

Chapter 1: Ordinary Differential Equations

1.1 First Order Ordinary Differential Equations

- 1.1.1 Basic concepts and ideas
- 1.1.2 Separable Equations
- 1.1.3 Equations Reducible to Separable Form
- 1.1.4 Exact Differential Equation
- 1.1.5 Integrating Factors
- 1.1.6 Linear First Order Differential Equations [Reading Assignment: Bernoulli's Equation]

1.2 Ordinary Linear Differential Equation of the second Order

- 1.2.1 Homogeneous Equations with Constant Coefficients
 - 1.2.1.1 General Solution, Basis, Initial Value Problem
 - 1.2.1.2 Real Roots, Complex Roots, Double Root of the Characteristic Equation.

1.3 Non-homogeneous Equations with Constant Coefficients

- 1.3.1 The Method of Undetermined Coefficients
- 1.3.2 Variation of Parameters [Reading Assignment: Linear ODE of a higher order]

1.4 Cauchy Equation

1.5 System of Ordinary Differential Equation of The First Order [Reading Assignment: System of ODE of a higher Order]

Chapter 2: Vector Analysis

2.1 Vector Differential Calculus

- 2.1.1 Vector Calculus (Limit Derivative and Integral of Vector Valued Functions)
- 2.1.2 Curves and Their Length
- 2.1.3 Tangent, Curvature and Torsion
- 2.1.4 Scalar Fields and Vector Fields
- 2.1.5 Gradient of a Scalar Field
- 2.1.6 Divergence and Curl of a Vector Field

2.2 Line and Surface Integral

- 2.2.1 Line Integral
- 2.2.2 The fundamental Theorem of Line Integrals and Independent of Path

- 2.2.3 Green's Theorem
- 2.2.4 Surface Integral
- 2.2.5 Divergence's Theorem and Stoke's Theorem

Chapter 3: Complex Analysis

3.1 Complex Analytic Functions

- 3.1.1 Complex Numbers; Complex Plane
- 3.1.2 Functions of Complex Variables: Limits, Derivatives and Analytic Functions
- 3.1.3 Cauchy ? Riemann Equations; Laplace Equation
- 3.1.4 Elementary Functions: Exponential, Trigonometric, Hyperbolic, and Logarithmic Functions; Power Functions

3.2 Complex Integrals

- 3.2.1 Line Integral in the Complex Plane; Basic Properties
- 3.2.2 Cauchy Integral Theorem
- 3.2.3 Evaluation of Line Integrals by Indefinite Integrals
- 3.2.4 Cauchy's Integral Formula
- 3.2.5 The Derivative of Analytic Functions

3.3 Taylor and Laurent series

- 3.3.1 Sequence and Series; Tests of Convergence
- 3.3.2 Power Series
- 3.3.3 Taylor Series of Elementary Functions
- 3.3.4 Laurent's Series

3.4 Integration by the Method of Residue

- 3.4.1 Zeros and Singularities
- 3.4.2 Residues
- 3.4.3 The Residue Theorem
- 3.4.4 Evaluation of Real Integrals

Assessment methods

- Assignments (at least two)... 20%
- Quizzes (at least four)... 30%
- Final Examination ... 50%

Text Book:

Erwin Kreyszig, Advanced Engineering Mathematics

References:

1. J. Stewart, Calculus
2. R. Ellis, Calculus with Analytic Geometry
3. R.V. Churchill, Complex Variables and Application