Calculus II

Academic Year: (2020 / 2021) **Review date: 11-02-2021**

Department assigned to the subject: Mathematics Department

Coordinating teacher: PEREZ PARDO, JUAN MANUEL

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 2

Branch of knowledge: Engineering and Architecture

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I
Linear Algebra

OBJECTIVES

The student must be able to state, solve and understand, from a mathematical point of view, problems related to Engineering and of Energy Engineering. First of all, a comprehensive approach to Euclidean spaces with a special emphasis in the two-dimensional and three-dimensional cases as well as their most relevant subsets will be done. He must handle the main properties of functions in several variables related to continuity, differentiability and integrability both in the scalar and vector cases. The study of problems related to optimisation, with and without constraints, constitutes a nice application of Taylor formula and local extrema.
Iterated integrals on domains as well as the integration on lines and surfaces will provide the basic background for the analysis of areas and volumes as well as the computation of some characteristics of rigid solids. The computation of such integrals will be used as applications of the most important theorems of integral Calculus.

By the end of this subject, students will be able to have:
1.- Knowledge and understanding of the mathematical principles underlying the branch of energy engineering;
2.- The ability to a ly their knowledge and understanding to identify, formulate and solve mathematical problems using established methods;
3.- The ability to choose and apply relevant analytical and modelling methods;
4.- The ability to select and use appropriate tools and methods to solve mathematical problems;
5.- The ability to combine theory and practice to solve mathematical problems;
6.- Understanding of the applicable methods and techniques and their limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

Chapter 1. n-dimensional Euclidean Space.
Chapter 2. Functions of several variables. Limits and continuity.
Chapter 3. Partial and directional derivatives. Differentiability. Gradient vector.Jacobian matrix.
Chapter 4. Chain rule. Higher order derivatives. Polar, spherical and cylindrical coordinates. Applications to PDE's, separation of variables.
Chapter 5. Taylor formula. Local extrema. Extremum problems with constraints. Lagrange multipliers. Open, closed, compact and connected subsets.
Chapter 6. Integration in R^n.Iterated integrals. Fubini,s Theorem. Applications.
Chapter 7. Line integrals. Conservative fields.
Chapter 8. Green's Theorem
Chapter 9. Surfaces in R^3.
Chapter 10. Surface integrals.
Chapter 11. Stokes and Gauss Theorems.

LEARNING ACTIVITIES AND METHODOLOGY

The learning activities will be focused on
- Magistral sessions devoted to the presentation of the basic concepts and results of every chapter as well as some exercises. The theoretical background will be supported by the basic monographs listed in the bibliography.
- Problem sessions. Here we will solve questions and problems proposed in the magistral classes as well as individual homeworks in order to allow the self asessment of the students.

- Continuous Evaluation: Two different and mutually exclusive types:
  · Two partial tests concerning Differential Calculos (Chapters 1-5) and Integral Calculus (Chapters 6-11).
  · Individual assignments to be solved at Home. 8 assignments during the semester.
- Final exam.
- Tutorial activities for small teams of 5-6 students.

ASSESSMENT SYSTEM

The assessment system will be focused on the following:

There will be two mutually exclusive options available for the continuous evaluation. Students will have two weeks at the beginning of the course to decide among them.

Option A: Weekly problem solving, maximum 11 submissions. There will be no partial examinations. The weight of this option in the final mark will be 50%

Option B: 2 partial examinations. One mid-term, the other at the end of the course. The weight of this option in the final mark will be 40%

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

BASIC BIBLIOGRAPHY

- B.P. DEMIDOVICH Problemas de Análisis Matemático,, Editorial Paraninfo , 1991
- D.M. Bressoud A radical approach to real analysis., Mathematical Association of American Textbooks, 2007
- J. E . MARSDEN A. J. TROMBA, Vector Calculus, Freemann, 2012
- R.C. Vrede, M. Spiegel Outline of Advanced Calculus, McGraw-Hill, 2002, 2002
- S. L. SALAS, E. HILLE, Calculus:One and several variables, Wiley, 1999

ADDITIONAL BIBLIOGRAPHY

- R. G. BARTLE The Elements of Real Analysis,, Editorial Wiley International, 1976
- T. APOSTOL Calculus, Volume 2, John Wiley& Sons, 1969