# Calculus

**Academic Year: ( 2020 / 2021 )** **Review date: 10-07-2020**

**Department assigned to the subject: Mathematics Department**

**Coordinating teacher: SANCHEZ VILLASEÑOR, EDUARDO JESUS**

**Type: Basic Core ECTS Credits : 6.0**

**Year : 1 Semester : 1**

**Branch of knowledge: Engineering and Architecture**

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

In terms of technical and educational matters, students are recommended to have knowledge of mathematics and physics, with the foundation of a LOGSE (Law on the General Organization of the Educational System) secondary school diploma or the equivalent.

## OBJECTIVES

The students should acquire the mathematical background needed to understand and apply new concepts and technical advances related to Computer Science and its practical applications.
LEARNING OBJECTIVES (PO a):
- To understand the real numbers concepts and to be able to use real number sets properties.
- To learn the princial methods of mathematical proof.
- To acquire the basic concepts related to the elementary functions and their analitical, numerical and graphical representations.
- To understand the formal definition of limit and to learn how to solve indeterminate limits.
- To learn the basic numerical root-finding methods.
- To understand the concepts of continuity and differentiation.
- To understand the Taylor expansion technique, its applications to the local approximation of functions and to be able to calculate the approximation error.
- To understand the interpolation concept and to calculate an approximation polynomial to a data set.
- To understand the formal definition of integral and to learn the basic integration techniques.
- To learn the numerical calculation of the definite integral.

SPECIFIC ABILITIES (PO a):
- To be able to handle functions given in terms of a graphical, numerical or analytical description.
- To acquire the capacity to analyze and describe the iterative Calculus processes by mean of numerical algorithms.
- To understand the concept of differentiation and its practical applications.
- To understand the concept of definite integral and its practical applications.
- To understand the relationship between integration and differentiation provided by the Fundamental Theorem of Calculus.

GENERAL ABILITIES (PO a):

- To acquire the capacity of abstract thinking and to undertake formal mathematical proofs.
- To acquire skills of communication orally and written of mathematical concepts.
- To acquire the ability to model real-world situations mathematically, by mean of function and differential or integral equation aiming at its solution.
- To acquire the capacity of problem solution interpretation and its limitations.

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Real numbers.
2. Sequences and series of real numbers.
3. Continuous functions.
4. Derivative.
5. Theorems about differentiable functions.
6. Taylor Expansions.
7. Applications of the Derivative.
8. Riemann Integral and Techniques of Integration.
9. Improper Integrals.
10. Applications of Integration.

## LEARNING ACTIVITIES AND METHODOLOGY

Theory (3 credits. PO a).
Problem sessions working individually and in groups 3 credits. PO a).

## ASSESSMENT SYSTEM

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

a) The continuous-assessment part consists in two mid-term exams that will be held in regular class hours, according to the current regulations.These mid-term tests allow the students to modify their own learning strategies, if necessary.

b) The final exam will be held at the end of the semester, and allows to assess globally the knowledge of the course topics, skills, and capabilities adquired by the students. (PO: a)

In both the mid-term and final exams, competence CBG3 will be evaluated.

There is an resit exam in June for those students who did not obtain the required end-of-semester mark. This resit exam has a maximum mark of 10, and the June final mark is given by max (EE, 0.6 EE + 0.4 EC), where EE (resp. CA) is the resit-exam (resp. continuous-assessment) mark.

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

## BASIC BIBLIOGRAPHY

- D. Pestana, J. M. Rodríguez, E. Romera, E. Touris, V. Álvarez, A. Portilla CURSO PRÁCTICO DE CÁLCULO Y PRECÁLCULO, Ariel Ciencia, 2000
- Juan de Burgos Román CÁLCULO INFINITESIMAL DE UNA VARIABLE, McGraw-Hill Interamericana de España, SL, 2008

## ADDITIONAL BIBLIOGRAPHY

- Juan de Burgos Román FUNCIONES DE UNA VARIABLE. LÍMITES, CONTINUIDAD Y DERIVADAS. 80 PROBLEMAS ÚTILES, García Maroto Editores, Madrid , 2006
- Juan de Burgos Román CÁLCULO INTEGRAL (UNA Y VARIAS VARIABLES). 70 PROBLEMAS ÚTILES, García Maroto editores, Madrid, 2007