Universidad Carlos III de Madrid

Calculus II

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Calculus I

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

The student must be able to state, solve and understand, from a mathematical point of view, problems related to Engineering and of Electrical Power 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, moments of inertia as well as heat flows. The student must know ordinary differential equations, concepts and problems, and be able to solve the main first and second order equations.

By the end of this content area, students will be able to have:
1.   Knowledge and understanding of the mathematical principles of calculus of several variables underlying electrical power engineering;
2.   The ability to apply their knowledge and understanding to identify, formulate and solve mathematical problems of calculus of several variables 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 in

terms of calculus of several variables;
5.   The ability to combine theory and practice to solve mathematical problems of calculus of several variables;
6.   Understanding of the applicable methods and techniques and their limitations.

DESCRIPTION OF CONTENTS: PROGRAMME

The Euclidean space. Functions of several variables. Continuity and differentiability. Polar, spherical and cylindrical coordinates. The chain rule. Directional derivatives. Gradient, divergence and curl. Free and conditional optimization. Multidimensional Iterated integration. Changes of variables. Integration along trajectories. Integration on surfaces. Computation of areas, volumes, centers of mass , moments of inertia and. other applications of the integral. Theorems of Green, Stokes and Gauss. Introduction to differential equations. Laplace transform.

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 partial tests concerning Differential Calculos (Chapters 1-5) and Integral Calculus (Chapters 6-11).
    · Individual assignments to be solved at Home.
- Final exam.

ASSESSMENT SYSTEM

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

The evaluation will be based in the following criteria:
- Partial evaluation controls (40%).
- Final examination (60%).

BASIC BIBLIOGRAPHY

 - MARSDEN, TROMBA VECTOR CALCULUS, W. H. FREEMAN, 2003

 - NAGLE FUNDAMENTALS OF DIFERENTIAL EQUATIONS, PEARSON-ADDISON WESLEY, 2008

 - SALAS, S. CALCULUS: ONE AND SEVERAL VARIABLES, WILEY, 2007

 - UÑA, SAN MARTIN, TOMEO PROBLEMAS RESUELTOS DE CALCULO EN VARIAS VARIABLES, THOMSON.

 - ZILL D. A FIRST COURSE IN DiFFERENTIAL EQUATIONS WITH MODELING APPLICATIONS, BROOKS/COLE, 2013

ADDITIONAL BIBLIOGRAPHY

 - APOSTOL. CALCULUS, John Wiley & Sons. .