

Tentative topics for ODE-I.

- (1) Introduction.
- (2) Existence, Uniqueness & Extension Theorems.
- (3) Geometric Interpretations of ODEs. Flows. Change of Variables.
- (4) Review of Integration Methods: Separable & Exact Equations. First Integrals. Hamiltonian Systems.
- (5) Motion in The Central Field. Kepler's Laws.
- (6) Gronwell and Other Differential Inequalities. Applications.
- (7) Refined uniqueness theorems.
- (8) Smoothness with respect to initial conditions and parameters. Applications.
- (9) Different notions of stability. Linearization Principle.
- (10) Lyapunov functions.
- (11) General theory of linear equations.
- (12) Review of Jordan canonical forms.
- (13) Equations with constant coefficients.
- (14) Stability of linear systems.
- (15) Stability of nonlinear systems.
- (16) Floquet theory.
- (17) Hill Equation.
- (18) Periodic solutions of periodic linear systems and their stability.
- (19) Periodic solutions of periodic nonlinear systems.
- (20) General conditions for existence of periodic solutions.
- (21) Euler-Lagrange equations.
- (22) Noether Theorem.
- (23) Motion of charged particles.
- (24) Inverted pendulum.