Faculty of Engineering & Technology

Second Semester B.E. Examination

ENGINEERING MECHANICS

Time—Two Hours] [Maximum Marks—40

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Due credit will be given to neatness and adequate dimensions.

(3) Assume suitable data wherever necessary.

(4) Illustrate your answers wherever necessary with the help of neat sketches.

1. (a) A rigid bar AB is subjected to a system of parallel forces as shown in Fig. 1. Reduce the given system of forces to an equivalent :

(i) Single resultant

(ii) Force system at D

(iii) Force system at A. 5

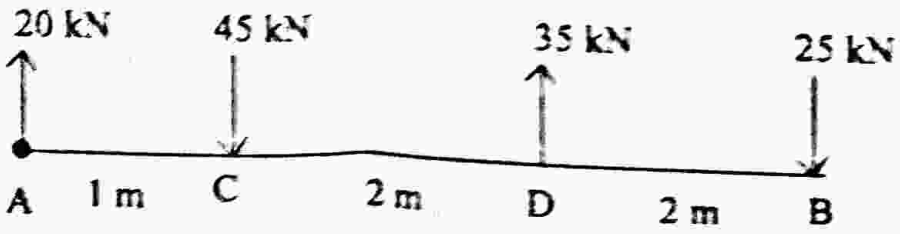

Fig. 1

(b) A force F = 70 N in magnitude passes through point A(–2, 1, 3) towards B(4, 4, 5) co-ordinates of point C and D are (–2, 0, 1) and (2, 0, –2) respectively.

Find :

(i) Moment of F about line AC

(ii) Moment of F about line BC. 5

OR

2. (a) Calculate resultant of the forces and its X and Y intercept shown in Fig. (2). 5

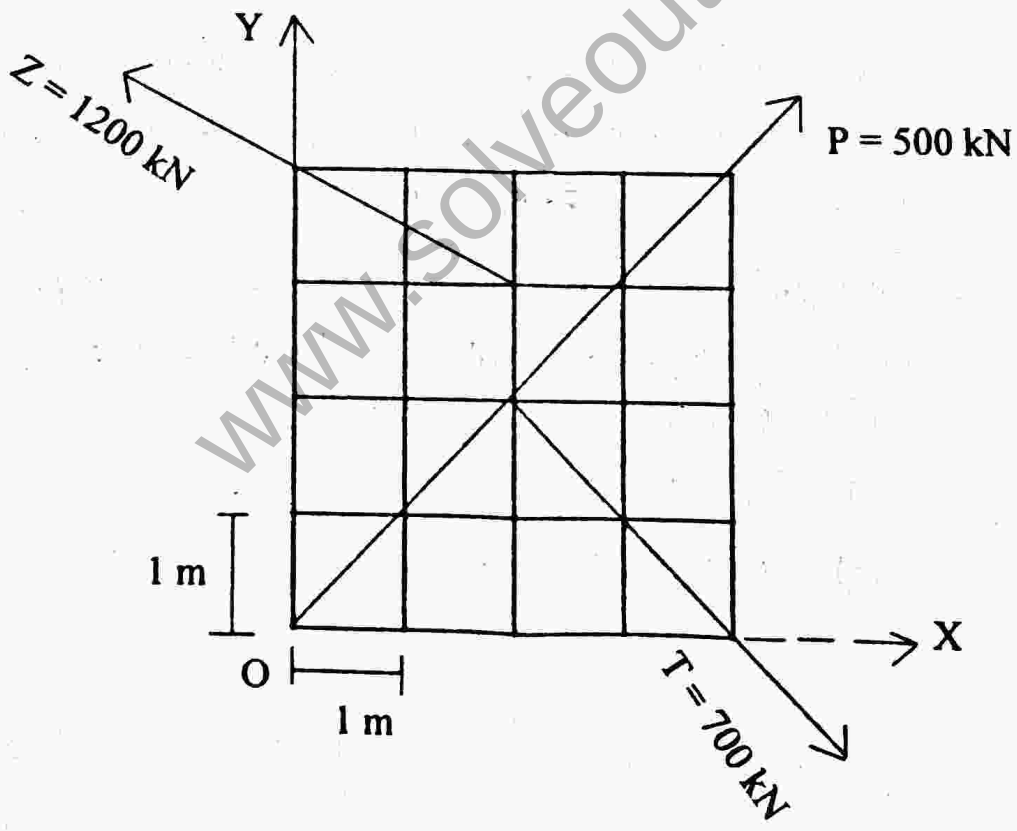

Fig. 2

(b) A force P = 200 N acts from A(0, 0, 10) to B(–8, –4, 0) and force T = 134 N acts from C(0, –4, 6) to D(7, 0, 0).

Find the force F to be applied at E(0, –10, 0) to reduce their resultant to a couple. What is the resultant couple ? 5

3. (a) State and explain Lami's theorem. 3

(b) A uniform wheel of 80 cm diameter rest against a rectangular block as shown in Fig. 3. Find least pull 'P' through centre of wheel to just turn the wheel over block. Assume all surfaces smooth. Weight of wheel 20 kN. 7

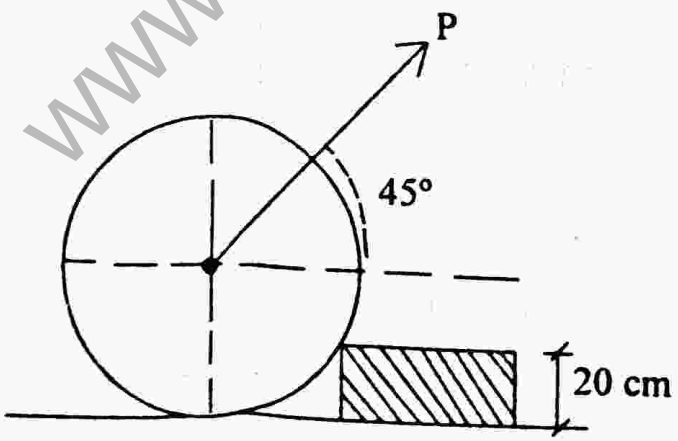

Fig. 3

OR

4. (a) What are the assumptions made in analysis of simple truss ? 3

(b) A truss of 6 m span is carrying a central load of 10 kN as shown in Fig. 4. Find by any method, the magnitude and nature of forces in all members of the truss and tabulated the results. 7

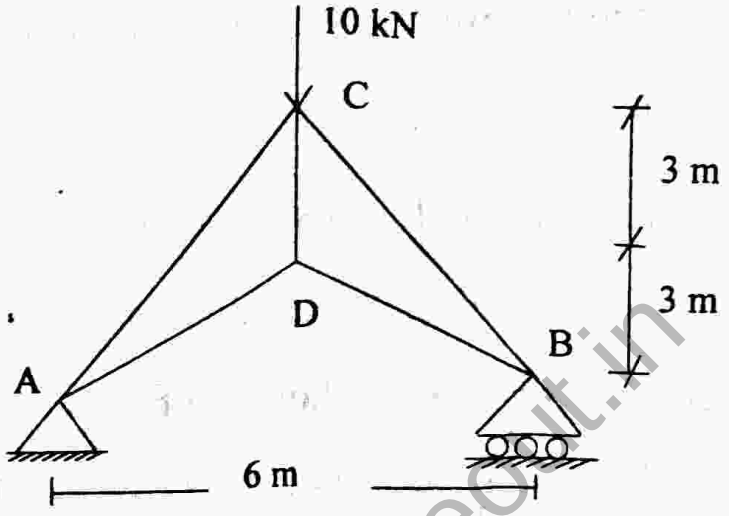

Fig. 4

5. (a) Determine co-ordinates of centroid of the area as shown in Fig. 5. Dimensions are in cm. 5

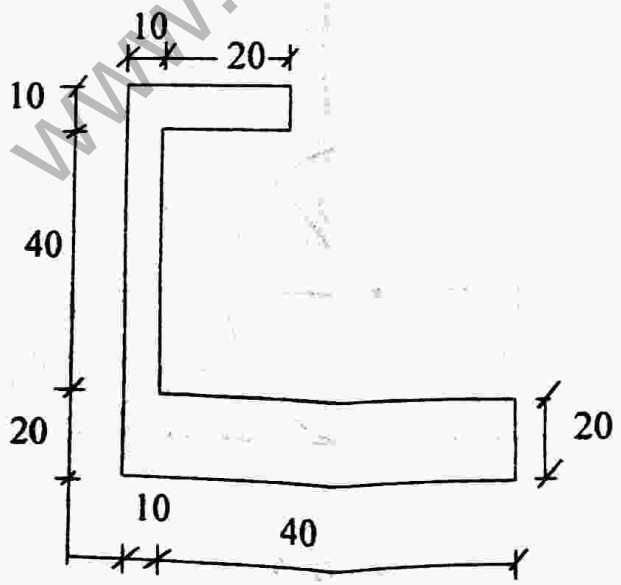

Fig. 5

(b) A simply supported beam of span 8 m carries point load of 2 kN, 3 kN, 4 kN and 5 kN at 1 m, 3 m, 5 m and 7 m from left hand support. Find support reaction applying principle of virtual work. 5

OR

6. (a) Determine the moment of inertia of shaded area shown in Fig. 6 with respect to X and Y axes. 6

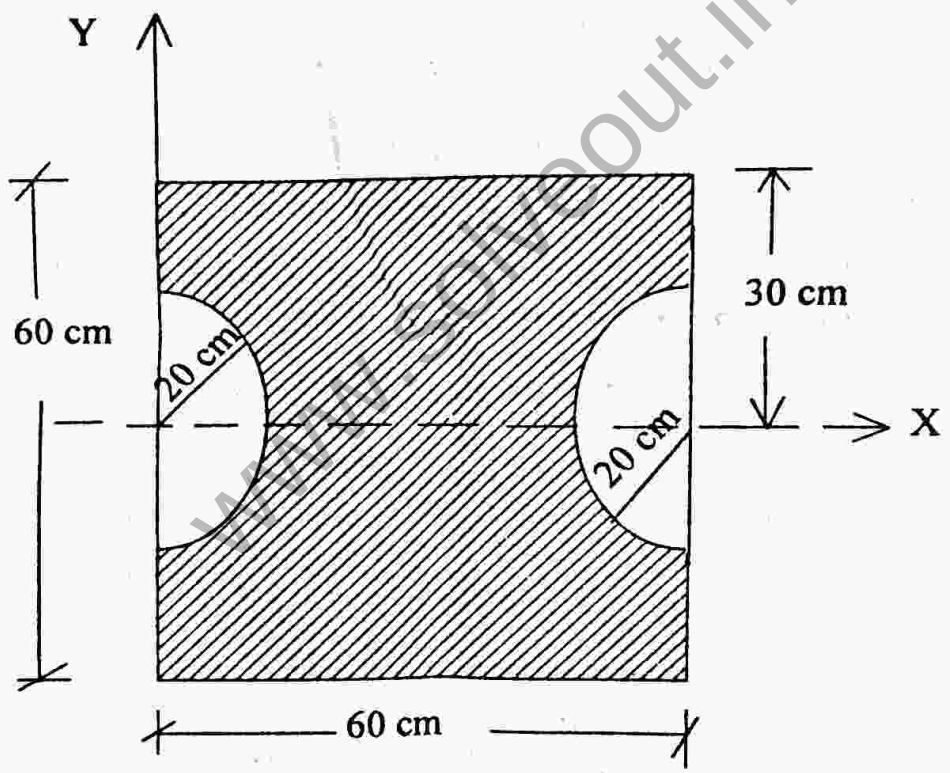

Fig. 6

(b) The thin rod of weight 'W' rests against the smooth wall and floor. Determine the magnitude of the

couple moment M, needed to hold it in equilibrium for a given angle 'θ' by using virtual work method. 4

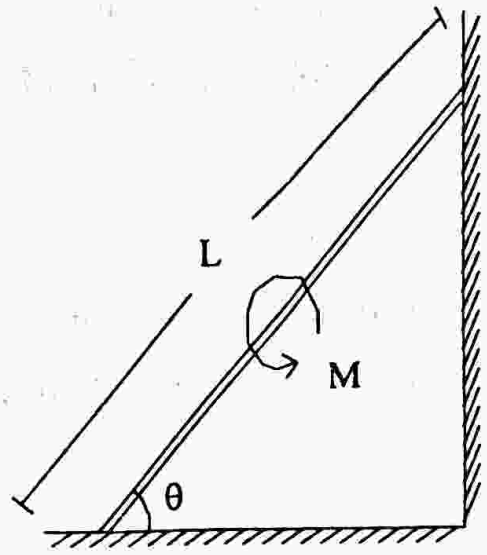

Fig. 6(b)

7. (a) Explain 'D' Alembert's principle. 3

   (b) Determine the acceleration of block 'A' in the system as shown in Fig. 7

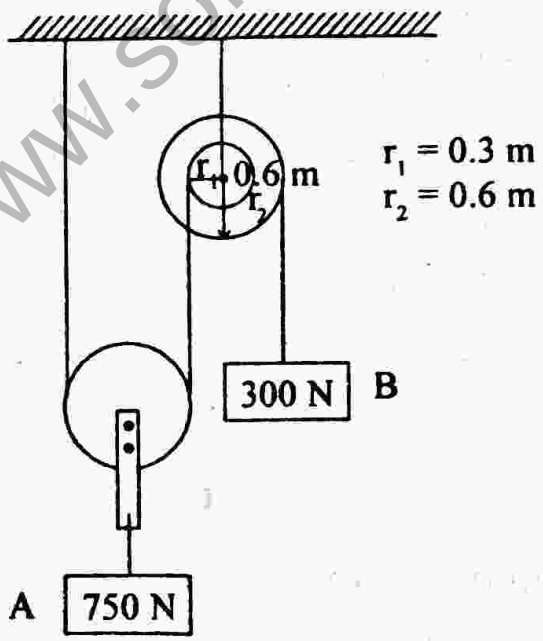

Fig. 7(b)

OR

8. (a) What is coefficient of restitution ? 3

(b) A sphere of weight 20 N is released from rest and strikes a block of weight 25 N resting on a horizontal surface. How far the block will move after impact ? Also find the maximum angle through which the sphere swings after impact. Assume e = 0.75 and the coefficient of friction between the block and the floor is 0.25. 7

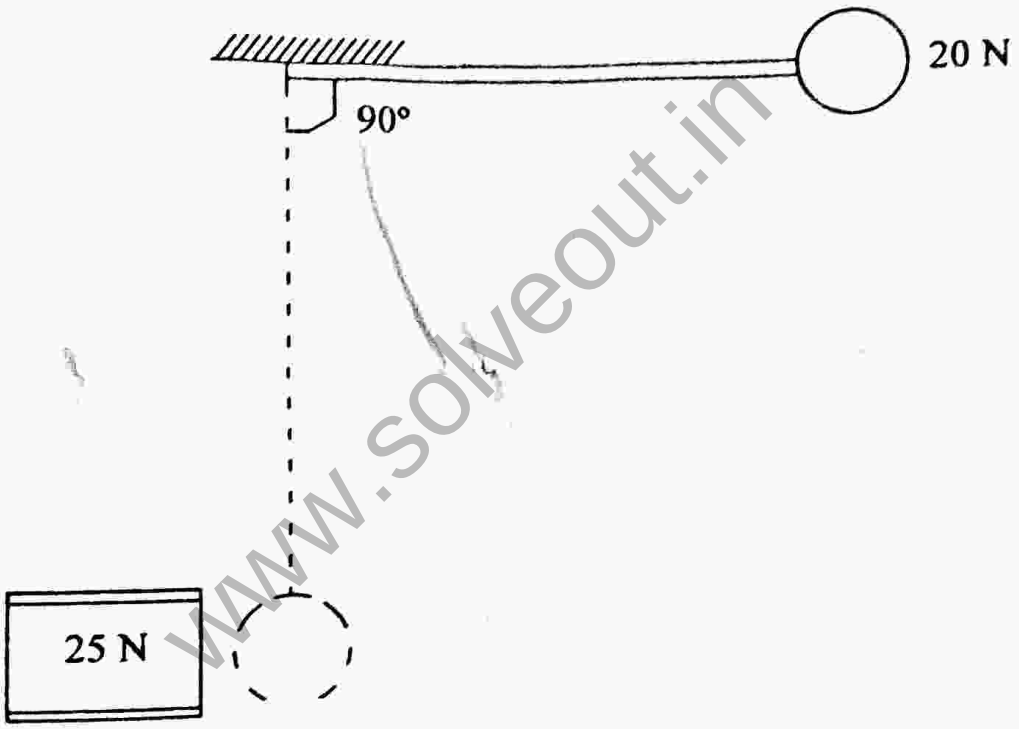

Fig. 8(b)