify your answers. 10
- (b) Find Moment of inertia of given area about centroidal X and Y axis. Refer figure. 10

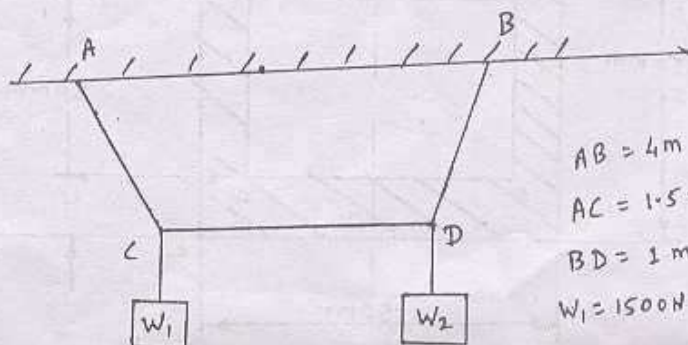
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3. (a) Find forces in all the members of the truss shown in figure. Also find support reactions. Use method of sections for any three members. 10



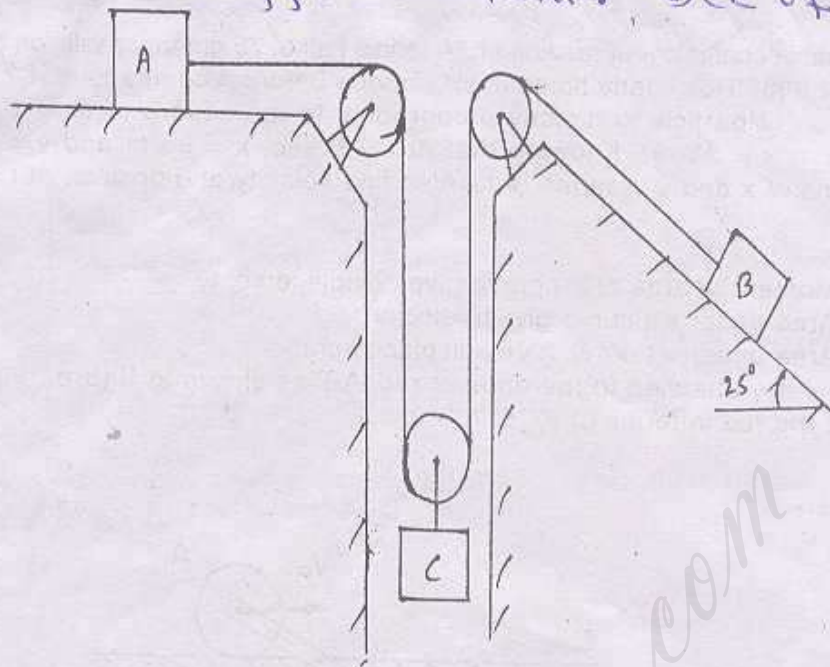
- (b) Rope AB 4.5 m long is connected at two points A and B at the same level and 4 m apart. Load of 1500 N is suspended at point 'C' as shown in figure. What load should be connected at point 'D' to maintain the shown position? 10



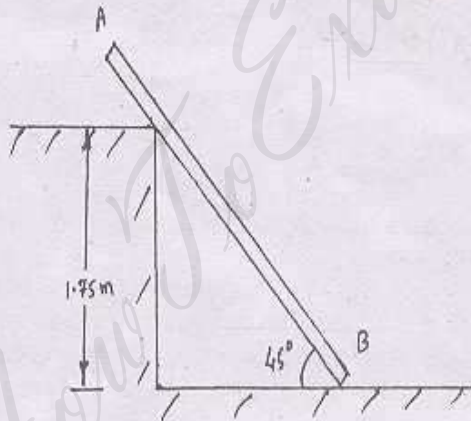
$AB = 4\text{ m}$
 $AC = 1.5\text{ m}$
 $BD = 1\text{ m}$
 $W_1 = 1500\text{ N}$

4. (a) Find acceleration of block A, B and C shown in the figure when the system is released from rest. Mass of block A, B and C is 5 kg, 10 kg and 50 kg respectively. Co-efficient of friction for block A and B is 0.3. Neglect weight of pulley and rope friction.

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- (b) Determine minimum value of co-efficient of friction so as to maintain the position shown in figure. Length of Rod AB is 3.5 m and it weighs 250 N. 10



5. (a) Find the velocity of block A and B when block A has travelled 1.2 m along inclined plane. Mass of A is 10 kg and that of B is 50 kg. coefficient of friction between block A and inclined plane is 0.25. Pulley are mass less and frictionless. Use work energy principle. Refer figure. 10

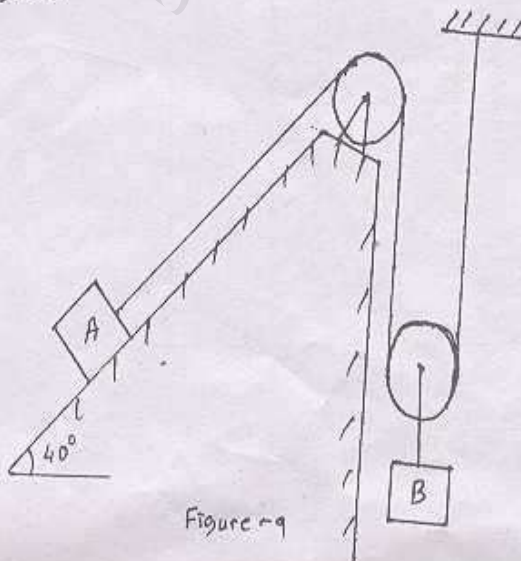


Figure -9

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Con. 5385-CD-8403-07.

- (b) Explain what is tangential and normal acceleration. A particle is moving in x-y plane and its position is defined by $\vec{r} = \left[\frac{3}{2} t^2 \right] \mathbf{i} + \left[\frac{2}{3} t^3 \right] \mathbf{j}$. Find radius of curvature when $t = 2$ sec. 10
6. (a) Explain what is coefficient of restitution. A tennis ball of 75 gm mass falls on ground through a height of 3 m. How many times it will bounce before it comes to rest? Take $e = 0.7$. 10
(b) Acceleration of particle is directly proportional to the square of time 't'. When $t = 0$, particle is at $x = 24$ m. Knowing that at $t = 6$ sec, $x = 96$ m and $v = 18$ m/s. Find expressions of x and v in terms of t . Also find velocity and position at $t = 2$ sec. 10
7. (a) Prove that— 10
(i) Moment of area of a-t curve gives displacement.
(ii) Area under a-t curve gives velocity
(iii) Area under v-t curve gives displacement.
(b) Two wheels are attached to the ends of rod 'AB' as shown in figure. Find the angular velocity of the rod in terms of V_B , L , α and θ . 10

