SECTION HEADING

MATH 2206: Ordinary Differential Equations

Description

Ordinary Differential Equations presents the theory, computations and applications of first and second order ordinary differential equations and two-dimensional systems.

Credits

4

Prerequisite

MATH 1122

Corequisite

None

Topics to be Covered

1. First Order Differential Equations

• Differential Equations and Mathematical Models

• Integrals and general and particular solutions

• Slope Fields and Solution Curves

• Separable Equations and Applications

• Linear First-Order Equations

• Substitution Methods and Exact Equations

• Existence and Uniqueness Theorem

2. Mathematical Models and Numerical Methods

• Population Models

• Equilibrium Solutions and Stability

• Acceleration-Velocity Models

• Euler's Method

• Runge-Kutta Method

3. Linear Equations of Higher Order

• Second Order Linear Equations

• General Solutions of Linear Equations

• Homogeneous Equations with Constant

• Coefficients

• Mechanical Vibrations

• Nonhomogeneous Equations and Undetermined Coefficients

• Endpoint Problems and Eigenvalues

• Applications in Forced Oscillations and/or Electrical Circuits

3. Systems of Differential Equations

• First-Order systems and Applications

• Method of Elimination

• Numerical Methods for Systems

4. Linear Systems of Differential Equations

• Matrices and Linear Systems

• Eigenvalue Method for Homogeneous Systems

• Set of Solution Curves for Linear Systems

5. Nonlinear Systems and Applications

• Stability and Phase Planes

• Predator – Prey Application

• Nonlinear Mechanical Systems

• Chaos in Dynamical Systems

6. Laplace Transform Methods

• Laplace Transforms and Inverse Transforms

• Transformation and Initial/Boundary Value Problems

• Translation and Partial Fractions

Learning Outcomes

1. Recognize and work with first and second-orders linear and nonlinear DE.

2. Model real-life situations using first-order differential equations.

3. Find numerical solutions of ordinary Differential Equations including Euler's Method.

4. Recognize and work with higher-order differential Equations.

5. Model real-life situations using higher-order differential equations.

6. Solve problems using the Laplace Transform.

7. Apply series solutions of linear differential equations.

8. Express a dynamical system as a mathematical model.

9. Use direction fields to illustrate solutions of differential equations.

10. Solve systems of differential equations.

11. Apply Existence and Uniqueness Theorem.

12. Solve boundary/initial value problems.

Credit Details

Lecture: 4

Lab: 0

OJT: 0

MnTC Goal Area(s): None

Transfer Pathway Competencies

1. Recognize and work with first and second-orders linear and nonlinear DE

2. Model real-life situations using first-order differential equation.

3. Find numerical solutions of ordinary differential equations including Euler's Method

4. Recognize and work with higher-order differential equations

5. Model real-life situations using higher-order differential equations

6. Solve problems using the Laplace Transform

7. Apply series solutions of linear differential equations

8. Express a dynamical system as a mathematical model

9. Use direction fields to illustrate solutions of differential equations

10. Solve systems of differential equations

11. Apply Existence and Uniqueness Theorem

12. Solve boundary/initial value problems