

Washtenaw Community College Comprehensive Report

MTH 295 Differential Equations Effective Term: Winter 2024

Course Cover

College: Math, Science and Engineering Tech

Division: Math, Science and Engineering Tech

Department: Math & Engineering Studies

Discipline: Mathematics

Course Number: 295

Org Number: 12200

Full Course Title: Differential Equations

Transcript Title: Differential Equations

Is Consultation with other department(s) required: No

Publish in the Following: College Catalog , Time Schedule , Web Page

Reason for Submission: Three Year Review / Assessment Report

Change Information:

Pre-requisite, co-requisite, or enrollment restrictions

Rationale: Update course master syllabus and course assessment.

Proposed Start Semester: Fall 2023

Course Description: In this course, students will learn to solve differential equations, including first and higher order linear and non-linear equations. Topics will include Cauchy-Euler types of equations, Bernoulli types of equations, homogeneous and non-homogeneous equations, and exact equations. The course also covers Laplace Transforms, solving systems of linear differential equations using the eigenvalue method. The course also covers linearization, numerical methods, and phase plane analysis. It is strongly recommended that students take MTH 197 and/or MTH 293 prior to or concurrently with MTH 295. A graphing calculator is required for this course. See the time schedule for current brand and model.

Course Credit Hours

Variable hours: No

Credits: 4

Lecture Hours: Instructor: 60 **Student:** 60

Lab: Instructor: 0 **Student:** 0

Clinical: Instructor: 0 **Student:** 0

Total Contact Hours: Instructor: 60 **Student:** 60

Repeatable for Credit: NO

Grading Methods: Letter Grades

Audit

Are lectures, labs, or clinicals offered as separate sections?: NO (same sections)

College-Level Reading and Writing

College-level Reading & Writing

College-Level Math

No Level Required

Requisites

Prerequisite

MTH 192 minimum grade "C"

General Education

Degree Attributes

Assoc in Applied Sci - Area 3

Assoc in Science - Area 3

Assoc in Arts - Area 3

MACRAO Science & Math

Michigan Transfer Agreement - MTA

MTA Mathematics

Request Course Transfer

Proposed For:

Eastern Michigan University

Ferris State University

Grand Valley State University

Jackson Community College

Kendall School of Design (Ferris)

Lawrence Tech

Michigan State University

Oakland University

University of Detroit - Mercy

University of Michigan

Wayne State University

Western Michigan University

Student Learning Outcomes

1. Solve first order and higher order linear and non-linear first order differential equations, both separable and non-separable.

Assessment 1

Assessment Tool: Outcome-related written exam questions

Assessment Date: Winter 2022

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Common written exam questions with a set of standard grading guidelines

Standard of success to be used for this assessment: At least 75% of the students will score 75% or higher on the questions for each outcome

Who will score and analyze the data: Current course instructor(s) and course mentor

2. Solve both homogeneous and non-homogeneous differential equations, using undetermined coefficients and variation of parameters methods for the particular integrals.

Assessment 1

Assessment Tool: Outcome-related written exam questions

Assessment Date: Winter 2022

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

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Who will score and analyze the data: Current course instructor(s) and course mentor

3. Solve systems of linear differential equations analytically with real and distinct, complex, and repeated eigenvalues, and analyze non-linear systems using phase plane analysis, and linearization techniques.

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Assessment Tool: Outcome-related written exam questions

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Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Common written exam questions with a set of standard grading guidelines

Standard of success to be used for this assessment: At least 75% of the students will score 75% or higher on the questions for each outcome

Who will score and analyze the data: Current course instructor(s) and course mentor

4. Solve differential equations IVP's and systems of differential equations IVP's, step functions, Delta and Impulse functions using Laplace Transforms.

Assessment 1

Assessment Tool: Outcome-related written exam questions

Assessment Date: Winter 2022

Assessment Cycle: Every Three Years

Course section(s)/other population: All sections

Number students to be assessed: All students

How the assessment will be scored: Common written exam questions with a set of standard grading guidelines

Standard of success to be used for this assessment: At least 75% of the students will score 75% or higher on the questions for each outcome

Who will score and analyze the data: Current course instructor(s) and course mentor

5. Solve and approximate Initial Value Problem using the numerical methods by Euler and Runge-Kutta.

Assessment 1

Assessment Tool: Outcome-related written exam questions

Assessment Date: Winter 2022

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Number students to be assessed: All students

How the assessment will be scored: Common written exam questions with a set of standard grading guidelines

Standard of success to be used for this assessment: At least 75% of the students will score 75% or higher on the questions for each outcome

Who will score and analyze the data: Current course instructor(s) and course mentor

Course Objectives

1. Define differential equations, order, ordinary, and partial types and introduce mathematical models.
2. Define linear, non-linear, homogeneous and non-homogeneous differential equations.
3. Solve differential equations by integration.
4. Solve separable differential equations.
5. Solve exact differential equations.
6. Use the integrating factor method to solve linear first order differential equations.
7. Solve Bernoulli type and other special types of differential equations using substitution methods.

8. Apply differential equations concepts to population models and velocity-acceleration motion types of real-life models.
9. Apply differential equations concepts to radioactivity and other models.
10. Plot slope fields and solution curves.
11. Define linear independence of functions and solutions.
12. Solve higher order linear homogeneous differential equations with constant coefficients.
13. Solve higher order linear homogeneous differential equations with variable coefficients.
14. Use variation of parameters to solve higher order non-homogeneous differential equations.
15. Use undetermined coefficients to solve higher order non-homogeneous differential equations.
16. Use differential equations to solve mechanical vibrations models.
17. Use differential equations to solve electrical circuit models.
18. Use differential equations to solve forced oscillations, resonance models, and endpoint problems.
19. Review matrices concepts, matrix operations, eigenvalues and eigenvectors.
20. Solve homogeneous systems of differential equations with real and distinct eigenvalues.
21. Solve homogeneous systems of differential equations with complex eigenvalues.
22. Solve homogeneous systems of differential equations with repeated eigenvalues.
23. Solve homogeneous systems of differential equations with repeated and defective eigenvalues.
24. Solve second-order systems of differential equations and cover applications.

25. Identify matrix exponentials, linear systems and the fundamental matrix.
26. Solve non-homogeneous linear systems of differential equations.
27. Identify equilibrium solutions, stability, and phase plane analysis.
28. Recognize autonomous linear systems.
29. Identify and analyze critical points and linearization.
30. Solve ecological models with predators and competitors.
31. Use phase plane analysis in non-linear systems.
32. Define and describe the properties of Laplace transforms and inverse transforms.
33. Recognize translation theorems and partial fractions.
34. Introduce derivatives, integrals of transforms, and the convolution Theorem.
35. Use Laplace transforms to solve homogeneous nth order differential equations.
36. Use Laplace transforms to solve non-homogeneous nth order differential equation.
37. Use Laplace transforms to solve cases of periodic, piecewise and step functions.
38. Use Laplace transforms to solve cases involving Impulses and Delta functions.
39. Use the Euler and the improved Euler methods to approximate solutions to IVP's.
40. Use the fourth order Runge-Kutta method to approximate solutions to IVP's.
41. Use the Euler and the fourth order Runge-Kutta method to approximate solutions to systems of differential equations.

New Resources for Course

Course Textbooks/Resources

Textbooks

Edwards, and Penney. *Differential Equations, Computing and Modeling*, Fifth ed. Pearson, 2015

Manuals

Periodicals

Software

Equipment/Facilities

Level III classroom

Reviewer

Faculty Preparer:

Yin Lu

Action

Faculty Preparer

Date

Jan 16, 2023

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Full Course Title: Differential Equations

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Is Consultation with other department(s) required: No

Publish in the Following: College Catalog , Time Schedule , Web Page

Reason for Submission: Three Year Review / Assessment Report

Change Information:

Consultation with all departments affected by this course is required.

Outcomes/Assessment

Objectives/Evaluation

Rationale: This is the three-year syllabus update.

Proposed Start Semester: Fall 2021

Course Description: This is a one-semester course on solving differential equations. Topics include solving first and higher order linear and non-linear differential equations, solving special differential equations including the Cauchy-Euler types of equations, the Bernoulli types of equations, both homogeneous and non-homogeneous equations, and exact equations. The course also covers Laplace Transforms, solving systems of linear differential equations using the eigenvalue method. The course also covers linearization, numerical methods, and phase plane analysis. In addition to the Calculus 3 prerequisite, successful completion of MTH 197 (Linear Algebra) is strongly recommended. A graphing calculator is required for this course. See the time schedule for current brand and model.

Course Credit Hours

Variable hours: No

Credits: 4

Lecture Hours: Instructor: 60 Student: 60

Lab: Instructor: 0 Student: 0

Clinical: Instructor: 0 Student: 0

Total Contact Hours: Instructor: 60 Student: 60

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Who will score and analyze the data: Current course instructor(s) and course mentor

2. Solve both homogeneous and non-homogeneous differential equations, using undetermined coefficients and variation of parameters methods for the particular integrals.

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3. Solve systems of linear differential equations analytically with real and distinct, complex, and repeated eigenvalues, and analyze non-linear systems using phase plane analysis, and linearization techniques.

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Equipment/Facilities

Level III classroom

Reviewer

Action

Date

Faculty Preparer:

<i>Mohammed Abella</i>	<i>Faculty Preparer</i>	<i>May 06, 2021</i>
Department Chair/Area Director: <i>WCC Default</i>	<i>Default</i>	<i>May 26, 2021</i>
Dean: <i>Victor Vega</i>	<i>Recommend Approval</i>	<i>Jun 16, 2021</i>
Curriculum Committee Chair: <i>Randy Van Wagnen</i>	<i>Recommend Approval</i>	<i>Aug 05, 2021</i>
Assessment Committee Chair: <i>Shawn Deron</i>	<i>Recommend Approval</i>	<i>Aug 10, 2021</i>
Vice President for Instruction: <i>Kimberly Hurns</i>	<i>Approve</i>	<i>Aug 17, 2021</i>