Total No. of Questions—8] [Total No. of Printed Pages—7

Seat No.	

[5667]-102

F.E. (Common) EXAMINATION, 2019
ENGINEERING MECHANICS
(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt Q. Nos. **1** or **2**, **3** or **4**, **5** or **6** and **7** or **8**.

(*ii*) Neat diagram must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

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

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

(*vi*) Use of electronic pocket calculator is allowed.

1. (*a*) Resolve the force of 300 N along the axis *u* and *v* and determine the magnitude of components. (Refer Fig. 1a.) [6]

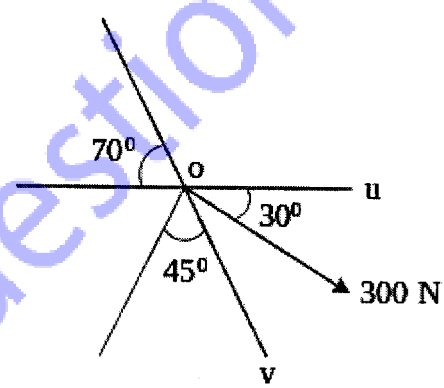

Fig. 1a

(*b*) 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*. [6]

P.T.O.

Or

2. (*a*) Determine the position of centroid in terms of '*a*' with respect to origin 'O' for the shaded area as shown in Fig. 2a. [6]

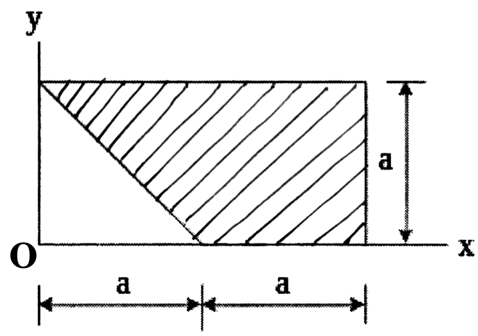

Fig. 2a

(*b*) The 50 kg box is moving on the floor shown in Fig. 2 b with an initial speed of 7 m/s at $x = 0$. The coefficient of kinetic friction between block and floor is $\mu_k = 0.4$. Calculate the time required for the box to come to rest using Newton's second law. [6]

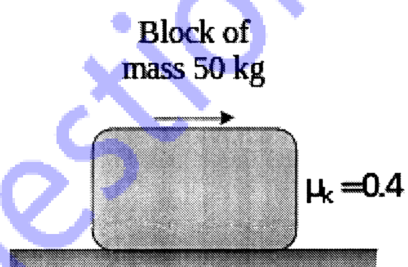

Fig. 2b

3. (*a*) A train starting from rest is moving along curved track with constant acceleration and attains a speed of 60 kmph in 30 s. Determine the acceleration of the train 1 minute after leaving the station. The radius of curvature of the track is 800 m. [6]

(*b*) The ball of mass '*m*' is fixed to a rod of length L having negligible mass shown in Fig. 3b. If it is released from rest when $\theta = 0$, determine the angle θ at which the compressive force in the rod become zero using work energy principle. [6]

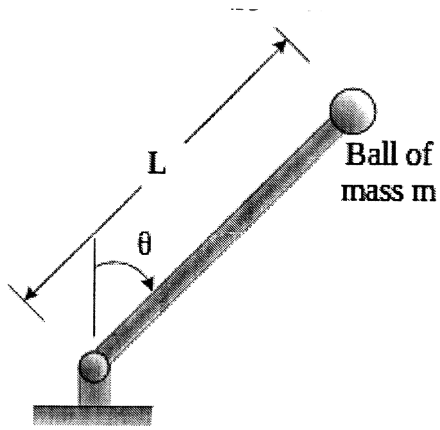

Fig. 3b

Or

4. (*a*) A 7.1 kg ball revolves at a constant speed '*v*' in a horizontal circle as shown in Fig. 4a. If radius of curvature is $\rho = 0.93$ m and angle $\theta = 60^{\circ}$, determine a tension in a wire and the speed of the ball. [6]

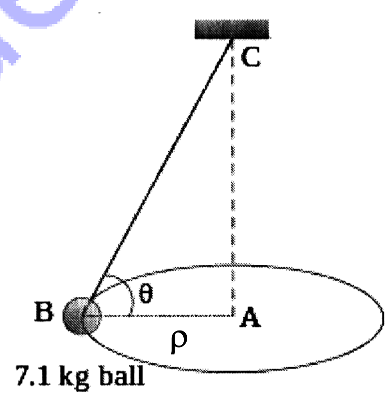

Fig. 4a

(*b*) Ball A has a mass of 0.25 kg and is sliding on a smooth horizontal surface with an initial velocity of 2 m/s. It makes direct impact with ball B, which has a mass of 0.175 kg and is originally at rest. If both balls are of the same size and the impact is perfectly elastic, determine the velocity of each ball just after impact. (Refer Fig 4b) [6]

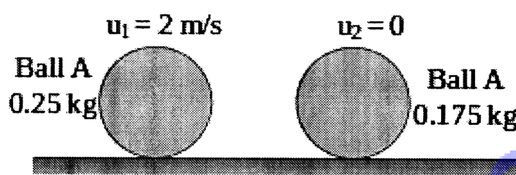

Fig. 4b

5. (*a*) Two cables are tied together at C and loaded as shown in Fig. 5a. Knowing that θ = 30°, determine the tension in AC and BC. [6]

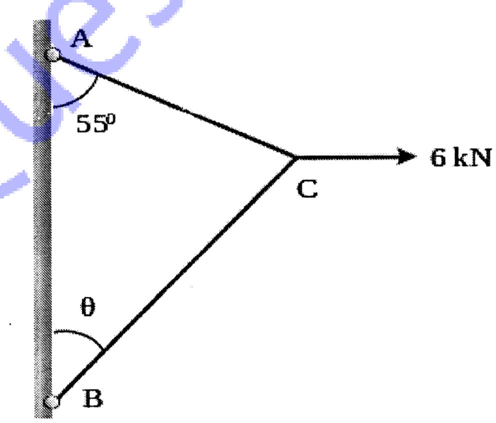

Fig. 5a

(*b*) The cables exert forces F_{AB} = 100 N and F_{AC} = 120 N on the ring at A as shown in Fig. 5b. Determine the magnitude of the resultant force acting at A. [7]

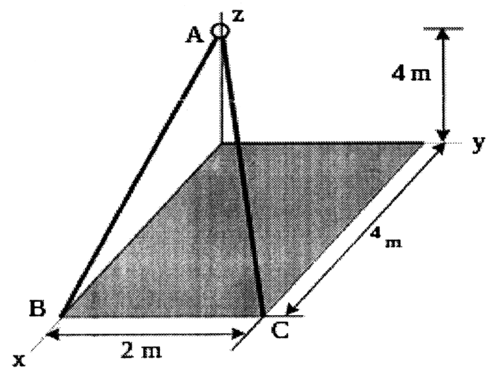

Fig. 5b

Or

6. (*a*) Determine the magnitude of the reactions on the beam at A and B loaded and supported as shown in Fig. 6a. [6]

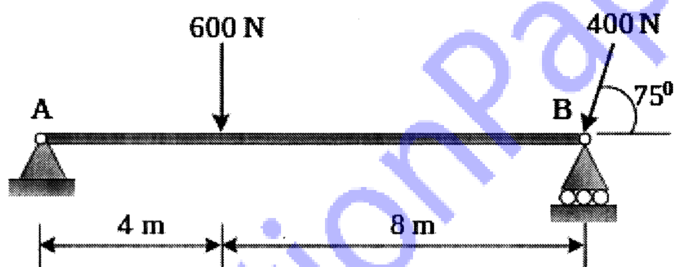

Fig. 6a

(*b*) The uniform concrete slab has a weight of 5500 N. Determine the tension in each of the three parallel supporting cables when the slab is held in the horizontal plane as shown in Fig. 6b. [7]

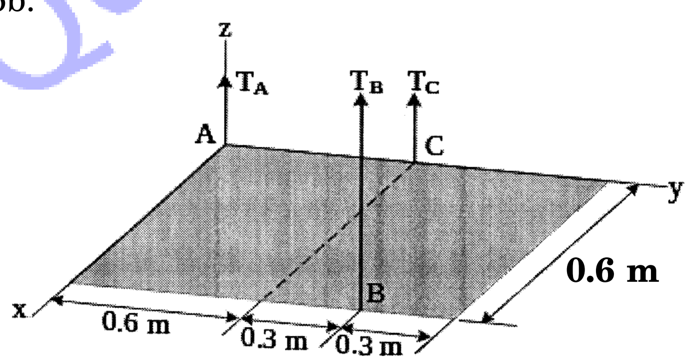

Fig. 6b

7. (*a*) Determine the magnitude and nature of forces in the member BC, BE and AE of the truss loaded and supported shown in Fig. 7a. [7]

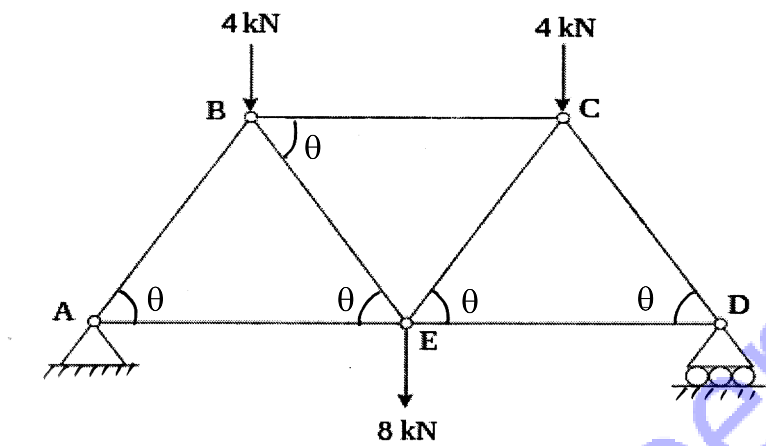

Fig. 7a

(*b*) A block of weight 200 N is kept on an incline plane and a force P is applied to just move the block as shown in Fig. 7b. Determine the range of force P for equilibrium if coefficient of static friction between block and plane is μ_s = 0.3. [6]

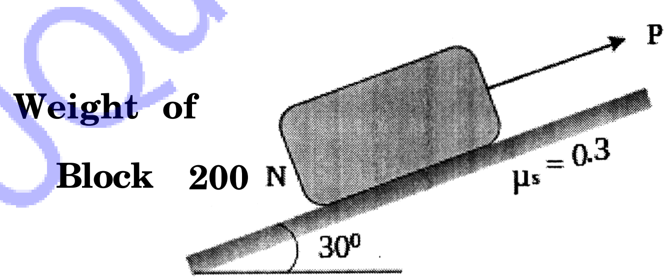

Fig. 7b

Or

8. (*a*) The cable segment support the loading as shown in Fig. 8a. Determine the support reactions and tension in segment CD of the cable. [7]

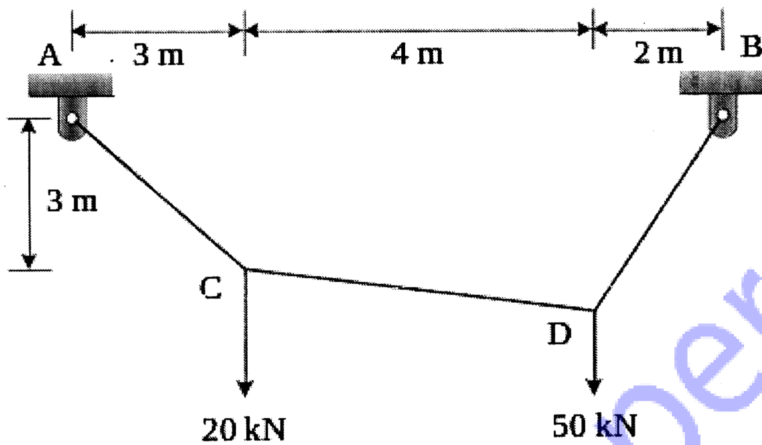

Fig. 8a

(*b*) The 15 m ladder has a uniform weight of 150 N and rest against the smooth wall at B shown in Fig. 8b. If the coefficient of statics friction at A is $\mu_A = 0.25$, determine the smallest angle θ at which the ladder will not slip. [6]

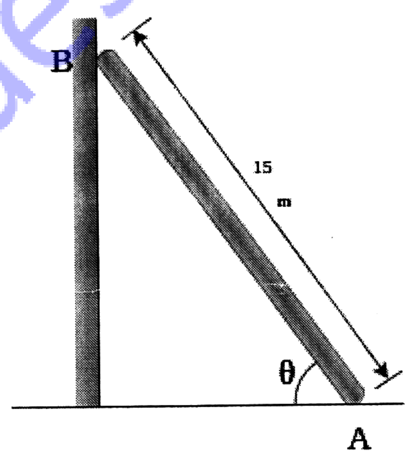

Fig. 8b