

10-06-2026 FE (SEM-I) (NEP-2020) EM QP CODE: 20015144

Time: 2 Hrs

Marks: 60

N. B. (1). Question no. 1 is compulsory.

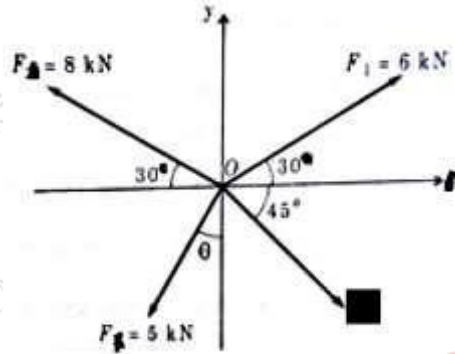
(2) Attempt any three question from remaining five question.

(3) assume suitable date if necessary and mention the same clearly.

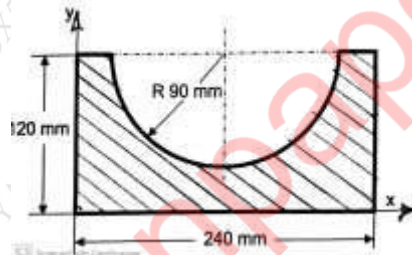
(4) Take $g = 9.81 \text{ m/s}^2$.

Q.1 Attempt any five.

- a) Find out the magnitude of the force F_4 and the direction of the force F_3 so that the resultant of the four forces is zero. 3

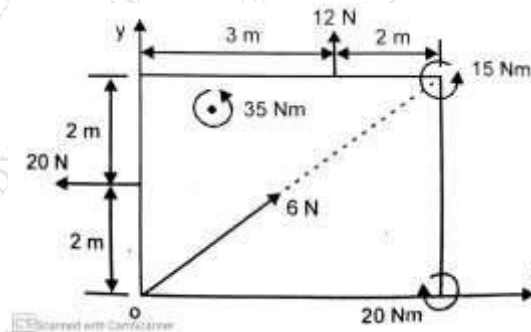


- b) Find the centroid of shaded area with respect to given axis. 3

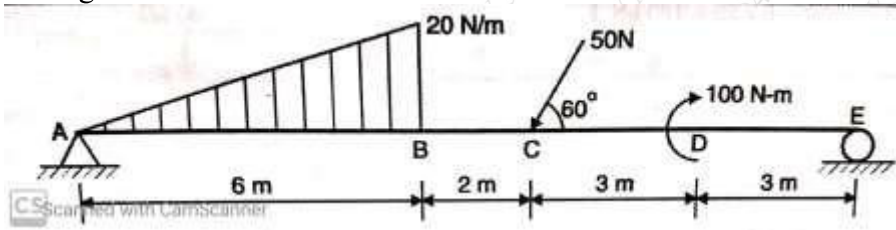


- c) Write note on D H parameters. 3
 d) A car at 72 kmph applies brakes and comes to rest in 8 sec. Find the minimum coefficient of friction between wheel and road. 3
 e) Explain robot kinematics. 3
 f) During a test, a car, moves in a straight line such that its velocity is defined by $v = 0.3(9t^2 + 2t) \text{ m/s}$ where 't' is in seconds. Determine its position and acceleration when $t = 3 \text{ sec}$. Take at $t = 0$ $x = 0$ 3

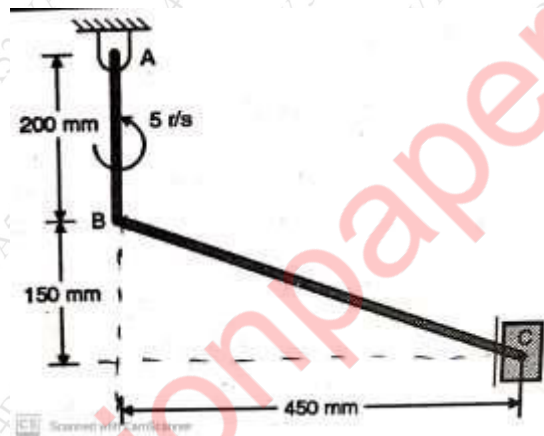
- Q.2 a) Replace the system of forces and couples by a single force and locate the point on the x-axis through which the line of action of the resultant passes. 8



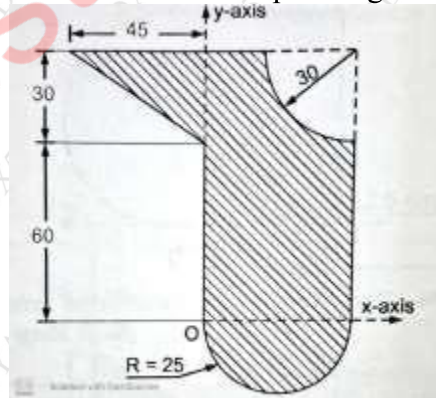
- b) Find the reactions at supports A and E for the beam loaded as shown in the Fig. 7



- Q.3 a) The lines of actions of three forces concurrent at origin O pass respectively through point A (-1, 2, 4), B (3, 0-3), C (2,2, 4). Force $F_1 = 40$ N passes through A, $F_2 = 10$ N passes through B, $F_3 = 30$ N passes through C. Find the magnitude and direction of their resultant. 7
- b) In the mechanism shown the angular velocity of link AB is 5 rad/sec anticlockwise. At the instant shown, determine the angular velocity of link BC and velocity of piston C. 8

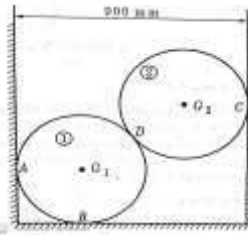


- Q.4 a) Find the centroid of shaded area with respect to given axis. 7

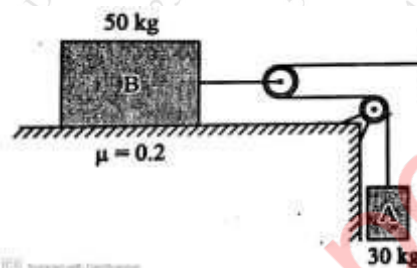


- b) The motion of a particle is defined by the position vector $r = 6t \mathbf{i} + 4t^2 \mathbf{j}$ where r is in metres and t is in seconds. At the instant when $t = 3$ sec, find (i) Tangential and Normal components of accelerations (ii) Radius of curvature. 8

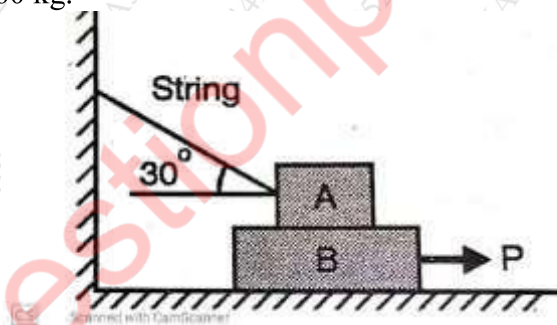
- Q.5 a) Two smooth spheres of weight 100 N and of radius 250 mm each are in equilibrium in a horizontal channel of width 900 mm as shown. Find the reaction at the surface of contact A, B, C, D assuming all the surfaces to be smooth. 7



- b) If the system is released from rest, find the acceleration of the blocks and the tension in the cable. Refer Fig. 8



- Q.6 a) Find force requires to pull block B as shown in Fig. Coefficient of friction between A and B is 0.3 and between B and floor is 0.25. Mass of A = 40 kg and B = 60 kg. 7



- b) The magnitude and direction of velocity of two identical smooth balls before central oblique impact are as shown in figure. Assuming, $e = 0.9$, determine the magnitude and direction of the velocity of each ball after impact. 8

