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

First Semester

(Common to All Branches except Marine Engineering)

GE 131 — ENGINEERING MECHANICS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the different laws of mechanics?

2. Explain coplanar concurrent forces.

3. Two forces $\vec{F}_1 = 5\vec{i}$ and $\vec{F}_2 = 8.66\,\vec{j}$ pass through a point whose co-ordinates are (2, 1). Calculate the moment of the force about the origin.

4. Explain perpendicular axis theorem.

5. Give the centroid of the semicircle shown in Fig. Q. 5.
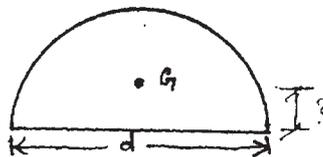

Fig. Q. 5

6. What is angle of friction?

7. What is uniformly accelerated rectilinear motion?

8. A car accelerates uniformly from a speed of 30 km/h to a speed of 75 km/h in 5 s. Determine the acceleration of the car and also the distance travelled during 5 s.

9. What is meant by time of restitution?

10. Define angular acceleration.

11. (i) A flywheel starts rotating from rest and is given an acceleration of 1 rad/s². Find the angular velocity and speed in rpm, after 1.5 minutes. If the flywheel is brought to rest with a uniform angular retardation of 0.5 rad/s², determine the time taken by the flywheel in seconds to come to rest. (8)

    (ii) What is angular acceleration of the pulley shown in Fig. Q 11 (ii) turning under the action of two masses? (8)
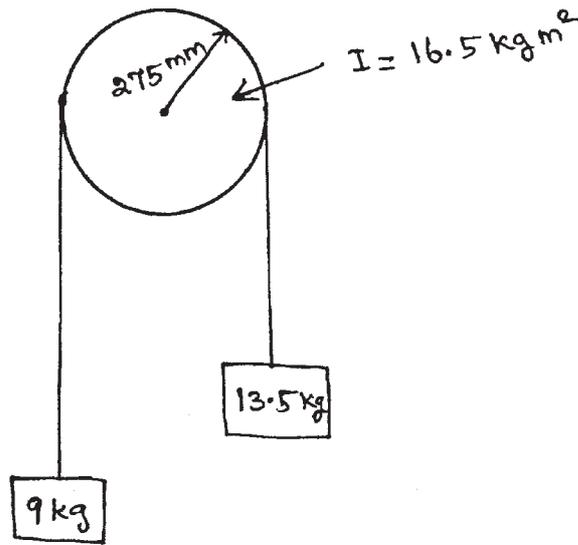

Fig. Q. 11 (ii)

12. (a) (i) Find the magnitude and direction of the resultant force for the system of forces acting on a particle A as shown in Fig. Q. 12 (a) (i). (8)
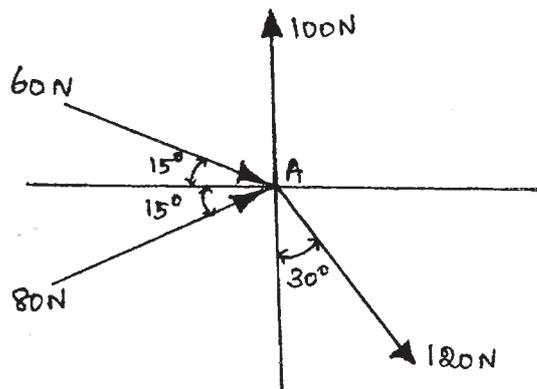

Fig. Q. 12 (a) (i)

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(ii) A ball of weight 120 N rests in a right–angled groove as shown in Fig. Q. 12 (a) (ii). The sides of the groove are inclined to an angle of 30° and 60° to the horizontal. If all the surfaces are smooth, then, determine the reactions R_A and R_C at the points of contact. (8)
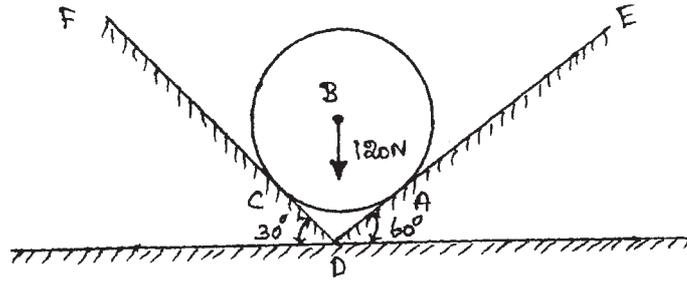

Fig. Q. 12 (a) (ii)

Or

(b) Forces 32 kN, 24 kN, 24 kN and 120 kN are concurrent at origin and are respectively directed through the points whose co–ordinates are A (2, 1, 6), B (4, –2, 5), C (–3, –2, 1) and D (5, 1, –2). Determine the resultant of the system. (16)

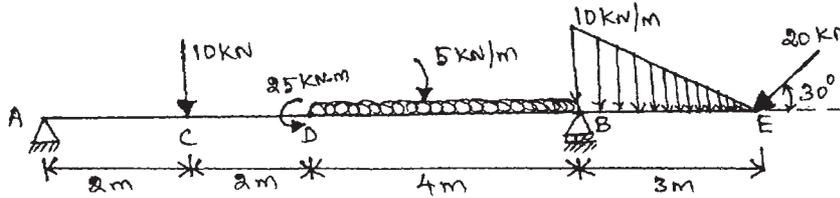13. (a) Find the reactions at A and B for the beam shown in Fig. Q. 13 (a). (16)

Fig. Q. 13 (a)

Or

(b) Refering to the Fig. Q. 13 (b) shown below, determine the least value of the force P to cause motion to impend rightwards. Assume the coefficient of friction under the blocks to be 0.2 and pulley to be frictionless. (16)
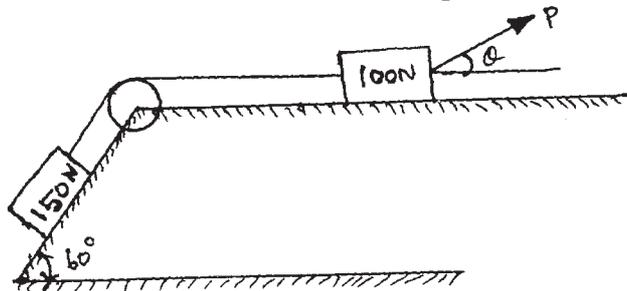

Fig. Q. 13 (b)

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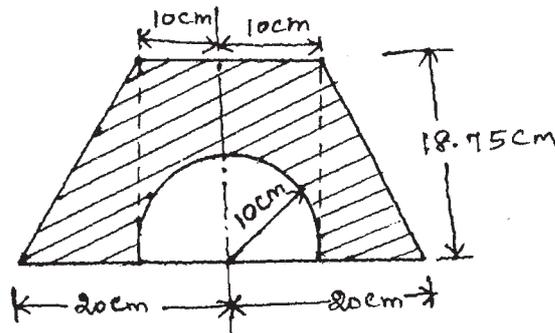14. (a) Determine the position of the centre of gravity of the plane figure shown in Fig. Q. 14 (a). (16)

Fig. Q. 14 (a)

Or

(b) Determine the moment of inertia of the section shown in Fig. Q. 14 (b) about XX axis passing through its centre of gravity and the base BC. (16)
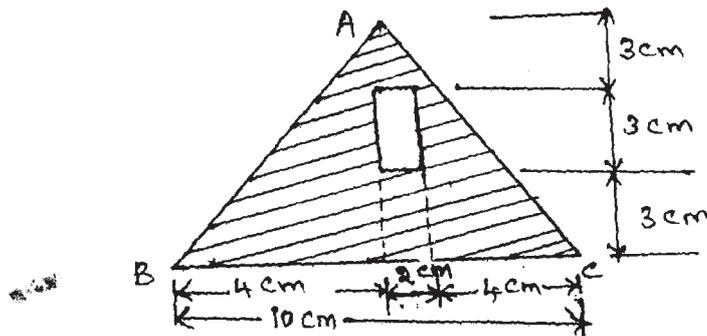

Fig. Q. 14 (b)

15. (a) Two vehicles travel between two stations 50 km apart. Both vehicles start at the same time from the same station. The first vehicle travels at 50 km/h while the second vehicle travels at 30 km/h. If the first vehicle halts in the second station for 5 minutes and then returns with the same speed, determine where the two vehicles will meet. (16)

Or

(b) A projectile is fired with an initial velocity of 250 m/s at a target located at a horizontal distance of 4 km and vertical distance of 700 m above the gun. Determine the value of firing angle to hit the target. Neglect air resistance. (16)