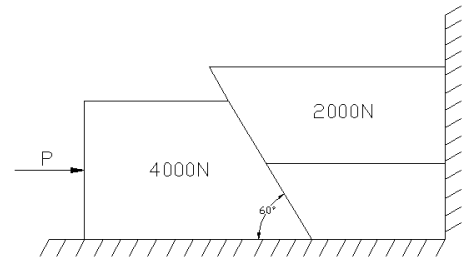
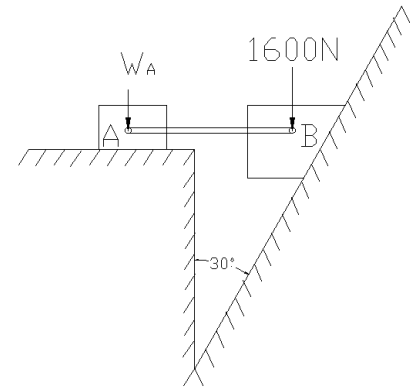


FRICTION (TUTORIAL SHEET 5)

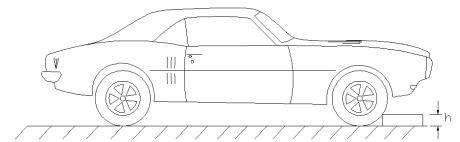
- The coefficient of friction are as follows: 0.25 at the floor, 0.30 at the wall, and 0.20 between blocks. Find the minimum value of force P applied to the lower block that will hold the system in equilibrium.



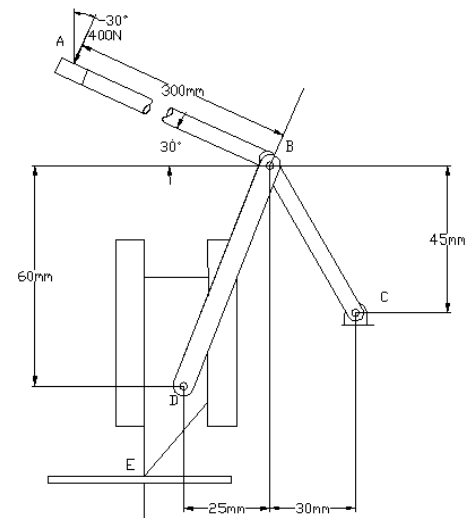
- Two blocks connected by a horizontal link AB are supported on two rough planes as shown. The coefficient of friction for block A on the inclined plane is $\mu = 0.15$. What is the smallest weight W_A for which equilibrium of the system can exist?



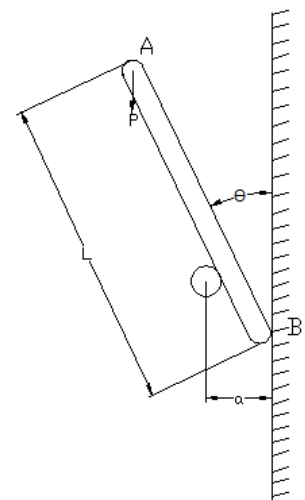
- A car is stopped with its front wheels resting against a curb when its driver starts the engine and tries to drive over the curb. If the radius of the wheels is 280 mm, $\mu = 0.85$ between the tyres and the pavement, and 60% of the weight of the car is distributed over its front wheels and 40% over its rear wheels, determine the largest curb height h that car can negotiate, assuming (a) front-wheel drive, (b) rear wheel drive.



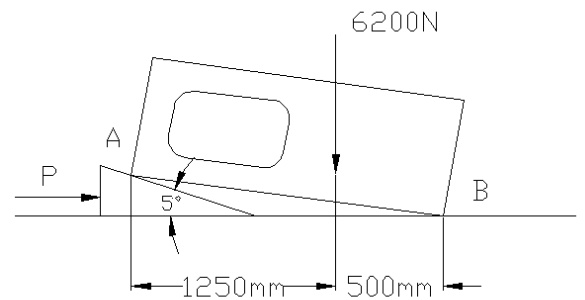
- A shear shown is used to cut and trim electronic-circuit-board laminates. If $\mu_k = 0.2$ between the blade and the vertical guide, determine the force exerted by the edge E of the blade on the laminate.



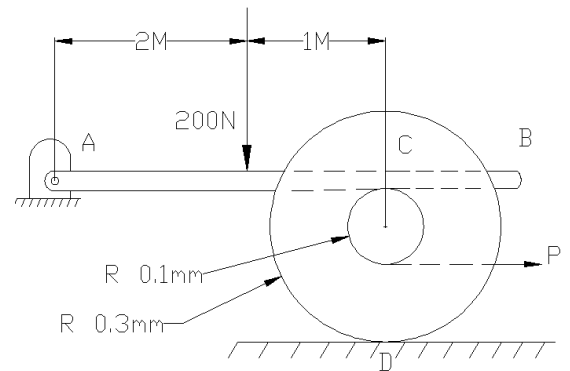
- A slender rod of length L is lodged between peg C and the vertical wall and supports a load P at the end A . knowing that $\theta = 35^\circ$ and that the coefficient of the static friction is 0.20 at both B and C , find the range of values of the ratio L/a for which equilibrium is maintained.



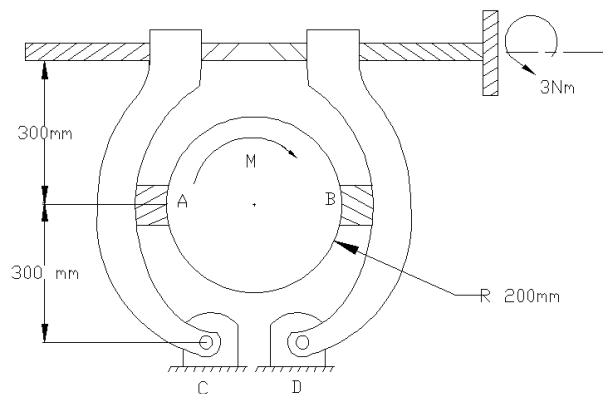
6. A 50 wedge is to be forced under a 6200N machine base at A. Knowing that $\mu=0.2$ at all surfaces, (a) determine the force P required to move the wedge. (b) Indicate whether the machine will move.



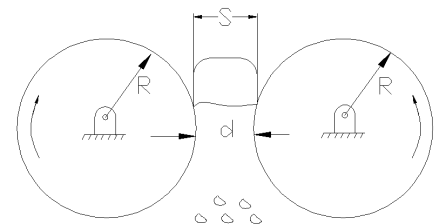
7. The beam AB has a negligible mass and is subjected to a force of 200N. It is supported at one end by a pin and at the other end by a spool having a mass of 35kg. If a cable is wrapped around the inner core of the spool, determine the minimum cable force P needed to move the spool from under the beam. $\mu_B=0.4$ and $\mu_D=0.2$



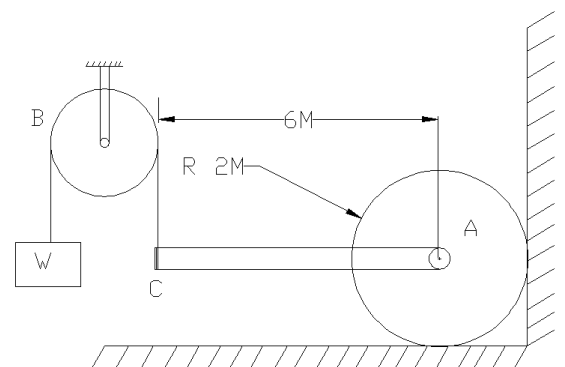
8. The braking mechanism consists of two pinned arms and a square threaded screw with left and right-hand threads. Thus, when turned, the screw draws two arms together. If the pitch of the screw is 4 mm, the mean diameter 12mm, and $\mu=0.35$, determine the tension in the screw when a torque of 3N-M is applied to the screw. If the coefficient of friction between the brake pads A and B and the circular shaft is $\mu'=0.5$. What is the maximum torque M the shaft can resist.



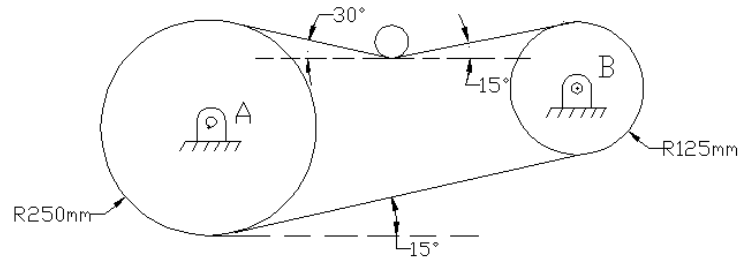
9. Two large cylinders each of radius $r=500\text{mm}$ rotates in opposite directions and from the main elements of a crusher for stone aggregate. The distance d is set equal to the maximum desired size of the crushed aggregate. If $d=20\text{mm}$, $\mu_s = 0.30$, determine the sizes of the largest stones which will be pulled through the crusher by friction alone.



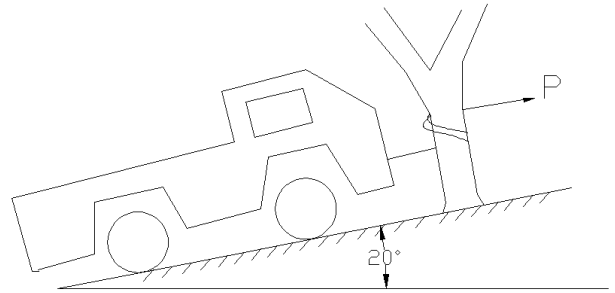
10. What is the maximum weight that can be supported by the system in the position shown? Pulley B can not turn. Bar AC is fixed to cylinder A, which weights 500N. The coefficient of static friction for all contact surfaces is 0.3.



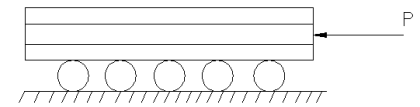
11. A freely turning idler pulley is used to increase the angle of wrap for the pulleys shown. if the tension in the slack side below is 900N, find the maximum torque that can be transmitted by the pulleys? Take $\mu=0.3$



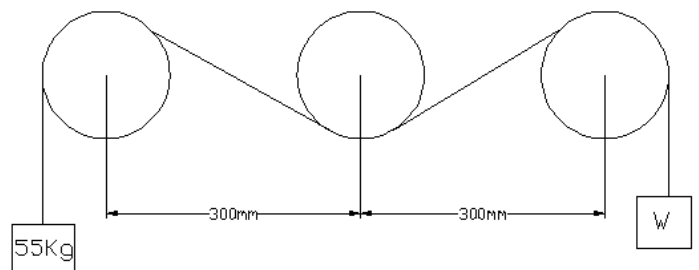
12. The truck, which has a mass of 3.4 tons, is to be lowered down the slope by a rope that is wrapped around a tree. If the wheels are free to roll and the rope at A can resist a pull of 500N. Determine the minimum numbers of turns the rope should be wrapped around the tree to lower the truck at constant speed. $\mu=0.4$ between the tree and rope.



13. The 1.2 ton steel beam is moved over a level surface using a series of 30mm diameter rollers for which the coefficient of rolling resistance is 0.4mm at the ground and 0.2mm at the bottom surface of the beam. Determine the horizontal force P needed to push the beam forward at a constant speed.



14. A cable is placed around three pipes, each of 15cm outside diameter, located in the same horizontal plane. Two of the pipes are fixed and do not rotate, the third pipe is rotated slowly. if $\mu_s=0.25$ and $\mu_k=.02$ for each pipe, determine the largest weight W which can be raised (a) if only pipe A is rotated, (b) if only pipe B is rotated, (c) if only C is rotated.



15. A 65 KN vehicle designed for polar expedition is on a very slippery ice surface with $\mu=0.005$ between tires and ice. Coefficient of rolling friction is 0.8mm. will the vehicle be able to move? The vehicle has four wheel drive. If it has rear wheel drive only what is the minimum μ needed between tires and ground for it to move?

