MATH 254 – Introduction to Ordinary Differential Equations

Credits, contact hours, categorization of credits:	3 credits, 45 contact hours, Math
Instructor's or course coordinator's name:	Various courses and instructors
Textbook, title, author and year:	Fundamentals of Differential Equations by Nagle, Saff and Snider. The book is delivered digitally via D2L (under content) through the Inclusive Access program.
Other Supplemental materials:	Notes and supplementary material will be posted on D2L.
2021-2022 catalog description:	Solution methods for ordinary differential equations, qualitative techniques; includes matrix methods approach to systems of linear equations and series solutions. Examinations are proctored.
Prerequisites:	MATH 129, 223 or 250A with C or better.
Co-requisites:	None
Required, Elective, or Selected Elective:	Required
Instruction Outcomes:	Students who complete the course will be able to solve and approximate a solution to linear differential equations (both scalar equations and systems of equations) using a variety of techniques.
Student Outcomes:	1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
Topics covered:	• Intro, classification, solutions, IVT, E&U (1.1, 1.2) • Direction fields (1.2, 1.3), Phase line, equilibrium analysis of autonomous DE. • 1st order: separable (2.2), linear (2.3) • Generalize idea of transformation and substitution (2.2-2.6) • Modeling and compartmental analysis • 2nd Order linear DE: mass-spring oscillator (4.1); Homogeneous linear equation (4.2, 4.3)

- Homogeneous linear equation continue(4.3)
- Structure of solutions to linear DE (a little linear algebra), expected structure of solution to non-homogeneous DE.
- Response to forcing/ particular solution. Method of undetermined coefficients. (4.4)
- Computation using complex exponentials; Superposition Principle (4.5)
- Variation of Parameters (4.6)
- Series solutions (some of chapter 8)
- Reduction of higher order DE to system of first order DE (some of chap 6)
- linear system, matrix equation (9.1, 9.3) Normal form (9.4) LHCC system by eigensystem (9.5-9.6)
- Continue LHCC system by eigensystem (9.6) Phase portraits of linear system (5.4);
- Applications to system
- Nonlinear system, linearization around fixed points, phase portraits.
- Laplace transform: definition, linearity, table (7.1, 7.2)
- Transform of piecewise functions, properties of transforms (7.2,7.3)
- Inverse transform, solving IVP with Laplace
- Convolution, transfer function