(PG1-696) Roll No. .....

S.C.No.—21703103

M. Sc. EXAMINATION, 2023

(First Semester)

(Main/Re-appear/Improvement)

(2021/2022)

MATHEMATICS

21MTH-103

Mechanics

Time : 3 *Hours* *Maximum Marks* : 80

Note : Attempt *Five* questions in all, selecting *one* question each from Unit II to Unit V. Unit I is compulsory. All questions carry equal marks.

Unit I

1. (a) Define moments and products of inertia.

(b) Define Equimomental Systems.

(c) Define Holonomic and Non-holonomic Systems.

(d) Define Cyclic Coordinates.

(e) Define Canonical Transformation.

(f) Define Poisson Brackets.

(g) Define Equipotential Surfaces.

(h) Define Surface Density.

Unit II

2. (a) State and prove the theorem of parallel axes for moments and products of inertia.

(b) Find the kinetic energy of a rigid body rotating about a fixed point.

3. (a) State and prove the necessary and sufficient conditions for two systems to be equimomental.

(b) Derive Euler's dynamical equations.

Unit III

4. (a) Derive Lagrange equations for simple holonomic dynamical system.

   (b) Prove that kinetic energy of a holonomic system can be expressed as quadratic function of the generalized velocities.

5. (a) State and prove Donkin's theorem.

   (b) Derive Routh's equations.

Unit IV

6. (a) State and prove Poisson's identity for Poisson Brackets.

   (b) Derive Whittaker's equation.

7. (a) Derive Hamilton-Jacobi equation.

   (b) Prove that Lagrange Brackets are invariant under a free univalent canonical transformation.

Unit V

8. (a) Discuss the problem of attraction for a disc.

(b) Discuss the problem of potential for a solid sphere.

9. (a) Write a note on self attracting systems and find the work done by self attracting systems.

   (b) Explain surface and solid harmonics and derive the surface density in terms of surface harmonics.