

MERRITT COLLEGE COURSE OUTLINE

COLLEGE:		STATE APPROVAL DATE:	09/29/2014
ORIGINATOR:	Tae-Soon Park	STATE CONTROL NUMBER:	CCC00055 7614
		BOARD OF TRUSTEES APPROVAL DATE:	06/10/2014
		CURRICULUM COMMITTEE APPROVAL DATE:	04/26/2018
		CURRENT EFFECTIVE DATE:	01/01/2015

DIVISION/DEPARTMENT:

1. REQUESTED CREDIT CLASSIFICATION:

Credit - Degree Applicable
Course is not a basic skills course.
Program Applicable

2. DEPT/COURSE NO:

MATH 003F

3. COURSE TITLE:

Differential Equations

4. COURSE: MC Course Modification

TOP NO. 1701.00

5. UNITS: 3.000

HRS/WK LEC: 3.00 **Total:** 52.50

HRS/WK LAB:

6. NO. OF TIMES OFFERED AS SELETED TOPIC: AVERAGE ENROLLMENT:

7. JUSTIFICATION FOR COURSE:

Satisfies the General Education Analytical Thinking requirement for Associate Degrees. Provides foundation for more advanced study in mathematics and related fields, such as Physics. Satisfies the Quantitative Reasoning component required for transfer to UC, CSU, and some independent four-year institutions. Acceptable for credit: CSU, UC.

8. COURSE/CATALOG DESCRIPTION

Ordinary differential equations: First-order, second-order, and higher order equations; separable and exact equations, series solutions, LaPlace transformations, system of differential equations.

9. OTHER CATALOG INFORMATION

a. Modular: No If yes, how many modules:

b. Open entry/open exit: No

c. Grading Policy: Letter Grade Only

d. Eligible for credit by Exam: No

e. Repeatable according to state guidelines: No

f. Required for degree/certificate (specify):

Mathematics, Mathematics

g. Meets GE/Transfer requirements (specify):

Acceptable for credit: CSU, UC

h. C-ID Number: MATH 240 Expiration Date:

i. Are there prerequisites/corequisites/recommended preparation for this course? Yes

Date of last prereq/coreq validation: 04/02/2014

j. Acceptable for Credit: CSU/UC

10. LIST STUDENT PERFORMANCE OBJECTIVES (EXIT SKILLS): (Objectives must define the exit skills required of students and include criteria identified in Items 12, 14, and 15 - critical thinking, essay writing, problem solving, written/verbal communications, computational skills, working with others, workplace

needs, SCANS competencies, all aspects of the industry, etc.)(See SCANS/All Aspects of Industry Worksheet.)

Students will be able to:

1. Create and analyze mathematical models using ordinary differential equations;
2. Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and selected higher order ordinary differential equations;
3. Apply the existence and uniqueness theorems for ordinary differential equations;
4. Find power series solutions to ordinary differential equations;
5. Determine the Laplace Transform and inverse Laplace Transform of functions; and
6. Solve linear systems of ordinary differential equations.

11A. COURSE CONTENT: List major topics to be covered. This section must be more than listing chapter headings from a textbook. Outline the course content, including essential topics, major subdivisions, and supporting details. It should include enough information so that a faculty member from any institution will have a clear understanding of the material taught in the course and the approximate length of time devoted to each. There should be congruence among the catalog description, lecture and/or lab content, student performance objectives, and the student learning outcomes. List percent of time spent on each topic; ensure percentages total 100%.

LECTURE CONTENT:

I. Introduction: (10%)

- A. Basic Models, Slope Fields
- B. Solutions of Ordinary Differential Equations
- C. Classification of Differential Equations

II. First Order Differential Equations: (15%)

- A. Linear Equations: Integrating Factors
- B. Separable Equations, Homogeneous Equations
- C. Applications of First Order Equations: Mixture problems, Population Growth, Orthogonal Trajectories
- D. Differences Between Linear and Nonlinear Equations.
- E. Autonomous Equations and Population Dynamics.
- F. Exact Equations and Integrating Factors
- G. Numerical Approximations: Euler's Method
- H. The Existence and Uniqueness Theorem

III. Second Order Linear Equations (15%)

- A. Homogeneous Equations with Constant Coefficients
- B. Solutions of Linear Homogeneous Equations: Fundamental solutions, Independence, Wronskian
- C. Complex Roots of the Characteristic Equation
- D. Repeated Roots; Reduction of Order
- E. Nonhomogeneous Equations; Undetermined Coefficients
- F. Variation of Parameters
- G. Applications: Harmonic Oscillators, Electrical Circuits, Forced Vibrations

IV. Higher Order Linear Equations (12.5%)

- A. General Theory of nth Order Linear Equations
- B. Homogeneous Equations with Constant Coefficients
- C. The Method of Undetermined Coefficients
- D. The Method of Variation of Parameters

V. Series Solutions of Second Order Linear Equations (12.5%)

- A. Review of Power Series
- B. Series Solutions Near an Ordinary Point
- C. Euler Equations
- D. Series Solutions Near a Regular Singular Point

E. Bessel's Equation

VI. Laplace Transform (12.5%)

- A. Definition of the Laplace Transform
- B. Solution of Initial Value Problems
- C. Step Functions
- D. Differential Equations with Discontinuous Forcing Functions
- E. Impulse Functions
- F. The Convolution Integral

VII. Systems of First Order Linear Equations (12.5%)

- A. Review of Matrices
- B. Linear Algebraic Equations; Linear Independence, Eigenvalues, Eigenvectors.
- C. Basic Theory of Systems of First Order Linear Equations
- D. Homogeneous Linear Systems with Constant Coefficients
- E. Complex Eigenvalues
- F. Fundamental Matrices
- G. Repeated Eigenvalues
- H. Nonhomogeneous Linear Systems

VIII. Partial Differential Equations and Fourier Series (10%)

- A. Two-Point Boundary Value Problems
- B. Fourier Series
- C. The Fourier Convergence Theorem
- D. Even and Odd functions
- E. Separation of Variables
- F. Heat Conduction in a Rod; Other Heat Conduction Problems
- G. The Wave Equation
- H. Laplace's Equation

11B. LAB CONTENT:

n/a

12. METHODS OF INSTRUCTION (List methods used to present course content.)

- 1. Lecture
- 2. Projects
- 3. Activity
- 4. Discussion

13. ASSIGNMENTS: 0.00 hours/week (List all assignments, including library assignments. Requires two (2) hours of independent work outside of class for each unit/weekly lecture hour. Outside assignments are not required for lab-only courses, although they can be given.)

Out-of-class Assignments:

Out-of-class Assignments: 1. Problem sets, including problems equivalent in content and level of difficulty to those covered in the lectures; additional problems, that introduce supplemental concepts and formulas, requiring the synthesizing of various concepts. 2. Quizzes and/or examinations

ASSIGNMENTS ARE: (See definition of college level):

Primarily College Level

14. STUDENT ASSESSMENT: (Grades are based on):

ESSAY (Includes "blue book" exams and any written assignment of sufficient length and complexity to require students to select and organize ideas, to explain and support the ideas, and to demonstrate critical thinking skills.)

COMPUTATION SKILLS

NON-COMPUTATIONAL PROBLEM SOLVING (Critical thinking should be demonstrated by solving unfamiliar problems via various strategies.)

SKILL DEMONSTRATION

15. TEXTS, READINGS, AND MATERIALS

A. Textbooks:

Boyce, William E. and DiPrima, Richard C.. 2012. *Elementary Differential Equations and Boundary Value Problems* 10th. Wiley

*Date is required: Transfer institutions require current publication date(s) within 5 years of outline addition/update.

B. Additional Resources:

Library/LRC Materials and Services:

The instructor, in consultation with a librarian, has reviewed the materials and services of the College Library/LRC in the subject areas related to the proposed new course

Are print materials adequate? Yes

Are nonprint materials adequate? Yes

Are electronic/online resources available? Yes

Are services adequate? Yes

Specific materials and/or services needed have been identified and discussed. Librarian comments: Please provide librarian with list of recent, recommended supplementary(non-textbook) titles to support the curriculum.

C. Readings listed in A and B above are: (See definition of college level):

Primarily college level

16. DESIGNATE OCCUPATIONAL CODE:

E - Non-Occupational

17. LEVEL BELOW TRANSFER:

Y - Not Applicable

18. CALIFORNIA CLASSIFICATION CODE:

Y - Credit Course

19. NON CREDIT COURSE CATEGORY:

Y - Not Applicable

20. FUNDING AGENCY CATEGORY:

Not Applicable - Not Applicable

SUPPLEMENTAL PAGE

Use only if additional space is needed. (Type the item number which is to be continued, followed by "continued."

Show the page number in the blank at the bottom of the page. If the item being continued is on page 2 of the outline, the first supplemental page will be "2a." If additional supplemental pages are required for page 2, they are to be numbered as 2b, 2c, etc.)

1a. Prerequisites/Corequisites/Recommended Preparation:

PREREQUISITE:

- MATH 003B: Calculus II

PREREQUISITE:

- MATH 003E: Linear Algebra

RECOMMENDED PREPARATION:

- MATH 003C: Calculus III

STUDENT LEARNING OUTCOMES

1. **Outcome:** 1. Use differential equations and dynamical systems to create mathematical models for real-world phenomena.

This outcome maps to the following Institution Outcomes:

- Critical Thinking - Think critically using appropriate methods of reasoning to evaluate ideas and identify and investigate problems and to develop creative and practical solutions to issues that arise in workplaces, institutions, and local and global communities.
- Quantitive Reasoning - Apply college-level mathematical reasoning to analyze and explain real world issues and to interpret and construct graphs, charts, and tables.

Assessment: exam, essay, written exercise, skill demonstration

2. **Outcome:** 2. Use appropriate solution and approximation techniques to analyze both models and their real world counterparts.

This outcome maps to the following Institution Outcomes:

- Critical Thinking - Think critically using appropriate methods of reasoning to evaluate ideas and identify and investigate problems and to develop creative and practical solutions to issues that arise in workplaces, institutions, and local and global communities.
- Quantitive Reasoning - Apply college-level mathematical reasoning to analyze and explain real world issues and to interpret and construct graphs, charts, and tables.

Assessment: exam, essay, written exercise, skill demonstration

3. **Outcome:** 3. Use differential analysis of models to both predict behavior of real-world phenomena and engineer systems with antecedently specified behavior.

This outcome maps to the following Institution Outcomes:

- Critical Thinking - Think critically using appropriate methods of reasoning to evaluate ideas and identify and investigate problems and to develop creative and practical solutions to issues that arise in workplaces, institutions, and local and global communities.
- Quantitive Reasoning - Apply college-level mathematical reasoning to analyze and explain real world issues and to interpret and construct graphs, charts, and tables.

Assessment: exam, essay, written exercise, skill demonstration

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