B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Second Semester

Aeronautical Engineering

GE 1151 — ENGINEERING MECHANICS

(Common to all branches and BE (PT) I Sem. R-2005 Civil and Mechanical)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the equations of equilibrium of a coplanar system of forces.

2. A force of magnitude 700 N is directed along PQ where P is (0.8, 0, 1.2) m and Q is (1.4, 1.2, 0) m. Write the vector form of the force.

3. State Varignon's theorem.

4. Three couples + 12 Nm, − 35 Nm and + 100 Nm are acting in the $xy$, $yz$ and $xz$ . Write the vector form.

5. A semi-circular lamina having radius 100 mm is located in the $xy$ plane such that its diametral edge coincides with $y$-axis. Determine the $x$ co-ordinate of its centroid.

6. Define principal axes and principal moment of Inertia.

7. A particle starting from rest, moves in a straight line and its acceleration is given by $a = 40 - 46t^2$ m/sec$^2$ where $t$ is in sec. Determine the velocity of the particle when it has travelled 52 m.

8. A steel ball is thrown vertically upwards from the top of a building 25 m above the ground with an initial velocity of 18 m/sec. Find the maximum height reached by the ball from the ground.

9. State the laws of dry friction.

10. What is general plane motion?

13.

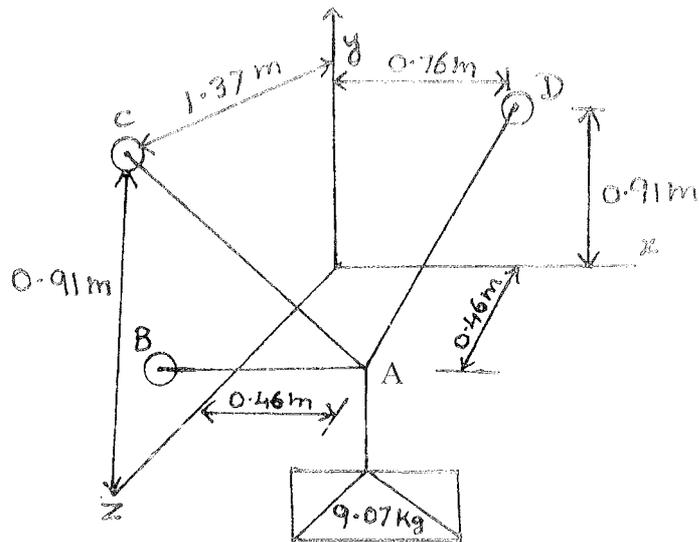11. Determine the tension in the cables AB, AC and AD if the crate shown in Fig. Q. 11. is weighing 9.07 kg.



Fig. Q. 11

(b

12. (a) Determine the reactions at supports A, B, C and D, for the beam shown in Fig. Q. 12 (a).
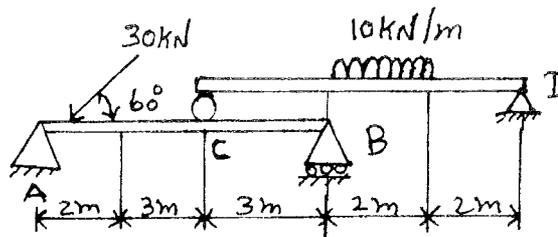
14. (a



Fig. Q. 12 (a)

Or

(b) Determine the resultant of the coplanar non-concurrent force system shown in Fig. Q. 12 (b). Calculate its magnitude and direction and locate its position with respect to the sides AB and AD.
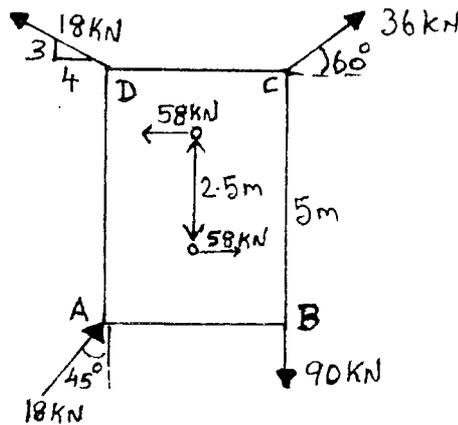
(b



Fig. Q. 12 (b)

13. (a) Find $I_{xx}, I_{yy}$ through centroid of the Fig. Q. 13 (a) with uniform thickness of 3 cm throughout.
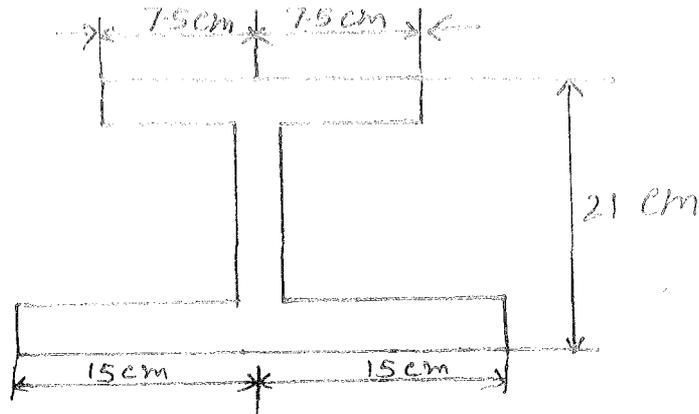


Fig. Q. 13 (a)

Or

(b) Derive an equation for the mass moment of Inertia of cone.

14. (a) A stone is projected with a speed of 30 m/s at an angle of elevation of 50°. Find its velocity

(i) After two seconds

(ii) At the highest point of its path

(iii) at a height of 6 m.

Find also the time interval between the two points at which the stone attains a speed of 23 m/s.

Or

(b) In the oblique central impact shown in Fig. Q. 14 (b), the co-efficient of restitution is 0.8. The flat disks shown, slide on a smooth horizontal surface. Determine the final velocity of each disk directly after impact.
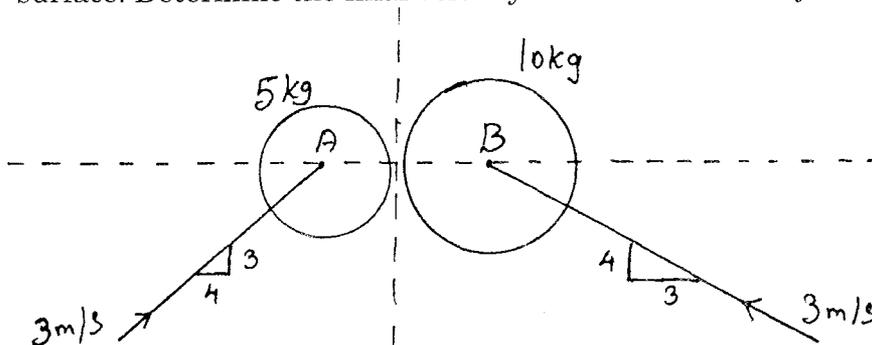


Fig. Q. 14 (b)

15. (a) Determine whether the block shown in Fig. Q 15 (a) having a mass of 40 kg is in equilibrium and find the magnitude and direction of the friction force.

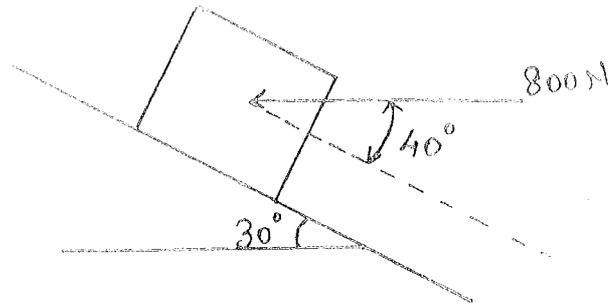Take $\mu_s = 0.40$ and $\mu_k = 0.30$ .



Fig. Q. 15 (a)

Or

(b) Determine the least value of 'P' required to cause the motion impend the system shown in Fig. Q. 15 (b) assume coefficient of friction on all contact surface as 0.2.
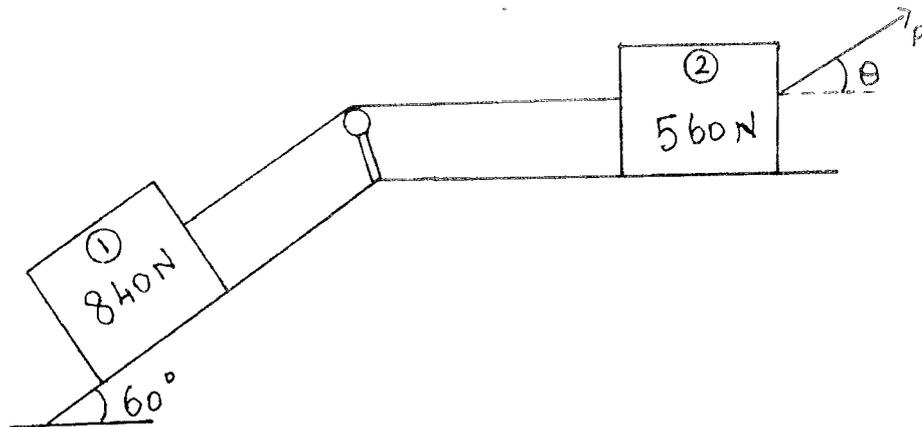


Fig. Q. 15 (b)

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1.

2.

3.