

Roll No.

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13113/N**L-4/2111****CLASSICAL MECHANICS**

Paper-MM-607/AMC-307

Semester-III

(Common for Maths./AMC)

Time Allowed : 3 Hours] [Maximum Marks : 70

Note : The candidates are required to attempt **two** questions each from Sections A and B carrying 10 marks each and the entire Section C consisting of 10 short answer type questions carrying 3 marks each.

SECTION—A

1. State and prove Conservation theorem of Linear and Angular momentum for a Single particle. 10

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2. A particle is constrained to move along a circle lying in the vertical xy-plane. With the help of the D'Alembert's principle ? Show that the equation of motion is

$$\ddot{x}y - \ddot{y}x - gx = 0$$

where g is the acceleration due to gravity. 10

3. Obtain the Lagrangian equation for the motion of a system of two particles of unequal masses connected by an in extensible string passing over a small smooth pulley. 10
4. Find out the differential equation for the orbit of a particle moving under the central force :

$$\mathbf{F}(\mathbf{r}) = -\frac{k}{r^2},$$

using Hamiltonian equation of motion. 10

SECTION—B

5. State and derive an expression for Kepler's third law of planetary motion. 10

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6. What is Scattering ? Derive Rutherford formula for scattering Cross section. 10
7. Prove that matrix multiplication is associative. Show that the product of two orthogonal matrices is also Orthogonal. 10
8. State and prove Euler's theorem on the motion of Rigid body. 10

SECTION—C

9. Write short notes on the following : 10×3=30
- (i) Show that the motion of a particle under Central force takes place in a Plane.
- (ii) Check whether the force $\mathbf{F} = yz \hat{i} + zx \hat{j} + xy \hat{k}$ is conservative or not.
- (iii) Show that the shortest distance between Two points in a plane is along a straight line.

- (iv) Write a note on Generalized coordinates.
- (v) Write down a note on Euler Angles.
- (vi) Write the matrix of transformation from space set of axes to body set of axes.
- (vii) State First and Second Kepler's law of Planetary motion.
- (viii) Write a note on Holonomic constraints.
- (ix) Write a note on Cayley-Klein Parameters.
- (x) What is differential scattering Cross section ?