Calculus I

Academic Year: (2023 / 2024) **Review date: 24-07-2023**

Department assigned to the subject: Mathematics Department

Coordinating teacher: MARGALEF BENTABOL, JUAN

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

SKILLS AND LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
COCIN4. Ability to resolve problems with initiative, decision-making, creativity, and critical reasoning skills and to communicate and transmit knowledge, skills and abilities in the Industrial Engineering field.
CEB1. Ability to solve the mathematic problems arising in engineering. Aptitude for applying knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives: numerical methods; numerical algorithms, statistics and optimization.

By the end of this content area, students will be able to have:
RA1.1. Knowledge and understanding of the mathematical principles underlying their branch of engineering.
RA2.1. The ability to apply their knowledge and understanding to identify, formulate and solve mathematical problems using established methods.
RA5.1. The ability to select and use appropriate tools and methods to solve mathematical problems.
RA5.2. The ability to combine theory and practice to solve mathematical problems.

OBJECTIVES

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

Evaluation of RAS

The first result from the student learning is evaluated through the implementation of approximated calculations, including error estimations, as obtained from the solution of optimization problems related to those found in the Electrical Power Engineering profession. These problems at the beginning are textually formulated (without the use of the mathematical notation). In a second step the Differential and Integral Calculus will be used to solve them. The 2th, 3th, 4th and 5th results from the student learning are evaluated in a systematic way through different partial and final exams because these learning results constitute essential parts in the formation of the mathematical way of thinking required to work as an Electrical Power Engineer.

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

3 Partial exams: The first one about the Differential Calculus, the second one about sequences and series an the third one about integral claculus. The average grade between the three 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 of a single variable, Cengeage Learning 9th ed., 2009
- SALAS, S. L. , HILLE, E. , ETGEN, G. J. "Calculus, one and several variables", Vol. 1,, Wiley, 2007

ADDITIONAL BIBLIOGRAPHY

- EDWARDS, C. H., PENNEY, D. E. Calculus : with analytic geometry early transcendentals , Prentice Hall, 1998
- THOMAS, G. B. Calculus and analytic geometry, Addison-Wesley, 1998