Total No. of Questions—**6**] [Total No. of Printed Pages—**9**

Seat No.	

[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]

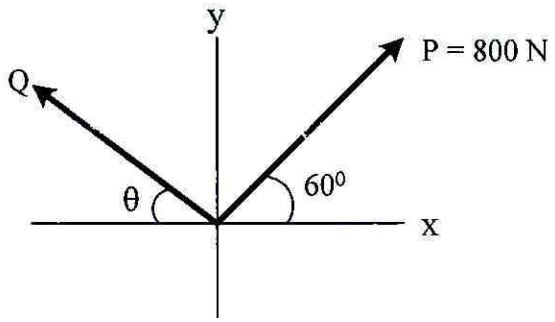

Fig. 1 a

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]

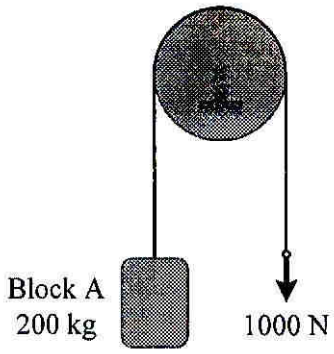

Fig. 1 b

(*c*) A cricket ball shot by a batsman from a height of 2.0 m at an angle of 30º 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]

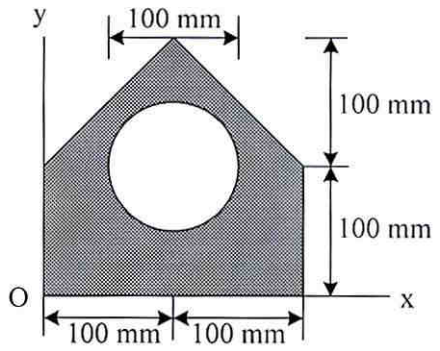

Fig. 2 a

(*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]

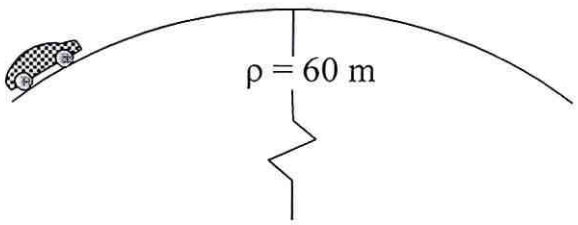

Fig. 2 b

(*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]

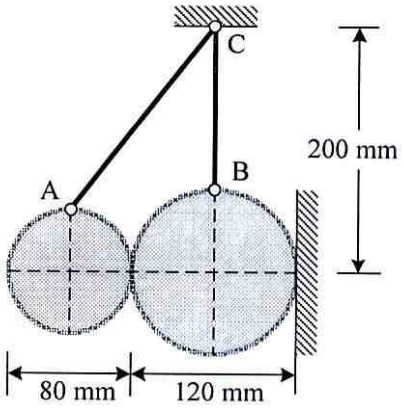

Fig. 3 a

(*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]

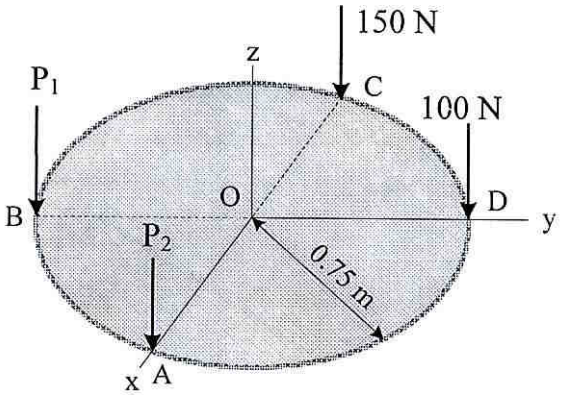

Fig. 3 b

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

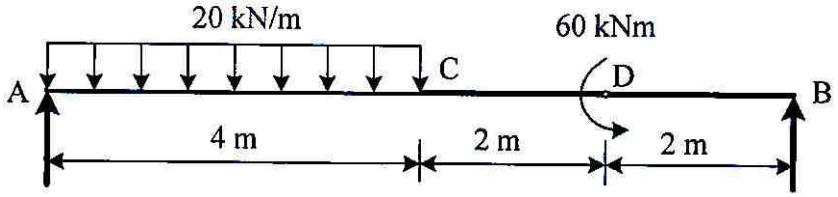

Fig. 3 c

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]

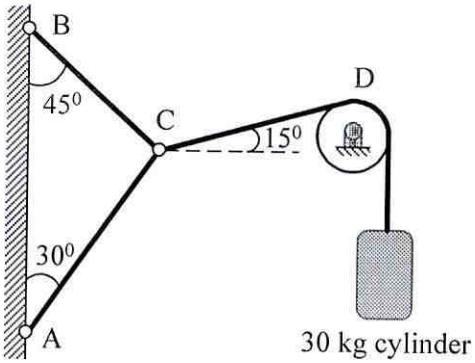

Fig. 4 a

(*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]

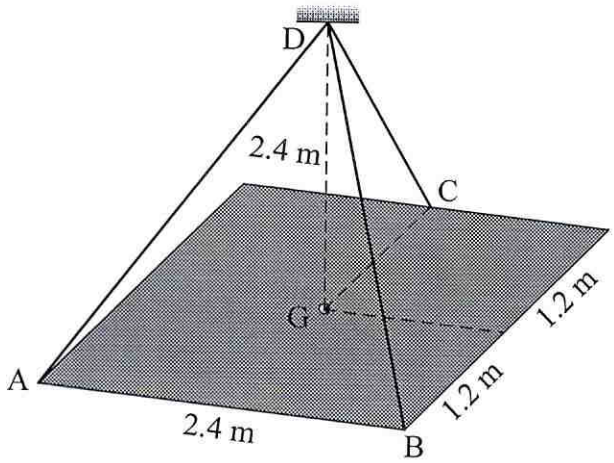

Fig. 4 b

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

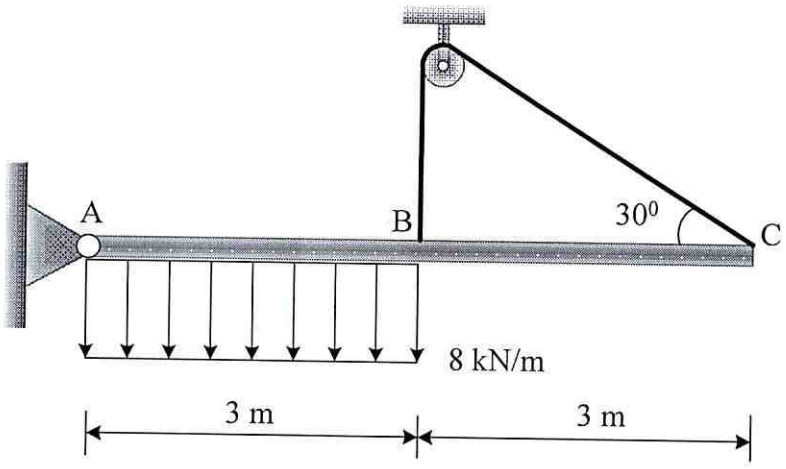

Fig. 4 c

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 μ_s = 0.25, determine the maximum force P to maintain equilibrium. [6]

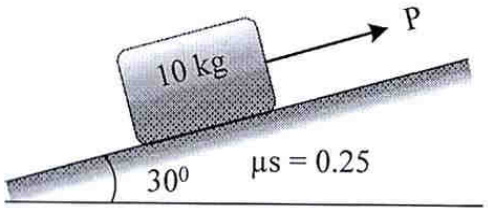

Fig. 5 a

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

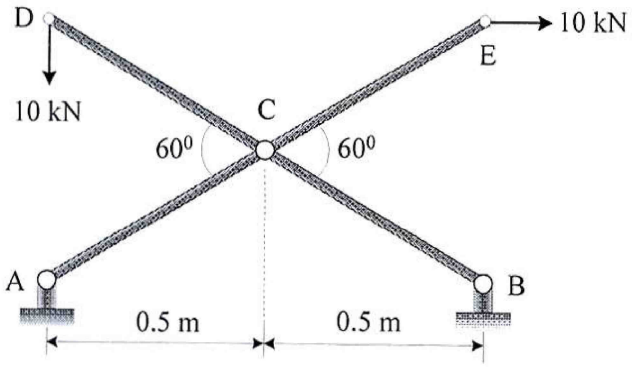

Fig. 5 b

(*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 μ_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]

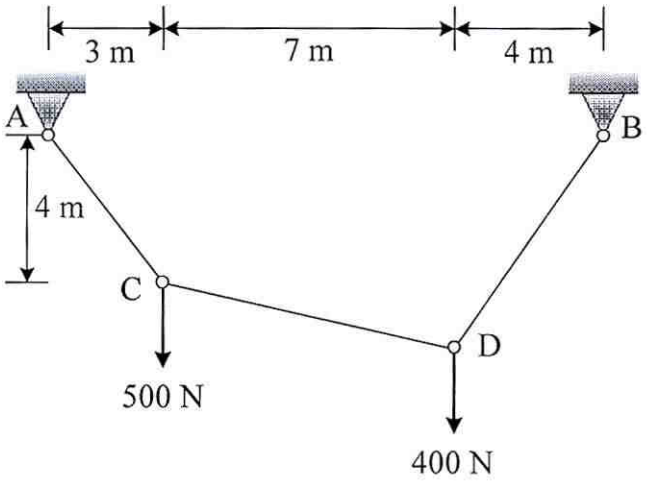

Fig. 6 a

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

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

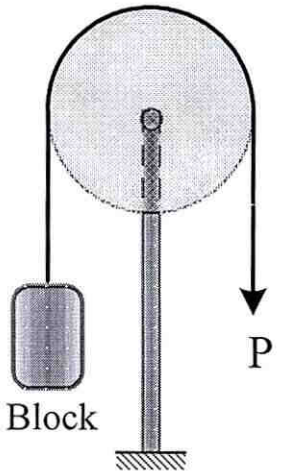

Fig. 6 b

(*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]

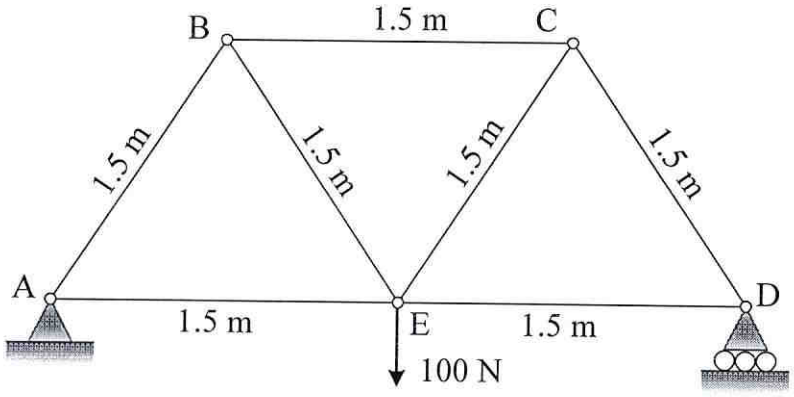

Fig. 6 c