Lecture Contact Hours: 48-54; Outside-of-Class Hours: 96-108; Total Student Learning Hours: 144-162

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Mathematics 285 – Differential Equations

3 hours lecture, 3 units

Catalog Description
This 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, singular points, Laplace transforms and linear systems.

Prerequisite
"C" grade or higher or "Pass" in MATH C2220 (formerly MATH 280) or equivalent

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Differentiation techniques involving algebraic, trigonometric, logarithmic and exponential functions
2) Implicit differentiation
3) Integration techniques, including: substitution, integration by parts, trigonometric substitution, and trigonometric power reduction methods.
4) Evaluating improper integrals
5) Characterizing different types of sequences and finding their limits
6) Determining limits of series, calculating partial sums, using various tests to determine convergence, and approximating functions using Taylor and Maclaurin series
7) Calculating limits of functions with indeterminate forms and using L'Hospital's Rule
8) Graphing in rectangular and polar coordinates, using parametric equations, and conics
9) Modeling applications, including related rates, relative extrema, area between curves, and surface area, volumes by slicing or cylindrical shells.

Course 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) Laplace Transforms
11) Series Solutions
12) Systems of Ordinary differential equations

Course Objectives
Students 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) 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.

Method of Evaluation
A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.
1) Exploration activities (both independent and group) which measure students' ability to classify a differential equation, analyze a differential equation to see if it satisfies the conditions of the Uniqueness and Existence Theorems, and compute a Laplace transformation of an expression.
2) Homework assignments which measure students' ability to: determine the best method of solution and then to solve first order and higher order differential equation; create equations for specific initial value problems; and operate on a differential equation by Laplace transform to produce a solution.
3) Exams, quizzes and comprehensive final exam which measure students' ability to: determine the best method of solution and then to solve first order and higher order differential equation; create specific solutions to initial value and boundary value problems; and operate on a differential equation by Laplace transform to produce a solution.
4) Computer laboratory assignments which measure students' ability to select a suitable method for solving a differential equation and to interpret the results of a difficult problem.

Special Materials Required of Student
Graphing utility

Minimum Instructional Facilities
Smart classroom

Method of Instruction
1) Lecture and discussion
2) Instructor-guided discovery
3) Individual and group tutoring
4) Guided practice

Out-of-Class Assignments
1) **Reading:** Lecture notes; assigned textbook sections explaining mathematical concepts and procedures; instructional materials provided by the instructor; worked example sets; reference materials for mathematical symbols and notation; supplemental explanations from approved online resources; and documentation for graphing calculators or mathematical software.
2) **Writing:** Problem sets requiring clear, step-by-step demonstration of reasoning using correct mathematical notation; written explanations supporting solutions and justifying methods; error analysis and revision of incorrect or incomplete work; solution summaries explaining conceptual understanding; problem-based learning tasks requiring application of multiple skills; written responses to mathematical prompts or inquiry problems; and organized documentation of problem-solving strategies used in individual or group assignments.
3) **Other:** Online homework assignments or quizzes using learning platforms; collaborative problem solving using shared documents or discussion boards; graph construction by hand and with technology; review and annotation of instructor feedback to revise and resubmit work; preparation for exams through practice tests and concept reviews; mathematical modeling activities using real-

world data; use of graphing calculators or math software to explore and verify solutions; and completion of study logs, learning reflections, or structured practice plans to build mastery.

Texts and References

1) Required (representative example): Zill, Dennis G. *First Course in Differential Equations with Modeling Applications*. 12th edition, Cengage, 2024.
2) Supplemental: None

Student Learning Outcomes

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

1) Use analytical, numerical, and graphical methods to solve ordinary differential equations.
2) Use ordinary differential equations to model and solve multi-disciplinary application problems and interpret the results in context.

*For the complete list of **learning objectives**, please see the **Course Objectives** section