(b) A circular board is placed on a smooth horizontal plane and a body runs round the edge of it at a uniform rate. What is the motion of the board? 4

5. (a) Prove that the time of complete oscillation of a compound pendulum is

$$2\pi \sqrt{\frac{k^2}{gh}}$$

where k is the radius of gyration of the body about a fixed axis and h is the distance of centre of inertia of the body from the fixed axis. 5

(b) Set up the Lagrangian for a simple pendulum and obtain an equation describing its motion. 5

6. A uniform sphere rolls down an inclined plane, rough enough to prevent any sliding. Discuss the motion. 10

Or

Obtain the equation of motion of a rigid body under impulsive forces. 10

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MATHEMATICS

(Major)

Paper : 5.4

(Rigid Dynamics)

Full Marks : 60

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer the following questions : 1×7=7

(a) Write down the moment of inertia of a solid sphere of radius a and mass M about a diameter.

(b) Define equimomental systems.

(c) State the theorem of parallel axes on moment of inertia.

(d) Define the centre of oscillation of a compound pendulum.

(e) What is the principle of conservation of energy?

(f) A particle moving freely in space requires three coordinates (x, y, z), to specify its position. What is the degree of freedom of the particle?

(g) What are generalized coordinates?