Question Paper Code : Q 2720

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Annual Pattern — First Year

Civil Engineering

GEIX 04 — ENGINEERING MECHANICS .

(Common to Bio-Technology/Chemical Engineering/
Petroleum Engineering/Polymer Technology/Textile Technology/
Textile Technology (Textile Chemistry))

(Regulation 2004)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   State the necessary and sufficient conditions for equilibrium of a particle in space.

2.   Explain briefly the principle of transmissibility.

3.   Represent the rectangular components of moment of a force in determinant form.

4.   What is the significance of a free body diagram?

5.   Define the terms : (a) lead angle and (b) pitch of a screw.

6.   Give the cause of rolling resistance.

7.   Express the integrals for finding moment of inertia of an area.

8.   Find the moment of inertia of a right triangle of width 60 mm and height 90 mm about its base.

9.   State the principle of work and energy.

10.   Define the terms position vector and velocity as applied to curvilinear motion of particles.

11. (a)   Determine the tension in the cables AB, AC and AD if the crate shown in Fig. 1 is weighing 10 kg.
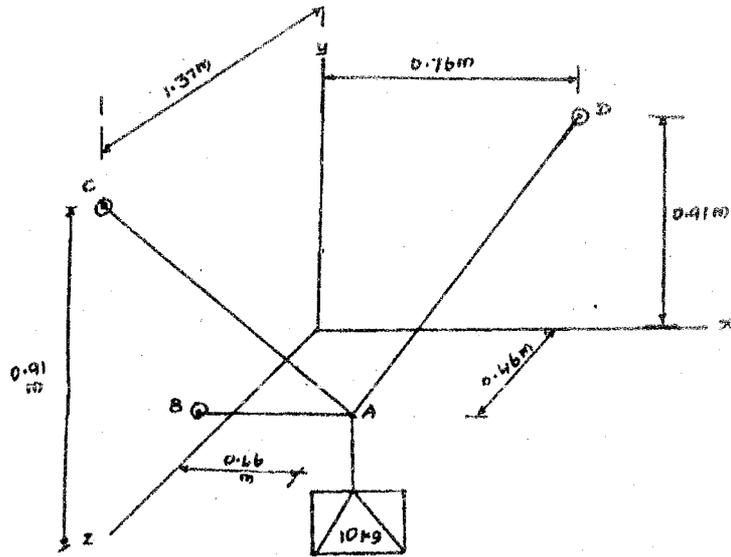

Fig. 1

Or

(b)   A 100 kg crate is hung by means of two cables AB and AC, which are attached to the top of a vertical wall. A horizontal force of magnitude 185 N perpendicular to the wall holds the cylinder in the position as shown in Fig. 2. Determine the tension in each cable.
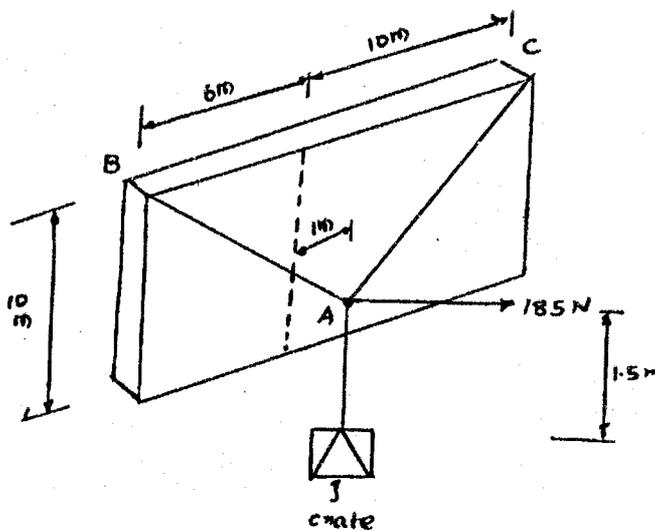

Fig. 2

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12. (a) Determine the moment created by the force acting at point B of the rod shown in Fig. 3. about point A.

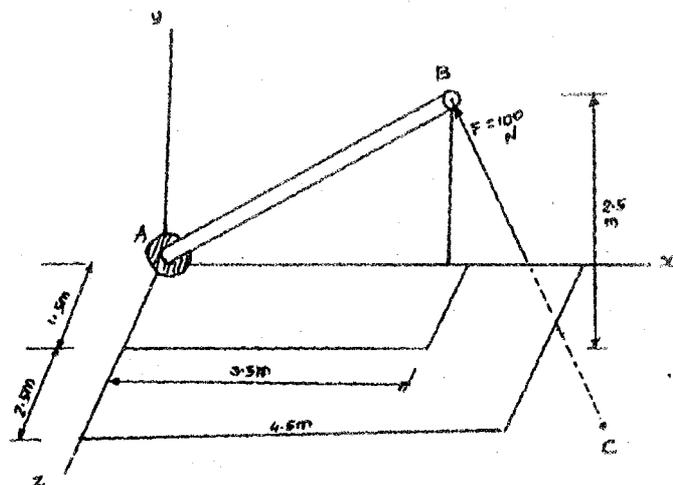

Fig. 3

Or

(b) The 8 m pipe AB shown in Fig. 4 has a fixed end at A. A steel cable is stretched from B to a point C on the vertical wall. If the tension in the cable is 1200 N, determine the moment about A of the force exerted by the cable at B.
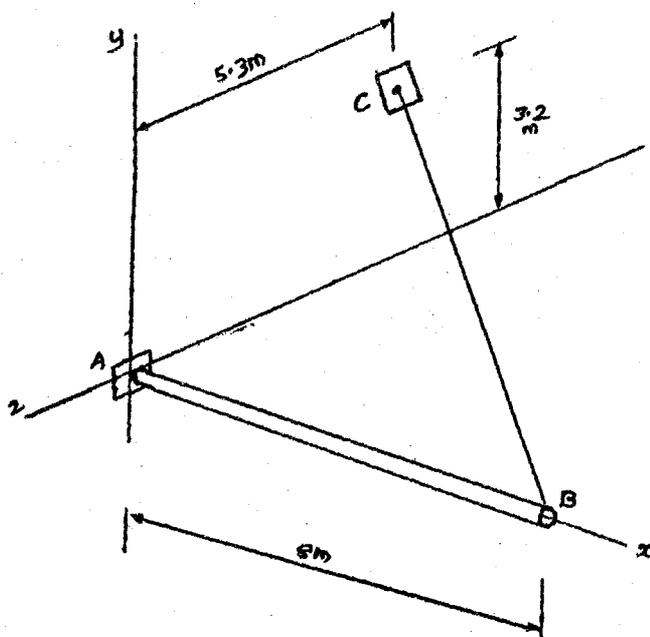

Fig. 4

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13. (a) Determine the smallest force P required to lift the 15 kN load shown in Fig. 5. The coefficient of static friction between A and C and between B and D is 0.3 and that between A and B is 0.4.
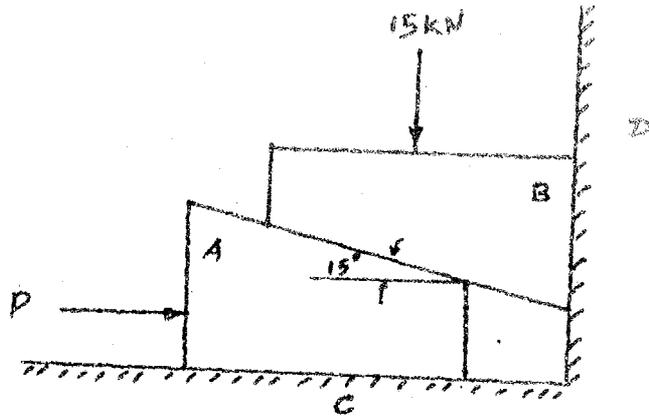

Fig. 5

Or

(b) (i) Assuming the coefficient of rolling resistance to be 3.0 mm, determine the horizontal force required to move a 2700 kg automobile along a horizontal road at a constant speed. The diameter of each tyre is 1150 mm. Neglect all forms of friction except rolling resistance.

(10)

(ii) A wheel 250 mm in diameter carries a load of 10 kN. If a horizontal force of 100 N is necessary to move it over a level surface, determine the coefficient of rolling resistance.

(6)

14. (a) For the section shown in Fig. 6 determine the principal moments of inertia and locate the principal planes.
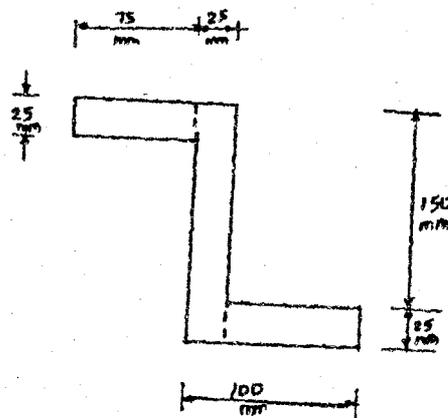

Fig. 6

Or

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(b) Find the moments of inertia about the centroidal axes for the section shown in Fig. 7.
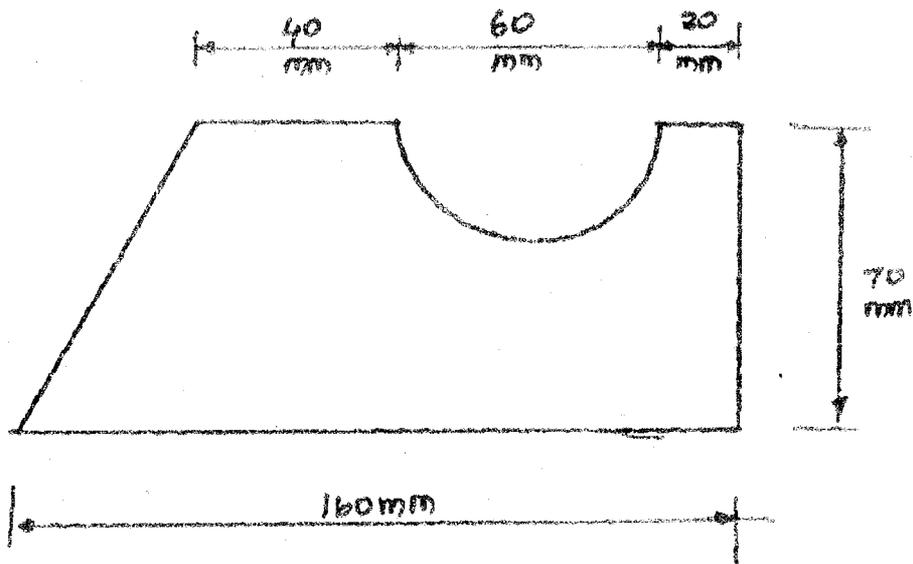

Fig. 7

15. (a) The 50 kg block shown in Fig. 8 rests on a horizontal plane for which the coefficient of kinetic friction is 0.3. If the block is pulled by a 350 N force as shown, determine the velocity of the block after it has moved 65 m starting from rest. Use principle of work and energy.
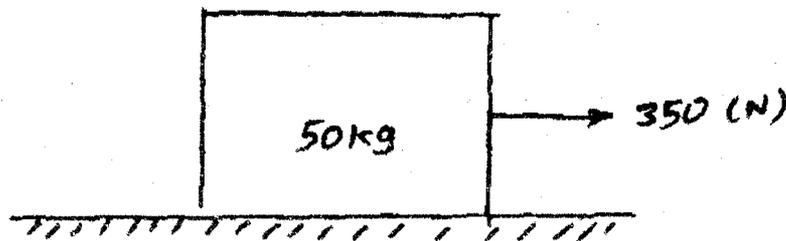

Fig. 8

Or

(b) A stone is thrown vertically upward from the top of a 30 m high building with a velocity of 15m/s. Taking the acceleration of stone as 9.81 m/s², and taking that as constant, determine

  (i)   Velocity V and elevation SY of the stone above the ground at any time t,

  (ii) The maximum altitude reached by the stone and

  (iii) The time when the stone strikes the ground.