Calculus II

Academic Year: (2023 / 2024) **Review date: 19/12/2023 13:14:20**

Department assigned to the subject: Mathematics Department

Coordinating teacher: DEAÑO CABRERA, ALFREDO

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

LEARNING OUTCOMES

RA1: Acquire knowledge and understanding of the basic general fundamentals of engineering and biomedical sciences.
RA2: Be able to solve basic engineering and biomedical science problems through a process of analysis, identifying the problem, establishing different methods of resolution, selecting the most appropriate one and its correct implementation.
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: Adequate knowledge and skills to analyse and synthesise basic problems related to engineering and biomedical sciences, solve them and communicate them efficiently.
CG3: Knowledge of basic scientific and technical subjects that enables them to learn new methods and technologies, as well as providing them with great versatility to adapt to new situations.
CG4: Ability to solve problems with initiative, decision-making, creativity, and to communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the biomedical engineer's activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG8: Ability to solve mathematical, physical, chemical and biochemical problems that may arise in biomedical engineering.
CG12: Ability to solve mathematically formulated problems applied to biology, physics and chemistry, using numerical algorithms and computational techniques.
ECRT1: Ability to solve mathematical problems that may arise in engineering and biomedicine. Ability to apply knowledge of: linear algebra; geometry; differential and integral calculus; differential and partial derivative equations; numerical methods; numerical algorithms; statistics and optimisation.
CT1: Ability to communicate knowledge orally and in writing to both specialised and non-specialised audiences.

OBJECTIVES

The student will be able to formulate, solve and understand mathematically the problems arising in Biomedical Engineering. To do so it is necessary to be familiar with the n-dimensional Euclidean space, making a special emphasis in dimensions 2 and 3, visualizing the more important subsets. He/she must be able to manage (scalar and vector) functions of several variables, as well as their continuity, differentiability, and integrability properties. The student must solve optimization problems with and without restrictions and will apply the main theorems of integration of scalar and vector functions to compute, in particular, lengths, areas and volumes, moments of inertia, and heat flow.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Differential Calculus in several variables
   1.1. R^n as an Euclidean space; topology
   1.2. Scalar and vector functions of n variables
   1.3. Limits and continuity
   1.4. Differentiability

2. Local properties of functions
   2.1. Higher-order derivatives
      2.1.1 Iterated derivatives
      2.1.2. Differential operators: divergence, curl, laplacian
      2.1.3. Taylor polynomial
   2.2. Free and constrained optimization
      2.2.1 Local extrema
      2.2.2. Global extrema: free optimization problems
      2.2.3. Lagrange multipliers

3. Integral Calculus in R^2 and R^3
   3.1. Double and triple integrals
   3.2. Changes of variables
   3.3. Applications

4. Integrals over curves and surfaces
   4.1. Line and path integrals
   4.2. Surface integrals
   4.3. Integral theorems of vector analysis

LEARNING ACTIVITIES AND METHODOLOGY

The learning methodology will include:
- Attendance to master classes, in which core knowledge will be presented that the students must acquire. The recommended bibliography will facilitate the students' work
- Resolution of exercises by the student that will serve as a self-evaluation method and to acquire the necessary skills
- Exercise classes, in which problems proposed to the students are discussed
- Tests
- Final Exam
- Tutorial sessions
- The instructors may propose additional homework and activities

ASSESSMENT SYSTEM

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

- Tests (40%)

- Final exam (60%)

BASIC BIBLIOGRAPHY

- J. E. Marsden and A. J. Tromba Vector Calculus, 6th. edition, W. H. Freeman, 2012

- M. D. Weir, J. Hass, and G. B. Thomas Multivariable Calculus, Addison-Wesley, 2010

ADDITIONAL BIBLIOGRAPHY

- J. Stewart Calculus, Cengage, 2008

- M. Besada, F. J. García, M. A. Mirás, and C. Vázquez Cálculo de varias variables. Cuestiones y ejercicios resueltos, Garceta, 2011

- M. J. Strauss, G. L. Bradley, and K. J. Smith Multivariable Calculus, Prentice Hall, 2002

- P. Pedregal Tercero Cálculo Vectorial, un enfoque práctico, Septem Ediciones, 2001

- R. Larson and B. H. Edwards Calculus II, 9th. edition, Cengage, 2009

- S. Salas, E. Hille, and G. Etgen Calculus. One and several variables, Wiley, 2007

- T. M. Apostol Calculus, Wiley, 1975