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Question Paper Code : 73017

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Second Semester

Aeronautical Engineering

GE 204 — ENGINEERING MECHANICS

(Common to all branches)

(Regulation 2007)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the units for the following physical quantities? (a) Force (b) Couple (c) Mass moment of inertia and (d) Linear momentum.

2. State the law of parallelogram of forces.

3. State varignon's theorem.

4. What do you mean by the term "Rigid body"?

5. Define the terms: Moment of inertia and Radius of gyration.

6. Write the expression for polar M.I of a hollow circular section of diameter 'd'.

7. Define the terms: Average velocity and Instantaneous velocity.

8. A ball dropped from a height of 1.6 m on a floor rebounds to a height of 0.9 m. Find the coefficient of restitution.

9. Define the terms: Static friction and Dynamic friction.

10. What do you mean by the term 'Instantaneous centre of rotation'?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Two concurrent forces of 30 N and 50 N are acting at an angle of 60°. Find the resultant force. (4)

(ii) Show that the vectors $2i - 3j - k$ and $-6i + 9j + 3k$ are parallel. (4)

(iii) A string ABCD attached to fixed points A and D has two equal weights of 500 N attached to it at B and C. The weight rest with the portions AB and CD inclined at angles as shown in Fig. Q.11a(iii). Find the tensions in the portion AB, BC, and CD of the string. (8)

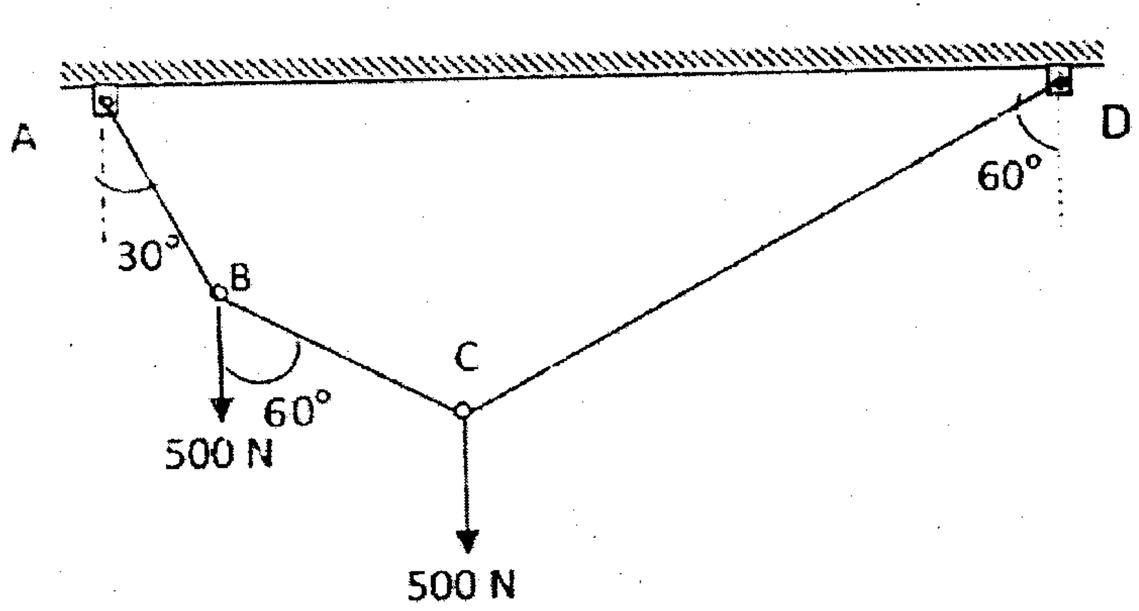

Fig. Q.11a(iii).

Or

(b) (i) A weight is supported by three ropes as shown in Fig.Q.11b(i). Determine the magnitude of the weight W if the tension in rope AD is 4500 N. (12)

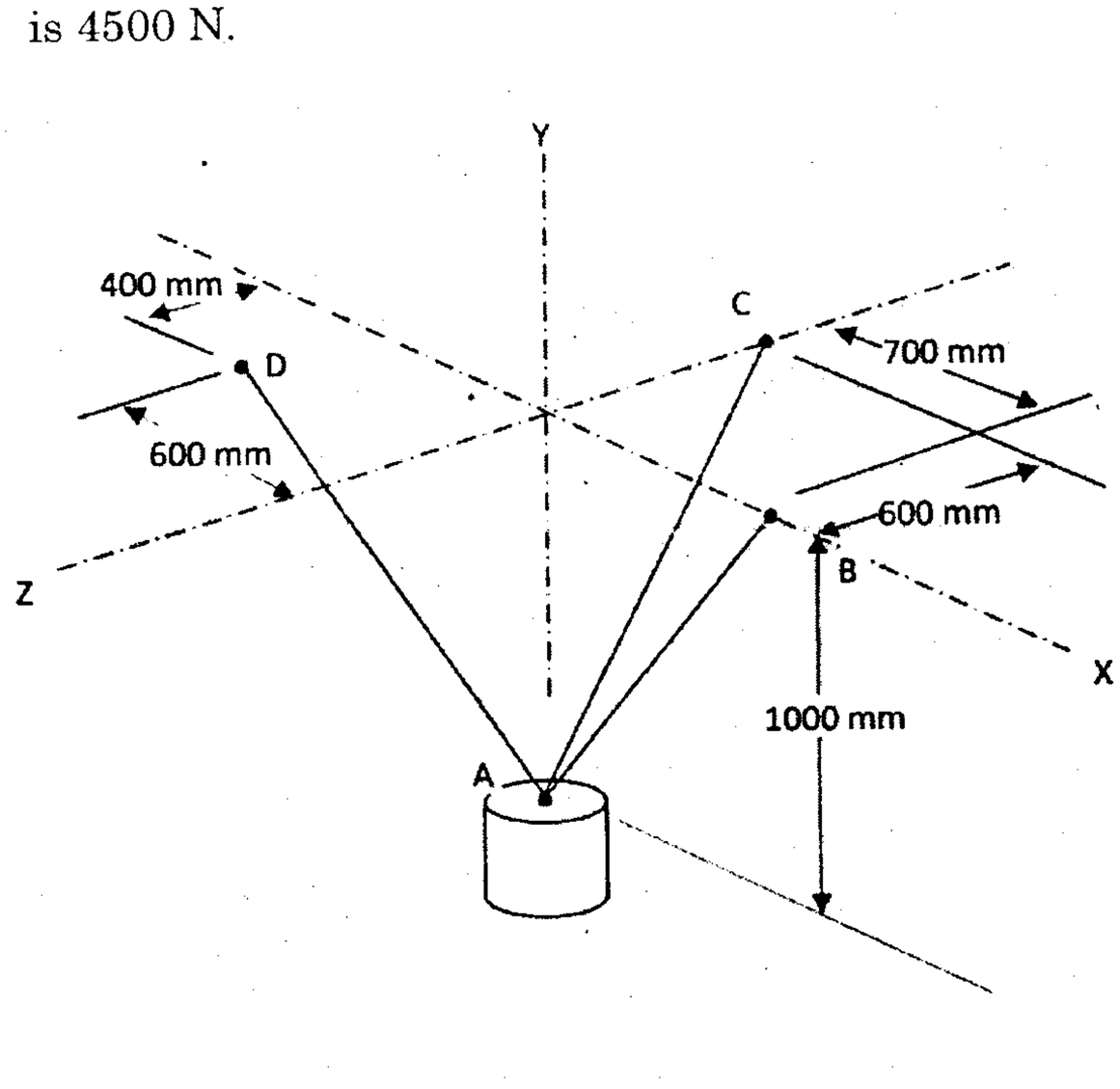

Fig.Q.11b(i).

(ii) A push of 200 N and pull of 350 N act simultaneously at a point. Find the resultant of the forces, if the angle between them be 135°. (4)

12. (a) (i) Determine completely the resultant of the three forces shown in Fig.Q.12a(i). Each force makes a 15° angle with the vertical, except the 2000 N force, which is vertical. (6)

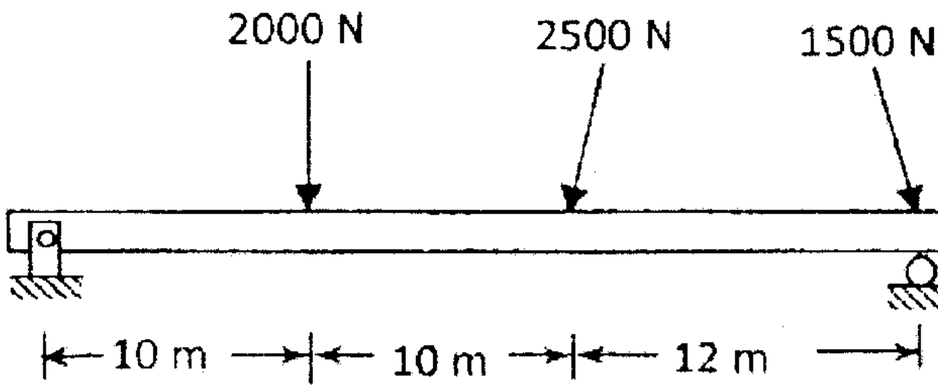

Fig.Q.12a(i).

(ii) Two spheres, each of weight 1000 N and radius 25 cm rest in a horizontal channel of width 90cm as shown in Fig.Q.12a(ii). Find the reactions on the points of contact A,B and C. (10)

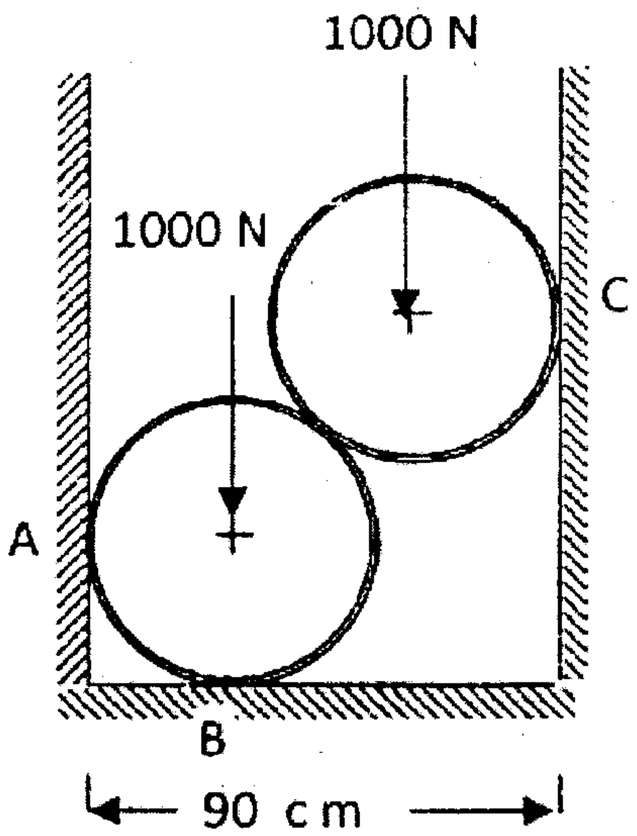

Fig.Q.12a(ii).

Or

(b) (i) Given the vectors $p = 7i - 2j + 5k$, $Q = -3i - 4j + 6k$ and $S = 8i + j - 9k$. Compute the scalar products P.Q, P.S, and Q.S. (6)

(ii) A cube of side a is acted upon by a force P as shown in Fig.Q.12b(ii).

Determine the moment of P

(1) about A,

(2) about the edge AB

(3) about the diagonal AG of the cube. (10)

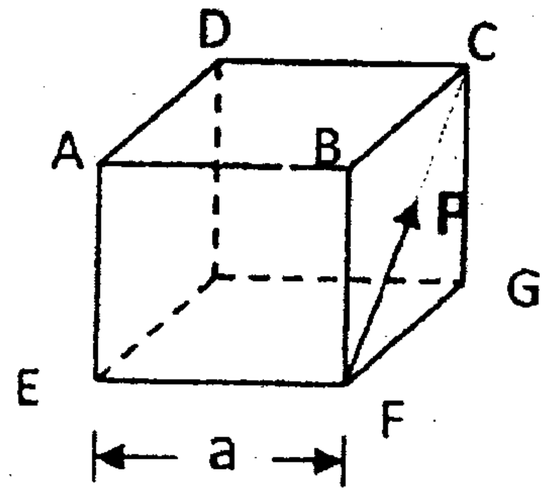

Fig.Q.12b(ii).

13. (a) (i) Find the centre of gravity of a T-section with flange 150mm × 10mm and web also 150 × 10 mm. (6)

(ii) Fig.Q.13a(ii). shows the cross section of a cast iron beam. Find the polar M.I about Its centroidal axes. (10)

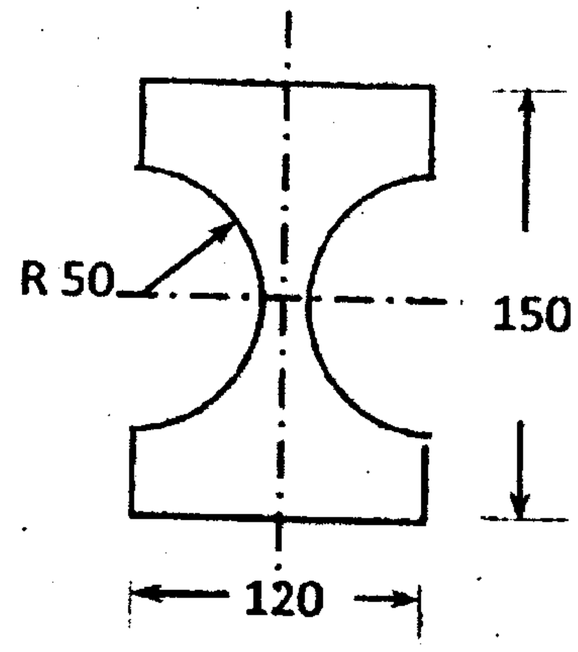

Fig.Q.13a(ii).

Or

(b) (i) A solid body formed by joining the base of a right circular cone of height 100mm to the equal base of right circular cylinder of height 20mm. Calculate the distance of the centre of mass of the solid from its plane face. (6)

(ii) As shown in Fig.Q.13b(ii). a brass cone is mounted on the top of an aluminum cylinder. Using the density of brass = 8500 kg/m^3 and that of aluminum = 2560 kg/m^3, determine the moment of inertia for the system about the vertical geometrical axis. (10)

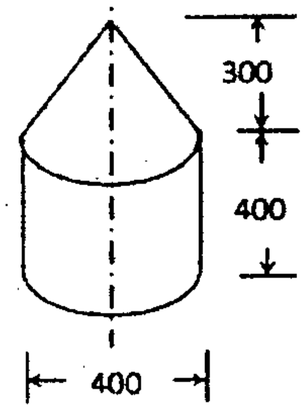

Fig.Q.13b(ii).

14. (a) (i) A body falling freely under the action of gravity passes two points 10 meters apart vertically in 0.2 Sec. from what height above the higher point did it start to fall. (8)

(ii) A car moves along a straight line, whose equation of motion is given by $s = 12t + 3t^2 - 2t^3$, where (s) is metres and (t) in seconds. Calculate (1) velocity and acceleration at start; (2) acceleration when velocity is zero. (8)

Or

(b) (i) A vehicle of mass 200 tonnes has a frictional resistance of 50 N per tonne. Speed of the train at the top of an incline of 1 in 80, is 45 kmph. Find the speed of the train after running down the incline for 1 km. (8)

(ii) Two bodies, one of which's 400 N with a velocity of 8 m/s and the other of 250 N with a velocity of 12 m/s move towards each other along a straight line and impinge centrally. Find the velocity of each body after impact if the coefficient of restitution is 0.8. (8)

15. (a) (i) An effort of 200 N is required just to move a certain body up an inclined plane of angle 15° the force acting parallel to the plane. If the angle of inclination of the plane is made 20° the effort required, again applied parallel to the plane, is found to be 230 N. Find the weight of the body and the coefficient of friction. (10)

(ii) Find the length of the belt required for driving two pulleys in an open belt drive of 600mm and 300 mm diameter when 3 m apart. (6)

Or

(b) A flywheel 30 kN having radius of gyration 0.5 m loses its speed from 240 rpm to 180 rpm in 1 minute. Calculate the retarding torque acting on it, change in the kinetic energy during the above period and change in its angular momentum during the same period. (16)
