

**Syllabus**  
**MATH 2420 - STEM**  
**Differential Equations**

**Western Texas College**

1. Basic Course Information

- a. MATH 2420 Course Description: Ordinary differential equations, including linear equations, systems of equations, equations with variable coefficients, existence and uniqueness of solutions, series solutions, singular points, transform methods, and boundary value problems; application of differential equations to real-world problems.
- b. Any required prerequisites: Students must make a C or better in MATH 2414.
- c. Advancement Via Individual Determination (AVID) learning strategies will be implemented periodically throughout the course.
- d. This course has been designed to prepare students whose chosen field of study requires a STEM mathematical pathway.
- e. Project Base Learning (PBL) is an active learning method in which students gain knowledge and skill by investigating and responding to a tangible, engaging and complex question, problem or challenge.
- f. Online course content is administered through the college's learning management system (LMS), Moodle, also called eCampus. A link to eCampus can be found on [mywtc.edu](http://mywtc.edu) and to Moodle (the big M with a graduation cap) on the college's home page, [www.wtc.edu](http://www.wtc.edu).

2. Student Learning Outcomes

- a. Identify homogeneous equations, homogeneous equations with constant coefficients, and exact and linear differential equations.
- b. Solve ordinary differential equations and systems of equations using:
  - I. Direct integration
  - II. Separation of variables
  - III. Reduction of order
  - IV. Methods of undetermined coefficients and variation of parameters
  - V. Series solutions
  - VI. Operator methods for finding particular solutions
  - VII. Laplace transform methods
- c. Determine particular solutions to differential equations with given boundary conditions or initial conditions.
- d. Analyze real-world problems in fields such as Biology, Chemistry, Economics, Engineering, and Physics, including problems related to population dynamics, mixtures, growth and decay, heating and cooling, electronic circuits, and Newtonian mechanics.

3. Course Requirements

- a. Major Requirements—All major requirements must be proctored.
  - I. Midterm Exam
  - II. Final Exam
- b. Minor Requirements
  - I. Homework
  - II. Quizzes
  - III. Projects

4. Testing Requirements
  - a. Students are NOT allowed to use their book or notes of any kind while completing major requirements.
  
5. Information on Books and Other Course Materials
  - a. Optional Book: A First Course in Differential Equations with Modeling Applications 11th Edition by Zill. Book ISBN: 9781305965720
  - b. Required Access Code: Online Students must purchase a WebAssign Access Code. WebAssign ISBN: 9781337652469
  - c. Calculators: A TI-84 or higher is strongly recommended. The TI-89, TI-Inspire with CAS or any other calculator with CAS capability are not permitted.
  
6. Other Policies, Procedures and important dates. Please refer to the WTC [Catalog](#) for the following:
  - a. Campus Calendar
  - b. Final exam schedule
  - c. How to drop a class.
  - d. Withdrawal information
  - e. Student Conduct/Academic Integrity
  - f. Class Attendance
  - g. Students with disabilities
  
7. Planned Course of Study

Chapters and Sections to be covered throughout the semester	
Chapter 1— Introduction to Differential Equations	Section 1.1—Definitions and Terminology Section 1.2—Initial-Value Problems Section 1.3—Differential Equations as mathematical Models
Chapter 2—First Order Differential Equations	Section 2.1—Solutions Curves Without a Solution 2.1.1—Direction Fields Section 2.2—Separable Equations Section 2.3—Linear Equations Section 2.4—Exact Equations Section 2.5—Solutions by Substitutions Section 2.6—A Numerical Method
Chapter 3— Modeling with First- Order Differential Equations	Section 3.1—Linear Models Section 3.2—Nonlinear Models Section 3.3—Modeling with Systems of First-Order DEs
Chapter 4—Higher- Order Differential Equations	Section 4.1—Preliminary Theory—Linear Equations 4.1.1—Initial-Value and Boundary- Value Problems 4.1.2—Homogeneous Equations Section 4.2—Reduction of Order

	<p>Section 4.3—Homogeneous Linear Equations with Constant Coefficients</p> <p>Section 4.4—Undetermined Coefficients—Superposition Approach</p> <p>Section 4.6—Variation of Parameters</p> <p>Section 4.7—Cauchy-Euler Equations</p> <p>Section 4.8—Green’s Function</p> <p>4.8.1—Initial-Value Problems</p> <p>4.8.2—Boundary-Value Problems</p>
Chapter 5—Modeling with Higher-Order Differential Equations	<p>Section 5.1—Linear Models: Initial-Value Problems</p> <p>5.1.1—Spring/Mass System: Free Undamped Motion</p> <p>5.1.2—Spring/Mass System: Free Damped Motion</p> <p>5.1.3—Spring/Mass System: Driven Motion</p> <p>5.1.4—Series Circuit Analogue</p>
Chapter 6—Series Solutions of Linear Equations	<p>Section 6.1—Review of Power Series</p> <p>Section 6.2—Solutions About Ordinary Points</p> <p>Section 6.3—Solutions About Singular Points</p>
Chapter 7—Laplace Transforms	<p>Section 7.1—Definition of the Laplace Transform</p> <p>Section 7.2—Inverse Transforms and Transforms of Derivatives</p> <p>7.2.1—Inverse Transforms</p> <p>7.2.2—Transforms of Derivatives</p> <p>Section 7.3—Operational Properties I</p> <p>7.3.1—Translation of the s-Axis</p> <p>7.3.2—Translation on the t-Axis</p>
Chapter 8—Systems of Linear First-Order Differential Equations	<p>Section 8.1—Preliminary Theory—Linear Systems</p> <p>Section 8.2—Homogeneous Linear Systems</p> <p>8.1.1—Distinct Real Eigenvalues</p> <p>8.1.2—Repeated Eigenvalues</p>
Appendices B—Matrices	<p>Section B.1—Basic Definitions and Theory</p> <p>Section B.2—Gaussian and Gauss-Jordan Elimination</p> <p>Section B.3—The Eigenvalue Problem</p>

\*This schedule is subject to change at the discretion of the instructor.

Last Modified: July 2020