Calculus I

Academic Year: (2022 / 2023) **Review date: 01-06-2022**

Department assigned to the subject: Mathematics Department

Coordinating teacher: APARISI CALVO, ADELA

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

OBJECTIVES

The student will be able to formulate, solve and understand mathematically the problems arising in engineering. To do so it is necessary, in this first course of Calculus, to be acquainted with the real functions of one variable, their properties of continuity, derivability, integrability and their graphic representation. The student will understand the concepts of derivative and integral and their practical applications. Also, he/she will manage sequences and series of real numbers and of functions that will apply to numeric approximation of functions and the resolution of equations.

DESCRIPTION OF CONTENTS: PROGRAMME

UNIT 1: SEQUENCES AND SERIES OF NUMBERS.
1.1. The real line, intervals, inequalities, absolute value, sets in the real line and in the plane. Mathematical induction.
1.2. Sequences of numbers, main notions, limits of sequences, recurrent sequences. Stirling formula and Stolz test.
1.3. Series of numbers, main notions. Tests for convergence for series of positive numbers, absolute and conditional convergence. Leibniz¿s test.

UNIT 2: LIMITS AND CONTINUOUS FUNCTIONS.
2.1. Elementary functions, composition of functions, inverse function. Polar coordinates and sketch of graphs of functions.
2.2. Limits of functions, definition, main theorems. Evaluation of limits.
2.3. Continuous functions, properties and main theorems.

UNIT 3: DIFFERENTIAL CALCULUS IN ONE VARIABLE
3.1. Differentiation of functions: definition, differentiation rules, interpretation.
3.2. Bernoulli-L'Hôpital rule. Main theorems on differentiation. Extrema of functions.
3.3. Optimization problems with constraints.
3.4. Convexity and asymptotes. Graph of functions.
3.5. Taylor polynomial and series: definition, main theorems. Evalution of limits with Taylor polynomial. Convergence domain for a Taylor series.

UNIT 4: INTEGRATION
4.1. Antiderivatives, integration rules, integration by parts and by decomposition in simple fractions. Integration by substitution and other methods to evaluate integrals.
4.2. Definite integral and the fundamental theorem of calculus. Applications of integration: areas, volumes and length. Physical applications of the definite integral.

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.
- Tutorials.

ASSESSMENT SYSTEM

The evaluation will be based in the following criteria:

- Partial evaluation controls (40%).
- Final examination (60%).

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

BASIC BIBLIOGRAPHY

- BRADLEY, G. L., SMITH, K. J. "Cálculo de una variable", Prentice - Hall.
- PESTANA, D., RODRÍGUEZ, J. M., ROMERA, E., TOURÍS, E., ÁLVAREZ, V., PORTILLA, A. "Curso práctico de Cálculo y Precálculo", Ariel.
- SALAS, S. L. , HILLE, E. , ETGEN, G. J. "Calculus de una y varias variables", Vol. 1,, Reverté.

BASIC ELECTRONIC RESOURCES

- CESGA . YAMWI (Yet Another Maxima Web Interface), a web interface to the CAS Maxima.: http://maxima.cesga.es/
- The OEIS Foundation . The On-Line Encyclopedia of Integer Sequences: https://oeis.org/
- WolframAlpha . Online Integral Calculator: https://www.wolframalpha.com/calculators/integral-calculator/