

LAST REVIEW: 2008-2009
(i.e. 2003-2004)

NEXT REVIEW: 2013-2014
(i.e. 2008-2009)

STATUS: A
(A, I, D)

COURSE TITLE: Differential Equations

COMMON COURSE NUMBER: MAP 2302

CREDIT HOURS: 3

CONTACT HOUR BREAKDOWN
(per 16 week term)

CLOCK HOURS:
(Voc. Course ONLY)

Lecture: **48** Lab:
Clinic: Other:

PREREQUISITE(S): MAC 2312

COREQUISITE(S): None

PRE/COREQUISITE(S):

COURSE DESCRIPTION *(750 characters, maximum):*

Topics including the classification, solution and application of differential equations, including numerical methods, Laplace transforms, linear systems and series solutions. Meets Area 5A of the general education requirements for the A.A. degree. Meets Areas 4 or 5 of the general education requirements for the A.S. degree. Recommendation of the Mathematics Department or at least a grade of "C" in the prerequisite course is required. This course may be taken for honors credit with the permission of the instructor.

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): Area
General Education Requirements – Associate in Science Degree (AS), meets Area(s): Area
General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

UNIT TITLES

- 1. Definitions, Elimination of Arbitrary Constants**
- 2. Equations of Order One**
- 3. Elementary Applications and Boundary Value Problems**
- 4. Linear Differential Equations**
- 5. Linear Equations with Constant Coefficients**
- 6. Non-homogeneous Equations, Undetermined Coefficients and Variations of Parameters**
- 7. The Laplace Transform**

Common Course Number: MAP2302

- 8. Systems of Equations**
- 9. Power Series Solutions**
- 10. Power Series Solutions Near Regular Singular Points (optional)**
- 11. Numerical Methods of Solving Differential Equations**

EVALUATION:

Please provide a brief description (250 characters maximum) that details how students will be assessed on the course outcomes.

Students will be assessed on the course outcomes of this course in a variety of ways. They will be assessed with chapter tests, quizzes on one or more sections, midterm exams and final exams.

**** Complete the following only if course is seeking general education status ****

GENERAL EDUCATION Competencies and Skills *:

Please highlight in green font all Competencies/Skills from the list below that apply to this course. In the box to the right of the Competency/Skill, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 5.12) that apply.

1. Read with critical comprehension	
2. Speak and listen effectively	
3. Write clearly and coherently	
4. Think creatively, logically, critically, and reflectively (analyze, synthesize, apply, and evaluate)	All
5. Demonstrate and apply literacy in its various forms: (highlight in green ALL that apply) (1. technological, 2. informational, 3. mathematical, 4. scientific, 5. cultural, 6. historical, 7. aesthetic and/or 8. environmental)	The entire outline
6. Apply problem solving techniques to real-world experiences	3.1, 3.2, 3.3, 10.3, 11.1, 2.7, 1.1, 1.2, 7.4, 8.1, 8.2, 9.2, 9.3
7. Apply methods of scientific inquiry	
8. Demonstrate an understanding of the physical and biological environment and how it is impacted by human beings	
9. Demonstrate an understanding of and appreciation for human diversities and commonalities	
10. Collaborate with others to achieve common goals.	
11. Research, synthesize and produce original work	
12. Practice ethical behavior	
13. Demonstrate self-direction and self motivation	
14. Assume responsibility for and understand the impact of personal behaviors on self and society	
15. Contribute to the welfare of the community	

* General Education Competencies and Skills endorsed by '05-'06 General Education Task Force

Common Course Number: MAP2302

Unit 1 Definitions, Elimination of Arbitrary Constants

General Outcome:

- 1.0 The students should be able to demonstrate familiarity with the basic definitions and procedures of differential equations.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1 Identify and classify differential equations.
- 1.2 Derive differential equations corresponding to families of curves (optional).

Common Course Number: MAP2302

Unit 2 Equations of Order One

General Outcome:

- 2.0 The students should be able to solve first order differential equations and recognize the limitations of the solutions.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Sketch the isoclines of an equation (optional).
- 2.2 Solve equations by the method of separation of variables.
- 2.3 Solve nonlinear equations with homogeneous coefficients.
- 2.4 Solve exact equations in general.
- 2.5 Determine the solution of the general first order linear equation.
- 2.6 Find integrating factors.
- 2.7 Solve Bernoulli's equation.
- 2.8 Solve equations in terms of non-elementary integrals (optional).
- 2.9 Expand non-elementary integrals in power series (optional).

Common Course Number: MAP2302

Unit 3 Elementary Applications and Boundary Value Problems

General Outcome:

- 3.0 The students should be able to establish mathematical models for physical situations in terms of first order differential equations and to recognize the limitations of the models.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1 Derive the escape velocity from a planet (optional).
- 3.2 Solve problems using Newton's law of cooling.
- 3.3 Solve problems involving rates of growth, decay, and chemical reaction.

Common Course Number: MAP2302

Unit 4 Linear Differential Equations

General Outcome:

- 4.0 The students should be able to recognize the requirements for the general solution to a linear differential equation.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1 Determine if functions are independent.
- 4.2 Evaluate the Wronskian of a set of functions.
- 4.3 Find the general solution of a linear non-homogeneous equation.
- 4.4 Write an equation in operator form.
- 4.5 Perform algebraic operations on operator expressions.

Common Course Number: MAP2302

Unit 5 Linear Equations with Constant Coefficients

General Outcome:

- 5.0 The students should be able to find the general solutions of linear differential equations with constant coefficients and describe the behavior of these solutions for various values of the constants.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1 Solve equations whose auxiliary equation has distinct roots.
5.2 Solve equations whose auxiliary equation has repeated roots.
5.3 Solve equations whose auxiliary equation has imaginary roots.

Common Course Number: MAP2302

**Unit 6 Non-homogeneous Equations, Undetermined Coefficients and
Variations of Parameters**

General Outcome:

- 6.0 The students should be able to solve non-homogeneous equations using the methods of undetermined coefficients and variations of parameters.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1 Construct differential equations from specified solutions (optional).
- 6.2 Solve second order differential equations using the method of undetermined coefficients.
- 6.3 Reduce the order of a differential equation.
- 6.4 Find the general solution of a non-homogeneous equation using the method of variation of parameters.

Common Course Number: MAP2302

Unit 7 The Laplace Transform

General Outcome:

- 7.0 The students should be able to solve a differential equation using the Laplace transform.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1 Find the Laplace transform of elementary functions and their derivatives.
- 7.2 Solve differential equations using the Laplace transform.
- 7.3 Use the convolution integral to find inverse transforms (optional).
- 7.4 Solve initial value problems.

Common Course Number: MAP2302

Unit 8 Systems of Equations

General Outcome:

- 8.0 The students should be able to set up and solve systems of linear differential equations.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 8.1 Set up systems of equations from given situations (optional).
8.2 Use elementary elimination techniques to solve systems of equations.

Common Course Number: MAP2302

Unit 9 Power Series Solutions

General Outcome:

- 9.0 The students should be able to use power series to solve nonelementary differential equations.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 9.1 Solve nonsingular differential equations by the power series method.
9.2 Identify singular points and ordinary points (optional).
9.3 Identify the interval of convergence of a power series solution.

Common Course Number: MAP2302

Unit 10 Power Series Solutions Near Regular Singular Points

General Outcome:

- 10.0 The students should be able to use power series to solve differential equations in a region near regular singular points.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 10.1 Find the indicial equation of a differential equation (optional).
- 10.2 Determine solutions of differential equations for various values of the roots of the indicial equation (optional).
- 10.3 Determine the validity of solutions (optional).

Common Course Number: MAP2302

Unit 11 Numerical Methods of Solving Differential Equations

General Outcome:

- 11.0 The students should be able to use numerical methods to find approximate solutions of differential equations.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 11.1 Approximate the solution of a differential equation using Euler's, or Picard's, or Taylor's, or Runge-Kutta's methods.