

A-1035

Total Pages : 4

Roll No.

MT-505

M.A./M.Sc. Mathematics (MAMT/MSCMT)

Mechanics-I

Examination, 2026 (Feb.)

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 $2 \times 19 = 38$

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. Find the moment of inertia of the triangle ABC about a perpendicular to its plane through A.
2. A circular area can turn freely about a horizontal axis which passes through a point O of its circumference and is perpendicular to its plane. If motion commences when the diameter through O is vertically above, show that when the diameter has turned through an angle θ the component of the strain at O along and perpendicular to this diameter are respectively $\frac{1}{3}W(7\cos\theta - 4)$ and $\frac{1}{3}W\sin\theta$.
3. A uniform Sphere rolls down an inclined plane, rough enough to prevent any sliding. Discuss the motion.
4. A circular ring of mass M and radius a, lies on a smooth horizontal plane and an insect of mass m , resting on it starts and walks round it with uniform velocity v relative to ring. Show that the centre of the ring describes circle with angular velocity $\frac{m}{M + 2m} \frac{v}{a}$.
5. Explain how Lagrange's equations are used in case of small oscillations.

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. Show that the momental ellipsoid at the centre of an elliptic plate is $\left(\frac{x^2}{a^2}\right) + \left(\frac{y^2}{b^2}\right) + z^2 \left[\left(\frac{1}{a^2}\right) + \left(\frac{1}{b^2}\right) \right] =$ constant.
2. A uniform rod OA, of length $2a$, free to turn about its end O, revolves with uniform angular velocity ω about a vertical OZ through O, and is inclined at a constant angle α to OZ, show that the value of α is either zero or $\cos^{-1}\left(\frac{3g}{4a\omega^2}\right)$.
3. Show that the centre of suspension and oscillation are convertible.
4. AB, BC are two equal similar rods freely hinged at B and lie in a straight line on a smooth table. The end A is struck by a blow perpendicular to AB. Show that resulting velocity of A is $3\frac{1}{2}$ times of B.

5. A circular plate rotates about an axis through its Centre perpendicular to its plane with angular velocity ω . This axis is set free and a point, in the circumference of the plate is fixed, show that the resulting angular velocity is $\frac{1}{3}\omega$.
6. Set Lagrangian for a simple pendulum.
7. A body under the action of no forces moves so that the revolved part of its angular velocity about one of the principal axes at the centre of gravity is constant. Show that the angular velocity of the body must be constant.
8. From the D'Alembert's principle deduce the general equations of motion of a rigid body.
