

1 Ordinary Differential Equations

1.1 First order ODEs

General and singular solutions of a differential equations. Exact differential equations and integrating factors, linear equations and Bernoulli equation, special integrating factors and transformations, Lipschitz condition and Picard's theorem (statement only).

1.2 Higher order ODEs and Sturm-Liouville theory

General solution of homogeneous equation of second order, principle of linear superposition for homogeneous equation, Wronskian: its properties and applications, linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undermined coefficients, method of variational parameters, orthogonal trajectories, oscillation theory and boundary value problem: Sturm comparison theorem, Sturm-Liouville boundary value problem, properties of eigenvalues and eigenfunctions.

1.3 Systems of ODEs

Systems of linear differential equations, an operator method for linear systems with constant coefficients, basic theory of linear systems in normal form, homogeneous linear system with constant coefficients: two equations in two unknown functions.

1.4 Power series solutions and Green's function

Power series solution of differential equation about ordinary point and its application to Legendre differential equations, solution about regular singular point and its application to Bessel's differential equation. Solution of differential equations using Green's functions.