# D 134

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Second Semester

Civil Engineering

(Common to all branches)

GE 1151 — ENGINEERING MECHANICS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State the principle of Transmissibility.

2. Three coplanar forces of magnitude P Newtons each are acting on a particle. If their lines of action make equal angles with each other, show that the forces are in equilibrium.

3. State the Varignon's theorem.

4. Find the moment of the force of 15 N acting along the positive direction of X–axis about the point $A\,(2, 3)$.

5. Distinguish between centroid and centre of gravity.

6. Define product of inertia.

7. Explain briefly the two types of collision.

8. If the distance $x$ cm travelled by a particle in $t$–seconds is given by $x = 20t^2 + 50t + 19$, find the velocity and acceleration after 3 seconds.

9. State the laws of friction.

10. Briefly explain "step of the belt" in belt drives.

PART B — (5 × 16 = 80 marks)

11. For a section given in fig. 1;

(i) Locate the horizontal centroidal axis–*X*. (8)

(ii) Locate the vertical centroidal axis–*Y*. (8)

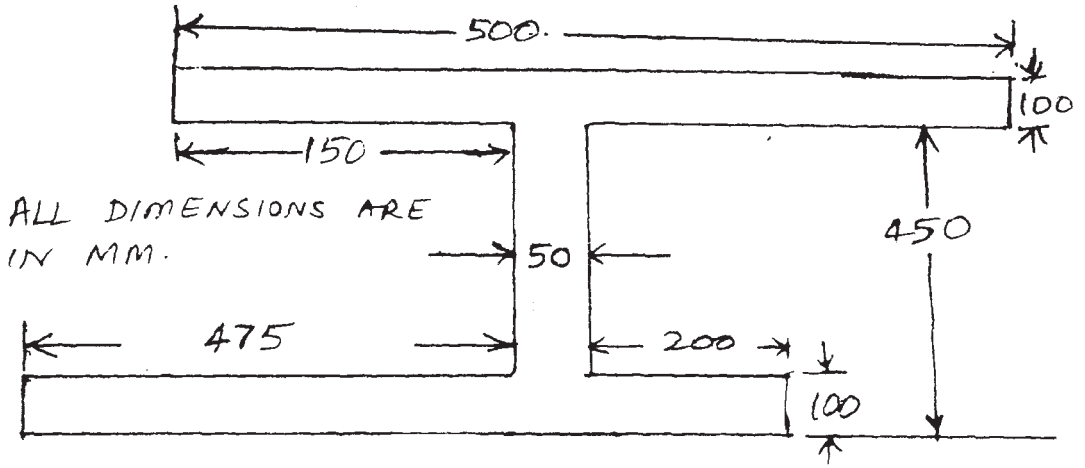


fig. 1

12. (a) A pole AB, 6 m long is held by three guy wires as shown in fig. 2. Determine the moment about each of the coordinate axes of the force exerted by wire BE on point B. The tension 'T' in wire BE is known to be 840 N. (16)

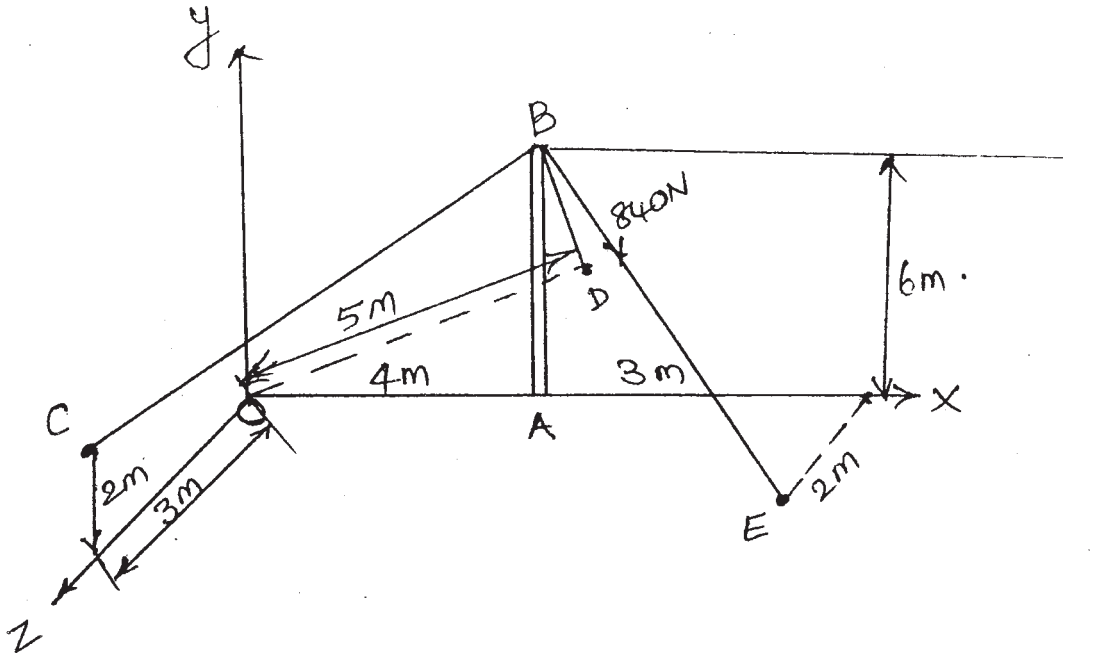


fig. 2

Or

(b) Determine the magnitude and direction of a single force P which keeps in equilibrium. The system of forces acting is shown in fig. 3. (16)

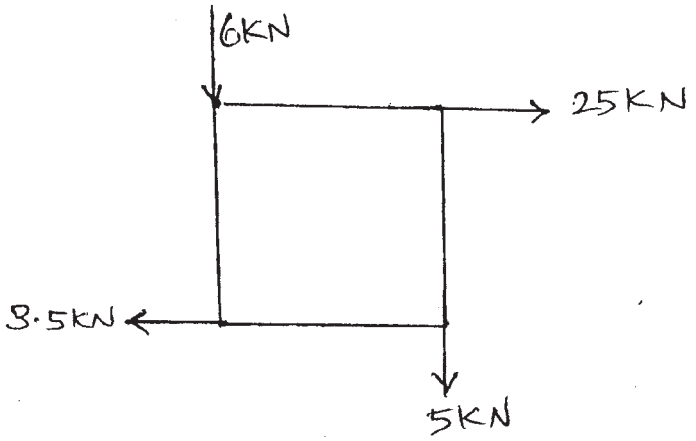


fig. 3

13. (a) Find the reactions at supports A and B of the beam as shown in fig. 4. (16)

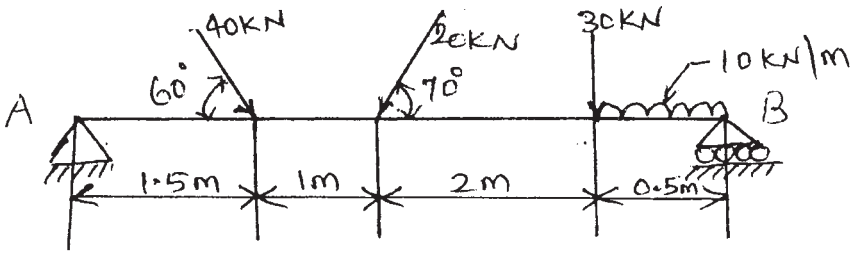


fig. 4

Or

(b) Forces of magnitudes 1, 2, 3, 4 and $2\sqrt{2}$ Newtons act respectively along the sides AB, BC, CD, DA and the diagonal AC of the square ABCD whose side is 3 m. Show that their resultant is couple and find its moment. (16)

14. (a) A force F = 30 N acts parallel to the inclined plane as it accelerates a block of mass m = 2 kg upto the 30° incline with a coefficient of kinetic friction $\mu_K = 0.3$ as shown in fig. 5. A spring whose force constant '$K$' is 40 $Nm^{-1}$ is attached to the block which starts from rest at a position $x = 0$, where the spring is unstressed. Find the speed of the block after travelling 0.2 m up the incline? Use work energy method. (16)

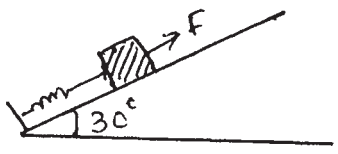


fig. 5

Or

(b) (i) A stone is thrown upwards from the top of a tower 70 m high with a velocity of 19.2 m/S. Determine its position and velocity when $t = 6$ sec. (8)

(ii) An elevator is required to lift a body of mass 65 kg. Find the acceleration of the elevator, which could cause a pressure of 800 Newtons on the floor. (8)

15. (a) Block A weighing 1500 N is to be raised by means of 15° wedge as shown in fig. 6. Assume the coefficient of friction between all contact surfaces be 0.2. Weight of the block B is 500 N. Determine the minimum force required to move the block A upwards. (16)

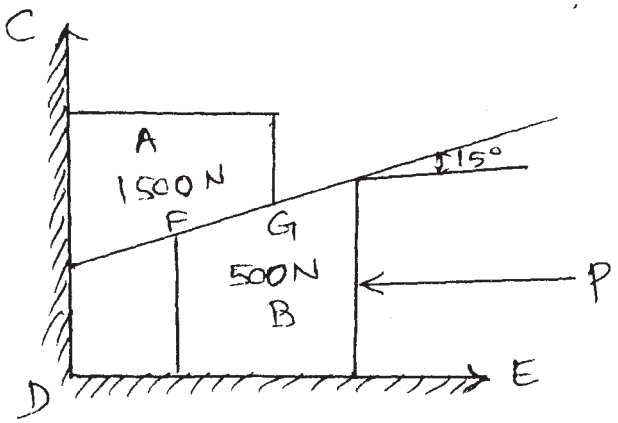


fig. 6

Or

(b) A reciprocating engine mechanism is shown in fig. 7. The crank OA is of length 150 mm and rotating at 600 rpm. The connecting rod AB is 700 mm long. Find

(i) The angular velocity of the connecting rod. (5)

(ii) The velocity of piston B. (5)

(iii) The velocity of point C on the connecting rod at a distance of 200 mm from A when $\theta = 45°$ (6)

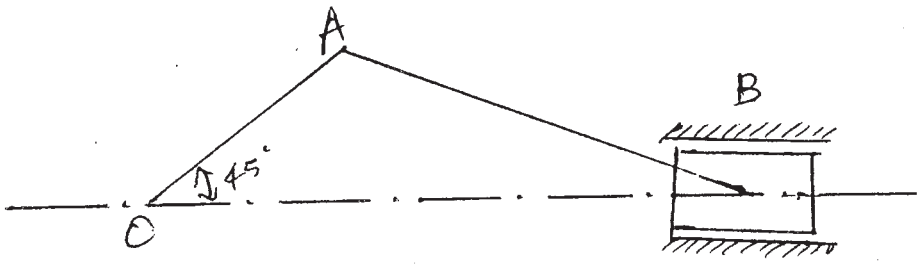


fig. 7