

Total No. of Questions—6]

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[5056]-19

F.E. (Common) EXAMINATION, 2016

ENGINEERING MECHANICS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6.

(ii) Neat diagram must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary and clearly state.

(v) Use of cell phone is prohibited in the examination hall.

(vi) Use of electronic pocket calculator is allowed.

1. (a) The resultant of two forces P and Q is 1400 N vertical. Determine the force Q and the corresponding angle θ for the system of forces as shown in Fig. 1a. [4]

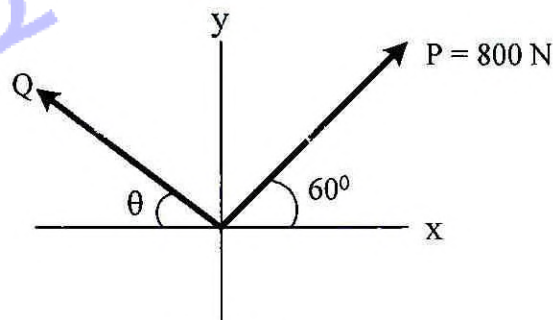


Fig. 1 a

P.T.O.

- (b) The system shown in Fig. 1b is initially at rest. Neglecting axle friction and mass of pulley, determine the acceleration of block. [4]

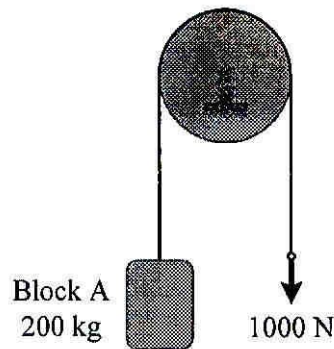


Fig. 1 b

- (c) A cricket ball shot by a batsman from a height of 2.0 m at an angle of 30° with the horizontal with a velocity of 20 m/s is caught by a fielder at a height of 0.8 m from the ground. Determine the distance between the batsman and fielder. [4]
- (d) A ball has a mass of 30 kg and is thrown upward with a speed of 15 m/s. Determine the time to attain maximum height using impulse momentum principle. Also find the maximum height. [4]

Or

2. (a) Determine the y coordinate of centroid of the shaded area as shown in Fig. 2a. [4]

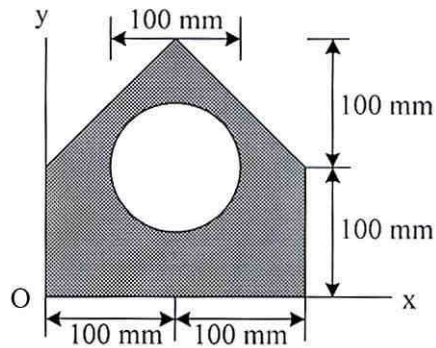


Fig. 2 a

- (b) If the crest of the hill has a radius of curvature $\rho = 60$ m, determine the maximum constant speed at which the car can travel over it without leaving the surface of the road. The car has a weight of 17.5 kN. (Refer Fig. 2b). [4]

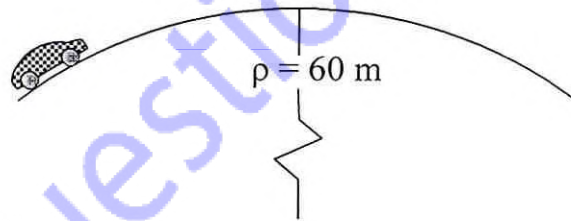


Fig. 2 b

- (c) A particle moves along a straight line with an acceleration $a = (4t^3 - 2t)$, where a is in m/s^2 and t is in s. When $t = 0$, the particle is at 2 m to the left of origin and when $t = 2$ s the particle is at 20 m to left of origin. Determine the position of particle at $t = 4$ s. [4]

- (d) A woman having a mass of 70 kg stands in an elevator which has a downward acceleration of 4 m/s^2 starting from rest. Determine work done by her weight and the work of the normal force which the floor exerts on her when the elevator descends 6 m. [4]

3. (a) Two spheres A and B of diameter 80 mm and 120 mm respectively are held in equilibrium by separate strings as shown in Fig. 3a. Sphere B rests against vertical wall. If masses of spheres A and B are 10 kg and 20 kg, determine the tension in the string and reactions at point of contact. [6]

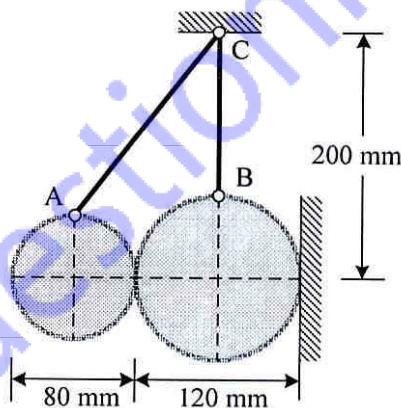


Fig. 3 a

- (b) Four parallel bolting forces act on the rim of the circular cover plate as shown in Fig. 3b. If the resultant force 750 N is passing through (0.15 m, 0.1 m) from the origin O, determine

the magnitude of forces P_1 and P_2 .

[6]

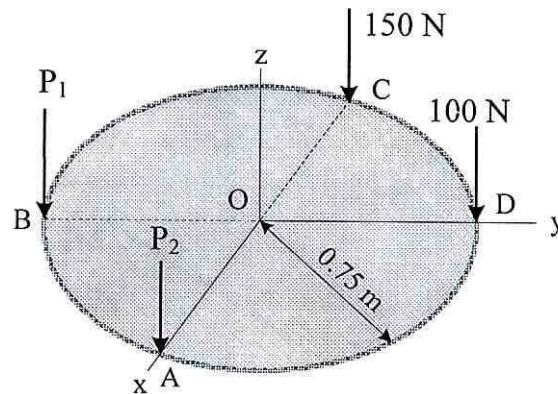


Fig. 3 b

- (c) Determine the support reaction for the beam loaded and supported as shown in Fig. 3c. [5]

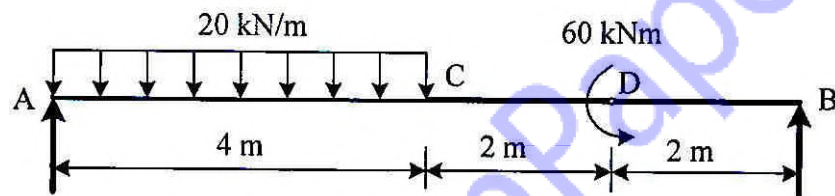


Fig. 3 c

Or

4. (a) Three cables are joined at the junction C as shown in Fig. 4a. Determine the tension in cable AC and BC caused by the weight of the 30 kg cylinder. [6]

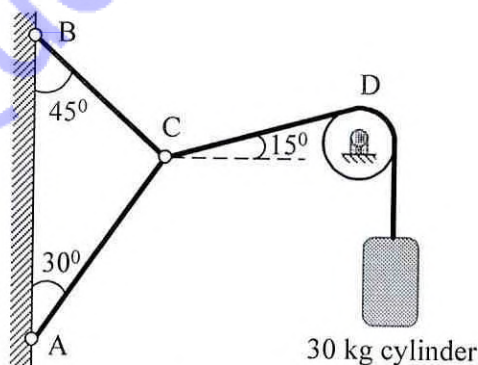


Fig. 4 a

- (b) The square steel plate has a mass of 1800 kg with mass center G as shown in Fig. 4b. Determine the tension in each cable so that the plate remains horizontal. [6]

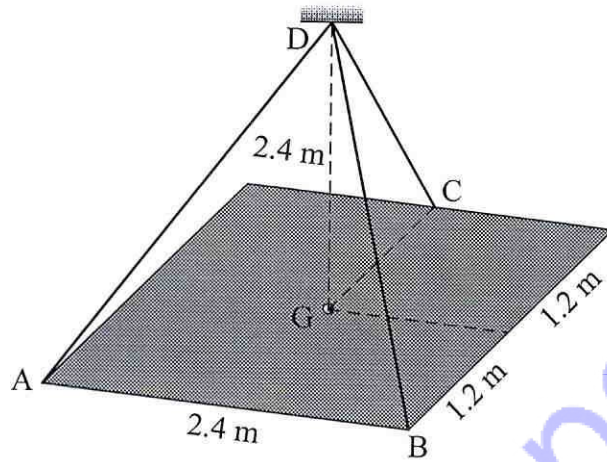


Fig. 4 b

- (c) Determine the component of reaction at hinge A and tension in the cable BC as shown in Fig. 4c. [5]

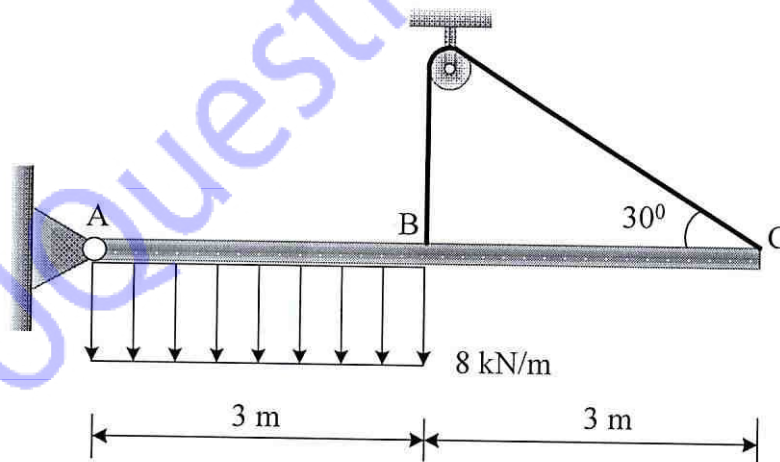


Fig. 4 c

5. (a) A block of mass 10 kg rests on an inclined plane as shown in Fig. 5a. If the coefficient of static friction between the block and plane is $\mu_s = 0.25$, determine the maximum force P to maintain equilibrium. [6]

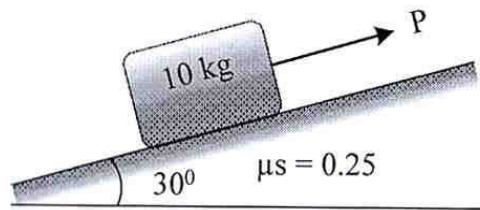


Fig. 5 a

- (b) Determine the components of reactions at supports A and B for the frame loaded and supported as shown in Fig. 5b. [6]

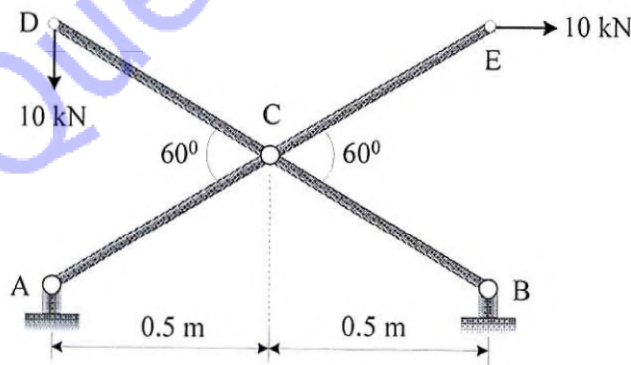


Fig. 5 b

- (c) The 15 m ladder has a uniform weight of 80 N. It rests against smooth vertical wall at B and horizontal floor at A. If the coefficient of static friction between ladder and floor at A is $\mu_s = 0.4$, determine the smallest angle θ with vertical wall at which the ladder will slip. [5]

Or

6. (a) The cable segment support the loading as shown in Fig. 6a. Determine the support reaction and maximum tension in segment of cable. [6]

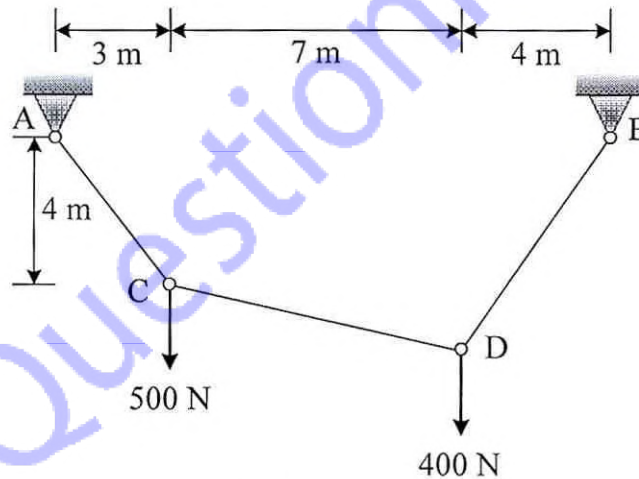


Fig. 6 a

- (b) A cable is passing over the disc of belt friction apparatus at a lap angle 180° as shown in Fig. 6b. If the weight of

block is 500 N, determine the range of force P to maintain equilibrium. [6]

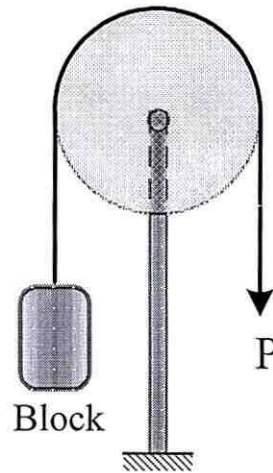


Fig. 6 b

- (c) Determine the forces in the members of the truss loaded and supported as shown in the Fig. 6c. Tabulate the result with magnitude and nature of force in the members. [5]

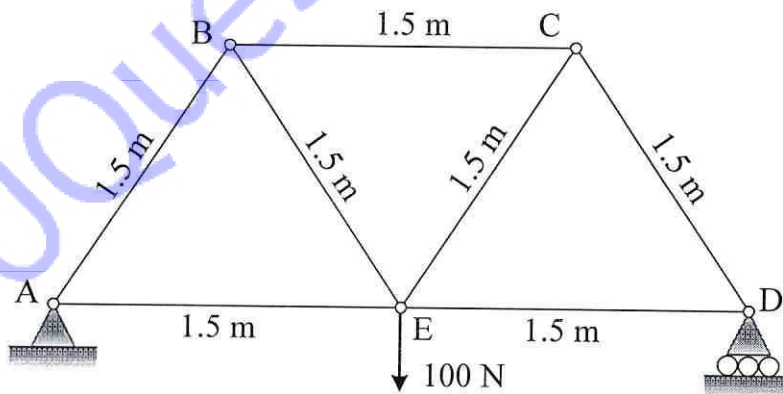


Fig. 6 c