College of San Mateo
Official Course Outline

1. **COURSE ID:** MATH 275 **TITLE:** Ordinary Differential Equations **C-ID:** MATH 240
   Units: 3.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; and 96.0-108.0 Homework hours
   Method of Grading: Letter Grade Only
   Prerequisite: MATH 253

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU; UC
   AA/AS Degree Requirements:
   CSM - COMPETENCY REQUIREMENTS: C1 Math/Quantitative Reasoning Basic Competency
   CSU GE:
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B4 - Mathematics/Quantitative Reasoning
   IGETC:
   IGETC Area 2: MATHEMATICAL CONCEPTS AND QUANTITATIVE REASONING: A: Math

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   Differential equations of first, second, and higher order; simultaneous, linear and homogeneous equations; solutions by power series; numerical methods, Fourier series, Laplace transforms, and applications.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Create and analyze mathematical models using ordinary differential equations;
   2. 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;
   3. Apply the existence and uniqueness theorems for ordinary differential equations;
   4. Find power series solutions to ordinary differential equations;
   5. Determine the Laplace Transform and inverse Laplace Transform of functions; and
   6. Solve Linear Systems of ordinary differential equations.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. Create and analyze mathematical models using ordinary differential equations;
   2. 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;
   3. Apply the existence and uniqueness theorems for ordinary differential equations;
   4. Explain the meaning of existence and uniqueness.
   5. Determine the Laplace Transform and inverse Laplace Transform of functions; and
   6. Solve Linear Systems of ordinary differential equations.

6. **COURSE CONTENT:**
   Lecture Content:
   1. Solutions of ordinary differential equations;
   2. First order DE including separable, homogeneous, exact, and linear;
   3. Existence and uniqueness of solutions;
   4. Applications of first order differential equations such as circuits, mixture problems, population modeling, orthogonal trajectories, and slope fields;
   5. Second order and higher order linear differential equations;
   6. Fundamental solutions, independence, Wronskian;
   7. Nonhomogeneous equations;
   8. Applications of higher order differential equations such as the harmonic oscillator and circuits;
   9. Variation of parameters;
   10. LaplaceTransforms;
   11. Series Solutions; and
   12. Systems of Ordinary differential equations

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**
Typical methods of instruction may include:
A. Lecture
B. Discussion
C. Other (Specify): A. Out-of-class assignments: problem sets requiring students to compute, solve, construct, prove, and assess. B. Required reading assignments: assignments requiring the student to read sections of the (linear algebra) textbook and/or selected materials supplied by the teacher. C. Required writing assignments D.Methods for teaching critical thinking: Assignments (see A and B above) that require students to calculate, judge, assess, construct, and solve. Also students will be encouraged to discuss and debate conceptual questions in classroom discussion. And of course students are always encouraged to question whatever the teacher or other students do. E. Collaborative work in or out of class. F. Work using computer software to analyze ODE's.

8. **REPRESENTATIVE ASSIGNMENTS**
Representative assignments in this course may include, but are not limited to the following:
Writing Assignments:
Writing assignments require extended logical argument and explanation of mathematical assertions, concepts, and processes.

Example: You have been assigned to present the topic Linear Independence and the Wronskian of Functions to your study group. Write teaching notes augmented by examples would be sufficient to teach this topic.

Example: Given a system of differential equations of the Lanchester sea battles, (a) construct a phase portrait of the system, (b) indicate the direction and motion along the solutions, and (c) explain what the phase portrait and the motion mean in terms of the naval forces involved.

Example: Are orthogonal functions linearly independent? Justify your answer.

Reflective writing assignments cause students to think about how they have studied and how their study habits might be improved or to identify errors in thinking that lead to missed problems on tests (and of course state what correct thinking should be).

Example: Redo all incorrect problems from Quiz XX. After each problem write an explanation of what you did wrong, why you got the incorrect answer, what your mistake was, etc. Explain how you have now corrected your thinking in your work toward the correct solution.

Reading Assignments:
Assignments requiring the student to read sections of the (linear algebra) textbook and/or selected materials supplied by the teacher.

Example: Read the section in the textbook on step functions and their use in expressing jump functions.

Example: Read the instructor's handout on deriving approximation formulas for solving first order ODE's.
Other Outside Assignments:
Problem sets requiring students to compute, solve, construct, prove, and assess. Collaborative work *in* or out of class. Work using computer software to analyze ODE's.

Example: Use Laplace transforms to solve the initial value problem y' - y' - 2y = x, with y(0)=0, and y'(0) = 1.

Example: y' = g(x,y(x)). Use a trapezoidal approximation to the integral of g(x,y(x)) from x0 to x0 + h to derive a formula for approximating y(x0+h).

Example: Explain what is meant when two functions are said to be orthogonal. Give two functions that are orthogonal and two that are not orthogonal.

9. **REPRESENTATIVE METHODS OF EVALUATION**
Representative methods of evaluation may include:

A. Class Work
B. Exams/Tests
C. Group Projects
D. Homework
E. Quizzes
F. Written examination

10. **REPRESENTATIVE TEXT(S):**
Possible textbooks include:
A. William E. Boyce and Richard C. DiPrima. *Elementary Differential Equations*, ed. J Wiley and Sons, 2017

Origination Date: November 2021
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Course Originator: Christopher Walker