MATH 2 Course Outline as of Fall 2023

CATALOG INFORMATION

Dept and Nbr: MATH 2 Title: CALCULUS 4
Full Title: Calculus, Fourth Course-Differential Equations
Last Reviewed: 11/28/2022

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	4.00	Lecture Scheduled	4.00	17.5	Lecture Scheduled	70.00
Minimum	4.00	Lab Scheduled	0	8	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	4.00		Contact Total	70.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 140.00 Total Student Learning Hours: 210.00

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	MATH 2B

Catalog Description:
Students will learn to recognize, solve, and model applications using first, second, and higher order differential equations. Topics studied will include series solutions, numerical methods, introduction to Laplace transforms, and systems of differential equations with applications.

Prerequisites/Corequisites:
Course Completion of MATH 1C

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: Students will learn to recognize, solve, and model applications using first, second, and higher order differential equations. Topics studied will include series solutions, numerical methods, introduction to Laplace transforms, and systems of differential equations with applications. (Grade Only)
Prerequisites/Corequisites: Course Completion of MATH 1C
Recommended:

Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	B	Communication and Analytical Thinking	Fall 1981	
	MC	Math Competency		
CSU GE:	**Transfer Area**		Effective:	Inactive:
IGETC:	**Transfer Area**		Effective:	Inactive:

CSU Transfer:	Transferable	Effective:	Fall 1981	Inactive:
UC Transfer:	Transferable	Effective:	Fall 1981	Inactive:

CID:
CID Descriptor: MATH 240 Ordinary Differential Equations
SRJC Equivalent Course(s): MATH2

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Identify and solve ordinary differential equations and initial value problems using analytical and numerical methods.
2. Identify and solve systems of differential equations.
3. Model and solve applied problems using differential equations and systems of differential equations.

Objectives:
At the conclusion of this course, the student should be able to:
1. Classify differential equations as to order, type, and kind.
2. Use slope fields to provide a qualitative analysis of the solutions to a differential equation.
3. Solve homogeneous and exact first order linear differential equations, including initial value problems.
4. Solve separable first order differential equations, including initial value problems.
5. Apply the existence and uniqueness theorems for ordinary differential equations.
6. Use the Wronskian to identify sets of fundamental solutions to higher order linear differential equations.
7. Solve homogeneous and nonhomogeneous linear differential equations of second and higher order using variation of parameters, the method of undetermined coefficients, or the annihilator method.
8. Solve ordinary differential equations using technology and numerical methods such as Euler's and Runge-Kutta.
9. Model and solve initial value problems for at least four out of the eight following applications:
    A. Mixture problems

B. First and second order electrical circuits
C. Population modeling
D. First and second order chemical reactions
E. Forced oscillations
F. Projectile motion with air-resistance
G. Coupled spring-mass systems
H. Competing species

10. Solve initial value problems using the methods of Laplace transforms.
11. Solve systems of differential equations.
12. Solve differential equations and initial value problems using power series methods.

Topics and Scope:

I. Ordinary Differential Equations
A. Identify type and order of differential equations
B. First order differential equations
1. Separable
2. Exact
3. Homogeneous
4. Linear
C. Second and higher order differential equations
1. Linear
2. Homogeneous
3. Nonhomogeneous, using at least one method:
i. Undetermined coefficients
ii. Variation of parameters
iii. Differential annihilators
D. Slope fields
1. By hand
2. Technology
E. Existence and uniqueness of solutions
F. Use of Wronskian
G. Numerical methods including
1. Euler's Method
2. Fourth order Runge-Kutta
H. Applications (at least three)
1. Mixture problems
2. Electrical circuits
i. Resistance and capacitance (RC) circuits
ii. Inductance and resistance (LR) circuits
iii. Inductance, resistance, and capacitance (LRC) circuits
3. Population modeling
i. The Malthusian model
ii. The logistic model
4. First and second order chemical reactions
5. Forced oscillations
6. Projectile motion with air-resistance

II. Introduction to Laplace Transforms
A. Laplace transform and inverse Laplace transform
B. Use of tables
C. Application to linear differential equations

III. Series Solutions to Differential Equations

A. Power series solutions
B. Taylor series solutions

IV. Systems of Differential Equations
A. Analysis of phase portraits
B. Solution by matrices
C. The operator method or Laplace transforms
D. Use of systems to solve higher order linear ordinary differential equations
E. Applications (at least one)
1. Coupled spring-mass systems
2. Two container mixture problems
3. Competing species (e.g., predator-prey)

Assignment:

1. Daily reading outside of class (20-50 pages per week)
2. Problem set assignment(s) from required text(s) or supplementary materials chosen by the instructor (1-6 per week)
3. Quiz(zes) (0-4 per week)
4. Exams (2-7)
5. Final Exam
6. Project(s) (0-10), for example:
A. Computer explorations
B. Modeling activities

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course.	Writing 0 - 0%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Problem set assignments	Problem solving 5 - 20%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Quiz(zes), exams, final exam	Exams 70 - 95%

Other: Includes any assessment tools that do not logically fit into the above categories.

Project(s)	Other Category 0 - 20%

Representative Textbooks and Materials:
Differential Equations and Boundary Value Problems, Computing and Modeling. 6th ed. Edwards, C. and Penney, David and Calvis, David. Pearson Education. 2022.
A First Course in Differential Equations. 11th ed. Zill, Dennis. Cengage Learning. 2019.
Elementary Differential Equations. 8th ed. Rainville, Earl and Bedient, Phillip and Bedient, Richard. Pearson. 1997 (classic).