Total No. of Questions—**6**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4856]-203

F.E. (Common) EXAMINATION, 2015

ENGINEERING MECHANICS

(2012 PATTERN)

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

N.B. :— (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4** and Q. No. **5** *or* Q. No. **6**.

(*ii*) Answers should be written in single answer-book.

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

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

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

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

1. (*a*) The force system shown in Fig. 1 (*a*) have a resultant of 200 N along positive Y-axis, determine the magnitude and position θ of force F. [4]

(*b*) Two blocks are connected by an inextensible string as shown in Fig. 1(*b*). If the system is released from rest, determine the velocity of the block A after it has moved 2 m by work energy principle. The coefficient of friction between block A and the plane is $\mu_S = 0.25$. [4]

(*c*) A stone is dropped from the top of a tower 50 m high. At the same time, another stone is thrown vertically upwards from the foot of tower with a velocity of 25 m/s. When and where the two stones cross each other ? [4]

P.T.O.

(*d*) A cricket ball thrown by a fielder from a height of 2 m at an angle of 45° to the horizontal with an initial velocity of 25 m/s hit the wickets at the height of 0.6 m from the ground, find distance of fielder from the wickets : [4]

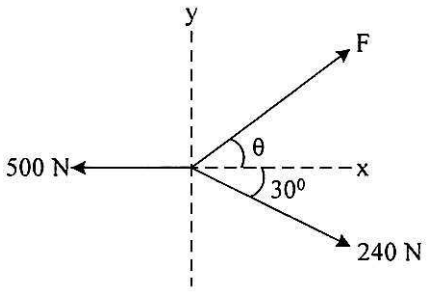

Fig. 1 (*a*)

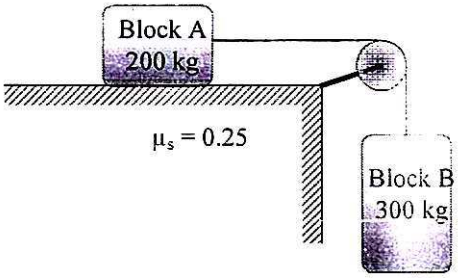

Fig. 1 (*b*)

Or

2. (*a*) A semicircular area is cut from a trapezium as shown in Fig. 2(*a*). Determine the centroid of the shaded portion with respect to the origin. [4]

(*b*) A pendulum bob has a mass of 10 kg and is released from rest when θ = 0° as shown in Fig. 2(*b*). Determine the tension in the cord at θ = 30°. Neglect the size of bob. [4]

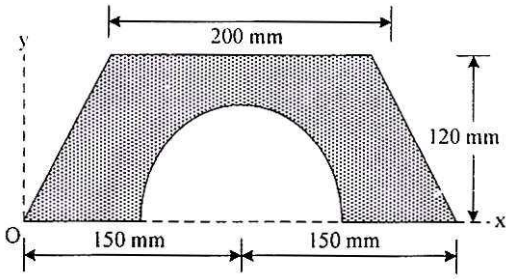

Fig. 2 (*a*)

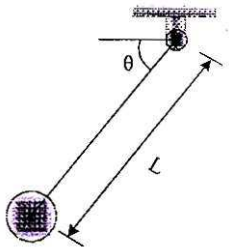

Fig. 2 (*b*)

(*c*) A ball is dropped from an unknown height on a horizontal floor from which it rebounds to height of 8 m. If e = 0.667, calculate the height from which the ball was dropped. [4]

(*d*) A bullet moving at a speed of 300 m/s has its speed reduce to 270 m/s when it passes through a board. Determine how many such boards the bullet will penetrate before it stops. [4]

3. (*a*) A simply supported beam AB of span 6 m is loaded and supported as shown in Fig. 3(*a*). Find the reactions at support A and B. [6]

(*b*) Determine the magnitude and direction of a resultant force of a given force system as shown in Fig. 3(*b*) and locate its point of application on the slab : [6]

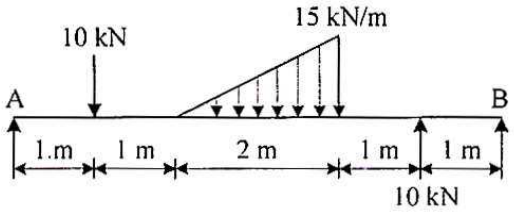

Fig. 3 (*a*)

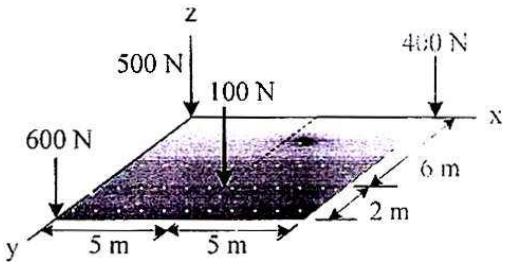

Fig. 3 (*b*)

(*c*) A sphere weighing 1000 N is placed in a wrench as shown in Fig. 3(*c*), find the reactions at the point of contacts : [5]

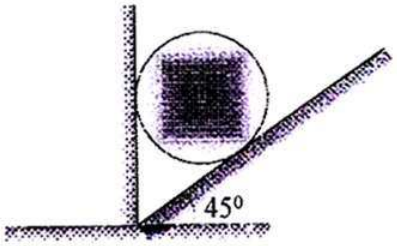

Fig. 3 (*c*)

Or

4. (*a*) Determine the magnitude and position of force F so that the force system shown in Fig. 4(*a*) maintain equilibrium. [6]

(*b*) If each cable can sustain a maximum tension of 600 N, determine the greatest weight of the bucket and its contents that can be supported. Refer Fig. 4(*b*). [6]

(*c*) Determine the reactions at roller A and pin B for equilibrium of the member ACB as shown in Fig. 4(*c*). [5]

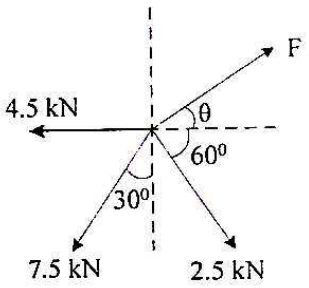

Fig. 4(*a*)

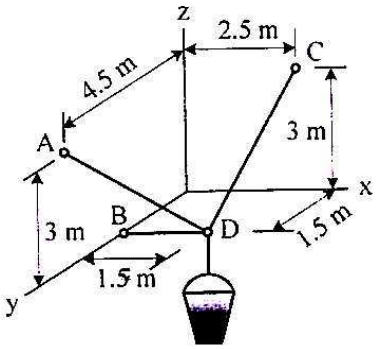

Fig. 4(*b*)

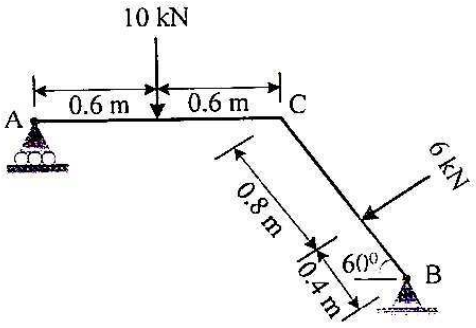

Fig. 4(*c*)

5. (*a*) Members AB and BC can support a maximum compressive force of 800 N and members AD, DC and BD can support a maximum tensile force of 2000 N. Determine the greatest load P the truss can support. Refer Fig. 5(*a*). [6]

(*b*) The uniform rod having a weight W and length L is suppported at its ends A and B as shown in Fig. 5(*b*), where the coefficient of static friction μ_s = 0.2. Determine the greatest angle θ so that the rod does not slip. Refer Fig. 5(*c*). [6]

(*c*) Determine the horizontal force P needed to just start moving the 300 N crate up the plane. Take μ_s = 0.3. Refer Fig. 5(*c*) : [5]

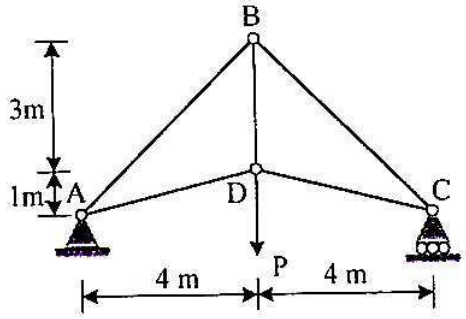

Fig. 5(*a*)

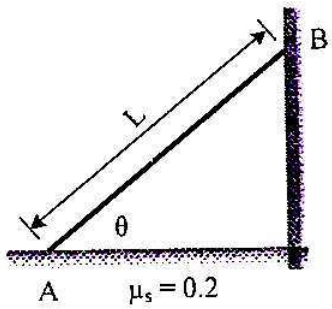

Fig. 5(*b*)

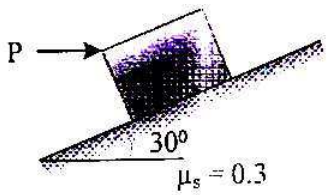

Fig. 5(*c*)

Or

6. (*a*) Determine the forces in the members BE and BD of the truss which supports the load as shown in Fig. 6(*a*). All interior angles are 60° and 120°. [6]

(*b*) Determine the magnitude of pin reactions at A, B and D for the frame loaded as shown in Fig. 6(*b*). [6]

(*c*) A force P = mg/6 is required to lower the cylinder with the cord making 1.25 turns around the fixed shaft. Determine the coefficient of friction μ_s between the cord and the shaft. Refer Fig. 6(*c*) : [5]

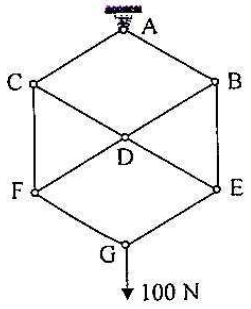

Fig. 6(*a*)

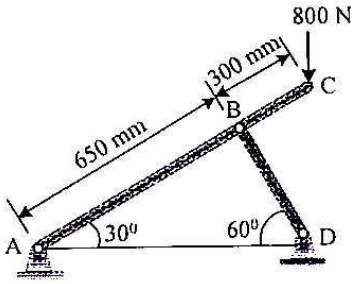

Fig. 6(*b*)

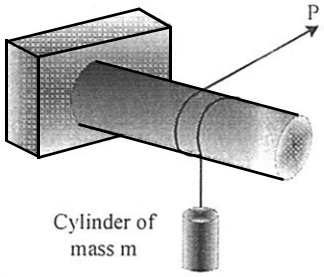

Fig. 6(*c*)