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 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:
    a. Implicitly
    b. Algebraic, trigonometric, logarithmic and exponential functions
2) Integration Techniques:
    a. Identify and apply appropriate integration techniques
    b. Using parts, trigonometric substitution and trigonometric power reduction methods
    c. Solving improper integrals
3) Limit Calculations:
    a. Using L'Hopital's Rule
    b. Solving limits with indeterminate forms
4) Sequences and Series:
    a. Characterizing special types of sequences
    b. Determining limits of sequences and series
    c. Calculating terms, partial sums and sums of infinite series
    d. Using various tests on series to determine convergence
    e. Using Maclaurin and Taylor series to approximate functions
5) Graphing and Analytic Geometry: using conics, polar coordinates and parametric equations
6) Modeling and Applications:
    a. Related rates, relative extrema
    b. Area between curves, surface area
    c. Volume by slicing or by 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) Problem sets
2) Take-home quizzes and/or exams
3) Reading and/or writing assignments

Texts and References
1) Required (representative example): Zill, Dennia G. *First Course in Differential Equations*. 11th edition, Cengage, 2018.
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