

**Información del Plan Docente**

<b>Academic Year</b>	2017/18
<b>Faculty / School</b>	175 - Escuela Universitaria Politécnica de La Almunia
<b>Degree</b>	424 - Bachelor's Degree in Mechatronic Engineering
<b>ECTS</b>	6.0
<b>Year</b>	2
<b>Semester</b>	First semester
<b>Subject Type</b>	Basic Education
<b>Module</b>	---

**1.General information****1.1.Introduction****1.2.Recommendations to take this course****1.3.Context and importance of this course in the degree****1.4.Activities and key dates****2.Learning goals****2.1.Learning goals****2.2.Importance of learning goals****3.Aims of the course and competences****3.1.Aims of the course****3.2.Competences****4.Assessment (1st and 2nd call)****4.1.Assessment tasks (description of tasks, marking system and assessment criteria)****5.Methodology, learning tasks, syllabus and resources****5.1.Methodological overview**

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

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.

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The current subject, 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.

### 5.2.Learning tasks

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

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.

### 5.3.Syllabus

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 order 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.

### 5.4.Course planning and calendar

The dates of the final exams will be those that are officially published at

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<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	2nd Exam	40	Systems, PDE

variables

## 5.5. Bibliography and recommended resources

### 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

You can also view an updated reference list through the webpage of the UNIZAR Library:

<http://psfunizar7.unizar.es/br13/eBuscar.php?tipo=a>

- **BB** Matemáticas avanzadas para ingeniería / Glyn James ... [et al.] ; traducción, Elena de Oteyza de Oteyza, Carlos Hernández Garcíadiago ; revisión técnica, Juan Carlos del Valle, Juan Aguilar Pascual . - 2a ed. México [etc.] : Pearson Educación, 2002
- **BB** Zill, Dennis G.. Ecuaciones diferenciales con problemas de valores en la frontera / Dennis G. Zill, Michael R. Cullen . - 6ª ed. México D. F. : International Thomson, cop. 2006
- **BC** 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
- **BC** Folland, Gerald B.. Fourier analysis and its applications / Gerald B. Folland.. - 1º edición Pacific Grove, Calif : Wadsworth & Brooks/Cole Advanced Books & Software, c1992.
- **BC** Kress, Rainer. Numerical analysis / Rainer Kress New York : Springer, cop. 1998
- **BC** Quarteroni, Alfio. Cálculo científico con MATLAB y Octave / A. Quarteroni, F. Saleri Milano : Springer, cop. 2006
- **BC** Simmons, George F.. 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