Subject Code : RNENS4

PAPER IV - CLASSICAL AND FLUID MECHANICS

Unit I

Introductory concepts – the mechanical systems – Generalized Coordinates – Constraints – Virtual work – Energy and momentum – Lagrange's equation – Integrals of the motion – Small oscillation.

Unit II

Special applications of Lagrange's equation – Rayleigh's dissipation function – impulsive motion – Gyroscopic systems – Velocity dependent potentials – Hamilton's equations – Hamilton's principles – Other variational principles – Phase space.

Unit III

Real fluids and ideal fluids – Velocity of a fluid at a point – Stream lines and path lines – Steady and unsteady flows – the velocity potential – The vorticity vector – Local and particle rate of change – The equation of continuity – worked examples – Acceleration of a fluid – Pressure at a point in a fluid at rest – Pressures at a point in a moving fluid – Conditions at a boundary of the inviscid invisible fluids – Euler's equation of motions – Bernoulli's equation – worked examples.

Unit IV

Some flows involving Aerial symmetry – Some special two dimensional flows – Impulsive motion – some three dimensional flows – Sources, sinks and doublets – Images in a rigid infinite plane – Axi symmetric flows – Stokes streams functions.

Unit V

Some two-dimensional flows – Meaning of a two dimensional flow – Use of cylindrical polar coordinates – the stream function – The complex potential for two dimensional irrotational, incompressible flow – complex velocity potentials for standard two dimensional flows – Some worked examples – the Milne's Thomson circle theorem and applications – the theorem of Blasius.

Text Books:

1. Donald T. Greenwood, "Classical Dynamics" PHI Pvt. Ltd., New Delhi, 1985
   Unit I: Chapter 1 (1.1 to 1.5) Chapter 2 (2.1 to 2.4)
   Unit II: Chapter 3 (3.1 to 3.4) Chapter 4 (4.1 to 4.4)
2. F. Chorton, "Text Book of Fluid Dynamics", CBS Publications, New Delhi, 1985
   Unit III: Chapter 2 (2.1 to 2.9) Chapter 3 (3.1 to 3.6)
   Unit IV: Chapter 3 (3.9 to 3.11) Chapter 4 (4.1, 4.2, 4.3, 4.5)
   Unit V: Chapter 5 (5.1 to 5.6, 5.8, 5.9)