Roll No. | | | | | | | | | | | | |

Total No. of Pages : 02

Total No. of Questions : 07

M.Sc.Mathematics (2017 Batch) (Sem.–2)

MECHANICS-I

Subject Code : MSM-203

Paper ID : [75010]

Time : 3 Hrs. Max. Marks : 80

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of EIGHT questions carrying TWO marks each.**
2. **SECTION - B & C. have THREE questions in each section carrying SIXTEEN marks each.**
3. **Select atleast TWO questions from SECTION - B & C EACH.**

1. a) Illustrate the properties of Lagrange bracket.

   b) State the Hamilton- Jacobi equations.

   c) State the Hamilton canonical equation.

   d) State D' Alembert's principle.

   e) State Jacobi-poisson theorem.

   f) State the conservation theorem for angular momentum.

   g) State the energy equation for conservative fields.

   h) What are Lagrange's equation?

SECTION-B

2. State and prove the fundamental lemma of calculus of variation.

3. Illustrate the following :

   a) Poisson's identity.

   b) Principle of least action.

4. a) A particle of mass m moves in a plane. Write the Lagrange's equations of motion for this particle using plane polar co-ordinates.

   b) Find the Lagrange's equation of motion for a pendulum in spherical polar coordinates, of length /.

SECTION-C

5. State and prove Jacobi-poisson theorem.

6. a) Show that poisson bracket is invariant under canonical transformation.

   b) State the necessary and sufficient condition for a transformation to be canonical.

7. The Hamiltonian H for the spherical polar co-ordinates is :

$$H = \frac{1}{2m}\left[p_r^2 + \frac{p_\theta^2}{r^2} + \frac{p_\phi^2}{r^2 \sin^2\theta} \right] + U(r, \theta, \phi).$$

   Find the differential equations to determine r, θ, ϕ using Hamilton- Jacobi equation.