Calculus III

Academic Year: (2022 / 2023) **Review date: 01-07-2021**

Department assigned to the subject: Mathematics Department

Coordinating teacher: PABLO MARTINEZ, ARTURO DE

Type: Basic Core ECTS Credits : 6.0

Year : 2 Semester : 1

Branch of knowledge: Engineering and Architecture

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I, Calculus II and Linear Algebra.

OBJECTIVES

The student will learn the basic topics of ordinary and partial differential equations:

1. Resolution of first-order differential equations
2. Resolution of higher-order, linear differential equations
3. Use of the Laplace transform to solve linear differential equations and systems
4. Separation of variables in partial differential equations
5. Solutions as Fourier series and generalized Fourier series

DESCRIPTION OF CONTENTS: PROGRAMME

1. DIFFERENTIAL EQUATIONS OF FIRST ORDER
   1.1. Definitions and examples
   1.2. Elementary methods of resolution
   1.3. Applications

2. HIGHER-ORDER DIFFERENTIAL EQUATIONS
   2.1. Linear differential equations of order n with constant coefficients
   2.2. Equations with variable coefficients: order reduction and equidimensional equations
   2.3. Relation between systems and linear equations

3. LAPLACE TRANSFORM
   3.1. Definition and properties
   3.2. Transforming and back-transforming
   3.3. Application to the resolution of linear equations and systems

4. METHOD OF SEPARATION OF VARIABLES
   4.1. Initial and boundary problems. Examples of partial differential equations from Mathematical Physics
   4.2. Different kinds of equations and data
   4.3. Odd, even and periodic extensions of a function. Trigonometric Fourier series
   4.4. Resolution of equations by separation of variables and Fourier series
   4.5. Complex form of Fourier series

5. STURM LIOUVILLE PROBLEMS
   5.1. Sturm-Liouville problems and theorem
   5.2. Rayleigh's quotient. Minimization theorem
   5.3. Resolution of equations by separation of variables and generalized Fourier series
   5.4. Sturm-Liouville problems in several variables

6. NUMERICAL METHODS
   6.1. Numerical methods for ODEs: Runge-Kutta
   6.2. Numerical methods for PDEs: finite differences

LEARNING ACTIVITIES AND METHODOLOGY

1, MASTERCLASSES: Development of the theoretical part of the subject

2. PROBLEMS CLASSES: Resolution of problems and exercises in participative classes

3. TUTORIALS: Personal or group assessment for the students

4. SELF-EVALUATIONS: Control of the evolution of the student

ASSESSMENT SYSTEM

- Two partial exams (40%)
- Final exam (60%)

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- HABERMAN, R. Elementary Applied Partial Differential Equations, 3rd. ed., Prentice Hall., 1998

- SIMMONS, G. F. ; KRANTZ, S. G. Differential Equations. Theory, Technique, and Practice., McGraw-Hill Companies, Inc., 2007

ADDITIONAL BIBLIOGRAPHY

- D.G. ZILL. Ecuaciones Diferenciales con Aplicaciones de Modelado, sexta edición., Thomson. , 1997

- BRANNAN, J.R. ; BOYCE, W.E.. Differential Equations with Boundary Value Problems: An Introduction to Modern Methods & Applications., Wiley., 2010

- EDWARDS, C.H., PENNEY, D. E.. Elementary differential equations with boundary value problems , Pearson Education, 2014.

- NAGLE, R. KENT; SAFF, E.B.; SNIDER A. D.. Fundamentals of differential equations, 7th ed., Pearson Addison-Wesley., 2008

- SIMMONS, G. F.. Differential equations with applications and historical notes , 3rd edition, CRC Press Textbooks in mathematics., 2017