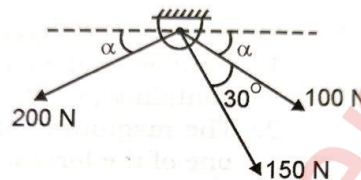


Time: 2 Hrs**Max. Marks: 60**

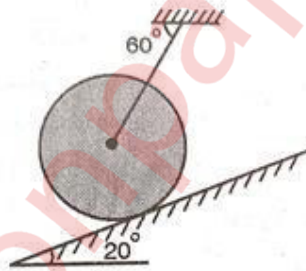
- N. B. (1) Question No.1 is compulsory.
 (2) Attempt any 3 questions from remaining five questions.
 (3) Assume suitable data if necessary and mention the same clearly.
 (4) Take $g = 9.81 \text{ m/s}^2$, unless otherwise specified.

Q1. Solve any Five

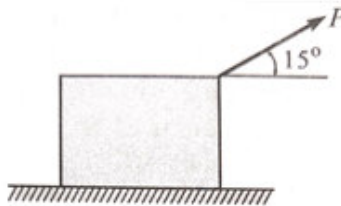
- a) For the system shown, determine: (03)
 (i) The required value of α , and if resultant of three forces is to be vertical.
 (ii) The corresponding magnitude and direction of the resultant.



- 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)

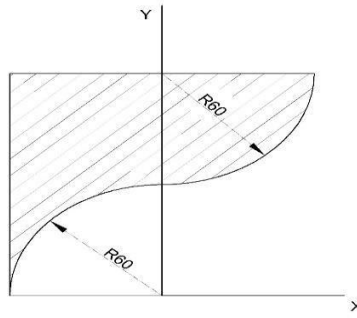


- c) A wooden block of 100 N weight rests on a horizontal plane as shown in figure. Determine the force P required to just impend the motion. For the surface $\mu_s = 0.4$ & $\mu_k = 0.25$. (03)

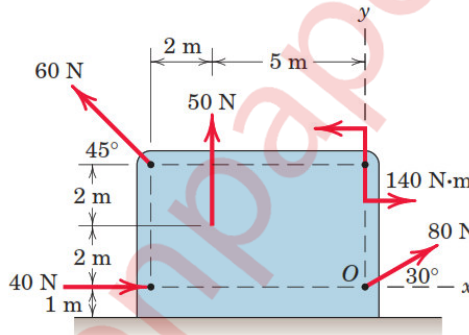


- d) A force acts at the origin in the direction defined by the angles $\theta_y = 65^\circ$ & $\theta_z = 40^\circ$. Knowing that the x-component of the force is 750 N. Determine (i) the value of θ_x (ii) other components. (iii) Magnitude of the force. (03)
- e) The car moves in a straight line such that for a short time its velocity is defined by $v = (9t^2 + 2t) \text{ m/s}$, where t is in seconds. Determine the position and acceleration when $t = 3 \text{ sec}$. (03)
- f) Explain The following with neat sketches (03)
 i) Direct central impact ii) Oblique central impact.

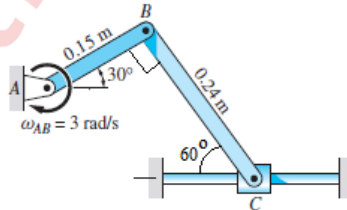
- Q 2 A) Find the coordinate of the centroid for the shaded part of the lamina with respect to given reference axis. (07)



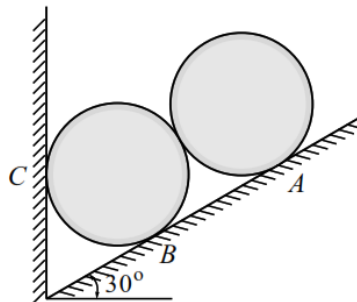
- B) A particle follows the path $y = 5 + 0.3x^2$. At certain instant when $x = 2\text{m}$, its speed is 10 m/s and increasing at the rate of 0.5 m/s^2 . Determine the components of velocity and total acceleration of the particle, when $x = 2$. (08)
- Q 3 A) Following figure shows the four forces and one couple which act on the plate shown. Find the resultant force and locate its position from point 'O'. (07)



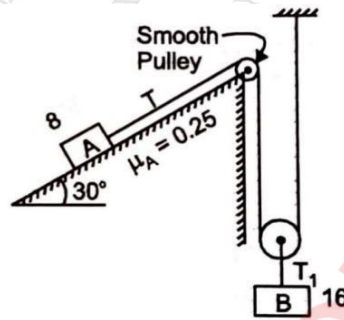
- B) When the mechanism is in the position shown, the angular velocity of bar AB is 3 rad/s clockwise. Using instantaneous center of rotation, calculate the angular velocity of bar BC and the velocity of slider C for this position. (08)



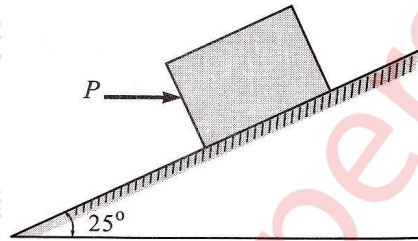
- Q 4. A) Two identical rollers each of mass 50 kg are supported by an inclined plane and a vertical wall as shown in fig. Assuming smooth surfaces, find the reactions induced at the point of support A, B and C. (07)



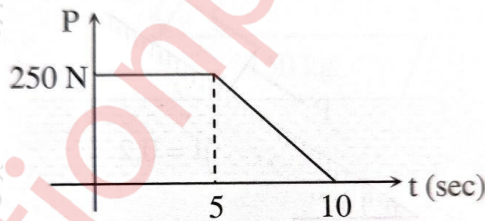
- B) In the figure shown, the two blocks are originally at rest. Neglecting the masses of the pulleys and considering the coefficient of friction between the block A and inclined plane as 0.25, determine (i) the acceleration of each block and (ii) the tension in the cable. $W_A = 8\text{ N}$, $W_B = 16\text{ N}$. (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 $t = 5\text{ sec}$ & $t = 10\text{ sec}$ 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)

