GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: MATH 2C DIVISION: 20 ALSO LISTED AS:

TERM EFFECTIVE: Summer 2025 CURRICULUM APPROVAL DATE: 11/12/2024

SHORT TITLE: DIFFERENTIAL EQUATIONS

LONG TITLE: Differential Equations

Units	Number of Weeks	Type	Contact Hours/Week	Total Contact Hours
3	18	Lecture:	3	54
		Lab:	0	0
		Other:	0	0
		Total:	3	54

Out of Class Hrs:	108.00
Total Learning Hrs:	162.00

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. 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. (C-ID: MATH 240) PREREQUISITE: Mathematics 1B with a grade of 'C' or better.

PREREQUISITES:

Completion of MATH 1B, as UG, with a grade of C or better.

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

02 - Lecture and/or discussion

05 - Hybrid

71 - Dist. Ed Internet Simultaneous

72 - Dist. Ed Internet Delayed

STUDENT LEARNING OUTCOMES:

By the end of this course, a student should:

1. Formulate, analyze and solve first, second, and higher order differential equations.

2. Solve applied problems involving differential equations.

3. Use technology to find numerical approximations to solutions of differential equations and to analyze graphs of solutions of differential equations.

COURSE OBJECTIVES:

By the end of this course, a student should:

1. Find and analyze general and specific solutions to separable DEs and use technology to graph and analyze the family of solutions.

2. Identify the order of a differential equation, whether it is linear or not, and verify a solution to a differential equation.

3. Apply existence-uniqueness theorem to determine if a differential equation has a unique solution.

4. Identify and solve linear, Bernoulli, Homogeneous DEs, and identify and solve exact DEs and find integrating factors to make a differential equation exact.

5. Use technology to find the numerical solution to an initial value problem using Euler's Method.

6. Solve applications of first-order DEs such as population modeling, mixture problems, circuits, slope fields and other applied problems.

7. Use the Wronskian to determine if a set of solutions forms a fundamental set and construct the general solution.

8. Find solutions to second-order homogeneous DEs where the characteristic equation has two distinct real roots, repeated roots and complex roots, and analyze

the solution graphically. Solve such problems when initial conditions are given and analyze the solution under various conditions.

9. Solve homogeneous and nonhomogeneous second-order DE using the method of Reduction of Order.

10. Solve DEs using change of variable technique.

11. Solve non-homogeneous DEs using the method of undetermined coefficients.

12. Find power series solutions to DEs about ordinary points.

13. Calculate Laplace transforms using both the definition and operational properties approaches. Find the inverse of the Laplace transform of a given function and

solve DEs using Laplace transforms.

14. Solve a system of linear first-order DEs.

15. Find Fourier series of step and piecewise functions and other discontinuous functions.

COURSE CONTENT:

Curriculum Approval Date: 11/12/2024

HOURS: 3

Content: Basic definitions: terminology and the origins of differential equations, Verifying the solution of a differential equation (DE), Existence and uniqueness of solutions

Student Performance Objectives: Students will identify the order of a differential equation, whether it is linear or not, and verify a solution to a differential equation. Students will apply existence-uniqueness theorem to determine if a differential equation has a unique solution.

HOURS: 3

Content: Separable first-order DEs, General vs. specific solutions, Family of curves

Student Performance Objectives: Students will find and analyze general and specific solutions to separable DEs and use technology to graph and analyze the family of solutions.

HOURS: 3

Content: Linear first-order DEs

Student Performance Objectives: Students will identify and solve linear DEs.

HOURS: 3

Content: Exact first-order DEs, Integrating factors

Student Performance Objectives: Students will identify and solve exact DEs and find integrating factors to make a differential equation exact.

HOURS: 3

Content: Bernoulli first-order DEs, Homogeneous first-order DEs

Student Performance Objectives: Students will identify and solve Bernoulli and homogeneous DEs.

HOURS: 3

Content: Euler's Method, Applications of first-order DEs

Student Performance Objectives: Students will use technology to find the numerical solution to an initial value problem using Euler's Method. Student will solve applications of first-order DEs such as population modeling, mixture problems, circuits, slope fields and other applied problems.

HOURS: 3

Content: DEs of higher order: fundamental sets, independent solutions, Wronskian, Reduction of Order

Student Performance Objectives: Students will use the Wronskian to determine if a set of solutions forms a fundamental set and construct the general solution. Students will use the method of Reduction of Order to solve a second-order DE.

HOURS: 3

Content: Homogeneous linear equations with constant coefficients: characteristic equations with real, repeated and complex roots

Student Performance Objectives: Students will find solutions to second-order homogeneous DEs where the characteristic equation has two distinct real roots, repeated roots and complex roots, and analyze the solution graphically. Student will also solve such problems when initial conditions are given and analyze the solution under various conditions.

HOURS: 6

Content: Change of variables, Solutions to nonhomogeneous DEs using the method of undetermined coefficients

Student Performance Objectives: Students will solve DEs using change of variable technique. Students will solve non-homogeneous DEs using the method of undetermined coefficients.

HOURS: 6

Content: Variation of Parameters, Applications of second-order DEs

Student Performance Objectives: Students will solve second-order nonhomogeneous equations using the method of variation of parameters. Students will solve applications of second-order DEs such as problems involving harmonic oscillators and circuits.

COURSE CONTENT (CONTINUED):

HOURS: 4

Content: Review of power series, Power series solutions

Student Performance Objectives: Students will find power series solutions to DEs about ordinary points.

HOURS: 6

Content: Laplace transforms: definitions, operational properties, inverse transforms, and applications to DEs

Student Performance Objectives: Students will calculate Laplace transforms using both the definition and operational properties approaches. Student will find the inverse of the Laplace transform of a given function and solve DEs using Laplace transforms.

HOURS: 3

Content: Systems of DEs including systems of linear first-order equations.

Student Performance Objectives: Students will solve a system of linear first-order DEs.

HOURS: 3

Content: Fourier series

Student Performance Objectives: Students will find Fourier series of step and piecewise functions and other discontinuous functions.

HOURS: 2

Final Exam

METHODS OF INSTRUCTION:

Instruction will follow a standard lecture/discussion format. Extensive homework will be assigned in order to assure mastery of the concepts covered in class. Students will also be required to utilize technology to enhance their understanding of the material. Students will be given opportunities to work together on problems given in class and group projects.

OUT OF CLASS ASSIGNMENTS:

Required Outside Hours 108

Assignment Description

1. Analyze and study pertinent text material, solved examples and lecture notes.
2. Apply principles and skills covered in class by solving regularly-assigned homework problems.
3. Regularly synthesize course materials in preparation for exams.
4. Projects to apply concepts learned in class

METHODS OF EVALUATION:

Writing assignments

Evaluation Percent 10

Evaluation Description

Out of class projects.

Problem-solving assignments

Evaluation Percent 10

Evaluation Description

Homework problems, quizzes.

Objective examinations

Evaluation Percent 80

Evaluation Description

In-class written exams.

REPRESENTATIVE TEXTBOOKS:

Differential Equations with Boundary Value Problems, Dennis Zill, Cengage, 2023 or a comparable textbook/material.

ISBN: ISBN-10 035776045X ISBN-13 978-0357760451

12 Grade Verified by: Jennifer Nari

OTHER MATERIALS:

Elementary Differential Equations and Boundary Value Problems, Boyce, DiPrima, Meade, Wiley, 2022.

ISBN: ISBN-10 1119820510 ISBN-13 978-1119820512

12 Grade Verified by: Jennifer Nari

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:
GAV B4, effective 200530
CSU GE:
CSU B4, effective 200530
IGETC:
IGETC 2A, effective 200530
CSU TRANSFER:
Transferable CSU, effective 200530
Not Transferable
UC TRANSFER:
Transferable UC, effective 200530
Not Transferable

SUPPLEMENTAL DATA:

Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN: MATH24
CAN Sequence: XXXXXXXX
CSU Crosswalk Course Department: MATH
CSU Crosswalk Course Number: 240
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: E
Maximum Hours:
Minimum Hours:
Course Control Number: CCC000215283
Sports/Physical Education Course: N
Taxonomy of Program: 170100