ESCUELA TÉCNICA SUPERIOR DE
INGENIERÍA

DMA-SAP-230 INTRODUCTION TO DIFFERENTIAL EQUATIONS

SEMESTER: Spring

CREDITS: 6 ECTS (4 hrs. per week)

LANGUAGE: English

DEGREES: SAPIENS program

Course overview

Techniques and applications of ordinary differential equations, including Fourier series and boundary value problems, linear systems of differential equations and an introduction to partial differential equations. Intended for engineering majors and other who require a working knowledge of differential equations.

The aim of this course is to provide you with:

- techniques, both explicit and numerical, to solve important classes of ordinary differential equations;

- practice in understanding how differential equations model physical phenomena;

- the ability to interpret the solutions that are found.

Prerequisites

Basic knowledge of calculus and linear algebra.

Course contents and methodology

Methodology

Lecture, solving calculation problems during exercises.

Contents

I.   First Order Differential Equations: Slope Fields and Solution Curves, Linear First-Order Equations, Substitution Methods and Exact Equations.

II.   Mathematical Models and Numerical Methods: Population Models and Acceleration-Velocity Models.

III. Linear Equations of Higher Order: Homogeneous Equations with Constant Coefficients, Nonhomogeneous Equations and Undetermined Coefficients, Mechanical Vibrations, Forced Oscillations and Resonance.

IV. Introduction to Systems of Differential Equations: The Eigenvalue Method for Homogeneous Systems, Matrix Exponentials and Linear Systems, Nonhomogeneous Linear Systems.

V. Fourier Series Methods: General Fourier Series and Convergence, Heat Conduction and Separation of Variables, Vibrating Strings and the One-Dimensional Wave Equation, Steady-State Temperature and Laplace's Equation.

VI. Eigenvalues and Boundary Value Problems: Sturm-Liouville Problems and Eigenfunction Expansions, Applications of Eigenfunction Series.

Textbook

Differential Equations with Boundary-Value Problems, 7th Edition, Dennis G. Zill, Michael R. Cullen.

Grading

The overall grade will be obtained as follows:

- Final examination (40%)
- Two midterms (25% each)
- Homework (10%)

The exams are all closed notebook, closed textbook and no calculator. The course will not be graded on a curve, i.e., there is no bound on the numbers A's, B's, C's, etc.