Calculus I

Academic Year: (2023 / 2024) **Review date: 30/08/2023 16:05:08**

Department assigned to the subject: Mathematics Department

Coordinating teacher: PIJEIRA CABRERA, HECTOR ESTEBAN

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

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.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG11. Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge of: linear algebra; geometry; differential geometry; differential and integral calculus; differential and partial derivative equations; numerical methods; numerical algorithms; statistics and optimisation.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.

OBJECTIVES

By the end of this content area, students will be able to have:
1. Knowledge and understanding of the mathematical principles underlying their branch of engineering.
2. The ability to apply their knowledge and understanding to identify, formulate and solve mathematical problems using established methods.
3. The ability to select and use appropriate tools and methods to solve mathematical problems.
4. The ability to combine theory and practice to solve mathematical problems.
5. The ability to understanding of mathematical methods and procedures, 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 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,
- Practical classes
- Selfevaluations.
- Partial controls.
- Tutorials.
- Final examination.

ASSESSMENT SYSTEM

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

We will do two midterm exams, each one with 20 % of weight of final mark.

BASIC BIBLIOGRAPHY

- D. Pestana, J. M. Rodríguez, E. Romera, E, Touris, V. Álvarez y A. Portilla Curso práctico de Cálculo y Precálculo, Ariel Ciencia, 2000

- Ron Larson y Bruce H. Edwards Calculus I (single variable), Cengage Learning (9th edition).

- Salas/Hille/Etgen Calculus. Una y varias varaibles (Volumen I)., Reverté, S. A., Cuarta edición 2005

ADDITIONAL BIBLIOGRAPHY

- BURGOS, J Cálculo infinitesimal de una variable, McGraw - Hill.

- EDWARDS, C. H., PENNEY, D. E. Cálculo diferencial e integral, Prentice Hall.

- SPIVAK, M. Cálculus, Reverté.

- STEWART, J. Cálculo, conceptos y contextos, Thomson.

- THOMAS, G. B., FINNEY, R. L. Cálculo una variable, Addison-Wesley.