BUTTE COLLEGE
COURSE OUTLINE

I. **CATALOG DESCRIPTION**

MATH 40 - Differential Equations **4 Unit(s)**

Prerequisite(s): MATH 31
Recommended Prep: NONE
Transfer Status: CSU/UC
68 hours Lecture

The course is an introduction to ordinary differential equations including both quantitative and qualitative methods as well as applications from a variety of disciplines. Introduces the theoretical aspects of differential equations, including establishing when solution(s) exist, and techniques for obtaining solutions, including, series solutions, and singular points, Laplace transforms and linear systems. (C-ID MATH 240).

II. **OBJECTIVES**

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

A. Create and analyze mathematical models using ordinary differential equations.
B. Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and selected higher order ordinary differential equations.
C. Apply the existence and uniqueness theorems for ordinary differential equations.
D. Find power series solutions to ordinary differential equations.
E. Determine the Laplace Transform and inverse Laplace Transform of functions.
F. Solve Linear Systems of ordinary differential equations.

III. **COURSE CONTENT**

A. **Unit Titles/Suggested Time Schedule**

Lecture

Topics	Hours
1. Solutions of ordinary differential equations	2.00
2. First order differential equations including separable, homogeneous, exact, and linear	12.00
3. Existence and uniqueness of solutions	2.00
4. Applications of first order differential equations such as circuits, mixture problems, population modeling, orthogonal trajectories, and slope fields	9.00
5. Second order and higher order linear differential equations; variation of parameters and undetermined coefficients	5.00
6. Fundamental solutions, independence, Wronskian	3.00
7. Nonhomogeneous equations	3.00
8. Applications of higher order differential equations such as the harmonic oscillator and circuits	8.00
9. Variation of parameters	2.00
10. Laplace Transforms	8.00
11. Series solutions	8.00
12. Systems of Ordinary differential equations	6.00

Total Hours 68.00

IV. METHODS OF INSTRUCTION

A. Lecture
B. Collaborative Group Work
C. Homework: Students are required to complete two hours of outside-of-class homework for each hour of lecture
D. Discussion
E. Board Work

V. METHODS OF EVALUATION

A. Exams/Tests
B. Quizzes
C. Class Assignments and Class Response
D. Daily Homework Assignments, where the student will demonstrate problem-solving skills

VI. EXAMPLES OF ASSIGNMENTS

A. Reading Assignments
   1. Read the "Illustrated Applications" in the first chapter of your book and be prepared to discuss your favorites in class.
   2. Read the instructor's handout on "Chaos Theory" and be prepared to discuss in class.

B. Writing Assignments
   1. Write a short (2 - 4 pages) paper on the life of a mathematician discussed in class and be prepared to give a short talk about this person based on your paper.
   2. Write a short (1 - 2 pages) paper on how this class will fit into your major and give specific examples of ordinary differential equations that you believe you might use.

C. Out-of-Class Assignments
   1. Interview someone who uses differential equations in their job and find out how the equation is used. The only restriction is that the person you interview cannot be a mathematics teacher.
   2. Find an application of a differential equation that is surprising to you and be prepared to share your find with other students in the class.

VII. RECOMMENDED MATERIALS OF INSTRUCTION

Textbooks:

A. Zill, D. G. A First Course in Differential Equations with Modeling Applications. 10th Edition. Brooks/Cole Cengage Learning, 2012.

Materials Other Than Textbooks:

A. Graphing calculator

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