Total Pages—10

B.Tech - 1
EM

Set-2

Full Marks : 70

Time : 3 hours

Answer **Q. No. 1** which is compulsory and any **five** out of rest seven questions

The figures in the right-hand margin indicate marks

1. Answer the following : 2×10

(*a*) What is the tension in the string BC shown in Fig. 1(*a*) ?

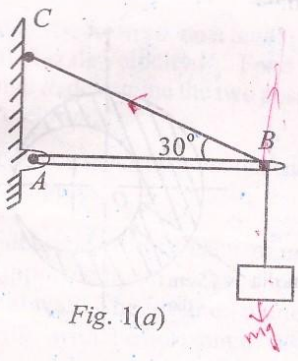
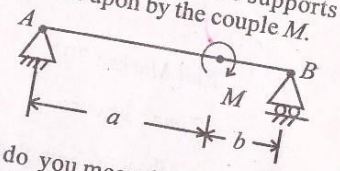


Fig. 1(*a*)

(*Turn Over*)

) Find the reactions at the supports of the beam acted upon by the couple M.

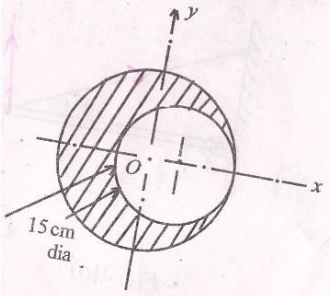


What do you mean by superposition and ansmissibility in respect to force system ?

ate and explain static and kinetic friction. hat do you mean by friction angle ?

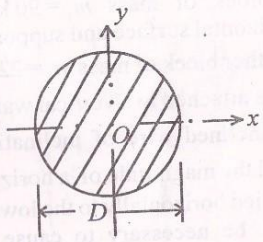
at is method of sections for solving truss blems ? Demonstrate through an example.

the C.G. of the figure for the shaded n.



(Continued)

(*g*) Find the M.I of the figure shown about the axis 1*r* to the plane and passing through the C.G.



(*h*) State and explain law of conservation of momentum. Is it different for linear and angular momentum ?

(*i*) A projectile is fired on a level ground with initial muzzle velocity V_0. For a fixed value of range R, determine the two possible angles of projection.

(*j*) What do you mean by potential energy ? Give four examples.

2. (*a*) Two identical rollers, each of mass 45 kg, are supported by an inclined plane and a vertical wall. The inclined plane makes an angle 30° with the horizontal. Assuming all

(Turn Over)

e contact surfaces to be smooth, find the actions produced at all the contact points.

block of mass $m_1 = 90$ kg rests on a rizontal surface and supports on top of it ther block of mass $m_2 = 22$ kg. The mass s attached to a vertical wall by means of nclined wire of inclination $\tan^{-1}(\frac{3}{4})$. the magnitude of a horizontal force P, ed horizontally to the lower block, that be necessary to cause slipping to nd. The coefficient of friction for all g surfaces may be taken as $\mu = 0{\cdot}3$. 5

he centroid of the shaded area shown 3(*a*).

5

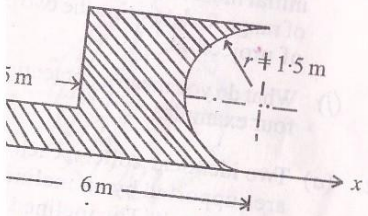


Fig. 3(*a*)

(*b*) Find the forces in the members CB and BE in *Fig.* 3(*b*) shown below : 5

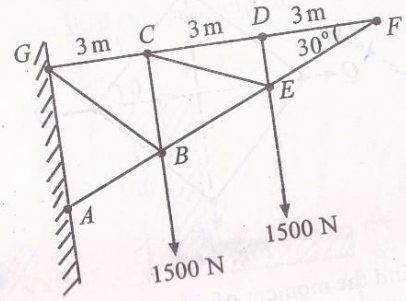


Fig. 3(*b*)

4. (*a*) Four bars of equal lengths '*l*' are hinged together at their ends in the form of a rhombus as shown in *Fig.* 4(*a*). Using the principle of virtual work, find the relation between the forces P and Q for equilibrium

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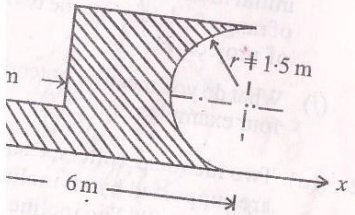

Fig. 3(*a*)

(*Continued*)

(*b*) Find the forces in the members CB and BE in *Fig.* 3(*b*) shown below : 5

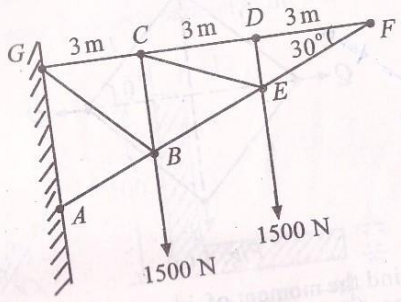

Fig. 3(*b*)

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(*Turn Over*)

of the system as defined by the angle θ. Neglect the weight of the bars.

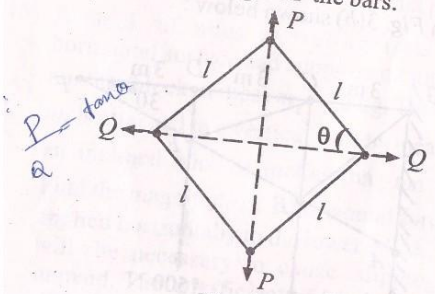
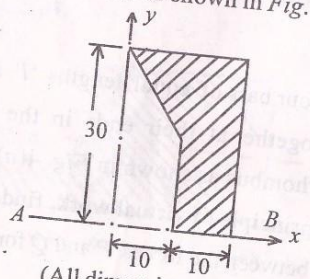


Fig. 4 (*a*)

(*b*) Find the moment of inertia of the Figure about the axis *AB* as shown in *Fig.* 4 (*b*). 5

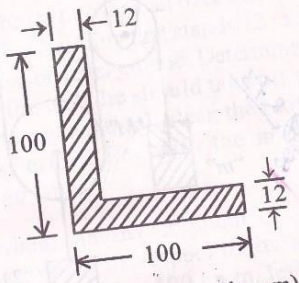


(All dimensions are in mm)

Fig. 4 (*b*)

(*Continued*)

(*a*) Calculate the moment of inertia of the area of the angle section having the dimensions as shown in *Fig.* 5(*a*) with respect to centroidal axis parallel to the *x*-axis. 5



(All dimensions are in mm)

Fig. 5 (*a*)

(*b*) Masses "*m*" and "2 *m*" are supported in a vertical plane by a string and pulleys arranged as shown in *Fig.* 5(*b*). Find the magnitude of the additional mass "*M*" applied on the left which will give a downward acceleration

(*Turn Over*)

$a = \frac{g}{10}$ to the mass 'm'. Neglect friction and inertia of pulleys.

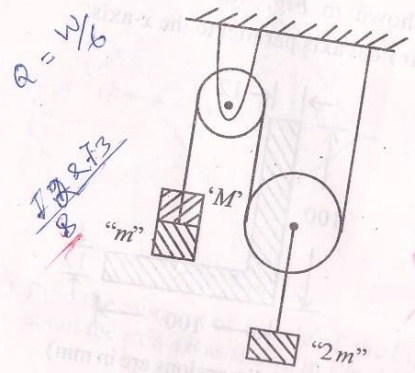


Fig. 5(b)

A stone is dropped into a well and falls vertically with constant acceleration due to gravity only. The sound of impact of the stone on the bottom of the well is heard 6·5 second after it is dropped. If the velocity of sound is 336 m/s, what is the depth of the well ?

5

(Continued)

(*b*) A ball is thrown against a rigid heavy floor at an angle of 60° with a speed at impact of 17 m/s. What is the angle of rebound, if coefficient of restitution is 0·7 ? 5

(*a*) A boy wishes to throw a ball over a flat roofed school house building that stands 12 m wide and 7·5 high on level ground. Determine how far from the wall he should take his stand in order to make the ball clear the roof with the least effort, i.e., with the minimum initial velocity. 5

(*b*) A flywheel having moment of inertia $I = 70$ kg-m² with respect to its axis of rotation and making 100 r.p.m, left alone, comes to rest with constant angular deceleration in 52 seconds, owing to friction in the bearings. Determine the friction couple that produces this deceleration. 5

8. (*a*) A projectile is fired at an angle of 60° from the origin to a hill described by the equation $y = 10^{-8}x^2$. The muzzle velocity is 1000 m/s. At what elevation 'y' does it strike the hill ? 5

(Turn Over)

(*b*) A coil spring of stiffness 800 N/m is stretched by 120 mm from the unstretched position. What is the energy stored in the spring ? What is the workdone by another stretching of 120 mm ? Are they same ? If not, why ? 5