

Course Outline

Course Title: Differential Equations

Common Course Title: MAP2302

Effective Term: Fall 2020 (Aug 1, 2020)

Credit Hours: 3 Units

Next Review : Aug 1, 2025

Contact Hour Breakdown: *(Per 16 week Term)*

Total: 48

Lecture:

Lab:

Clinic:

Other:

Requirements

Pre-requisite(s) with minimum grade required

MAC2312 (C) OR MAC2313 (C)

Course Description:

Topics include the classification, solution and application of differential equations, including numerical methods, Laplace transforms, and series solutions. Recommendation of the Mathematics Department or at least a grade of "C" in the prerequisite course is required.

Course Outline

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Unit 1 : Definitions and Procedures

General Outcome

1.0 Demonstrate familiarity with the basic definitions and procedures of differential equations.

Specific Learning Outcomes

1.1 Identify and classify differential equations.

1.2 Eliminate arbitrary constants given initial or boundary conditions.

Unit 2 : Equations of Order One

General Outcome

2.0 Solve first-order differential equations and recognize the limitations of the solutions.

Specific Learning Outcomes

2.1 Solve equations by the method of separation of variables.

2.2 Solve nonlinear equations with homogeneous coefficients.

2.3 Solve exact equations.

2.4 Determine the solution of the general first-order linear equation.

2.5 Find integrating factors.

2.6 Solve Bernoulli equations.

Unit 3 : Elementary Applications and Boundary Value Problems

General Outcome

3.0 Establish mathematical models for physical situations in terms of first-order differential equations and to recognize the limitations of the models.

Specific Learning Outcomes

- 3.1 Solve problems using Newton's law of cooling.
- 3.2 Solve problems involving rates of growth, decay, and chemical reaction.

Unit 4 : Linear Differential Equations

General Outcome

4.0 Recognize the requirements for the general solution to a linear differential equation.

Specific Learning Outcomes

- 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.

Unit 5 : Linear Equations with Constant Coefficients ;

General Outcome

5.0 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 Learning Outcomes

- 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.

Unit 6 : Non-Homogeneous Equations, Undetermined Coefficients, and Variation of Parameters

General Outcome

6.0 Solve non-homogeneous equations using the methods of undetermined coefficients and variation of parameters.

Specific Learning Outcomes

- 6.1 Solve second order differential equations using the method of undetermined coefficients.
- 6.2 Reduce the order of a differential equation.
- 6.3 Find the general solution of a non-homogeneous equation using the method of variation of parameters.

Unit 7 : The Laplace Transform

General Outcome

7.0 Solve a differential equation using the Laplace transform.

Specific Learning Outcomes

- 7.1 Find the Laplace transforms of elementary functions and their derivatives.
- 7.2 Solve differential equations using the Laplace transform.
- 7.3 Solve initial value problems.

Unit 8 : Power Series Solutions

General Outcome

8.0 Use power series to solve nonelementary differential equations.

Specific Learning Outcomes

8.1 Solve nonsingular differential equations by the power series method.

8.2 Identify the interval of convergence of a power series solution.

8.3 Solve Cauchy-Euler Equations

Unit 9 : Numerical Methods of Solving Differential Equations

General Outcome

9.0 Use numerical methods to find approximate solutions of differential equations.

Specific Learning Outcomes

9.1 Approximate the solution of a differential equation using Euler methods.

9.2 Approximate the solution of a differential equation using the Runge-Kutta methods.