K-6/2110 7417/N

Paper: MM 607/ AMC 314

Title of paper: **Classical Mechanics - I**

SEM-III

Time allowed: 03 Hours Maximum Marks: 70

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

Section – A

I. a. Express angular momentum of the system as the sum of angular momentum of motion concentrated at the center of mass and the angular momentum of motion about the center of mass. (10)

b. State and prove the Lagrange's equation for a holonomic system in the form:

$$\frac{d}{dt}\left(\frac{\partial T}{\partial q_j}\right) - \frac{\partial T}{\partial q_j} = Q_j \qquad (\partial = 1,2,\ldots.n)$$

where T is the kinetic energy of the system at t when the system is specified by n generalized coordinates q_j (j= 1,2,…..n) and Q_j are of the generalized force. (10)

II. State and prove Hamilton's principle. Also deduce Hamilton's principle from D' Alembert principle. (10)

III. Define (i) Generalized displacement (ii) Generalized momentum
(iii) Generalized force (iv) Generalized potential. (10)

IV. Sate and prove Viral Theorem. (10)

Section – B

V. Write a note in Laplace – Runge – Lenz – vector. (10)

VI. Discuss the problem of scattering of charged particles by Coulomb's field and obtain Rutherford's formula for the scattering cross-section. Transform the results into Laboratory co-ordinates. (10)

VII. Illustrate with diagrams Euler's angles involved in the transformation from one set of three dimensional co-ordinate system to another having the same origin. Obtain the complete transformation matrix for such a transformation. (10)

VIII. Describe Euler's equations of motion for a rigid body with a fixed point. Also describe finite rotations and Coriolis effect. (10)

Section – C

IX. Write short notes on the following:

(i) What are generalized coordinates?

(ii) Define constraints.

(iii) Define Angular momentum.

(iv) Define Rayleigh's dissipation function.

(v) define Holonomic and non-holonomic constraints.

(vi) State Kepler's first law.

(vii) Define scattering angle and impact parameter.

(viii) State similarity transformation.

(ix) Define Cayley – Klein parameters.

(x) Describe infinitesimal rotation. (10×3=30)