Sr.No. 14339

Exam Code:211002

Subject Code: 4978

M.Sc. (Mathematics) - 2nd Semester

(2721)

Paper: Math-564 Mechanics-II

Time Allowed: 2 hrs. **Max. Marks: 100**

Note: There are EIGHT questions of equal marks. Candidates are required to attempt any FOUR questions.

1. Calculate the center of mass acceleration of the cylinder rolling down an inclined plane of inclination θ, for the case of no slipping.

2. A uniform sphere of mass m and radius r is projected along a rough horizontal surface with a linear velocity v_1 and no angular velocity. Let the coefficient of kinetic friction between the sphere and the surface is μ, determine the time at which the sphere will start rolling without sliding.

3. Find the angular momentum about the origin of the square plate side a and mass m, when it is rotating with angular speed ω about (a) the x-axis and (b) the diagonal through the origin.

4. A uniform block of mass m and dimensions $a \times 2a \times 3a$ spins about a long diagonal with angular velocity ω. Using a coordinate system with origin at the center of the block, find (i) the kinetic energy (ii) the angle between the angular velocity vector and the angular momentum vector about the origin.

5. Consider a disc that has a string wrapped around it with one end attached to a fixed support and allowed to fall with the string unwinding as it falls. (Just like yo-yo whose string is attached to a finger and then allowed to drop, the finger held motionless as a fixed support.) Find the equations of motion of the falling disc and the forces of constraint.

6. A particle slides on a smooth inclined plane whose inclination θ is increasing at a constant rate ω. If $\theta = 0$, at time $t = 0$, at which time the particle starts from rest, find the subsequent motion of the particle.

7. Find the Hamiltonian equations of motion for a particle in a central field.

8. Solve the boundary value problem $y'' + y + x = 0$, $y(0) = y(1) = 0$ with integrand functional $y'^2 - y^2 - 2xy$ by Rayleigh-Ritz method.

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