01435

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

December, 2010

ET-202(A) : ENGINEERING MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any seven questions.*
Use of calculator is permitted.

1. (a) Two forces of magnitude 20 N and 40 N are acting on a particle such that the angle between the two is 135°. If both these forces are acting away from the particles, calculate their resultant and find its direction. **5+5**

(b) The four coplanar forces are acting at a point as shown in figure - 1. One of the forces is unknown and its magnitude is shown by P. The resultant is having a magnitude of 500 N and is acting along x-axis. Determine the unknown force P and its inclination with x-axis.

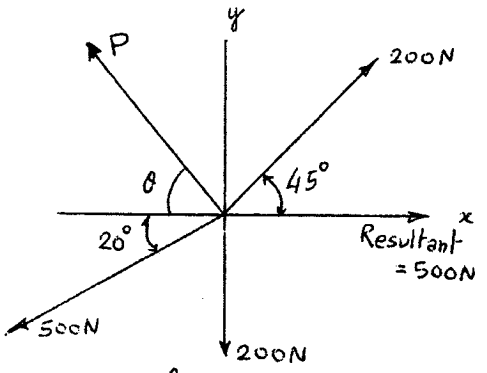

Figure - 1

2. (a) Four parallel forces of magnitudes 100 N, 200 N, 50 N and 400 N are shown in figure - 2. **5+5**

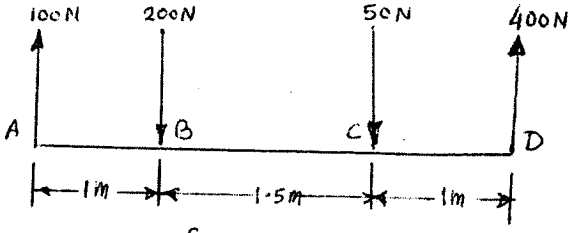

Figure 2

Determine the magnitude of the resultant and also the distance of the resultant from point A.

(b) A ball of weight 120 N rests in a right - angled groove, as shown in figure - 3. The sides of the groove are inclined to an angle of 30° and 60° to the horizontal. If all the surfaces are smooth, then determine the reactions. R_A and R_C at the points of contact.

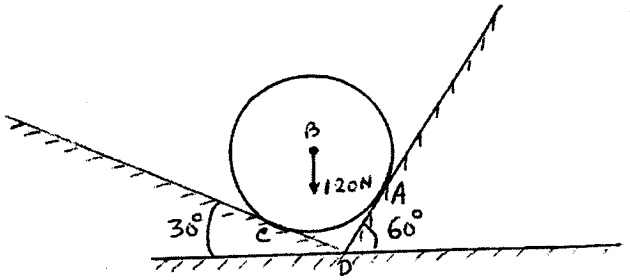

Figure 3

3. (a) A beam is loaded as shown in figure - 4. Determine the reactions at both ends. 5+5

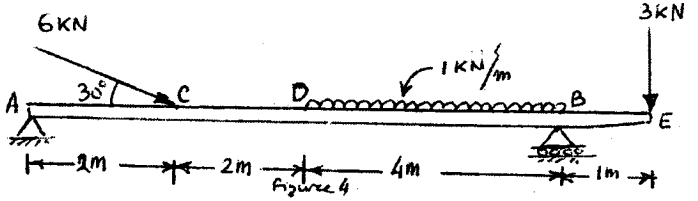

Figure 4

(b) Two identical rollers, each of weight 50 N, are suspended by an inclined plane and a vertical wall as shown in figure–5. Find the reactions at the points of supports A, B and C. Assume all the surfaces to be smooth. 5

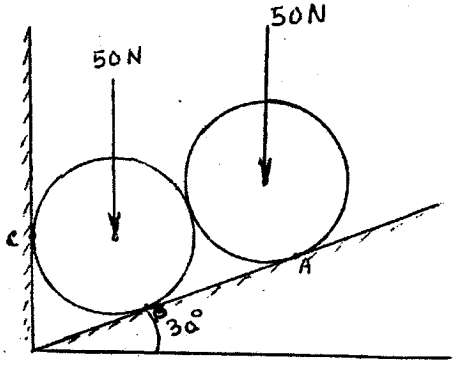

Figure 5

4. (a) Determine the forces in all the members of a cantilever truss as shown in figure - 6. 5+5

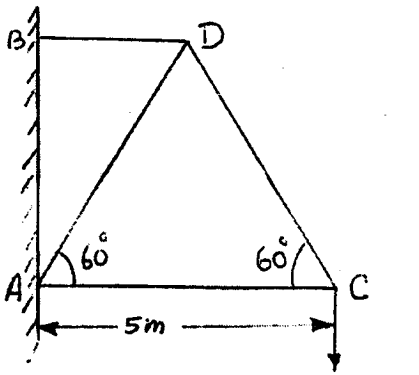

figure 6

(b) From a circular plate of diameter 100 mm, a circular part of diameter 50 mm is cut as shown in figure - 7.
Find the centroid of the remainder.

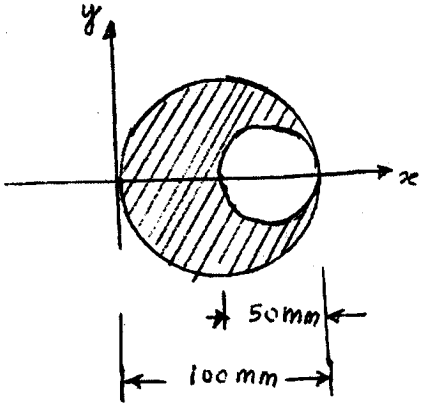

figure 7

5. (a) For the T-section shown in figure - 8, determine the moment of inertia of the section about the horizontal and vertical axes, passing through the centroid of the section. 5+5

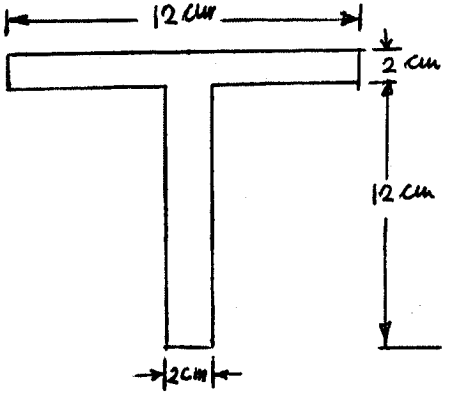

Figure 8

(b) Two blocks A and B are connected by a horizontal rod and are supported on two rough planes as shown in figure - 9. If the weight of block B is 1500 N and co-efficient of friction of block A and B are 0.25 and 0.35 respectively, find the smallest weight of block A for which equilibrium can exist.

5+5

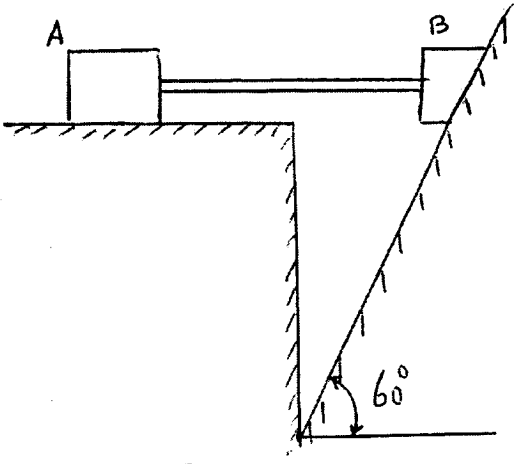

Figure 9

6. A uniform ladder of weight 200 N of length 4.5 m rests on a horizontal ground and leans against a vertical wall. The co-efficient of friction between the ladder and floor is 0.4 and between ladder and vertical wall is 0.2. When a weight of 900 N is placed on the ladder at a distance of 1.2 m from the top of the ladder, the ladder is at the point of sliding. Find **10**

(i) The angle made by the ladder with horizontal.

(ii) Reaction at the foot of the ladder, and

(iii) Reaction at the top of the ladder.

7. (a) A stone dropped into a well is heard to strike the water after 6 seconds. Find the depth of the well, if the velocity of sound is 350 m/s. 5+5

(b) A fly wheel is rotating at 150 r.p.m and after 8 seconds it is rotating at 120 r.p.m. If the retardation is uniform, determine the number of revolutions made by the flywheel and the time taken by the flywheel before it comes to rest from the speed of 150 r.p.m.

8. (a) A particle is projected in air with a uniform velocity 80 m/s at an angle of 45° with the horizontal. 5+5

Find

(i) horizontal range

(ii) the maximum height attained by the particle, and

(iii) the time of flight.

(b) Two bodies of weight 40 N and 20 N are connected to the two ends of a light inextensible string, passing over a smooth pulley. The weight of 40 N is placed on a smooth horizontal surface while the weight of 20 N is hanging free in air.

Find

(i) The acceleration of the system, and

(ii) the tension in the string.

Take $g = 9.81$ m/sec^2.

9. (a) A body is moving with simple harmonic motion and has an amplitude of 4.0 m and period of complete oscillation as 3.0 seconds. Find the time required by the body in passing between two points which are at a distance of 3 m and 1.0 m from the centre and are on the same side. 5+5

(b) A body of mass 100 kg, moving with a velocity of 9 m/s, collides directly with a stationary body of mass 50 kg. If the two bodies become coupled so that they move on together after the impact, what is their common velocity.

10. Draw the S.F. and B.M. diagrams for the beam which is loaded as shown in figure - 10. Determine the points of contraflexure within the span AB. 10

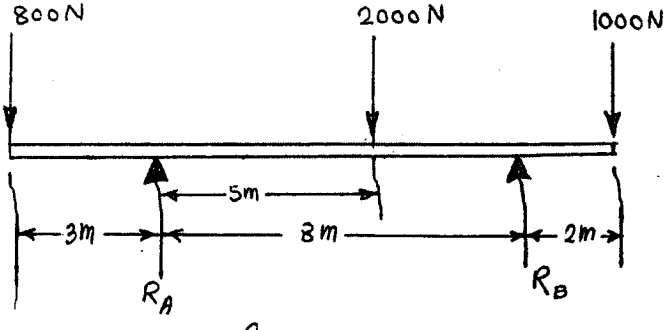

Figure - 10