



Code	Subject Title	Cr. Hrs	Semester
MATH-410	Analytical Dynamics	3	VII
Year	Discipline		
4	Mathematics		

Objectives:

Lagrange's Theory of Holonomic Systems

- Generalized coordinates
- Holonomic and non-holonomic systems
- D'Alembert's principle, d-delta rule
- Lagrange equations
- Generalization of Lagrange equations
- Quasi-coordinates
- Lagrange equations in quasi-coordinates
- First integrals of Lagrange equations of motion
- Energy integral

Hamilton's Theory

- Hamilton's principle
- Generalized momenta and phase space
- Hamilton's equations
- Ignorable coordinates, Routhian function
- Derivation of Hamilton's equations from variational principle
- The principle of least action

Lagrange's Theory of Non-Holonomic Systems

- Lagrange equations for non-holonomic systems with and without Lagrange multipliers
- Hamilton's Principle for non-holonomic systems

Canonical Transformations

- The equations of canonical transformations
- Examples of canonical transformations
- The Lagrange and Poisson brackets
- Equations of motion, infinitesimal canonical transformations and conservation theorems in the Poisson bracket formulation

Hamilton-Jacobi Theory

- The Hamilton-Jacobi equation for Hamilton's principal function
- The harmonic oscillator problem as an example of the Hamilton-Jacobi method
- The Hamilton-Jacobi equation for Hamilton's characteristic function
- Separation of variables in the Hamilton-Jacobi equation

Recommended Books:

- D. T. Greenwood, Classical Dynamics (Dover, 1997).
- F. Chorlton, Chorlton Text Book of Dynamics (Ellis Horwood, 1983).
- H. Goldstein, C. P. Poole and J. L. Safko, Classical Mechanics (Addison-Wesley Publishing Co., 2003).
- S. D. Lindenbaum, Analytical Dynamics: Course Notes (World Scientific, 1994).
- E. J. Saletan and J. V. José, Classical Dynamics: A Contemporary Approach (Cambridge, 1998).
- J. B. Marion and S. T. Thornton, Classical Dynamics of Particles and Systems (Thomson Learning, 2003).