No. of Printed Pages : 7

BME-016

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) / B.Tech. AEROSPACE ENGINEERING (BTAE)

01360

Term-End Examination

June, 2015

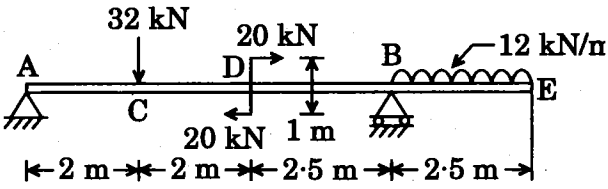
BME-016 : ENGINEERING MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***five*** *questions. Use of calculator (non-programmable) is permitted.*

1. (a) Determine reactions at the support for the beams shown in Figure 1. 7

(i)



(ii)

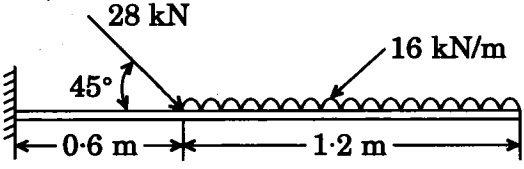


Figure 1

(b) Two 8° wedges are used to push a block horizontally as shown in Figure 2. If the coefficient of friction is 0·25 for all surfaces of contact, determine the minimum load P required to push the block weighing 6 kN. 7

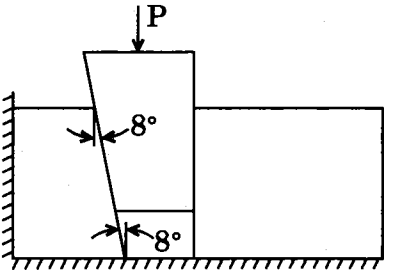


Figure 2

2. (a) Determine the moment of inertia of the lamina shown in Figure 3 about an axis parallel to the base and passing through the centroid. 6

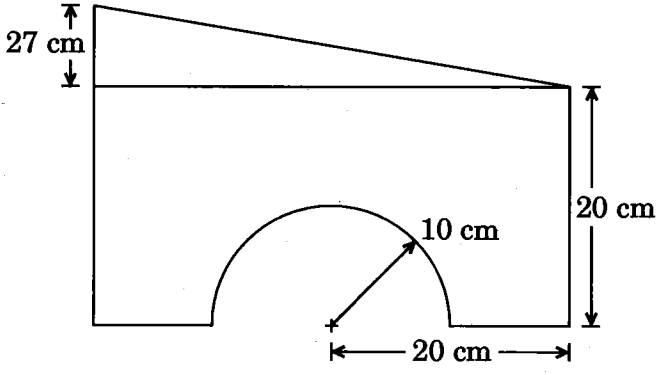


Figure 3

(b) Determine the forces in members DE and DC in the truss shown in Figure 4. *8*

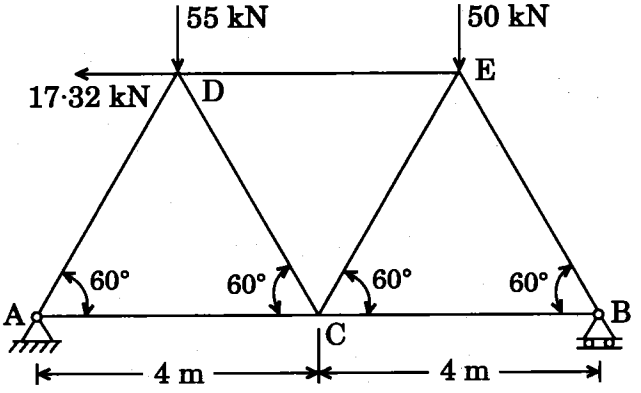


Figure 4

3. (a) A force system is shown in Figure 5. Compute the force F and θ required to give the resultant as mentioned below : *8*

(i) 300 N pointing up along Y-axis.

(ii) 300 N down to the right at 60° with X-axis.

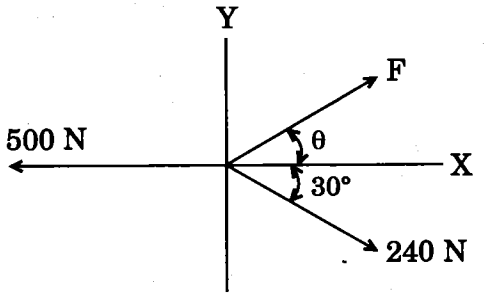


Figure 5

(b) Replace the force system acting on a frame shown in Figure 6 by a resultant force R through A and a couple acting horizontally through B and C. *6*

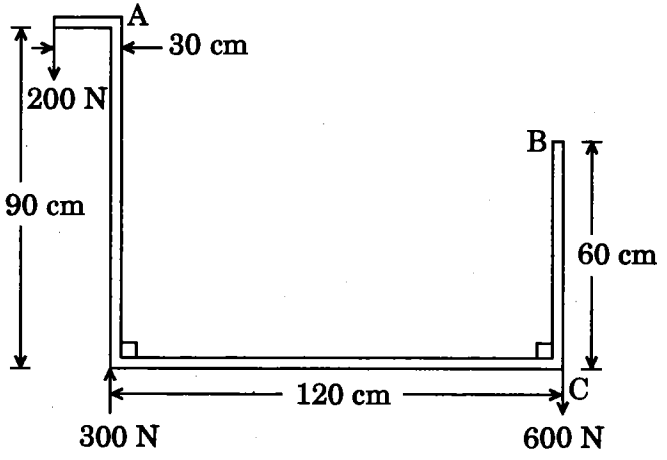


Figure 6

4. (a) Determine the value of angle 'θ' so that the motion of block of weight 900 N impends down the plane. The coefficient of friction for all the surfaces is 0·5 (Figure 7). *7*

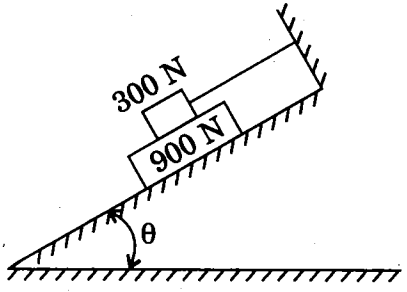


Figure 7

(b) A uniform ladder of length 13 m and weighing 250 N is placed against a smooth vertical wall with its lower end 5 m away from the wall. The coefficient of friction between the ladder and the floor is 0·3. Show that the ladder will remain in equilibrium. 7

5. (a) The angle of rotation of a body is given by $\theta = \theta_0 + at + bt^2$, where θ_0 is initial angular displacement, a and b are constants.

If initial angular velocity is 3π r/s and after 2 seconds it is 8π r/s, determine the expression for velocity and acceleration. 7

(b) A body of mass 15 kg falls on the ground from a height of 19·6 m. It penetrates into the ground. Find the distance through which the body will penetrate into the ground, if the resistance by the ground is equal to 4900 N and remains constant. 7

6. (a) A car is moving on a straight road. It skids 60 m after application of brakes. Determine the speed of the car just before the brakes were applied. The coefficient of friction between the car tyres and the road is 0·4. 4

(b) A train of small dump cars is pulled along a level track from A to B and then up a 5% grade from B to C. At C 100 m up the grade the last car becomes detached when its velocity is 24 kmph. The car weight is 20 kN and track resistance is 8 N/kN. Determine

(i) How far up the grade will the car continue before stopping at D ?

(ii) Will the car stop at D or move again down the grade ?

(iii) If the car moves again down the grade, what will be the distance travelled by the car towards A on the level track before stopping at E ? *10*

7. (a) An elevator weighing 5 kN is ascending with an acceleration of 3 m/sec^2. The operator, at this time, is standing on the weighing scale. What is the scale reading, if his original weight is 700 N ? Determine the tension in the cable during this motion. *6*

(b) Two bodies A and B weighs 150 N and 15 N respectively. They are connected to the two ends of a light inextensible string passing over a smooth pulley. Body A is placed on a rough horizontal surface while body B is hanging vertically in air. The friction between A and the table is just sufficient to prevent motion. If an additional weight of 5 N is added to block B, determine the (i) acceleration of the two bodies, and (ii) tension in the string after addition of weight. *8*

8. (a) A projectile is aimed at a mark on the horizontal plane through the point of projection and falls 12 m short when the angle of projection is 15°, while it overshoots the mark by 24 m when the angle is increased to 45°. Find the angle of projection to hit the mark. Assume velocity of projection constant in all the cases. *6*

(b) The block A weighs 15 N. It moves with a velocity of 3 m/s on a horizontal plane when it strikes a 100 N weight ball B which is suspended from a 2 m long chord. If the coefficient of restitution is 0·8, determine the final position of block A and the maximum and minimum tension in the chord supporting B. The coefficient of friction between block A and the plane is 0·2. *8*