30111 - Mathematics III

Información del Plan Docente

Academic Year	2016/17
Academic center	175 - Escuela Universitaria Politécnica de La Almunia 179 - Centro Universitario de la Defensa - Zaragoza
Degree	425 - Bachelor's Degree in Industrial Organisational Engineering 563 - Bachelor's Degree in Industrial Organisational Engineering 457 - Bachelor's Degree in Industrial Organisational Engineering
ECTS	6.0
Course	2
Period	First semester
Subject Type	Basic Education
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

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The learning process designed for this subject is based on the following:

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Strong interaction between the teacher/student. This interaction is brought into being through a division of work and responsibilities between the students and the teacher. Nevertheless, it must be taken into account that, to a certain degree, students can set their learning pace based on their own needs and availability, following the guidelines set by the teacher.

The current subject, Matemáticas III, is conceived as a stand-alone combination of contents, yet organized into three fundamental and complementary forms, which are: the theoretical concepts of each teaching unit, the solving of problems or resolution of questions, at the same time supported by other activities.

The organization of teaching will be carried out using the following steps:

Theory Classes: Theoretical activities carried out mainly through exposition by the teacher, where the theoretical supports of the subject are displayed, highlighting the fundamental, structuring them in topics and or sections, interrelating them. **Practical Classes:** The teacher resolves practical problems or cases for demonstrative purposes. This type of teaching complements the theory shown in the lectures with practical aspects. **Individual Tutorials:** Those carried out giving individual, personalized attention with a teacher from the department. Said tutorials may be in person or online.

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The methodology of the course encourages students' continuous assessment focusing on the most practical aspects of differential equations. In order to achieve this goal, the theoretical concepts of the subject are presented with examples and case studies. Additionally, the notions discussed in class are reinforced weekly with tutorials and seminars. Also, the use of a mathematical software tool is promoted.

5.2.Learning activities

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The programme offered to the student to help them achieve their target results is made up of the following activities...

Involves the active participation of the student, in a way that the results achieved in the learning process are developed, not taking away from those already set out, the activities are the following:

- Face-to-face generic activities:
  - Theory Classes: The theoretical concepts of the subject are explained and illustrative examples are developed as support to the theory when necessary.
  - Practical Classes: Problems and practical cases are carried out, complementary to the theoretical concepts studied.
- Generic non-class activities:
  - Study and understanding of the theory taught in the lectures.
  - Understanding and assimilation of the problems and practical cases solved in the practical classes.
  - Preparation of seminars, solutions to proposed problems, etc.
  - Preparation of the written tests for continuous assessment and final exams.

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The subject has 6 ECTS credits, which represents 150 hours of student work in the subject during the trimester, in other words, 10 hours per week for 15 weeks of class.

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Theoretical lectures for the understanding of the basic knowledge, fostering a participatory approach.
Exercise and problem lectures, combining standard resolution of exercises on the blackboard with group work and discussion.
Computer lab sessions using a specific mathematical software. Classes are designed to allow students to practice and develop a wide range of practical and manipulative skills.
Personal attention both in small groups and individually.
Individual continuous work from the beginning of the academic year. Basic theoretical contents, worksheets, guides of computer lab sessions as well as any other complementary material are available on the Moodle platform.

5.3.Program

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Matemáticas III program:

1. Ordinary Differential Equations: basic concepts, existence and uniqueness.
2. Analytic solvability.
3. Qualitative aspects: fixed points and linear stability.
4. Numerical methods: Euler, Runge-Kutta.
5. Higher orden ODE: Oscillators; resonance. Beam stability.
6. Higher order numerical methods (FDM y FEM).
7. Introduction to Partial Differential Equations: separation of variables; vibrations.
8. Laplace Transform.
9. Laplace Transform Applications.
10. Discrete time systems.
11. The Z Transform.
12. Z Transform Applications.
13. Fourier Series and Fourier Transform.
14. Applications of Fourier Series and Transforms.
15. Discrete Time Fourier Transform: FFT and Applications.

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The contents of this subject are organized as follows:
Chapter 1: Introduction to differential equations
Chapter 2: First-order ordinary differential equations
Chapter 3: Geometrical interpretation of first-order ordinary differential equations
Chapter 4: Higher-order ordinary differential equations
Chapter 5: System of ordinary differential equations
Chapter 6: Laplace transform
Chapter 7: Partial differential equations
Computer lab session 1: Symbolic computation and ordinary differential equations
Computer lab session 2: Numerical methods for ordinary differential equations

5.4.Planning and scheduling

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The dates of the final exams will be those that are officially published at http://www.eupla.es/secretaria/academica/examenes.html .

1	1	ODE: Introduction, 1st order				
2		Linear equation, Systems	1st test	5	ODE 1st order	
3		Linear stability				
4		Numerical Methods				
5	2	2nd order ODE				
6		Oscillators, resonance	2nd test	5	Oscillators	
7		Beam Stability				
8			1st Exam	40	ODE, Oscillators	
9	3	Signals and systems				
10		Laplace Transform				
11		Applications	3rd test	5	Laplace Transf.	
12		Z Transform				
13	4	Fourier Series and Transform	4th test	5	Z/Fourier Transf.	

14	5	PDE: Introduction				
15		Separation of variables	2nd Exam	40	Systems, PDE	

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The course is organized in 15 weeks of two-hour lectures twice a week approximately. The academic calendar, computer lab sessions, and the formal examination dates are published on the Moodle platform and the website of the Institution (http://cud.unizar.es) at the beginning of the academic year.

5.5.Bibliography and recomended resources

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Main resources

- Subject presentations (available in the subject's Moodle webpage)
- Problem sheets (available in the subject's Moodle webpage)
- Symbolic calculus tool Maxima http://andrejv.github.io/wxmaxima/ .

Bibliography

- **Ecuaciones diferenciales con problemas de valores en la frontera** / Dennis G. Zill, Michael R. Cullen . - 6ª ed. México D. F. : International Thomson, cop. 2006
- **Ecuaciones diferenciales y problemas con valores en la frontera** / R. Kent Nagle, Edward B. Saff, Arthur David Snider ; traducción, Óscar Alfredo Palmas Velazco ; revisión técnica, Ernesto Filio López ... [et al.] . - 4ª ed. México [etc.] : Pearson Educación, 2005
- **Ecuaciones diferenciales: con aplicaciones y notas históricas** / George F. Simmons ; con un capítulo sobre métodos numéricos de John S. Robertson ; traducción Lorenzo Abellanas Rapun . - 2a ed. Madrid [etc.] : McGraw-Hill, D.L. 1998
- **Cálculo científico con MATLAB y Octave** / A. Quarteroni, F. Saleri Milano : Springer, cop. 2006
- **Numerical analysis** / Rainer Kress New York : Springer, cop. 1998
- **Matemáticas avanzadas para ingeniería** / Glyn James ... [et al.] ; traducción, Elena de Oteyza de Oteyza, Carlos Hernández Garciadiego ; revisión técnica, Juan Carlos del Valle, Juan Aguilar Pascual . - 2a ed. México [etc.] : Pearson Educación, 2002
- **Fourier analysis and its applications** / Gerald B. Folland. - 1ª edición Pacific Grove, Calif : Wadsworth & Brooks/Cole Advanced Books & Software, c1992.

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Defensa, 2013

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