

Academic Year: ( 2019 / 2020 )

Review date: 26/04/2019 18:45:25

Department assigned to the subject: Mathematics Department

Coordinating teacher: CARRETERO CERRAJERO, MANUEL

Type: Basic Core ECTS Credits : 6.0

Year : 2 Semester : 2

Branch of knowledge: Engineering and Architecture

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus.  
Linear Algebra.

## OBJECTIVES

KNOWLEDGE (PO a - RA1.1):

- Solving linear differential equations and interpret results.
- Understand the concept of stability.
- Know how to plot slope fields.
- Know how to calculate Laplace transforms and how to use them to solve differential equations.
- Know how to solve systems of linear differential equations of first order.
- Understand the concept of Fourier series and using them to solve differential equations.
- Know how to use numerical methods to compute approximate solutions of first order non-linear systems of differential equations.

SPECIFIC ABILITIES (PO a - RA1.1):

- Increase the level of abstraction.
- To be able to solve practical problems using differential equations.

GENERAL ABILITIES (PO a - RA1.1):

- Ability to communicate orally and in writing correctly using signs and the language of mathematics.
- Ability to model a real situation described in words by differential equations.
- Ability to interpret the mathematical solution of a problem, their reliability and limitations.
- To be able to use mathematical software in specific situations.

## DESCRIPTION OF CONTENTS: PROGRAMME

- 1.- First order differential equations:
  - a. Linear Equations.
  - b. Separable Equations.
  - c. Qualitative Techniques: Slope Fields. Equilibrium and Phase line. Bifurcations.
- 2.- Second Order Differential Equations.
  - a. Nonlinear and linear Equations.
  - b. Homogeneous Linear Equations.
  - c. Reduction of Order.
  - d. Euler-Cauchy Equations.
- 3.- Laplace transformations:
  - a. Definition.
  - b. Application to differential equations.
  - c. Convolution.
- 4.- Systems of differential equations:
  - a. Linear and Nonlinear Systems.
  - b. Vector representation.
  - c. Eigenvalues and linearization.
5. Fourier series and separation of variables:

- a. Basic results.
  - b. Fourier Sine and Cosine Series.
  - c. Convergence of Fourier series.
  - d. Applications of Fourier series to Differential Equations.
- 6.- Numerical methods:
- a. Euler method.
  - b. Runge-Kutta method.
  - c. Solution of boundary value problems.

## LEARNING ACTIVITIES AND METHODOLOGY

Lectures sessions: 3.0 ECTS credits (PO:a - CGB1 - RA1).)

Problem sessions: 3.0 ECTS credits (PO:a CGB1 - RA1).)

Office hours: each teacher offers a number of office hours according to the regulations of the Carlos III University. In particular, a minimum of one hour per group with time schedule compatible with the students.

## ASSESSMENT SYSTEM

<b>% end-of-term-examination/test:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

We follow a continuous-assessment system (40%) plus a final exam (60%) :

- The continuous-assessment part consists in a written examination contributing with weight 40% to the final mark. The mid-term examination will take place, approximately, at two thirds of the semester and it will be held in regular class hours, according to the current regulations.
- The final exam (contributing with weight 60% to the final mark) will be held at the end of the semester. (PO: a.)

## BASIC BIBLIOGRAPHY

- Boyce, William E. Elementary differential equations and boundary value problems , John Wiley & Sons,.
- Simmons, George Finlay Differential equations with applications and historical notes 2nd ed., McGraw-Hill.
- Zill, Dennis G. Ecuaciones diferenciales con aplicaciones de modelado , International Thomson.

## ADDITIONAL BIBLIOGRAPHY

- Gockenbach, Mark S. Partial differential equations : analytical and numerical methods, SIAM.
- Haberman, Richard Elementary applied partial differential equations with Fourier series and boundary value problems 3rd ed, Prentice Hall.
- Kiseliov, Aleksandr I. Problemas de ecuaciones diferenciales ordinarias , Mir.
- Weinberger, Hans F. A first course in partial differential equations with complex variables and transform methods, Dover.