Glendale College

Course Outline of Record Report

Course ID 003253

Revision - May 2023

MATH108 : Ordinary Differential Equations

General Information

Author:	• Suzanne Palermo
Course Code (CB01) :	MATH108
Course Title (CB02) :	Ordinary Differential Equations
Department:	MATH
Proposal Start:	Fall 2023
TOP Code (CB03) :	(1701.00) Mathematics, General
CIP Code:	(27.0101) Mathematics, General.
SAM Code (CB09) :	Non-Occupational
Distance Education Approved:	Yes
Will this course be taught asynchronously?:	No
Course Control Number (CB00) :	CCC000583864
Curriculum Committee Approval Date:	05/10/2023
Board of Trustees Approval Date:	
Last Cyclical Review Date:	03/01/2020
Course Description and Course Note:	MATH 108 covers the solution of ordinary differential equations using various techniques including variation of parameters, the Laplace transform, power series, and numerical methods. Systems of linear differential equations and an introduction to nonhomogeneous linear systems are also covered. Applications are drawn from the physical sciences.
Justification:	Coding/Category Change
Course Control Number:	
Academic Career:	• Credit
Author:	• Suzanne Palermo

Academic Senate Discipline

Primary Discipline:	• Mathematics

Transferability & Gen. Ed. Options

General Education Status (CB25)

GE Status (CSU) B4, (UC) 2

Transferability

Transferable to both UC and CSU

Transferability Status

Approved

IGETC Area	Area	Status	Approval Date	Comparable Course
2-Math	Mathematical Concepts and Quantitative Reasoning	Approved	09/09/1991	No Comparable Course defined.

CSU GE-Breadth Area	Area	Status	Approval Date	Comparable Course
B4-Mathematics/Quantitative Reasoning	Mathematics/Quantitative Reasoning	Approved	No value	No Comparable Course defined.

C-ID	Area	Status	Approval Date	Comparable Course
MATH	Mathematics	Approved	06/18/2012	MATH 240 - Ordinary Differential Equations

Units and Hours

Summary

Minimum Credit Units (CB07)	5
Maximum Credit Units (CB06)	5
Total Course In-Class (Contact) Hours	90
Total Course Out-of-Class Hours	180
Total Student Learning Hours	270

Credit / Non-Credit Options

Course Type (CB04)

Credit - Degree Applicable

Noncredit Course Category (CB22)

Credit Course.

Noncredit Special Characteristics

No Value

Course Classification Code (CB11)

Credit Course.

Funding Agency Category (CB23)

Not Applicable.

☐ Cooperative Work Experience Education Status (CB10)

☐ Variable Credit Course

Weekly Student Hours

	In Class	Out of Class
Lecture Hours	5	10
Laboratory Hours	0	0

Course Student Hours

Course Duration (Weeks)	18
Hours per unit divisor	0
Course In-Class (Contact) Hours	

Studio Hours	0	0

Lecture	90
Laboratory	0
Studio	0
Total	90

Course Out-of-Class Hours

Lecture	180
Laboratory	0
Studio	0
Total	180

Time Commitment Notes for Students

No value

Pre-requisites, Co-requisites, Anti-requisites and Advisories

Prerequisite

MATH104E - Calculus and Analytic Geometry II

Objectives

- evaluate definite and indefinite integrals using a variety of techniques, including integration by parts, trigonometric substitution, and partial fractions;
- evaluate improper integrals;
- model differential equations;
- solve separable differential equations;
- work with exponential and logistic models of growth and decay;
- determine divergence or convergence of infinite sequences and series by applying convergence tests;
- represent functions as power series and determine their radius and interval of convergence;
- differentiate and integrate power series;
- find Taylor and Maclaurin series for a function.

OR

Prerequisite

MATH104EH - Honors Calculus and Analytic Geometry II

Objectives

- evaluate definite and indefinite integrals using a variety of techniques, including integration by parts, trigonometric substitution, and partial fractions;
- evaluate improper integrals;
- model differential equations;
- solve separable differential equations;
- work with exponential and logistic models of growth and decay;
- determine divergence or convergence of infinite sequences and series by applying convergence tests;
- represent functions as power series and determine their radius and interval of convergence;
- differentiate and integrate power series;
- find Taylor and Maclaurin series for a function.

OR

Prerequisite

MATH 104/104H

AND

Advisory

MATH105 - Multivariable and Vector Calculus (in-development)

Objectives

- determine differentiability and differentiate functions of two or more variables;
- perform basic vector algebra operations;

AND

Advisory

MATH107 - Linear Algebra (in-development)

Objectives

- Perform matrix arithmetic;
- find the inverse of a matrix;
- solve a linear system of equations using matrix operations (Gaussian and Gauss Jordan elimination);
- evaluate determinants by raw reduction and cofactor expansion;
- determine if a set of vectors is linearly independent;
- find the eigenvalues and eigenvectors of a matrix;

Entry Standards

Entry Standards	Description
Graph logarithmic and exponential functions.	MATH 104/104H
Integrate functions using variety of techniques.	MATH 104/104H
Differentiate inverse trigonometric functions.	MATH 104/104H
Apply l'Hospital's rule to find limits of indeterminate forms.	MATH 104/104H
Evaluate improper integrals.	MATH 104/104H
Model differential equations.	MATH 104/104H
Solve separable differential equations.	MATH 104/104H

Solve differential equations using slope fields and Euler's Method.	MATH 104/104H
Work with exponential and logistic models of growth and decay.	MATH 104/104H
Determine divergence or convergence of infinite series.	MATH 104/104H
Differentiate and integrate power series.	MATH 104/104H
Find Taylor and Maclaurin series for a function.	MATH 104/104H
Determine the radius and interval of convergence of power series.	No Value

Specifications

Methods of Instruction

Methods of Instruction	Lecture
Methods of Instruction	Discussion
Methods of Instruction	Multimedia
Methods of Instruction	Collaborative Learning
Methods of Instruction	Presentations

Out of Class Assignments

- homework (e.g. problem sets related to course content);
- projects (e.g. use software to find the numerical solutions to differential equations).

Methods of Evaluation	Rationale
Exam/Quiz/Test	Quizzes
Presentation (group or individual)	In-class presentations
Exam/Quiz/Test	Four or more exams are required
Exam/Quiz/Test	A comprehensive final examination is required

Textbooks

Author	Title	Publisher	Date	ISBN
Nagle, R. Kent	Fundamentals of Differential Equations	Pearson	2018	978-0-321-97706-9

Other Instructional Materials (i.e. OER, handouts)

No Value

Learning Outcomes and Objectives

Course Objectives

Select the appropriate method of solution, given a list of first order differential equations.

Solve both homogeneous and nonhomogeneous differential equations with constant coefficients of second or higher order.

Use the Laplace transform to solve nonhomogeneous differential equations with constant coefficients and initial conditions.

Use power series to solve differential equations with variable coefficients.

Use eigenvalues of matrices to solve systems of linear differential equations.

Approximate solutions to first order differential equations by using numerical methods on a computer.

Apply the techniques of solution to applications from at least two different areas of the physical sciences.

SLOs

Utilize undetermined coefficients, variation of parameters, series solutions, Laplace transforms, systems of linear differential equations, and numerical methods to solve homogeneous and non-homogeneous linear and non-linear differential equations. Expected Outcome Performance: 70.0

MATH Mathematics - A.A. Degree Major	Analyze, synthesize and evaluate theorems in Linear Algebra.
	Evaluate limits, derivatives and integrals.
	solve a variety of rudimentary and second order differential equations.
	solve applications in math and science using derivatives, integrals, differential equations and linear algebra.
MATH Mathematics - A.S. Degree Major	analyze, synthesize and evaluate theorems in Linear Algebra.
	solve applications in math and science using derivatives, integrals, differential equations and linear algebra.
ILOs General Education	apply techniques of analysis and critical thinking to critique real world and theoretical topics and issues
MATH Mathematics - AS-T	evaluate limits, derivatives and integrals.
	solve a variety of rudimentary and second order differential equations.
	solve applications in math and science using derivatives, integrals, differential equations and linear algebra.

Apply various techniques to solve application problems involving homogeneous and non-homogeneous linear and non-linear differential equations. Expected Outcome Performance: 70.0

MATH Mathematics - A.A. Degree Major	Analyze, synthesize and evaluate theorems in Linear Algebra.
	Evaluate limits, derivatives and integrals.
	solve a variety of rudimentary and second order differential equations.
	solve applications in math and science using derivatives, integrals, differential equations and linear algebra.
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MATH Mathematics - AS-T	evaluate limits, derivatives and integrals.
	solve a variety of rudimentary and second order differential equations.
	solve applications in math and science using derivatives, integrals, differential equations and linear algebra.

Additional SLO Information

Does this proposal include revisions that might improve student attainment of course learning outcomes?

No Value

Is this proposal submitted in response to learning outcomes assessment data?

No Value

If yes was selected in either of the above questions for learning outcomes, explain and attach evidence of discussions about learning outcomes.

No Value

SLO Evidence

No Value

Course Content

Lecture Content

Introduction to Differential Equations (5)
- Some basic mathematical models: Direction fields
- Solutions of some differential equations
- Classification of differential equations

First Order Differential Equations (18)
- Homogeneous differential equations
- Linear equations with variable coefficients
- Separable equations
- Modeling with first order equations
- Differences between linear and nonlinear equations
- Autonomous equations and population dynamics
- Exact equations and integrating factors
- Numerical approximations: Euler's method
- The existence and uniqueness theorem
- Applications such as circuits, mixture problems, population modeling, orthogonal trajectories, and slope fields

Second Order and Higher Order Linear Equations (13)
- Homogeneous equations with constant coefficients
- Fundamental solutions of linear homogeneous equations
- Linear independence and the Wronskian
- Complex roots of the characteristic equation
- Repeated roots; reduction of order
- Nonhomogeneous equations: Method of undetermined coefficients
- Variation of parameters
- Mechanical and electrical vibrations
- Forced vibrations

Series Solutions of Second Order Linear Equations (13)
- Review of power series
- Series solutions near an ordinary point
- Regular singular points
- Euler equations

The Laplace Transform (11)
- Definition of the Laplace transform
- Solutions of initial value problems
- Step functions
- Differential equations with discontinuous forcing functions
- Impulse functions
- The convolution integral

Systems of First Order Linear Equations (17)
- Review of matrices
- Systems of linear algebraic equations: Linear independences, eigenvalues, eigenvectors
- Basic theory of systems of first order linear equations
- Homogeneous linear systems with constant coefficients
- Complex eigenvalues
- Fundamental matrices
- Repeated eigenvalues

- Nonhomogeneous linear systems

Numerical Methods (7)
- The Euler or tangent line method
- Improvements on the Euler method
- The Runge-Kutta method

Partial Differential Equations and Fourier Series (6)
At least two of the following topics should be covered by the instructor:
- Two-point boundary value problems
- Fourier series
- The Phase Plane: Linear Systems
- Autonomous systems and stability
- Series solutions near a regular point
- Bessel's equation

Total Hours = 90