MATH 002C: ORDINARY DIFFERENTIAL EQUATIONS

Originator

tle

Co-Contributor(s)

Name(s)
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Justification / Rationale

There are two justifications to update the Course Outline.
The first justification is to update the textbooks that are more than five years old to their latest edition. An OER textbook is added. A justification for a textbook that is more than 5 years old is given.
The second justification is to lower the class size maximum to 30. The reason for this lowering of the class size maximum is to allow more time with the students. The lab component of this class necessitates more interaction between faculty and students. Also several community colleges in California have class size maximum at 30 or lower, like Antelope Valley College, Cabrillo College, Chaffey College, Fullerton College, Mt. San Jacinto College and Pasadena College.

Effective Term

Fall 2022

Credit Status

Credit - Degree Applicable

Subject

MATH - Mathematics

Course Number

002C

Full Course Title

Ordinary Differential Equations

Short Title

DIFFER EQUATIONS

Discipline

Disciplines List
Mathematics

Modality

Face-to-Face

Catalog Description

This is a standard introductory course in differential equations and their applications in
modeling dynamic phenomena. Topics include first, second and higher order differential equations; systems of first order equations, linear, homogeneous and nonhomogeneous differential equations; solutions by power series; numerical methods, LaPlace transforms; and applications.

Schedule Description

MATH 002C is the traditional sophomore level Differential Equations course with Calculus 1B prerequisite.
Prerequisite: MATH 001B
IGETC: 2A

Lecture Units

3

Lecture Semester Hours

54

Lab Units
1
Lab Semester Hours
54

In-class Hours
108

Out-of-class Hours
108

Total Course Units
4
Total Semester Hours
216

Prerequisite Course(s)
MATH 001B

Required Text and Other Instructional Materials

Resource Type
Book

Author
Zill

Title
A First Course in Differential Equations with Modeling Applications

Edition
11th

Publisher
Cengage

Year
2018

College Level
Yes

Flesch-Kincaid Level
12

ISBN #
9781305965720

Resource Type
Book

Author
Borrelli, Robert; Coleman, Courtney

Title
Differential Equations - A Modeling Perspective

Edition
2

Publisher
Wiley

Year
2004

College Level
Yes

ISBN #
9780471433323

Resource Type
Book
Open Educational Resource
No

Author
Boyce DiPrima Meade

Title
Elementary Differential Equations

Edition
11th

City
NY

Publisher
John Wiley Sons Inc.

Year
2017

College Level
Yes

Flesch-Kincaid Level
12

ISBN #
9781119320630

Resource Type
Book
Open Educational Resource
Yes

Author
Trench

Title
Elementary Differential Equations with Boundary Value Problems

Publisher
LibreTexts

Year
2021

College Level
Yes

For Text greater than five years old, list rationale:
The text book Differential Equations-A Modeling Perspective by Borelli has no edition beyond the second edition. The reason that we keep this textbook because it is a classic textbook that has been used as a standard textbook in an introductory differential equations course for many years. We would like to give faculty an option to use this classic textbook if they so choose.

Class Size Maximum
30

Entrance Skills
Evaluate definite and indefinite integrals using a variety of integration formulas and techniques.

Requisite Course Objectives
MATH 001B-Evaluate definite and indefinite integrals using a variety of integration formulas and techniques;

Entrance Skills
Apply integration to areas and volumes, and other applications such as work or length of a curve.

Requisite Course Objectives
MATH 001B-Apply integration to areas and volumes, and other applications such as work or length of a curve;

Entrance Skills
Evaluate improper integrals.

Requisite Course Objectives
MATH 001B-Evaluate improper integrals;

Entrance Skills
Apply convergence tests to sequences and series.

Requisite Course Objectives
MATH 001B-Apply convergence tests to sequences and series;

Entrance Skills
Represent functions as power series.

Requisite Course Objectives
MATH 001B-Represent functions as power series; and

Entrance Skills
Graph, differentiate and integrate functions in polar and parametric form.

Requisite Course Objectives
MATH 001B-Graph, differentiate and integrate functions in polar and parametric form.

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. Introduction to linearity as an abstract mathematical concept;
6. How linearity (or lack of it) affects the nature of solutions of differential equations;
7. Second order and higher order linear differential equations;
8. Application of Superposition principle to get more solutions;
9. Geometric interpretations for solutions using direction fields and phase portraits;
10. Apply Numerical methods to find numerical solutions to ordinary differential equations, including Euler's methods
11. Fundamental solutions, independence, Wronskian;
12. Nonhomogeneous equations;
13. Applications of higher order differential equations such as the harmonic oscillator and circuits;
14. Variation of parameters;
15. Apply Laplace transforms to solve second order equations, in particular to second order equations with discontinuous forcing functions;
16. Solutions to some nonlinear differential equations of contemporary interest including bifurcation and chaotic dynamics;
17. Series Solutions;
18. Systems of Ordinary differential equations;
19. Sensitivity of solutions to changes in initial conditions especially in relation to the eigensystem of the matrix that defines the system.

Lab Content

1. Use of technology in solving differential equations.
2. Use of technology in mathematical modeling using differential equations.

Course Objectives

	Objectives
Objective 1	Use slope fields to examine qualitative behavior of solutions;
Objective 2	Create and analyze mathematical models using ordinary differential equations, including circuits, mixture problems, population modeling, orthogonal trajectories and harmonic oscillator;
Objective 3	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;
Objective 4	Apply the existence and uniqueness theorems for ordinary differential equations;
Objective 5	Apply numerical methods to find numerical solutions to ordinary differential equations, with error analysis;
Objective 6	Characterize equations as linear vs. non-linear using linear operators;
Objective 7	Find power series solutions to ordinary differential equations;
Objective 8	Determine the Laplace Transform and inverse Laplace Transform of functions;
Objective 9	Apply Laplace transforms to solve second order equations, in particular to second order equations with discontinuous forcing functions;
Objective 10	Solve Linear Systems of ordinary differential equations.

Student Learning Outcomes

	Upon satisfactory completion of this course, students will be able to:
Outcome 1	Define an ordinary differential equation or system of equations and classify them in terms of order, linearity, and homogeneity.
Outcome 2	Define a solution to an ordinary differential equation or system of equations and describe the requirements for a solution to exist and be unique.
Outcome 3	Use ordinary differential equations as a tool to model and solve real-world problems that involve rates of change (e.g. velocity and acceleration) and solve these models using a variety of methods.
Outcome 4	Demonstrate critical and logical thinking, by frequent use of deductive reasoning in mathematics, in the context of differential equations.

Methods of Instruction

Method	Please provide a description or examples of how each instructional method will be used in this course.
Discussion	Discussion will be used to review, analyze, and evaluate various methods of solution.
Technology-based instruction	Mathematics software like Maple, Mathematica, Geogebra, etc. will be used to graph vector fields, solution functions, etc. Technology will be used to solve Differential equations numerically.
Lecture	Lecture will be used for introduction and explanation of course topics.
Laboratory	Lab will be used, in groups or individually, for student exploration of the topics of the course.

Methods of Evaluation

Method	Please provide a description or examples of how each evaluation method will be used in this course.	Type of Assignment
Written homework	Students will be evaluated by homework assignments covering topics from lecture. Students will typically be assigned 5-6 hours of homework per week.	Out of Class Only
Mid-term and final evaluations	Students will be evaluated by examinations involving problems that require the application of studied principles and skills to new situations as well as problems that mimic those done on homework and in class. The exam should consist of short answer or free response questions.	In Class Only
Mid-term and final evaluations	Students will be evaluated by a comprehensive two-hour final exam.	In Class Only
Computational/problem-solving evaluations	Students will be evaluated by completing challenging problem sets requiring careful reasoning and application of a variety of course topics.	In and Out of Class
Student participation/contribution	Students will be evaluated by their participation in lab assignments, especially when collaboration is required. Participation in lab assignments may also require write-ups of problem sets or other lab activities.	In Class Only
Self-paced testing	Students will be expected to read the textbook before coming to class as well as reviewing their notes after class. Students will be evaluated on their preparation and review by their performance on homework and exams. Students should typically spend an average of 1-2 hours per week on preparation and review.	Out of Class Only

Assignments

Other In-class Assignments

1. Attend classroom lectures and take notes
2. Participate in classroom discussions to review, analyze, diagnose, and evaluate various methods of solution used in homework
3. Complete laboratory assignments using appropriate mathematical tools.
4. Complete examinations involving problems that apply studied principles to new situations.

Other Out-of-class Assignments

1. Read textbooks and supplementary.
2. Complete assigned homework including problem solving, exercises to improve mathematical skills.
3. Complete examinations involving problems that apply studied principles to new situations.

Grade Methods

Letter Grade Only

Comparable Transfer Course Information

University System
UC
Campus
UC Riverside

Course Number
Math 46
Course Title
Intro to Ordinary Differential Equations

Catalog Year
2020-2021

COD GE
C4.B - Language and Rationality - Communication and Analytical Thinking

CSU GE
B4 - Mathematics

IGETC GE
2A - Mathematical Concepts & Quantitative Reasoning

MIS Course Data

CIP Code
27.0101 - Mathematics, General.

TOP Code
170100 - Mathematics, General

SAM Code
E - Non-Occupational

Basic Skills Status
Not Basic Skills

Prior College Level
Not applicable

Cooperative Work Experience
Not a Coop Course

Course Classification Status
Credit Course

Approved Special Class
Not special class

Noncredit Category
Not Applicable, Credit Course

Funding Agency Category
Not Applicable

Program Status
Program Applicable

Transfer Status
Transferable to both UC and CSU

General Education Status
B = Mathematics/Quantitative Reasoning/Analytical Thinking

Support Course Status
N = Course is not a support course

C-ID
MATH 240

Allow Audit
No

Repeatability
No

Materials Fee
No

Additional Fees?
No

Approvals

Curriculum Committee Approval Date
11/18/2021

Academic Senate Approval Date
12/09/2021

Board of Trustees Approval Date
01/21/2022

Chancellor's Office Approval Date
03/07/2022

Course Control Number
CCC000326726

Programs referencing this course
Engineering AS Degree (http://catalog.collegeofthedesert.eduundefined/?key=24)
Chemistry UC Transfer Pathway AS Degree (http://catalog.collegeofthedesert.eduundefined/?key=274)
Liberal Arts: Math and Science AA Degree (http://catalog.collegeofthedesert.eduundefined/?key=29)
Mathematics AS-T Degree (http://catalog.collegeofthedesert.eduundefined/?key=38)
Mathematics AS Degree (http://catalog.collegeofthedesert.eduundefined/?key=68)