Assignment-1 Sub:-Engg. Mechanics (Topic: Basic Concept)

Q(1)

(a) Two cylinders C, F of diameter 60mm and 30mm. weighing 160 N and 40 N respectively are placed as shown in Fig. 11(a). Assuming all the contact surfaces to be smooth, find the reactions at A, B and C.

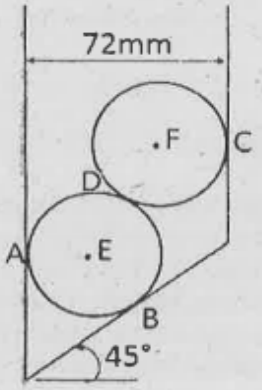


Fig. 11(a)

Or

(b) Forces 32 kN, 24 kN, 24 kN and 120 kN are concurrent at origin (0,0,0) and are respectively directed through the points whose coordinates are A(2, 1, 6). B(4, –2, 5), C(–3, –2, 1) and D(5, 1, –2). Determine resultant of the system.

Q(2)

a) A tripod supports a load of 2kN as shown in Fig. 11 (a). The ends P, Q and R are in x-z plane. Find the forces in the three legs of the tripod.

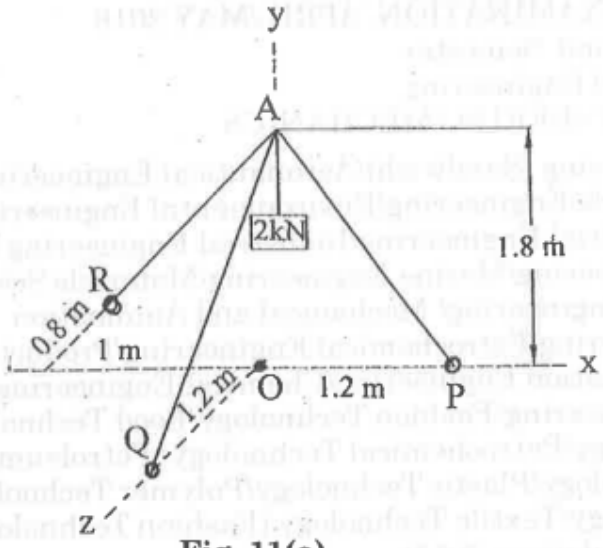


Fig. 11(a)

(OR)

b) A weight of 8kN is suspended by means of three cables as shown in Fig. 11 (b). Determine the forces in the cables PA, PB and PC.

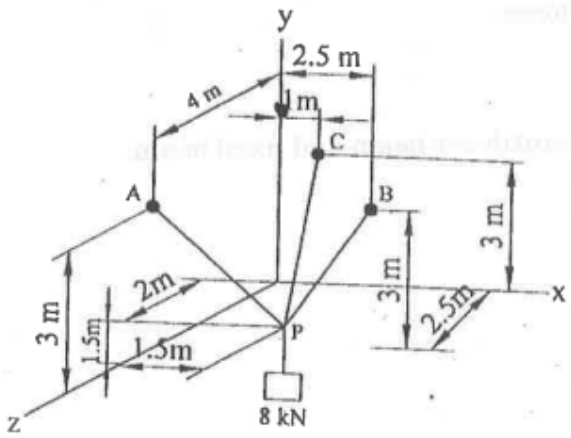


Fig. 11(b)

Q(3)

a) Three links PQ, QR and RS connected as shown in Fig. 11 (a) support loads W and 50 N. Find the weight W and the force in each link if the system remains in equilibrium.

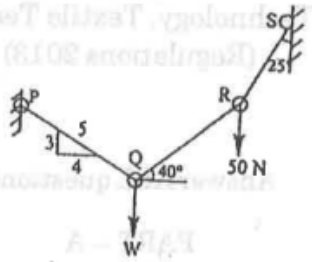


Fig. 11 (a)

(OR)

b) Two identical rollers each of weight 2.5 kN rest in between an inclined wall and a vertical wall as shown in Fig. 11 (b). Determine the reactions at the points of contact P, Q and R. Assume the wall surfaces to be smooth.

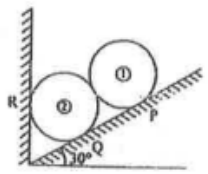


Fig. 11 (b)

Q(4)

a) Reduce the given system of forces acting on the beam AB in figure, 12 (a) t (i) an equivalent force couple system at A (ii) an equivalent force couple syster at B.

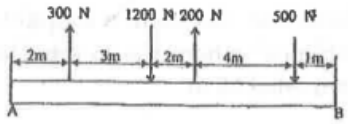


Fig. 12 (a)

(OR)

b) Find the pin reaction of A and the Roller reaction at B. For the beam shown i Fig. 12 (b).

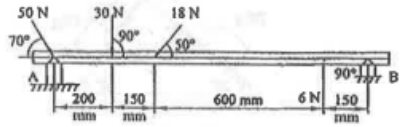
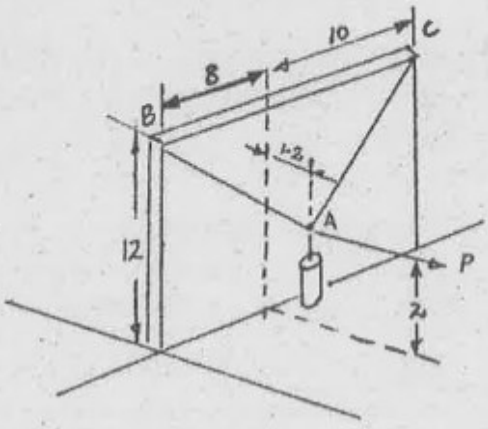


Fig. 12 (b)

Q(5)

(a) (i) Four coplanar forces are acting at a point. Three forces have magnitude of 20 N, 50 N and 20 N at angles of 45°, 200° and 270° respectively with respect to $+x$ axis. Fourth force is unknown. Resultant force has a magnitude of 50 N and acts along x-axis at an angle of 0° with respect to $+x$ axis. Determine the unknown force and its direction or angle from $+x$-axis. (8)

(b) A 200 kg cylinder is hung by means of two cables AB and AC, which are attached to the top of a wall. A horizontal force P perpendicular to the wall holds the cylinder in the position shown. Determine the magnitude of P and the tension in each cable. (16)



Q(6)

(a) (i) A bar ABCD is hinged at A and supported by a cable, at BC, passing over a frictionless pulley at P above it. Determine the tension in the cable and the reaction at A for a load of 500 N hanging at D. (8)

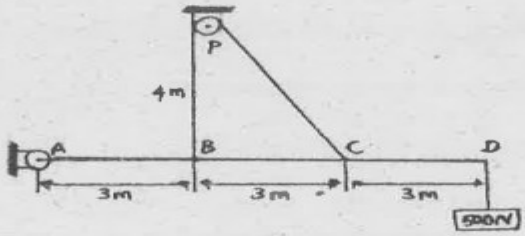


Fig. 12(a)(i)

(ii) Three forces are applied to an angle bracket as shown in Fig. 12(a)(ii). Determine the magnitude and direction of the resultant and the distance from 'O' to the line of action of the resultant. (8)

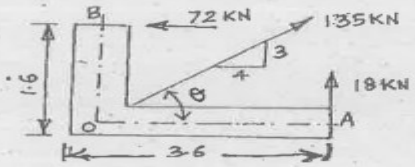


Fig. 12(a)(ii)

Or

(b) The boom of a crane is shown in Fig. 12(b). If the weight of the boom is negligible compared with the load W = 60 kN, find the compression in the boom and also the limiting value of the tension T when the boom approaches the vertical position. (16)

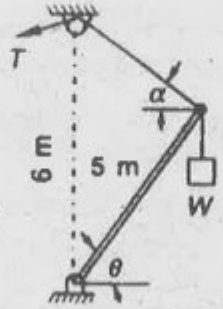


Fig. 12(b)

(7) a) A horizontal line PQRS is 12 m long, where PQ = QR = RS = 4m. Forces of 1000 N, 1500 N, 1000 N and 500 N act at P, Q, R, S respectively in downward direction. The line of action of these forces makes angle of 90°, 60°, 45° and 30° respectively with PS. Find the magnitude, direction and position of resultant force. **(16)**

(OR)

b) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown Fig. 11 b. If in the equilibrium position, BC is horizontal and AB and CD make 150° and 120° with BC, find (i) Tensions in the portion AB, BC and CD of the string and (ii) Magnitudes of W_1 and W_2. **(16)**

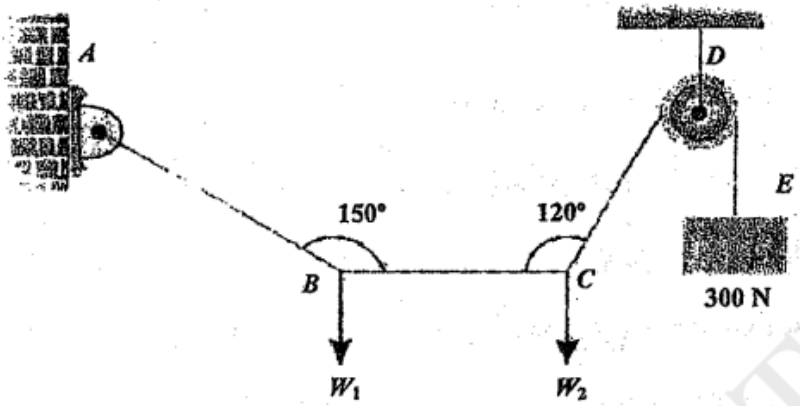


Fig. 11(b)

(8) a) A roller of radius 30 cm weighs 2.5 kN. It is to be pulled over a rectangular obstruction of height 10 cm by a horizontal force F passing through the centre of the roller. Find the magnitude, if the force F required just to turn the roller over the corner of the obstruction. Also find the magnitude and direction of the minimum force required for the same.

b) i) A body of mass 900 kg is suspended by two cables PR and PQ making an angle of 40° and 50° respectively with the ceiling. Find the tension in the cables PQ and PR. **(8)**

ii) A father and his son carry a block of mass 50 kg by using a uniform bar of length 3 m and mass 16 kg. The son can bear only half the load carried by the father. Find the location of the block on the bar. **(8)**