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Date reviewed: Spring 2012
C & GE Approval: May 14, 2012
Board Approval: June 14, 2012

Mathematics (MATH) 2140 Ordinary Differential Equations (4 Units) CSU:UC
[formerly Mathematics 14B]

Prerequisite: Successful completion of Mathematics 2130 with a grade of 'C' or better

Prerequisite knowledge/skills:

Before entering the course the student should be able to:

1. understand the use of functional notation,
2. plot and interpret graphs of functions,
3. differentiate algebraic, trigonometric, exponential, logarithmic and hyperbolic functions,
4. apply derivatives,
5. find the integrals of basic functions,
6. compute standard integral forms and use corresponding tables,
7. apply integration to selected physical problems,
8. differentiate and integrate functions involving parametric equations, and polar coordinates,
9. develop and test for convergence of mathematical series,
10. perform vector operations,
11. compute and apply partial derivatives,
12. compute and apply integrals over plane and solid regions, and,
13. compute and apply vector functions including use of Green's Theorem.

Total Hours: 64 hours lecture

Catalog Description:

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

Type of Class/Course: Degree Credit



Text: Zill, Dennis G. *Differential Equations with Computer Labs Experiments*. 9th ed. Boston, MA: PWS Publishing Co., 2009. Print.

Additional Instructional Materials: Study and Solutions Guide for this class.

Course Objectives:

At the completion of the course, a successful student will be able to understand and perform the following mathematical procedures:

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.

Course Scope and Content:

Unit I First Order Ordinary Differential Equations

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;

Unit II Second Order Ordinary Differential Equations

1. Second order and higher order linear differential equations;
2. Fundamental solutions, independence, Wronskian;
3. Nonhomogeneous equations;
4. Applications of higher order differential equations such as the harmonic oscillator and circuits;
5. Variation of parameters;

Unit III Laplace Transforms



1. Laplace Transforms;
2. Series Solutions; and
3. Systems of Ordinary differential equations

Learning Activities Required Outside of Class:

The students in this class will spend a minimum of 8 hours per week outside of the regular class time doing the following:

1. Studying
2. Answering questions
3. Skill practice
4. Completing required reading
5. Problem solving activity or exercise

Methods of Instruction:

1. Problem solving
2. Lecture-demonstrations and sample problems done by the instructor
3. Individual work with calculators and computers on numerical problems

Methods of Evaluation:

1. Tests
2. Examinations
3. Homework or projects where students demonstrate their mastery of the learning objectives and their ability to devise, organize and present complete solutions to problems.