EASTERN ARIZONA COLLEGE
Differential Equations
Course Design
2018-2019

Course Information

Division	Mathematics
Course Number	MAT 260 (SUN# MAT 2262)
Title	Differential Equations
Credits	4
Developed by	Pedro Dabalsa
Lecture/Lab Ratio	4 Lecture/0 Lab

Transfer Status

ASU	NAU	UA
MAT 275, Mathematics (MA)	MAT 239	MATH 254

Activity Course	No
CIP Code	27.0101
Assessment Mode	Final Exam (12 Questions/100 Points)
Semester Taught	Spring
GE Category	Mathematics
Separate Lab	No
Awareness Course	No
Intensive Writing Course	No
Diversity and Inclusion Course	No

Prerequisites

MAT 230 with a grade of "C" or higher and ENG 091 with a grade of “C” or higher or reading placement test score as established by District policy

Educational Value

Students majoring in Mathematics, Physics, Chemistry, and Engineering.

Description

Basic concepts, ordinary differential equations of first order, higher order linear equations, variation of parameters, undetermined coefficients. Systems of equations, series solutions and Laplace transform methods. The course includes six MatLab assignments.

Supplies

A graphing calculator (e.g. T184 or Casio CFX-9850GB Plus) is recommended. Graphing calculators which perform symbolic manipulation (e.g. TI89, TI92, Casio FX2 or 9970G) will not be allowed for tests or quizzes.

Competencies and Performance Standards

1. Define and classify ordinary differential equations.

Learning objectives

What you will learn as you master the competency:

a. Differentiate Ordinary Differential Equations(ODE) from Partial Differential Equations (PDA).

b. Classify ODE by type, order, and linearity.

Performance Standards

You will demonstrate your competence:

- on assigned activities
- on written exams
- on a two hour cumulative final exam

Your performance will be successful when:

- learner can define and classify ordinary differential equations
- learner can recognize the order and linearity of an ODE

2. Apply the fundamental existence and uniqueness theorem for solutions of ordinary differential equations and initial value problems.

Learning objectives

What you will learn as you master the competency:

a. Describe when solutions exist and, if so, are they unique.

b. Determine if an initial value problem has a unique solution.

Performance Standards

You will demonstrate your competence:

- on assigned activities
- on written exams
- on a two hour cumulative final exam

Your performance will be successful when:

- learner can apply the fundamental existence and uniqueness theorem
- learner can test conditions for a solution of an initial value problem for uniqueness

3. Differentiate boundary value problems from initial value problems and determine their solutions using the boundary conditions.

Learning objectives

What you will learn as you master the competency:

a. Apply boundary values in solutions of differential equations.

b. Differentiate boundary value problems from initial value problems.

Performance Standards

You will demonstrate your competence:

- on assigned activities
- on written exams
- on a two hour cumulative final exam

Your performance will be successful when:

- learner can determine the boundary values for a given equation and use them to determine integration constants for the solution
- learner can tell a boundary value problem from an initial value problem

4. Use direction fields and the method of isoclines to study possible solutions.

Learning objectives

What you will learn as you master the competency:

a. Study the nature of solutions without solving the equations.

b. Graph a slope field using MatLab programming language.

Performance Standards

You will demonstrate your competence:

- on assigned activities
- on written exams
- on a two hour cumulative final exam

Your performance will be successful when:

- learner can study the nature of possible solutions using isoclines
- learner can use MatLab and other visualization technology to graph a slope field

5. Use the differential operator to write differential equations in compact form.

Learning objectives

What you will learn as you master the competency:

a. Use operators to rewrite equations in operator form.

b. Show the property of linearity of the differential operator.

Performance Standards

You will demonstrate your competence:

- on assigned activities
- on written exams
- on a two hour cumulative final exam

Your performance will be successful when:

- learner can write differential equations in operator form
- learner can use the differential operator to prove the property of linearity

6. Solve exact equations by different methods.

Learning objectives

What you will learn as you master the competency:

a. Test whether an equation is exact or not.

b. Solve an exact equation by the traditional method assuming that $\frac{\partial f(x,y)}{\partial x} = M\left(x,y\right)$ or $\frac{\partial f(x,y)}{\partial y} = N\left(x,y\right)$.

c. Use a formula to solve an exact equation.

d. Turn a non-exact differential equation into an exact equation by using an integrating factor.

Performance Standards

You will demonstrate your competence:

- on assigned activities
- on written exams
- on a two hour cumulative final exam

Your performance will be successful when:

- learner checks if a given equation is exact or not
- learner solves a given exact equation using the traditional method of solution
- learner solves an exact equation directly by the use of a solution formula
- learner finds an integrating factor to an equation to turn it into an exact equation

7. Solve first order linear differential equations.

Learning objectives

What you will learn as you master the competency:

a. Apply the general solution to particular first order linear equations.

b. Use an integrating factor to solve a linear first order differential equation.

c. Solve application problems containing linear first order differential equations.

Performance Standards

You will demonstrate your competence:

- on assigned activities
- on written exams
- on a two hour cumulative final exam

Your performance will be successful when:

- learner can solve the first order linear equation
- learner can find an integrating factor to integrate a linear first order differential equation
- learner can solve initial value problems applied to electric circuits and engineering

8. Solve selected linear equations of order higher than first.

Learning objectives

What you will learn as you master the competency:

a. Apply general techniques to selected linear equations of order higher than first.

b. Solve homogeneous differential equations.

c. Solve nonhomogeneous differential equations by the method of undetermined coefficients.

Performance Standards

You will demonstrate your competence:

- on assigned activities
- on written exams
- on a two hour cumulative final exam

Your performance will be successful when:

- o learner can solve higher order equations
- o learner can write the characteristic equation and solve a homogeneous ODE
- o learner can solve a nonhomogeneous equation by first solving the associated homogeneous equation and adding a particular solution of the nonhomogeneous equation

9. Solve problems in forced, damped, simple, harmonic motion, radiation decay, population growth, and Newton's Law of Cooling.

Learning objectives

What you will learn as you master the competency:

a. Apply general theory to study harmonic motion.

b. Determine the half-life and disintegration constant of a radioactive element.

c. Find the future number of individuals in a population.

d. Predict temperature in a cooling process.

Performance Standards

You will demonstrate your competence:

- o on assigned activities
- o on written exams
- o on a two hour cumulative final exam

Your performance will be successful when:

- o learner can solve the equations of harmonic motion which may be simple, forced or damped
- o learner can use the relation between the half-life and disintegration constant to solve a decay problem
- o learner can write an equation describing the growth tendency of a given population
- o learner can solve an initial value problem containing Newton's Law of Cooling

10. Define and compute Laplace transforms.

Learning objectives

What you will learn as you master the competency:

a. Use the definition to compute Laplace transforms of simple functions and their derivatives.

b. Use a table of inverse Laplace transform to operate on different functions.

Performance Standards

You will demonstrate your competence:

- o on assigned activities
- o on written exams
- o on a two hour cumulative final exam

Your performance will be successful when:

- o learner can define the Laplace transform to operate on elementary functions
- o learner can operate on functions with the inverse Laplace Transform

11. Use Laplace transforms techniques to solve initial value problems with ordinary differential equations.

Learning objectives

What you will learn as you master the competency:

a. Apply the transforms to elementary equations and find their solutions.

b. Solve initial-value problems with applications to engineering using the Laplace and inverse Laplace transforms.

Performance Standards

You will demonstrate your competence:

- o on assigned activities
- o on written exams
- o on a two hour cumulative final exam

Your performance will be successful when:

- o learner can use the transform to solve ordinary differential equations
- o learner will solve initial value problems to engineering

12. Use MatLab to solve ordinary differential equations.

Learning objectives

What you will learn as you master the competency:

a. Apply MatLab basics to solve differential equations and initial value problems.

b. Use MatLab to graph a family of solutions of a differential equation.

c. Apply MatLab programming to numerical methods of solutions.

Performance Standards

You will demonstrate your competence:

- o on assigned MatLab activities
- o on written exams
- o on a two hour cumulative final exam

Your performance will be successful when:

- o learner can solve a differential equation using MatLab
- o learner can graph a family of solutions to a differential equation with Matlab
- o learner will apply MatLab to numerical method procedures

Types of Instruction

Classroom Presentation

Grading Information

Grading Rationale

Each instructor has the flexibility to develop evaluative procedures within the following parameters.

1. Written exams must represent at least 50% of the final course grade
2. Final exam must represent at least 20% of the final course grade.
3. Other activities may represent at most 20% of the final course grade.

Grading Scale

A 90%-100%

B 80%-89%

C 70%-79%

D 60%-69%

F Below 60%