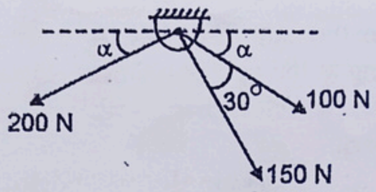
FE Sem-I (ALL) NEP 2020 1/1/2025

Time: 2 Hrs **Max. Marks: 60**

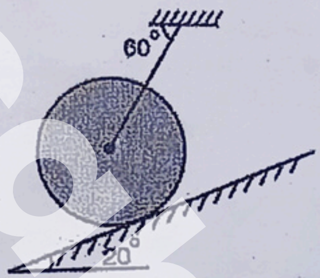
N. B. (1) Question No.1 is compulsory.
(2) Attempt any 3 questions from remaining five questions.
(3) Assume suitable data if necessary and mention the same clearly.
(4) Take $g = 9.81\ m/s^2$, unless otherwise specified.

Q1. Solve any Five

a) For the system shown, determine: (03)
(i) The required value of α, and if resultant of three forces is to be vertical.
(ii) The corresponding magnitude and direction of the resultant.



b) A cylinder having a 25 kg mass is suspended as shown in fig. Calculate the tension in the string and the reaction from the slope. (03)



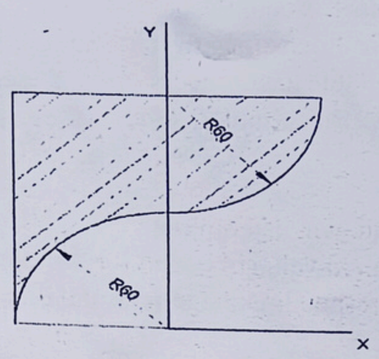
c) A wooden block of 100 N weight rests on a horizontal plane as shown in figure. Determine the force P required to just impend the motion. For the surface $\mu s = 0.4$ & $\mu k = 0.25$. (03)

d) A force acts at the origin in the direction defined by the angles $\theta_y = 65^0$ & $\theta_z = 40^0$. Knowing that the x-component of the force is 750 N. Determine (i) the value of θx (ii) other components. (iii) Magnitude of the force. (03)

e) The car moves in a straight line such that for a short time its velocity is defined by $v = (9t^2 + 2t)$ m/s. where t is in seconds. Determine the position and acceleration when t = 3 sec. (03)

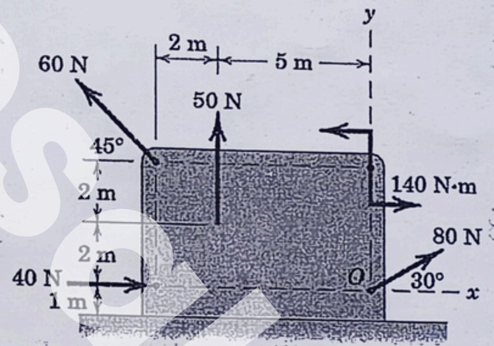
f) Explain The following with neat sketches
i) Direct central impact ii) Oblique central impact. (03)

Q 2 A) Find the coordinate of the centroid for the shaded part of the lamina with respect to given reference axis. (07)

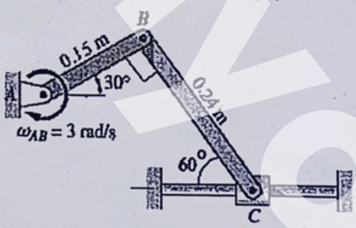


B) A particle follows the path $y = 5 + 0.3x^2$, At certain instant when $x = 2m$, its speed is 10 m/s and increasing at the rate of 0.5 m/s^2. Determine the components of velocity and total acceleration of the particle, when $x = 2$. (08)

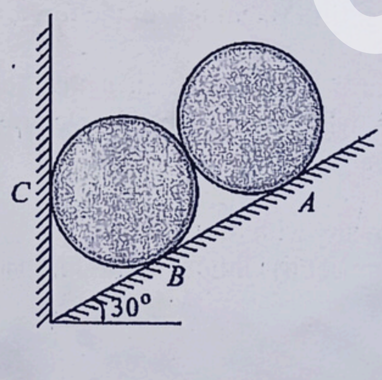
Q 3 A) Following figure shows the four forces and one couple which act on the plate shown. Find the resultant force and locate its position from point 'O' (07)



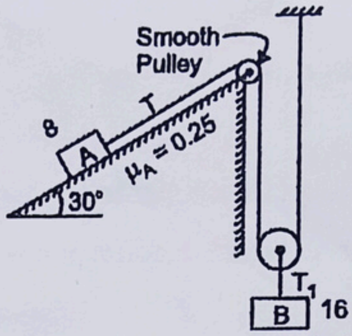
B) When the mechanism is in the position shown, the angular velocity of bar *AB* is 3 rad/s clockwise. Using instantaneous center of rotation, calculate the angular velocity of bar *BC* and the velocity of slider *C* for this position. (08)



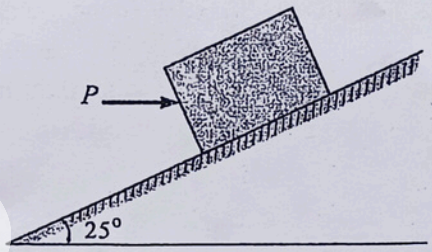
Q 4. A) Two identical rollers each of mass 50 kg are supported by an inclined plane and a vertical wall as shown in fig. Assuming smooth surfaces, find the reactions induced at the point of support A, B and C. (07)



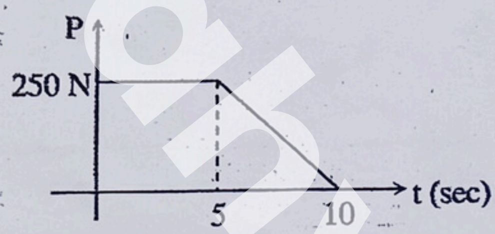
B) In the figure shown, the two blocks are originally at rest. Neglecting the masses of the pulleys and considering the coefficient of friction between the block A and inclined plane as 0.25, determine (i) the acceleration of each block and (ii) the tension in the cable. $W_A = 8N$, $W_B = 16$ N. (08)



Q 5. A) A block of weight 800 N is acted upon by a horizontal force P as shown in fig. Knowing that the coefficient of friction between the block & the incline are $\mu_s = 0.35$, $\mu_k = 0.25$. Determine the range of force P required to keep the block in equilibrium. (07)

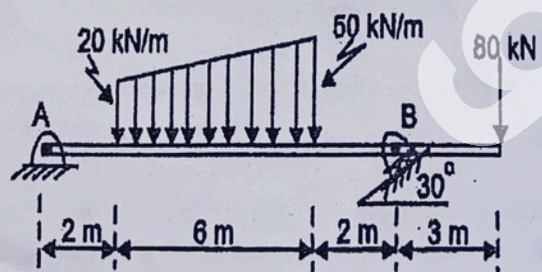


B) A block of 50 kg resting on a horizontal surface is acted upon by a horizontal force P which varies as shown in figure, If the coefficient of friction between the block & surface is 0.2. Find velocity of block at t = 5sec & t = 10 sec Also determine time when the block will come to rest. At t=0, V=0 (08)



Q 6.A) Classify Robot Mechanics and explain main parts of a robotic arm with neat sketch. (07)

B) For the beam loaded as shown in figure, Calculate the support reactions at A and B. (08)



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