MATH R143: DIFFERENTIAL EQUATIONS

Originator
jkuang

Co-Contributor(s)

Name(s)
Hall , Steven (shall)

College
Oxnard College

Discipline (CB01A)
MATH - Mathematics

Course Number (CB01B)
R143

Course Title (CB02)
Differential Equations

Banner/Short Title
Differential Equations

Credit Type
Credit

Start Term
Fall 2021

Catalog Course 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. The course 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

Taxonomy of Programs (TOP) Code (CB03)
1701.00 - Mathematics, General

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
B - Satisfies Math/Quantitative Reasoning req (CSUGE-B B4, IGETC 2, or 4-yr)

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
52.5
Maximum Contact/In-Class Lecture Hours
52.5

Activity

Laboratory

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
52.5
Total Maximum Contact/In-Class Hours
52.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
105
Maximum Outside-of-Class Hours
105

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
MATH R121

Entrance Skills

Entrance Skills
Differentiate and integrate transcendental functions and test series for convergence.

Prerequisite Course Objectives
MATH R121-Evaluate definite and indefinite integrals using a variety of integration formulas and techniques
MATH R121-Apply integration to areas and volumes, and other applications such as work or length of a curve
MATH R121-Evaluate improper integrals
MATH R121-Apply convergence tests to sequences and series
MATH R121-Represent functions as power series

Requisite Justification

Requisite Type
Prerequisite

Requisite
Math R121

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Students will calculate solutions to first order ordinary differential equations.
2	Student will calculate solutions to second order ordinary differential equations using different methods.

Course Objectives

	Upon satisfactory completion of the course, 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
6	Solve Linear Systems of ordinary differential equations

Course Content

Lecture/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: Frobenius Theory, Bessel's Equation and Fourier Series
12. Systems of Ordinary differential equations

Laboratory or Activity Content

None.

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Objective exams
Problem-Solving Assignments
Problem-solving exams
Quizzes

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Audio-visual presentations
Computer-aided presentations
Collaborative group work
Class activities
Class discussions
Distance Education
Demonstrations

Group discussions
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Lecture
Small group activities

Describe specific examples of the methods the instructor will use:

Instructor will lead synchronous and asynchronous interactive instructional activities inside the classroom or via an online meeting platform (e.g. Zoom). In the online environment, group discussions or group activities may be done using Zoom breakout room or via Canvas discussion board. Technologies and simulations will be use as visual aids to enhance understanding.

Representative Course Assignments

Writing Assignments

The course is primarily computational in nature, but students must present written, worked out solutions using correct mathematical notation on problems such as:
"Solve y"+2y'+5y=sin(3t), when y(0)=1 and y'(0)=-1"

Critical Thinking Assignments

Logical, step-by-step solutions of the different types of ordinary differential equations, explaining why the method selected is appropriate, and including restrictions for the obtained solution. Interpretation of the solutions of application problems modeled by ordinary differential equations or initial value problems that include correct units and explanations.

Reading Assignments

Critical reading and thinking skills in application problems such as population modeling, for example:
"Given a differential equation that models the population of fish in a pond, find the population that fish tend towards?"

Other assignments (if applicable)

Understanding of mathematical computational procedures, for example:
"Find a particular solution to the nonhomogeneous second order linear differential equation y"+3y'+2y=3x+1"

Outside Assignments

Representative Outside Assignments

1. Sections of the textbook and other assigned material before and after each lecture to improve the learning experience of the topics covered in class. Analysis of verbal problems which apply the concepts taught.
2. Logical, step-by-step solutions of the different types of ordinary differential equations, explaining why the method selected is appropriate, and including restrictions for the obtained solution. Interpretation of the solutions of application problems modeled by ordinary differential equations or initial value problems that include correct units and explanations.
3. Step-by-step approximate solutions of first order initial value problems that include, if applicable, input and output of the computer software or algebra system used, as well as interpretation of the results that includes information about the error of the approximation.
4. Regular participation in class discussion and group work.

Articulation

C-ID Descriptor Number

MATH 240

Status

Approved

Equivalent Courses at 4 year institutions

University	Course ID	Course Title	Units
CSULA	MATH 2150	Differential Equations	
CSU Chico	MATH 260	Elementary Differential Equations	
CSU Bakersfield	MATH 2540	Ordinary Differential Equations	

Comparable Courses within the VCCCD

MATH M35 - Applied Differential Equations
MATH V23 - Introduction to Differential Equations

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
College of the Canyons	MATH 215	Differential Equations	
Santa Barbara City College	MATH 220	Differential Equations	

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

D2. Communication/Analytical Thinking
Approved

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
Fall 2013

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

B4 Mathematical/Quantitative Reasoning
Approved

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

UC TCA

UC TCA
Approved

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 2A: Mathematical Concepts & Quantitative Reasoning
Approved

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Edwards, C. and Penney, D. (2019). *Elementary Differential Equations with Boundary Value Problems* (5th). Pearson. New York City.

Library Resources

Sufficient Library Resources exist
Yes

Distance Education Addendum

Definitions

Distance Education Modalities
Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.
Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.
Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Video Conferencing	live zoom lecture, in-class quiz, and group discussion
Other DE (e.g., recorded lectures)	recorded lectures and assignment solutions

E-mail	Q&A
Face to Face (by student request; cannot be required)	Optional zoom Q&A sections
Asynchronous Dialog (e.g., discussion board)	Regular and effective interactions among students and between students and instructor for the online portion of the class will be demonstrated and recorded via Canvas discussion board. Some examples are 1) Whack-a-mole. Each week, three students will be randomly selected to produce solution videos for three different homework questions and post them on the discussion board. One student will be secretly instructed to include a mathematical mistake and other students need to identify who is the mole and what is the mistake. All three students will be encouraged to meet with the instructor in private prior to producing their video presentation. 2) Crowd-source chapter summaries. After each chapter, a few students will be tasked to write a short summary for the chapter and post it on the discussion board. All students will participate and vote in or out certain items from the summary. A different group will be tasked to compile the feedback and write a final draft of the summary. Instructor will monitor the discussion and make public and private comments. 3) Open-ended discussion. Instructor will post open-ended questions like “during a cycling competition, when is it best to put out maximum power” (vector field and maximization). Students will use what they learn in the class to answer and defend their answers. The best answer will be voted by peers using the “like” function in Canvas. 4) Crowd-source exam. Students will crowd-source their own exam questions and the best answer will be voted by peers using the “like” function in Canvas.

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100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular and effective interactions among students and between students and instructor for the online portion of the class will be demonstrated and recorded via Canvas discussion board. Some examples are 1) Whack-a-mole. Each week, three students will be randomly selected to produce solution videos for three different homework questions and post them on the discussion board. One student will be secretly instructed to include a mathematical mistake and other students need to identify who is the mole and what is the mistake. All three students will be encouraged to meet with the instructor in private prior to producing their video presentation. 2) Crowd-source chapter summaries. After each chapter, a few students will be tasked to write a short summary for the chapter and post it on the discussion board. All students will participate and vote in or out certain items from the summary. A different group will be tasked to compile the feedback and write a final draft of the summary. Instructor will monitor the discussion and make public and private comments. 3) Open-ended discussion. Instructor will post open-ended questions like “during a cycling competition, when is it best to put out maximum power” (vector field and maximization). Students will use what they learn in the class to answer and defend their answers. The best answer will be voted by peers using the “like” function in Canvas. 4) Crowd-source exam. Students will crowd-source their own exam questions and the best answer will be voted by peers using the “like” function in Canvas.
Other DE (e.g., recorded lectures)	recorded lectures and assignment solutions
E-mail	Q&A
Face to Face (by student request; cannot be required)	Optional zoom Q&A sections

Examinations

Hybrid (1%–50% online) Modality

Online
On campus

Hybrid (51%–99% online) Modality

Online
On campus

Primary Minimum Qualification

MATHEMATICS

Review and Approval Dates

Department Chair

08/27/2020

Dean

08/27/2020

Technical Review

09/09/2020

Curriculum Committee

09/09/2020

Curriculum Committee

10/28/2020

CCCCO
MM/DD/YYYY

Control Number
CCC000542119

DOE/accreditation approval date
MM/DD/YYYY