

M-39/2110

Classical Mechanics -I
M.Sc. Mathematics/M.Sc. AMC
Part II (Semester-III)
(MM607/AMC 314)

10497/N

M.M. : 70

Note : Attempt two question each from section A and section B carries 10 marks each.

Section C has 10 compulsory questions carries 3 marks each.

Section A

Attempt any Two questions.

- 1 State and prove Conservation theorem of angular momentum for system of particles.
- 2 Establish the Lagrangian for a simple pendulum and obtain an equation describing the motion.
- 3 Obtain the equation of motion for one-dimensional harmonic oscillator using Hamilton's principle.
- 4 A particle describes a circular orbit under the influence of an attractive central force directed towards a point on the circle. Show that the force varies as the inverse fifth power of distance.

(2×10 = 20)

Section B

Attempt any Two questions.

- 5 What is scattering? Derive Rutherford formula for scattering cross section.
- 6 State and derive an expression for Kepler's second law of planetary motion.
- 7 Show that the trace of a matrix is invariant under any similarity transformation. Show also that the anti symmetry property of a matrix is preserved under an orthogonal similarity transformation.
- 8 State and prove Euler's theorem on the motion of rigid body.

(2×10 = 20)

Contd. —

Section C

9 All questions are compulsory.

- a) What are Euler's Angles?
- b) Write a note on Non-holonomic constraints.
- c) What are body and space coordinate system in relation to the motion of a rigid body?
- d) Show that the shortest distance between two points in a plane is along a straight line.
- e) What is differential scattering cross section ?
- d) Write a note on D'Alembert's principle.
- e) State first and third Kepler's law of planetary motion.
- f) Write a note on Central force.
- g) Check whether the force $F = yz \hat{i} + zx \hat{j} + xy \hat{k}$ is conservative or not.
- h) Write the matrix of transformation from space set of axes to body set of axes.

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(10×3 = 30)