Calculus I

Academic Year: (2022 / 2023) **Review date: 12-07-2022**

Department assigned to the subject: Mathematics Department

Coordinating teacher: HERNANDO OTER, PEDRO JOSE

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

OBJECTIVES

By the end of this subject, students will be able to have:
1. Knowledge and understanding of the of the principles of calculus of one variable, underlying their branch of engineering.
2. The ability to apply their knowledge and understanding to identify, formulate and solve problems of the calculus of one variable using established methods.
3. The ability to select and use appropriate tools and methods to solve problems of the calculus of one variable.
4. The ability to combine theory and practice to solve problems of the calculus of one variable.
5. The ability to understanding the methods and procedures of the calculus of one variable, their area of application and their limitations.

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 continuous evaluation consists of:
1. Quizzes (40%).
2. Final exam (60%).
3. The FINAL ORDINARY MARK is the sum of the marks obtained in the final exam (out of 6) and the quizzes (out of 4 points).
4. The RESIT (EXTRAORDINARY) EXAM is evaluated over 10 points.
5. The FINAL EXTRAORDINARY MARK is the maximum between:
 - 0.6*RESIT EXAM+ CONTINUOUS EVALUATION (out of 4).
 - RESIT EXAM.

% 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.