Calculus I

Academic Year: (2022 / 2023) **Review date: 09-09-2022**

Department assigned to the subject: Mathematics Department

Coordinating teacher: PABLO MARTINEZ, ARTURO DE

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

OBJECTIVES

By the end of this content area, students will be able to have:

1. Knowledge and understanding of the mathematical principles of Real Calculus in one variable underlying their branch of engineering.
2. The ability to apply their knowledge and understanding of Real Calculus to identify, formulate and solve mathematical problems using established methods.
3. The ability to select and use appropriate tools and methods of Real Calculus: limits, differentiation, integrals, sequences and series, to solve mathematical problems.
4. The ability to combine theory and practice to solve mathematical problems that require Real Calculus.
5. The ability to understand mathematical methods and procedures of Real Calculus, their area of application and their limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Functions o real variable

1.1 Sets of numbers. Real line, Mathemathical induction. Inequalities and absolute value.
1.2 Elementary functions, elementary trnasformations. Composition of functions, inverse function. Polar coordinates.
1.3 Limits of functions, definition, main theorems.
1.4 Continuous functions, properties and main theorems.

2. Differential Calculus

2.1 Diffentiation of functions, definitions, differentiation rules, differentiation of elementary functions.
2.2 Main theorems of differentiation, L'Hopital rule. Extrema of functions.
2.3 Local study of functions: Convexity and asymptotes. Graph of functions.
2.4 Taylor polinomial, definition, main theorems and known taylor expansions. Evaluations of limits with taylor polynomial.

3. Sequences and series.

3.1 Sequence of numbers, main notions, limits of sequences, recurrent sequences.
3.2 Series of numbers, main notions. Tests for convergence for series of positive numbers, absolute and conditional convergence. Leibniz's test. Sum of some series.
3.3 Taylor series, definitions, properties, convergence interval. Main examples.

4. Integration in one variable.

4.1 Integration, antiderivatives, integration by parts, substitution.
4.2 Definite integral. Fundamental theorem of Calculus and applications.
4.3 Application of integration: Areas, volumes and lengths.

LEARNING ACTIVITIES AND METHODOLOGY

The docent methodology will include:

- Master classes, where the knowledge that the students must acquire will be presented. To make easier the development of the class, the students will have written notes and also will have the basic texts of reference that will facilitate their subsequent work.
- Resolution of exercises by the student that will serve as self-evaluation and to acquire the necessary skills.
- Small groups classes, in which problems proposed to the students are discussed and developed.
- Office hours

ASSESSMENT SYSTEM

2 Partial exams. The average grade between the two exams is the 40% of the final grade. Final exam 60%

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

BASIC BIBLIOGRAPHY

- PESTANA, D., RODRÍGUEZ, J. M., ROMERA, E., TOURÍS, E., ÁLVAREZ, V., PORTILLA, A. Curso práctico de Cálculo y Precálculo, Ariel, 2009
- R. Larson, B.H. Edwards Calculus, Brooks-Cole Cengage Learning, 2010, 10th edition
- S.L. Salas, G.J. Etgen & E. Hille Calculus: One and Several Variables, Wiley, 2007, 10th edition

ADDITIONAL BIBLIOGRAPHY

- J. Stewart Calculus, Brooks/Cole Cengage, 2010, 7th edition
- M. Spivak Calculus, Publish or Perish, 1994, 3rd edition
- T. M. Apostol Mathematical Analysis, Pearson, 1974, 2nd edition
- T.M. Apostol Calculus vol. 1, Wiley, 1991