

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

Term-End Examination

December, 2015

BME-016 : ENGINEERING MECHANICS

Time : 3 hours

Maximum Marks : 70

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

1. (a) Determine the resultant, both in magnitude and direction, for the forces acting on the body as shown in the figure 1, given below : 10

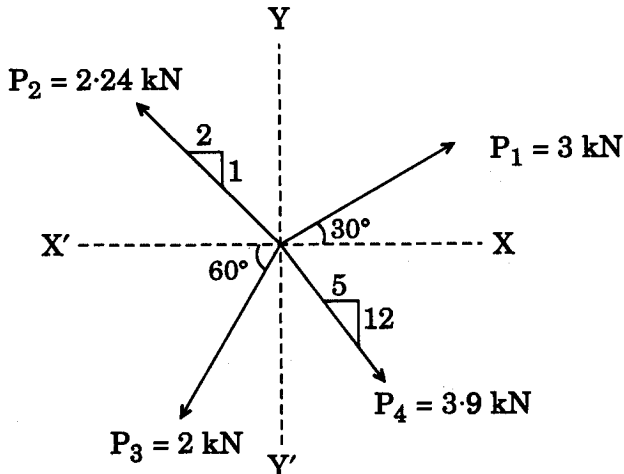


Figure 1

- (b) Determine the magnitude and direction of the force

$$\bar{F} = (360 \text{ N})\hat{i} + (400 \text{ N})\hat{j} - (500 \text{ N})\hat{k}. \quad 4$$

2. (a) A wooden block of weight 50 N rests on a horizontal plane. Determine the force required to just

- (i) pull it,
(ii) push it.

Take coefficient of friction $\mu = 0.4$ between the mating surfaces. 7

- (b) Determine the reaction of the beam as shown in figure 2. 7

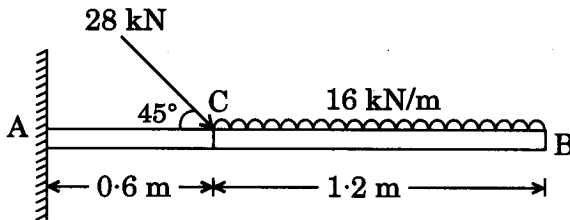


Figure 2

3. (a) Determine the product of inertia of the equal angle section $150 \times 150 \times 10$ mm about the centroidal axes parallel to the two sides. 7

- (b) A right circular cone of 20 cm height, weighs 1000 N. A cone of 8 cm height and 64 N weight is removed from the top. Determine the distance of CG of the frustrum from the base. 7

4. (a) Find the velocity and acceleration after 0.4 seconds from the extreme position of a body moving with S.H.M. with an amplitude of 0.8 m and period of complete oscillation of 1.8 seconds. 7
- (b) An automobile of mass 1300 kg, travelling at a speed of 60 kmph hits a depression in the road, which has a radius of curvature of 15 m. Calculate the total force which will be acting on the springs. 7
5. (a) A sphere is having a radius R and mass 'm'. Determine the moment of inertia about its diameter. 7
- (b) A train weighing 400 kN is running up an inclined path of 1 in 100 at a steady speed of 54 kmph. If the frictional resistance is 0.5% of its weight, determine the output of the engine, in kW. 7
6. (a) A mass of 4 kg moving with a velocity of 10 m/sec along x direction, follows another mass of 10 kg moving with 5 m/sec in the same direction. Determine the final velocity of the two masses after collision, if $e = 0.6$. 7

- (b) Two blocks A and B are released from rest on a 45° inclined plane, when they are 15 m apart. The coefficient of friction under the block A is 0.2 and that under the block B is 0.4. Compute the time from start when they meet. After they meet and move as a unit, what will be the contact force between them (Refer figure 3)?

7

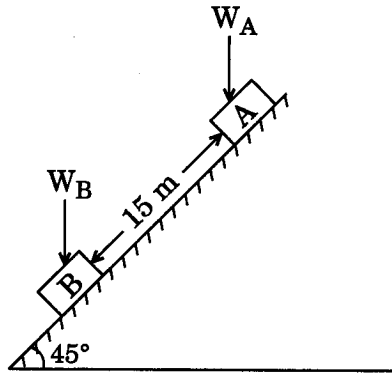


Figure 3

7. (a) Find the forces in all the members of the truss shown in figure 4.

7

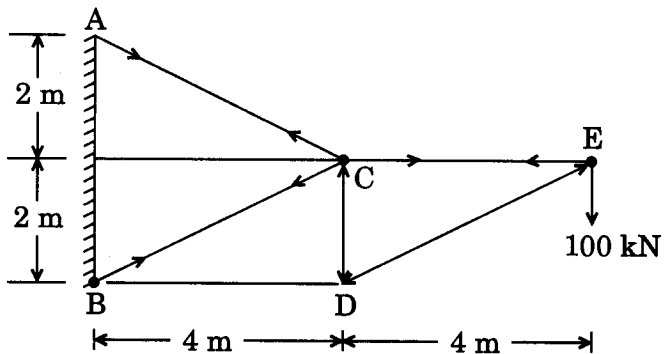


Figure 4

- (b) Determine the forces in the members of the pin-jointed steel structure shown in figure 5.

7

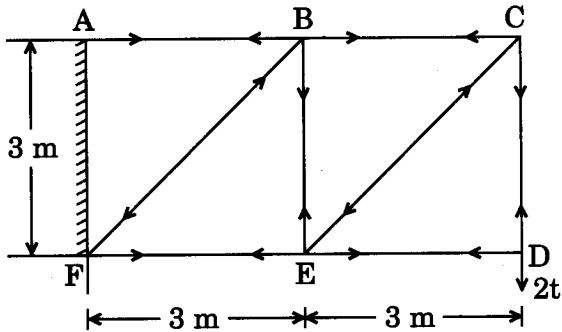


Figure 5

8. (a) The effort applied to raise a load is 50 N. The effort lost in overcoming friction is 10% of it, and the velocity ratio of lifting machine is 10. Determine the load lifted.
- (b) The number of teeth on the worm wheel are 80. The radius of the effort wheel is 30 cm and the load cylinder is 10 cm. Determine the load which can be lifted by applying 200 N effort. Take efficiency as 20% when worm is
- (i) single start
 - (ii) double start

7

7