Washtenaw Community College Comprehensive Report

MTH 295 Differential Equations
Effective Term: Spring/Summer 2017

Course Cover

Division: Math, Science and Engineering Tech
Department: Mathematics
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:
Consultation with all departments affected by this course is required.
Course description
Outcomes/Assessment
Objectives/Evaluation
Rationale: Three year annual review
Proposed Start Semester: Spring/Summer 2017
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
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 293 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:

Central Michigan University
College for Creative Studies
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 linear and non-linear first order differential equations, both separable and non-separable.

Assessment 1

Assessment Tool: Written exam questions.
Assessment Date: Winter 2018
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 higher order linear and non-linear differential equations.

Assessment 1

Assessment Tool: Written exam questions.
Assessment Date: Winter 2018
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.

3. Solve both homogeneous and non-homogeneous differential equations, using undetermined coefficients and variation of parameters methods.

Assessment 1

Assessment Tool: Written exam questions.
Assessment Date: Winter 2018
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.

4. 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.

Assessment 1

Assessment Tool: Written exam questions.
Assessment Date: Winter 2018
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. Use Laplace Transforms to solve differential equations IVP's and systems of differential equations IVP's, step functions, Delta and Impulse functions.

Assessment 1

Assessment Tool: Written exam questions.
Assessment Date: Winter 2018
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.

6. Use the numerical methods by Euler and Runge-Kutta to approximate Initial Value Problems.

Assessment 1

Assessment Tool: Written exam questions.
Assessment Date: Winter 2018
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.

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 and velocity-acceleration models.
9. Apply differential equations concepts to radioactivity and other models.
10. Introduce slope fields and solution curves.
11. Introduce 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 and cover applications.
25. Cover matrix exponentials, linear systems and the fundamental matrix.
26. Solve non-homogeneous linear systems of differential equations.
27. Cover equilibrium solutions, stability, and phase plane analysis.
28. Cover autonomous linear systems.
29. Cover critical points and linearization.
30. Solve ecological models with predators and competitors.
31. Use phase plane analysis in non-linear systems.
32. Cover Laplace transforms, and inverse transforms: definitions and properties.
33. Cover translation theorems and partial fractions.
34. Cover 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

Edwars, and Penney. *Differential Equations, Computing and Modeling*, fifth ed. Pearson, 2015

Manuals

Periodicals

Software

Equipment/Facilities

Level III classroom

Reviewer	Action	Date
Faculty Preparer:		
Mohammed Abella	*Faculty Preparer*	*Nov 22, 2016*
Department Chair/Area Director:		
Lisa Rombes	*Recommend Approval*	*Nov 22, 2016*

Dean:		
Kristin Good	*Recommend Approval*	*Nov 22, 2016*
Curriculum Committee Chair:		
David Wooten	*Recommend Approval*	*Jan 10, 2017*
Assessment Committee Chair:		
Ruth Walsh	*Recommend Approval*	*Jan 11, 2017*
Vice President for Instruction:		
Bill Abernethy	*Approve*	*Jan 12, 2017*