# MATH 252 – Introduction to Differential Equations

**Course Description from Bulletin:** Linear differential equations of order one. Linear differential equations of higher order. Series solutions of linear DE. Laplace transforms and their use in solving linear DE. Introduction to matrices. Systems of linear differential equations.(4-0-4)

**Enrollment:** Required for AM majors and some engineering majors

**Textbook(s):** Zill, *A First Course in Differential Equations with Modeling Applications,* 11th ed., Brooks/Cole

**Other required material:** None

**Prerequisites:** Math 152

**Objectives:**
1. Students will be able to classify and solve first-order DEs and IVPs of various types: especially separable, exact, linear, and others reducible to them.
2. Students will be able to solver higher-order linear DEs and IVPs having constant coefficients via the method of undetermined coefficients and variation of parameter.
3. Students will be able to obtain power series solutions (about regular points) of second-order linear DEs having variable coefficients.
4. Students will be able to manipulate Laplace transforms and to solve linear IVPs using them.
5. Students will be able to solve systems of first-order linear DEs.
6. Students will be able to solve a variety of physical problems modeled by first-order and linear second-order IVPs.

**Lecture schedule:** Three 75 minute lectures per week

**Course Outline:**                                                                                       Hours
1. Review of  methods for first-order DEs                                       4
2. Linear Equation of Higher Order                                                 12
      a. Initial-value and boundary-value problems
      b. Linear dependence and linear independence
      c. Solutions of linear equations
      d. Homogeneous linear equations with constant coefficients
      e. Undetermined coefficients
      f. Variation of parameters
3. Application                                                                                 4
      a. Free undamped motion
      b. Free damped motion
      c. Driven motion
      d. Power series solutions, solutions about ordinary points
4. Laplace Transforms                                                                    13
      a. Laplace transform and inverse transform
      b. Translations theorems and derivatives of a transform

      c. Transforms of derivatives, integrals and periodic functions
      d. Applications
      e. Systems of linear equations
5. Introduction to Matrices                          10
      a. Basic definitions and theory
      b. Gaussian elimination
      c. Eigenvalues
6. Systems of Linear First-Order Differential Equations      12
      a. Preliminary theory
      b. Homogeneous linear systems
      c. Distinct real eigenvalues, repeated eigenvalues, complex eigenvalues
      d. Variation of parameters

**Assessment**:
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|---|---|---|
| Homework | 10-25% | |
| Quizzes/Tests | 40-50% | |
| Common Final Exam | 35% | |

**Syllabus prepared by**: Andre Adler and Warren Edelstein
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