Syllabus
MATH 2420 - STEM
Differential Equations
Western Texas College
2020-2021

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 and to Moodle (the big M with a graduation cap) on the college's home page, 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: 978-1-30596572-0
    b. Required Access Code: Online Students must purchase a WebAssign Access Code. WebAssign ISBN: 978-1-33765246-9
    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 | |
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| Chapter 1—Introduction to Differential Equations | Section 1.1—Definitions and Terminology<br>Section 1.2—Initial-Value Problems<br>Section 1.3—Differential Equations as mathematical Models |
| Chapter 2—First Order Differential Equations | Section 2.1—Solutions Curves Without a Solution<br>2.1.1—Direction Fields<br>Section 2.2—Separable Equations<br>Section 2.3—Linear Equations<br>Section 2.4—Exact Equations<br>Section 2.5—Solutions by Substitutions<br>Section 2.6—A Numerical Method |
| Chapter 3—Modeling with First-Order Differential Equations | Section 3.1—Linear Models<br>Section 3.2—Nonlinear Models<br>Section 3.3—Modeling with Systems of First-Order DEs |
| Chapter 4—Higher-Order Differential Equations | Section 4.1—Preliminary Theory—Linear Equations<br>4.1.1—Initial-Value and Boundary-Value Problems<br>4.1.2—Homogeneous Equations<br>Section 4.2—Reduction of Order<br>Section 4.3—Homogeneous Linear Equations with Constant Coefficients<br>Section 4.4—Undetermined Coefficients—Superposition |

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

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

Last Modified: July 2020