

## FE Sem-I (NEP 2020) June 2026

Time: 2 Hrs

Marks: 60

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

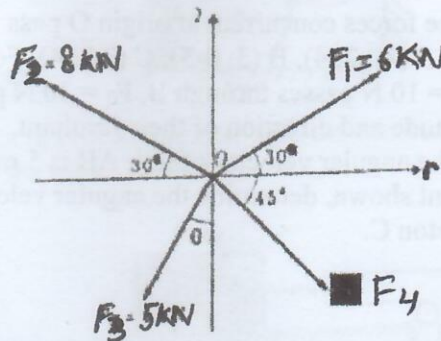
(2) Attempt any three question from remaining five question.

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

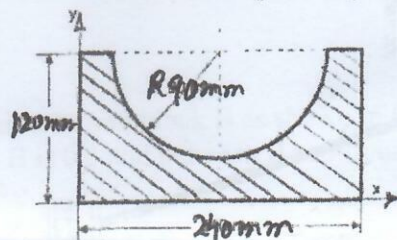
(4) Take  $g = 9.81 \text{ m/s}^2$ .

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

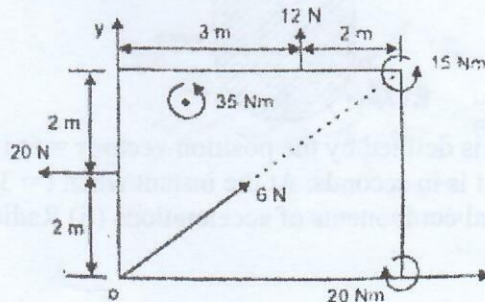


- b) Find the centroid of shaded area with respect to given axis. 3

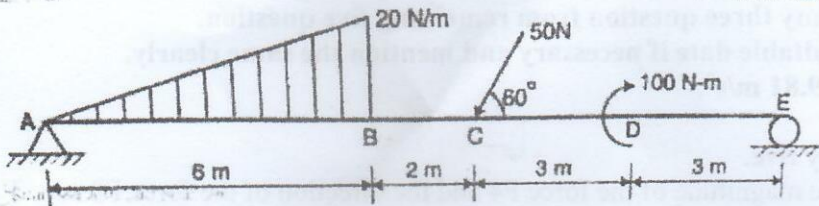


- c) Write note on D H parameters. 3  
 d) A car at 72 kmph applies brakes and comes to rest in 8 sec. Find the minimum coefficient of friction between wheel and road. 3  
 e) Explain robot kinematics. 3  
 f) During a test, a car, moves in a straight line such that its velocity is defined by  $v = 0.3(9t^2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

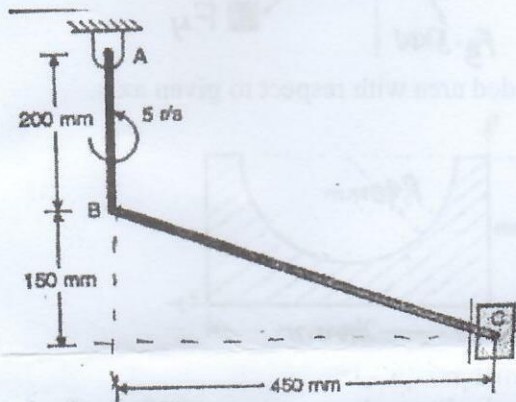
- Q.2 a) Replace the system of forces and couples by a single force and locate the point on the x-axis through which the line of action of the resultant passes. 8



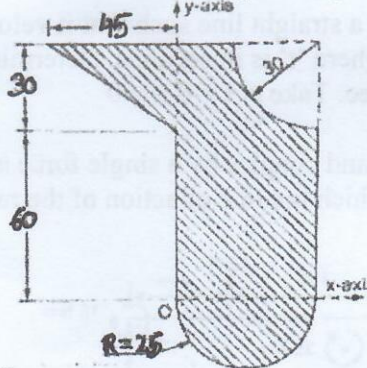
- b) Find the reactions at supports A and E for the beam loaded as shown in the Fig.



- 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.
- 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.

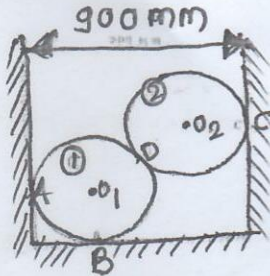


- Q.4 a) Find the centroid of shaded area with respect to given axis.

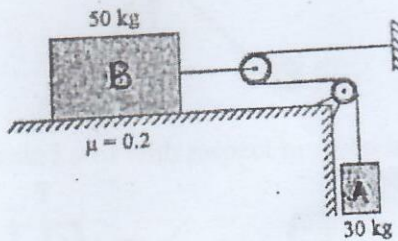


- b) The motion of a particle is defined by the position vector  $\mathbf{r} = 6t \mathbf{i} + 4t^2 \mathbf{j}$  where  $\mathbf{r}$  is in metres and  $t$  is in seconds. At the instant when  $t = 3$  sec, find (i) Tangential and Normal components of accelerations (ii) Radius of curvature.

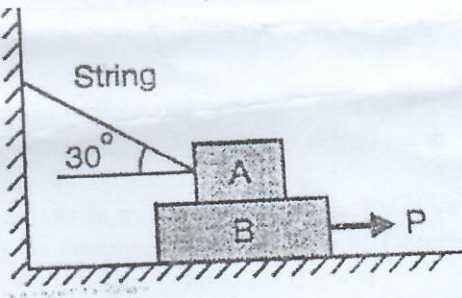
- Q.5 a) Two smooth spheres of weight 100 N and of radius 250 mm each are in equilibrium in a horizontal channel of width 900 mm as shown. Find the reaction at the surface of contact A, B, C, D assuming all the surfaces to be smooth. 7



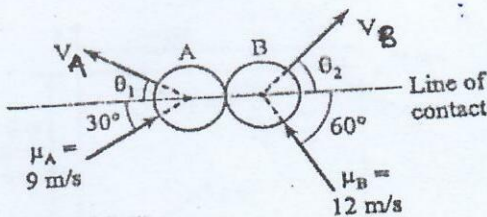
- b) If the system is released from rest, find the acceleration of the blocks and the tension in the cable. Refer Fig. 8



- 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



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Correction ✓

