

Academic Year: (2023 / 2024)

Review date: 07-06-2023

Department assigned to the subject: Mathematics Department

Coordinating teacher: LAMPO , ANIELLO

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.

CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.

CB4. Students should be able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.

CG1. Analyze, formulate and solve problems with initiative, decision-making, creativity, critical reasoning skills and ability to efficiently communicate and transmit knowledge, skills and abilities in the Energy Engineering field

CG10. Being able to work in a multi-lingual and multidisciplinary environment

CE1 Módulo FB. Ability to solve the mathematic problems arising in engineering. Aptitude for applying knowledge on: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives in differential equations; numerical methods; numerical algorithms; statistics and optimization.

CT1. Ability to communicate knowledge orally as well as in writing to a specialized and non-specialized public.

CT2. Ability to establish good interpersonal communication and to work in multidisciplinary and international teams.

CT3. Ability to organize and plan work, making appropriate decisions based on available information, gathering and interpreting relevant data to make sound judgement within the study area.

CT4. Motivation and ability to commit to lifelong autonomous learning to enable graduates to adapt to any new situation.

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 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 of a real variable
 - 1.1 Sets of numbers. Real line, Mathematical induction. Inequalities and absolute value.
 - 1.2 Elementary functions, elementary transformations. 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 Differentiation 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 polynomial, 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 (assignments, 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