

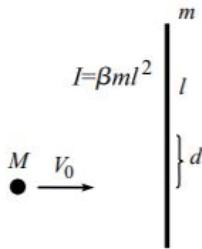
Physics I
ISI B.Math
HW set 5
Total Marks :40

1. If a particle is projected vertically upward to height h above a point on Earth at a northern latitude λ , show that it strikes the ground at a point $\frac{4}{3}\omega \cos \lambda \sqrt{8h^3/g}$ to the west. (Neglect air resistance and consider only small vertical heights).(10)

2. Consider a thin homogeneous plate that lies in the $x_1 - x_2$ plane. Show that the inertia takes the form (10)

$$\{\mathbf{I}\} = \begin{Bmatrix} A & -C & 0 \\ -C & B & 0 \\ 0 & 0 & A + B \end{Bmatrix}$$

3. A uniform ball of mass M and radius a is pivoted so that it can turn freely about one of its diameters which is fixed in a vertical position. A beetle of mass m can crawl on the surface of the ball. Initially the ball is rotating with angular speed Ω with the beetle at the north pole. The beetle then walks (in any manner) to the equator of the ball and sits down. What is the angular speed of the ball now ?(10)



4. A ball of mass M collides with a stick with moment of inertia $I = \beta m l^2$ (relative to its centre which is the CM). The ball is initially travelling with a speed V_0 perpendicular to the stick. The ball strikes the stick at a distance d from the centre. The collision is elastic. Find the resulting translational and rotational speeds of the stick, and also the resulting speed of the ball . (3 + 3 + 4)