MOREHOUSE COLLEGE
DEPARTMENT OF MATHEMATICS

COURSE OUTLINE

DIFFERENTIAL EQUATIONS (MATH 321)

TEXTBOOK:

A First Course In Differential Equations With Modeling Applications
Author: Dennis G. Zill ; Edition: 9TH; Publisher: Brooks/Cole CENGAGE Learning

GENERAL OBJECTIVES

The primary objectives of Math 321 are:

1. to expose the student to some of the more commonly used techniques for finding explicit solutions of ordinary differential equations;
2. to introduce several numerical techniques for finding approximate solutions to ordinary differential equations and;
3. to explore some of the applications of ordinary differential equations to the physical, behavioral and engineering sciences.

TOPICAL OUTLINE

I. DIFFERENTIAL EQUATIONS AND THEIR SOLUTION (Chapter 1)
   A. Classification of Differential Equations
   B. Solutions and Initial Value Problems

II. FIRST ORDER DIFFERENTIAL EQUATIONS (Chapter 2)
   A. Direction Fields and Autonomous Equations
   B. Separable Equations
   C. Linear Equations and Bernoulli Equations
   D. Exact Equations and Special Integrating Factors
   E. Solutions by Substitutions
   F. Euler’s Method
   G. Selected Applications (From Chapter 3)
      (1) Growth and Decay
      (2) Mixtures

III. HIGHER ORDER DIFFERENTIAL EQUATIONS (Chapters 4)
   A. Fundamental Solutions of Homogeneous Equations
   B. Reduction of Order
   C. Homogeneous Linear Equations with Constant Coefficients
   D. Nonhomogeneous Differential Equations
E. Method of Undetermined Coefficients
F. Variation of Parameters
G. Cauchy-Euler Equations

IV. MODELING WITH HIGHER-ORDER DIFFERENTIAL EQUATIONS (Chapter 5)
A. Spring/Mass Systems
B. Elementary Electric Circuits

V. SERIES SOLUTIONS OF LINEAR DIFFERENTIAL EQUATIONS (Chapter 6)
A. Power Series Solutions About an Ordinary Point
B. Solutions About Singular Points (Optional)
C. Bessel’s Equation and/or Legendre’s Equation (Optional)

VI. THE LAPLACE TRANSFORM (Chapter 7)
A. Definition and Properties of the Laplace Transform
B. Inverse Laplace Transform
C. Transforms of Derivatives
D. Solving Initial Value Problems Using Laplace Transforms
E. Operational Properties I and II
   (1) A Piecewise–Defined Function
   (2) Solving Initial Value Problems with Piecewise-Defined Functions
   (3) Solving Integral Equations
F. The Dirac Delta Function

VI. SYSTEMS OF LINEAR DIFFERENTIAL EQUATIONS (Chapter 8)
A. Solving Systems by Elimination (Chapter 4, Section 4.8)
B. Homogeneous Linear Systems (Chapter 8)
C. Nonhomogeneous Linear Systems (Optional; Chapter 8)

VIII. NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS (Chapter 9)
A. The Fourth Order Runge-Kutta Method
B. A Multistep Method (Optional)

REFERENCES

Introduction to Ordinary Differential Equation by Shepley L. Ross; Fourth Edition
John Wiley and Sons


STUDENT RESPONSIBILITIES

(1) Attend class regularly and take notes
(2) Complete all assignments on time. Assignments
should be handed in at the beginning of the class.
(3) Take all exams when scheduled or notify instructor in advance of conflicts.
(4) Maintain a high level of personal integrity, including honesty on all graded work.