

**A-0709**

Total Pages : 4

Roll No. ....

**MT-505**

**MA/MSc Mathematics (MAMT/MScMT)**

**(Mechanics-I)**

Examination, June 2025

Time : 2:00 Hrs.

Max. Marks : 70

**Note :-** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. *Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.*

**Section-A**

**(Long Answer Type Questions)**     2×19=38

**Note :-** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

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( 1 )

P.T.O.

1. A weight  $W$  homogeneous cube, can swing about an edge which is horizontal, it start from the rest being displaced from its unstable position of equilibrium. When the perpendicular from the centre of gravity upon the edge has turned through an angle  $\theta$ , show that the component of the action at the hinge at right angles to this perpendicular is  $\frac{1}{4}W \sin \theta$ .
2. Discuss Lagrange's equations for Impulsive Forces.
3. A perfectly rough sphere lying inside a hollow sphere, which rest on perfectly rough plane, is slightly displaced from its position of equilibrium. Show that the time of small oscillation is :

$$\sqrt{\frac{(a-b)}{g} \frac{14M}{(10M + 7m)}},$$

where  $a$  is the radius of cylinder,  $b$  is the sphere,  $M$  and  $m$  are the masses of cylinder and sphere.

4. To determine the general equations of motion of a body moving about fixed point  $O$ .
5. When impulsive force act, discuss the principal of conservation of linear and angular momentum.

## Section–B

(Short Answer Type Questions)  $4 \times 8 = 32$

**Note** :– Section ‘B’ contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. A perfectly rough circular horizontal board is capable of revolving freely round a vertical axis through the centre. A man whose weight is equal to that of the board walks on and around it the edge. When he has completed the circuit, what will be his position in space ?
2. Discuss the general cases of centre of percussion.
3. A uniform sphere rolls down an inclined plane, rough enough to prevent any sliding; to discuss the motion when the body is circular disc.
4. Find the moment of inertia of a solid sphere.
5. A uniform rod of mass  $M$  and length  $2a$  at rest is struck by horizontal blow  $I$  at right angle to its length at a distance  $b$  from its centre. Find the point about which it will begin to run, also find K.E.

6. Deduce greatest kinetic energy with impulsive couple.
7. Find the length of simple equivalent pendulum in the Hemisphere; axis a diameter of the base when the axis is horizontal.
8. Determine the motion about centre of inertia.

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