27001 - Calculus I

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	453 - Degree in Mathematics
ECTS	13.5
Year	1
Semester	Annual
Subject Type	Basic Education
Module	---

1.General information

1.1.Introduction

Brief presentation of the course:

It is a basic course.

In this course one of the fundamental ideas in Mathematical Analysis is introduced and developed: the concept of limit. This takes a more concrete form in the study of limits of sequences and functions, continuity of functions, differentiability, computation of antiderivatives, integration, improper integration, series...These are the concepts that this course covers.

1.2.Recommendations to take this course

It is advisable the presence in the theoretical and practical lecures and work in a continuous way with the material, notes, scripts for practical lectures, and problem sheets provided by the instructor. It is also advisable to make use of individual tutorization, the schedule of which will be provided at the beginning of the course. the people who cannot follow the course in a presential way must inform the instructor and will be evaluated with exams corresponding to the official period in June.

1.3.Context and importance of this course in the degree

The course is included in the module of Initiation to Mathematical Analysis. It is advisable to have passed this course before continuing with other courses in this module. As a basic course, the knowledge of the contents in Mathematical Analysis I is convenient for most of the courses in later courses.

1.4.Activities and key dates

Written test by the middle of the course.

Final written exam at the end of the course corresponding to the official calendar.

2.Learning goals

Universidad Zaragoza

27001 - Calculus I

2.1.Learning goals

In order to pass this course, the student must show the following:

He/She knows how to handle inequalities, sequences, and series.

He/She analizes and draws graphs of functions, deduces properties of a function from its graph, understands and works in an intituitive, geometric, and formal way with the notions of limit, derivative, and integral.

He/She computes derivatives of functions by using the chain rule.

He/She computes and studies extrem values of functions.

He/She computes integrals of functions.

He/She solves problems that imply the use of integration (computation of lengths, areas, volumes, areas of revolution bodies, and so on).

He/She understands the use of power series and their convergence.

2.2.Importance of learning goals

They provide a basic formation in the degree (see the Context and meaning of the subject in the degree).

3.Aims of the course and competences

3.1.Aims of the course

The course and the foreseen results correspond to the following setting and goals:

It is a basic course in the degree. The goal is that the student understands which kind of problems require the use of one variable calculus and how to make use of it to deal with this kind of problems.

3.2.Competences

After passing this course the student will be more competent to...

Develop in the handle of the goals described in the Learning outcomes section.

Among the general competences that the student graduated in mathematics acquires, we point out the following:

CG1. Having and comprehending knowledge in the area of Mathematics in a level that, starting from the education acquired in secondary studies, makes use of advanced texts and includes some aspects that imply knowledge from the vanguard in the study of Mathematics.

CT3. Distinguish, when in front of a problem, what is substantial and what is accesory. Formulate conjectures and reason in order to confirm them or refute them. Identify mistakes in incorrect reasonings, and so on.

CE1. Understand and make use of the mathematical language and methods. Know rigurous proofs of basic theorems in

different branches of Mathematics.

CE3. Solve mathematical problems by basic calculus skills and other techniques.

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The student will have to show that he has acquired the foreseen learning outcomes by the means of the following evaluation activities:

The course is divided in theoretical contents, problems, and practical sessions with a computer.

The evaluation of the theoretical part and the problems will have two parts: evaluation during the course and the exams. For the final mark, the evaluation during the course will be counted as a ten per cent. The exams will consist of a partial exam at the end of the first 4-months period and a final exam, both of them including theoretical contents and problems.

In the same way, there will be an exam regarding the practical sessions with the computer for those students who did not pass these practical sessions with their work in the class.

In no case the students' right, according to present regulation, to pass the course by taking a final global exam will be violated.

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The learning process designed for this course is based in the following:

Theoretical lectures.

Problem sessions.

Practical lessons for smaller groups using a computer.

Individual tutorization requested by the student.

Use of moodle.

Individual study and personal work made by the student.

5.2.Learning tasks

The program offered to the student in order to help him/her achieve the foreseen goals include the following activities:

Presence to theoretical lectures.

27001 - Calculus I

Writing of exercises.

Individual tutorization.

Practical sessions using computers.

5.3.Syllabus

The teaching plan will follow the program:

1. **Real numbers.** Inequalities.
2. **Sequences of real numbers** . Convergence. Computation of limits.
3. **Series of real numbers** . Series of non-negative terms. Convergence criteria. Series of any kind of terms.Methods to sum series.
4. **Continuity** . Limits of functions. Continuous functions. Properties. Weierstrass, Bolzano and Darboux theorems. Classification of discontinuities.
5. **Differentiability** . Differentiation rules. Rolle's and Mean Value theorem. Extreme values of functions. L'Hopital's rule. Taylor's and Young's theorems. Applications.
6. **Integration** . Riemann's integral. Pproperties of the integral. Fundamental theorems of Integral Calculus. Applications of Integral Calculus. Improper integrals.
7. **Power series** . Convergence of power series. Differentiability and integrability of power series.

5.4.Course planning and calendar

Calendar of presential sessions and presentation of works:

See the paragraph related to dates and milestones of the course, as well as the academic calendar of the University of Zaragoza and the schedule set by the Faculty of Sciences.

5.5.Bibliography and recommended resources

- Brannan, David Alexander. A first course in mathematical analysis / David Alexander Brannan . 1st publ., repr. Cambridge : Cambridge University Press, 2009
- Apostol, Tom M.. Calculus. Vol.1, One-variable calculuswith an introduction to linear algebra / Tom M. Apostol. - 2nd ed. Wiley, 1975
- Arregi, José Luis [et al.]. Teoría de funciones de una variable real / José Luis Arregui, Julio Bernués, Bienvenido Cuartero y Mario Pérez . 1ª ed. Zaragoza: Prensa Universitarias de Zaragoza, 2009
- Ortega, Joaquín M.. Introducción al análisis matemático / Joaquín M. Ortega . - [1a. ed.] Barcelona : Labor, 1993
- Pestana, Domingo [et al.] . Curso práctico de cálculo y precálculo / Domingo Pestana...[et al.] . Barcelona : Ariel, D.L. 2000
- Bartle, Robert G.. Introduction to Real Analysis / Robert G. Bartle, Donald R. Sherbert . - 4th ed., Wiley, 2011.
- Demidovich, B.P.. Problems in mathematical analysis / B. P. Demidóvich ; Beekman Books, Inc. 1975

27001 - Calculus I

- Krantz, Steven G.. Real analysis and foundations / Steven G. Krantz Boca Raton [etc.] : CRC Press, cop. 1991
- Ross, Kenneth A.. Elementary analysis : the theory of calculus / Kenneth A. Ross . - [4rd. corr. printing] New York [etc] : Springer, 1986
- Spivak, Michael. Calculusl / Michael Spivak . - 4th. ed. Publish or perish, 2008.
- Tebar Flores, E.. 909 problemas de cálculo integral : totalmente resueltos / E. Tebar Flores, M.A. Tebar Less Madrid : Tebar Flores, D.L. 1990-1991
- Pastor, Eduardo. Teoría y problemas de cálculo integral / Eduardo Pastor, Victor Varela . - [1a. ed.] Madrid : Crisser, D.L. 1974
- Rudin, Walter. Principles of mathematical analysis / Walter Rudin . - 3rd. ed. McGraw-Hill, 1976.

In the adresses http://www.unizar.es/analisis_matematico/docencia.html and https://moodle.unizar.es/ there is more information available.