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Roll No.....

Sr. No of Question Paper : 8135 D

Unique Paper Code : 235606

Name of the Course : B. Sc. (H)

Name of the Paper : Mechanics

Semester : VI

Duration: 3 Hours

Maximum Marks: 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt any two parts from each question.

SECTION-I

1. (a) Compute the moment of a Force $F = 50i + 30j \text{ N}$, which goes through position $r_a = i + 2j \text{ m}$, about a line going through points $r_1 = 2i + 3j - k \text{ m}$ and $r_2 = -i - 4j + 2k \text{ m}$ respectively. (6.5)
- (b) Find the centre of gravity of a solid right circular cone. The radial distance of the surface from the y axis is given as: $r = \frac{3}{20}y^2 \text{ m}$. The body force is 3 m long and has cylindrical hole at the right end of length 0.6 m and diameter 0.3 m. (6.5)
- (c) State and Prove the Equation of Equilibrium for a rigid body. (6.5)
2. (a) Describes the Equation of Equilibrium of concurrent system of force, coplanar force system and Parallel force in space. (6.5)
- (b) Find the Couple- Moments of body forces
 $F_1 = 5i + 10j + 30k \text{ N}$, $F_2 = 3i + 15j - 10k \text{ N}$,
 and Position through origin are:
 $r_1 = i + 3j + k \text{ m}$ and $r_2 = 3i + 11j + 7k \text{ m}$ (6.5)
- (c) Consider a concurrent system of forces in a space. Show that that setting the sum of the forces equal to zero is equivalent to setting the sum of the moments of the forces about some point in space equal to zero. (6.5)

SECTION-II

3. (a) Describes the Law of Coulomb Friction. (6)
 (b) A strongbox of mass 75 kg rests on the floor. The static coefficient for the contact surface is 0.20. What is the highest central position for a horizontal load that permits it to just move the box without tipping it? (6)
 (c) State and Prove Transfer Theorem of the second moments of rigid body. (6)
4. (a) Find the coordinates of the centroid of the plane area bounded by the curve $y = ax^2$, the x -axis, and the line $x = b$. (6)
 (b) State and Prove theorems of Pappus-Guldinus with surfaces of revolution. (6)
 (c) Find the center of mass of the body described of solid right circular cone. (6)

SECTION-III

5. (a) Describes the Conservative Force Fields in force system. (6)
 (b) Find the Kinetic-Energy Expression Based on centre of mass. (6)
 (c) A particle of mass 0.15 kg is acted on by the following force field :
 $F = 25i + (80 + 10y)j + 100k$ N, what is its kinetic energy when it reaches position (7, 2, 5) while moving along a frictionless path (6)
6. (a) A particle of mass 16 kg is initially stationary at the origin of a reference. A force Having a known variation with time acts on the particle. That is:
 $F(t) = t^2i + (6t + 10)j + 1.6t^2k$
 after 10 sec What is the velocity of the body? (6.5)
 (b) Describes the translation and Rotation of Rigid bodies (6.5)
 (c) Two points move in space with the following velocities at a certain time t .
 $V_1 = 6i + 10j, V_2 = 3k$
 (i) What is the relative velocity between the particles?
 (ii) What is the angular velocity of a line going through the particles if they have positions $r_1 = -3i$ and $r_2 = 10i$ at the instant t . (3+3.5)