



- Notes :
1. All questions carry equal marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) State and explain Varignon's Theorem. 4
- b) Two identical rollers each of 50 N are supported by inclined plane and a vertical wall as shown in figure 1. Find reaction at point of contact A, B and C. 12

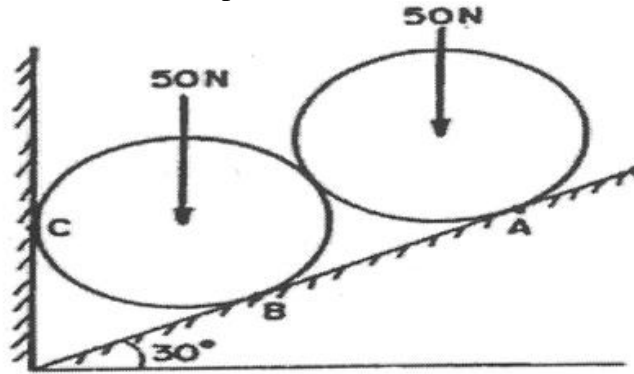


Figure 1

OR

2. a) Write down types of support with help of neat sketches. 4
- b) The line actions of three forces concurrent at Origin O passes through point A(-2, 2, 5), B (4, 0, -3) and C (2, -2, 4) shown in figure. The magnitude of the forces are $F_a = 50\text{N}$, $F_b = 15\text{N}$ and $F_c = 20\text{N}$. Find the magnitude and direction of their resultant. 12
3. a) Write down the advantage of method of section over method of joint. 4
- b) Determine the forces in member of truss shown in figure 2. 12

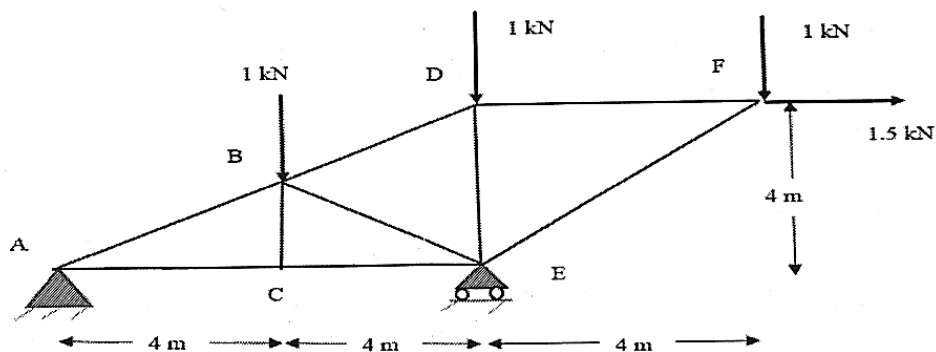


Figure 2

OR

4. a) Derive relation between tension on tight side T_1 and slack side T_2 of pulley. 6

- b) Two identical blocks A and B are connected by rod and rest against vertical and horizontal planes respectively as shown in figure 3. If $\alpha = 45^\circ$, determine the coefficient of friction assuming that it to be same at both floor and wall. 10

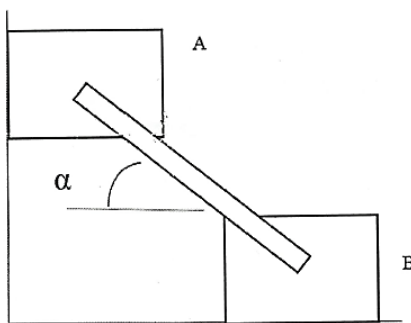


Figure 3

5. a) Explain: 4
 i) Centroid ii) Polar moment of inertia.
 b) Find moment of inertia of shaded area about centroidal axis as shown in figure 4. 12

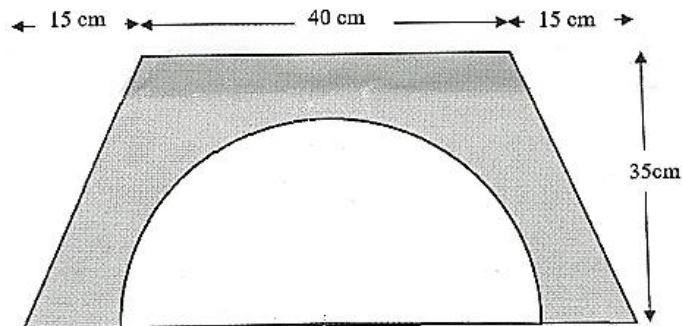


Figure 4

OR

6. a) Find the reaction at support A and B of beam as shown in figure 5 using virtual work method. 8

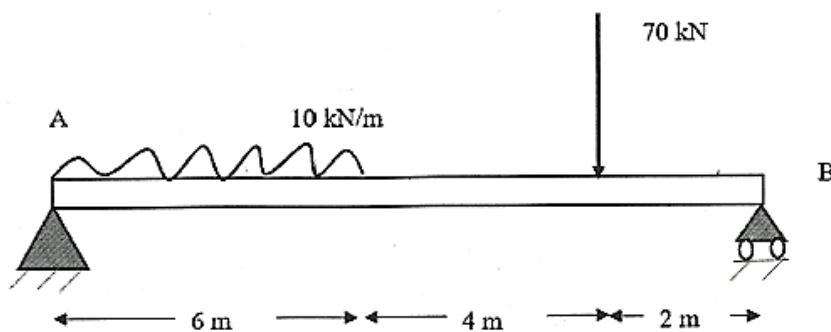


Figure 5

- b) Find the reaction at support A and B of beam as shown in figure 6 using virtual work method. 8

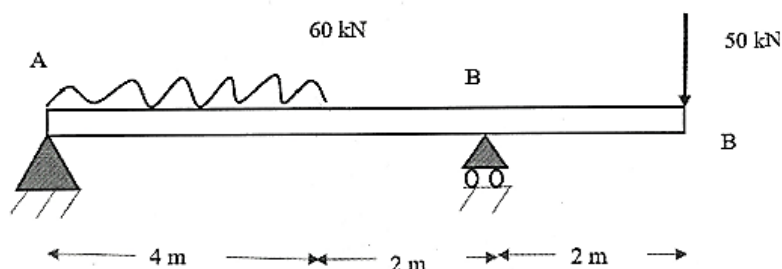
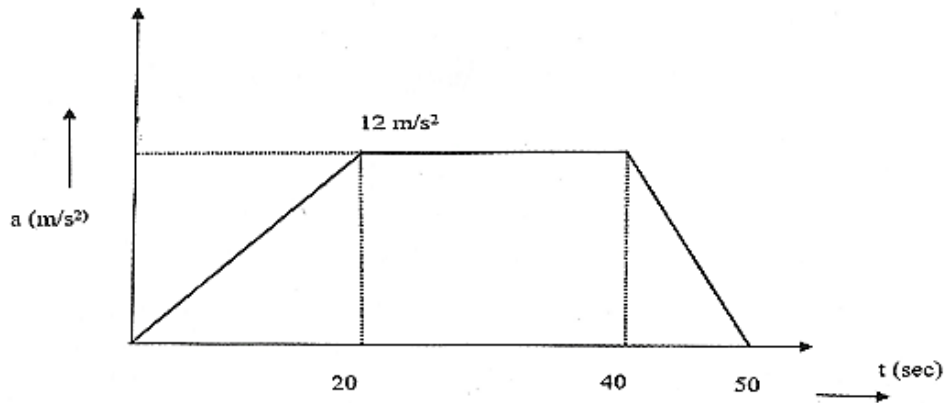


Figure 6

7. A train travelling with a speed of 90 kmph slow down on account of work in progress, at a retardation of 1.8 kmph per second to 36 kmph. With this, it travels 600 m. thereafter it gains further speed with 0.9 kmph per second till getting original speed. Find the delay caused. 16

OR

8. Figure 7 shows a diagram of acceleration verses time for a particle moving along x axis for a time interval of 0 to 50 sec. for the same time interval plot i) the velocity time diagram and ii) the displacement time diagram and find the maximum speed attained and maximum distance covered by particle during the interval. 16



9. a) What is work done by force state and explain work energy equation. 6
- b) Blocks A and B of mass 20 kg and 45 kg respectively are connected by a weightless rope over a frictionless pulley as shown in the Figure 8. Assume a coefficient of friction of 0.2 for all the planes. Determine the velocity of the system 5 seconds after starting from rest. 10

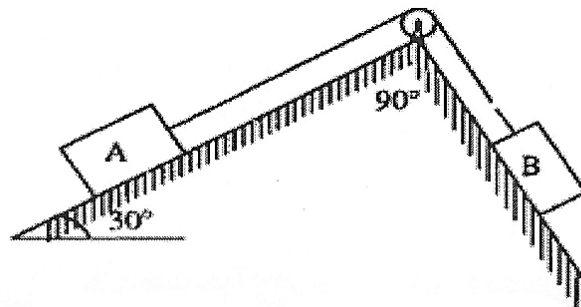


Figure 8

OR

10. a) State and explain principle of impulse momentum. 4
- b) Two particles of masses 10 kg and 20 kg are moving along straight line towards each other at velocities of 4 m/s and 1 m/s respectively. If $e = 0.6$, determine the velocities of the particles immediately after their collision. Also find the loss of kinetic energy. 12
