MATH 261-T01 (Fall 2016)
Elementary Differential Equations

Course description: Introduction to first-order differential equations and applications; higher order linear differential equations and applications; series solutions; Laplace transforms and their application to differential equations; system of differential equations; Fourier series and partial differential equations.

Objective: Upon completion of the course, the student should be able to classify and solve the types of ordinary differential equations covered in this course, be able to write and solve a differential equation for an applied problem, and be able to interpret the meaning of the solution for an applied problem.

Outcomes: Upon completion of this course, the student will be able to:

1) Solve first order differential equations.
2) Solve ordinary differential equations using the methods of undetermined coefficients and the method of variation of parameters
3) Develop a system of linear differential equations to model a physical process.
4) Find the Laplace transform of functions and use the Laplace transform to solve differential and integral equations.
5) Find power series solutions of second order ordinary differential equations.
6) Find the Fourier series of functions.
7) Solve partial differential equations and boundary (initial) value problems using separation of variables.

Instructor: Susan Barton, Ph.D., Professor of Mathematics
Office & phone: Elab 101 F 304-442-3297
E-mail: susan.barton@mail.wvu.edu
Office Hour: M 9:00 – 9:50 in the math lab and 2:00 – 2:50 in my office
T 9:00 – 9:50 in my office
W 9:00 – 9:50 in the Math Lab and 2:00 – 2:50 in my office
R 9:00 – 10:50 and 12:00 – 12:50 all in my office
F 9:00 – 9:50 in my office

Class time/room: MTWF 12:00 – 12:50 in ELab 205
Resource: A course calendar etc. may be found at community.wvu.edu/~sbarton
Tutoring: You may stop by my office any time, office hours are just the times I promise to be there. You may also make an appointment. **Additional help:** The Math Lab (Elab 107) is open from 8am to 4:30pm for quiet study. A schedule will be posted before the second week of class detailing the hours that tutoring is available. Free tutoring is also available through the Student Success Center (located on the third floor of Vining Library) and Student Support Services (located in Old Main 308/309).

Grading and Assessment:

Quizzes/Homework: I will count your best 6 (out of 8?) quizzes. Quizzes will be 25 points apiece and thus count for 150 points (about 19%) of your course grade. Homework will not be collected but must be done to be successful in the course. Questions answered in class and in my office.

Participation: One point every day that you attend class AND you do not use your cell phone or other distracting device in class. This is a participation point and may be taken away at the instructor's discretion. The result will be scaled to 50 points (about 6%) of your course grade.

Exams: Four in class hourly tests, each worth 100 points (about 12.5%) of your course grade.

Final Exam: A comprehensive final exam worth 200 points (about 25%) of the course grade will be given on the date of the official schedule (when it is posted). The final exam may replace your lowest grade.

NOTE: Only excused absences will enable a student to make up exams. This means that you must have an excuse for the day of the missed exam and every subsequent day until you have made it up. In general quizzes may not be made-up.

Course Grade: Grades are assigned according to the following scale:
A – 90 - 100% (900 – 1000 points); B – 80 – 89.9% (800 – 899 points)
C – 70 - 79.9% (700 – 799 points) ; D – 60 - 69.9% (600 – 699 points); F - below 60%
Borderline grades may be improved based on performance and grade distribution of the whole class.

Calculator Usage: Graphing calculators will be forbidden on most exams and quizzes.
Computer Usage: None **Reference:** None **Laboratory Projects:** None
ABET Category Content: Mathematics - Credit 3 or 100%

Academic Integrity:

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me *before* the assignment is due to discuss the matter.

Text Book: Differential Equations with Boundary-Value Problems, (Eighth Edition) by Dennis G. Zill and Warren S. Wright

Chapters Covered:

Chapter 1, sections 1,2
Chapter 2, sections 2,3,4,5
Chapter 3, sections 1, 3(opt)
Chapter 4, sections 1,2,3,4 or 5,6,7,9(opt)
Chapter 5, sections 1
Chapter 6, sections 1,2,3
Chapter 7, sections 1,2,3,4,6(opt)
Chapter 11, sections 1,2,3,4
Chapter 12, sections 1,2,3,4,5,

Topics:

1. Introduction to Differential Equations and First-Order Differential Equations (6 days):
    a) Basic Definitions and Terminology
    b) Separation of Variables
    c) Homogeneous Equations
    d) Exact Equations
    e) Linear Equations
    f) Bernoulli's Equation
2. Applications of First-Order Differential Equations (3 days):
    a) Growth and Decay
    b) Cooling Problems
    c) Chemical Mixtures
3. Linear Differential Equations of Higher Order (9 days)
    a) Initial-Value and Boundary-Value Problems
    b) Linear Independence and Linear Dependence
    c) The Structure of Solutions of Linear Equations
    d) Reduction of Order
    e) Auxiliary Equation; Distinct Roots
    f) Auxiliary Equation; Repeated Roots
    g) Auxiliary Equation; Complex Roots
    h) Differential Operator
    i) Undetermined Coefficients
    j) Variation of Parameters
4. Differential Equations with Variable Coefficients (2 days):
    a) Cauchy-Euler Equation
5. Applications of 2nd Order Differential Equations (3 days):
    a) Simple Harmonic Motion
    b) Damped Motion
    c) Forced Motion
6. The Laplace Transform (10 days):
    a) The Basic Definition
    b) The Inverse Transform
    c) Translation Theorems
    d) Derivatives of a Transform
    e) Transform of Derivatives
    f) Transform of Integrals and Convolution
    g) Transform of the Unit Step Function and Multipart Functions
    h) Transform of a Periodic Function
    i) Solving Differential and Integral Equations Using Laplace Transforms
7. Systems of Linear Differential Equations (3 days):
    a) Systems of Linear First-Order Equations
    b) Operator Method (OPT)
8. Series Solutions of Linear Equations (6 days):
    a) Solutions About Ordinary Points
    b) Solutions About Singular Points
9. Fourier Series (6 days)
    a) Orthogonal Functions
    b) Fourier Series
    c) Sine and Cosine Series

10. Partial Differential Equations and Boundary Value Problems (6 days)
    a) Sturm-Liouville Problem
    b) Separation of Variables Technique
    c) Heat Equation
    d) Wave Equation
    e) Laplace's Equation
    f) 3-Dimensional Rectangular Partial Differential Equations (OPT)

Schedule: The professor reserves the right to make any necessary adjustments and/or modifications to this syllabus. (Especially Below)

Quiz, and Tests:

Quiz 1	Friday August 26
Quiz 2	Wednesday September 7
Test 1	Tuesday September 13
Quiz 3	Friday September 23
Quiz 4	Friday September 30
Test 2	Tuesday October 4
Quiz 5	Friday October 14
Quiz 6	Friday October 21
Test 3	Tuesday October 25
Quiz 7	Friday November 4
Quiz 8	Friday November 11
Test 4	Tuesday November 15
Final Exam	Pre official schedule