

A-0630

Total Pages : 4

Roll No.

MT-505

M.A./M.Sc. MATHEMATICS (MAMT/MSMCT)

(Mechanics-I)

1st Semester Examination, Session December 2024

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.

1. Describe the principal of conservation of linear and angular momentum.
2. A heavy homogeneous cube of weight W , 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 θ , show that the component of the action at the hinge along to this perpendicular is :

$$\frac{1}{2}W(3 - 5\cos\theta)$$

3. State and prove D' Alembert's Principle.
4. A homogeneous rod OA of mass M_1 and length $2a$ is freely hinged at O to a fixed point at its other end is freely attached homogeneous rod AB of mass M_2 and length $2b$; the system moves under gravity. Find equations to determine the motion (Lagrange's approach).
5. Find Euler's dynamical equations.

Section-B

Short Answer Type Questions 4×8=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 straight uniform rod can turn freely about one end O, hangs from O vertically. Find the least angular velocity with which it must be moving so that it may perform complete revolution in a vertical plane.
2. Define centre of percussion. Find centre of percussion of a rod which is suspended freely from one end.
3. A rough uniform board of mass m and length $2a$ at rest on a smooth horizontal plane and a boy of mass M , walks on it from one end to other. Show that the distance through which the board moves in this time is :

$$\frac{2Ma}{(M + m)}$$

4. A uniform solid sphere rolls down an inclined plane, rough enough to prevent any sliding; to discuss the motion.

5. Find the moment of inertia of a circular disc about its diameter.
6. A uniform rod of mass M and length $2a$ is lying on smooth horizontal plane and struck by horizontal blow I acting at one end and inclined an angle α to the rod. Find the velocity of that end just after the impact.
7. Deduce Euler's equations from Lagrange's equations.
8. Find the length of simple equivalent pendulum in the Circular disc, axis a tangent it when the axis is horizontal.
