Total No. of Questions—**6**] [Total No. of Printed Pages—**8**

Seat No.	

[4756]-26

F.E. (Second Semester) EXAMINATION, 2015

ENGINEERING MECHANICS

(2008 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**, Q. No. **5** *or* Q. No. **6**.

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

(*iii*) Neat diagrams 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 angle between the two concurrent forces is 90° and their resultant is 2500 N. The resultant makes an angle of 45° with one of the force. Determine the magnitude each force. [6]

(*b*) The velocity of a particle is given by

$$v = 20t^2 - 100t + 50,$$

where v is in m/s and t is in seconds. Determine the velocity of particle, when acceleration is zero. [6]

P.T.O.

Or

2. (*a*) Determine the y coordinate of the centroid of a trapezoidal area in terms of dimension shown in Fig. 2a with respect to origin O. [6]

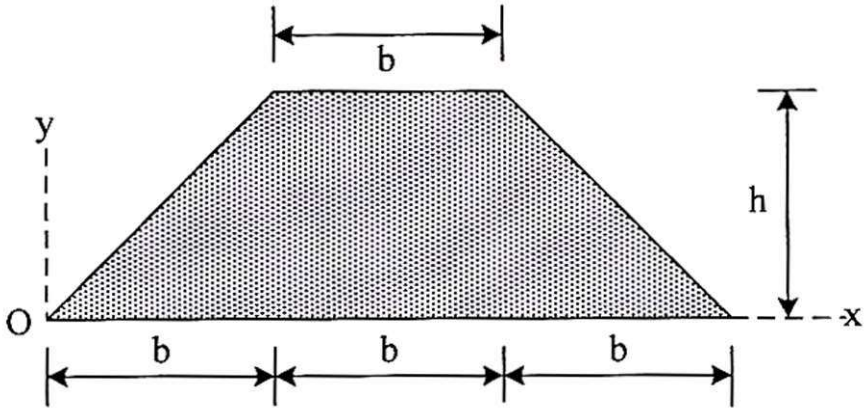

Fig. 2a

(*b*) The system shown in Fig. 2b is initially at rest. Neglecting friction and the mass of pulley, determine and acceleration of block A and the velocity of block A after it has moved through 3 m. [6]

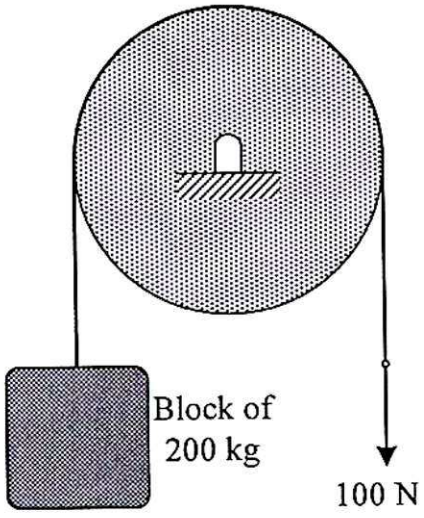

Fig. 2b

3. (*a*) A square foundation supports four loads as shown in Fig. 3a. Determine magnitude, direction and point of application of resultant of four forces. [6]

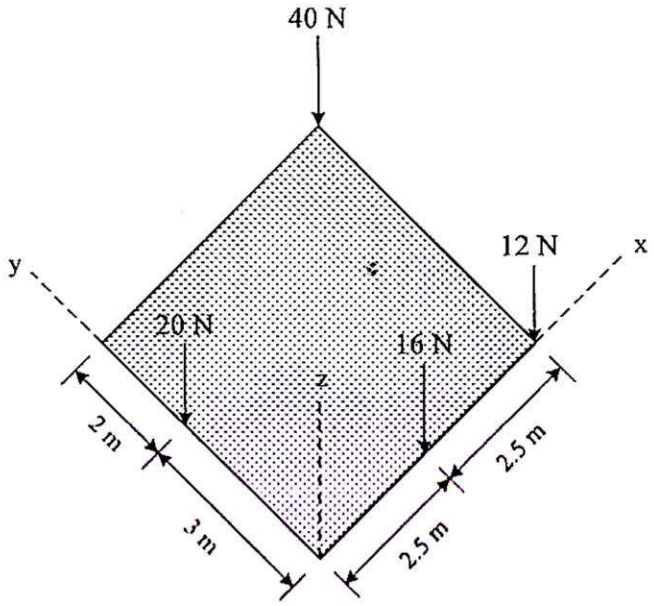

Fig. 3a

(*b*) A sphere of weight 100 N and a radius of 200 mm as shown in Fig. 3b. Determine the reaction at the points of contact. [6]

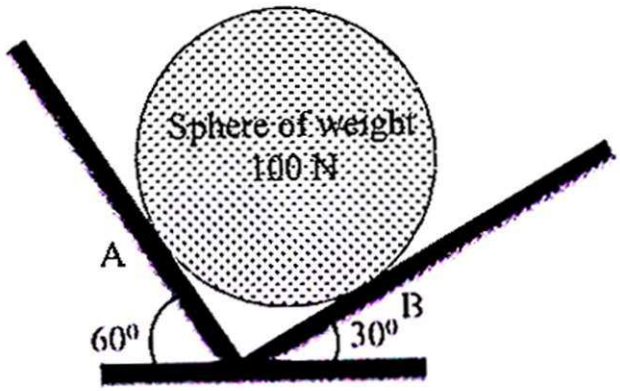

Fig. 3b

(*c*) A cricket ball shot by a batsman from a height of 1.8 m at an angle of 30° with the horizontal with a velocity of 18 m/s is caught by a fielder at a height of 0.6 m from the ground. Determine the horizontal distance between the batsman and fielder. [7]

Or

4. (*a*) For the given loading of the beam AB, determine the range of values of the mass '*m*' of the crate for which the system will be in equilibrium, knowing that the maximum allowable value of the reactions at each support is 2.5 kN and the reaction at E must be directed downward. (Refer Fig. 4a). [6]

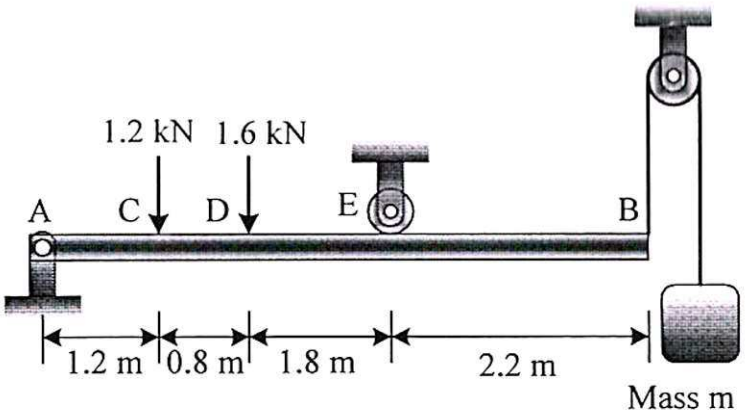

Fig. 4a

(*b*) A vertical load of 50 kg is supported by three rods DA, DB and DC as shown in Fig. 4b. Determine the force in each

rod for the coordinates of points as shown. A(–4, –1, 0), B(3, 3, 0), C(3, –2, 0) and D(0, 0, 6). [7]

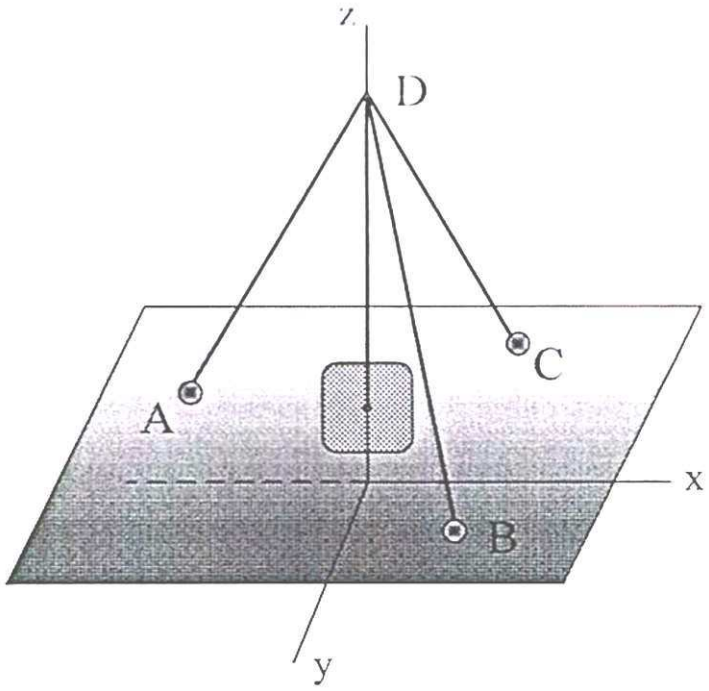

Fig. 4b

(*c*) The small ball of mass *m* is attached to a light cord of length L and moves as a conical pendulum in a horizontal circle with a tangential velocity *v* as shown in Fig. 4c. Used the relation $v = r\omega$. Determine *h* and tension T in the cord. [6]

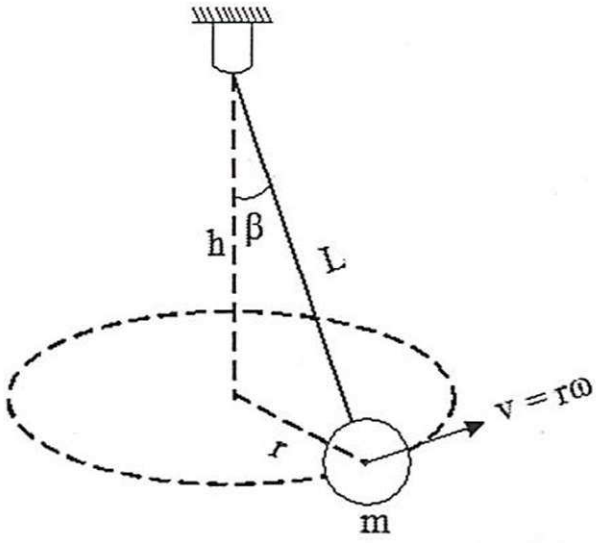

Fig. 4c

5. (*a*) A block weighing 200 N is pulled up a 30° plane by a force P producing a velocity of 5 m/s in 5 s. If the coefficient of friction is 0.2, determine the magnitude of force P using impulse momentum principle. Refer Fig. 5a. [6]

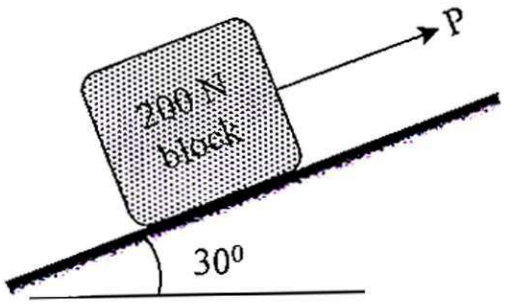

Fig. 5a

(*b*) Determine the mganitude and nature of force in the members BC, BG and HG of the pin jointed truss loaded and supported as shown in Fig. 5b by method of section. [7]

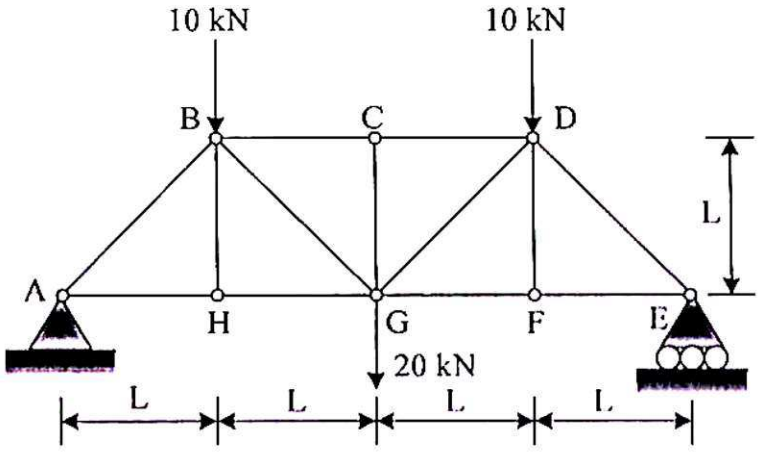

Fig. 5b

(*c*) A 200 N block is rest on a plane which makes an angle 30° with the horizontal as shown in Fig. 5a. If the coefficient of static friction between the block and plane is 0.3, determine the range of force P to maintain the equilibrium. [6]

Or

6. (*a*) A cable passes around three 0.05 m radius pulleys and supports two blocks as shown in Fig. 6a. Pulleys C and E are locked to prevent rotation and the coefficient of friction between the cable and pulleys are $\mu_s = 0.2$. Determine the range of values of the weight of block A for which equilibrium is maintained, if the pulley D is free to rotate. [6]

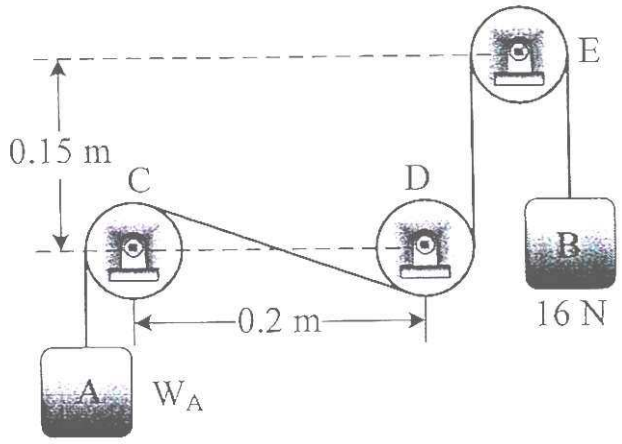

Fig. 6a

(*b*) One of the requirement for tennis balls to be used in official competition is that, when dropped onto a rigid surface from a height of 2540 mm, the height of the first bounce of the ball must be in the range of 1346 mm $\leq h \leq$ 1473 mm. Determine the range of the coefficient of restitution of the tennis balls satisfying this requirement. [6]

(*c*) Determine the magnitude and nature of force in all the members of the truss loaded and supported as shown in Fig. 5b by method of joint. [7]