Program	61IW – Bachelor of Science in Software Engineering 61CI – Bachelor of Science in Computer Engineering 61SI – Bachelor of Science in Information Systems 61TI – Bachelor of Science in Information Society Technologies

Course number and name	
Number	
Name	Digital Signal Processing
Semester	S8 February-June

Credits and contact hours	
ECTS Credits	6
Contact hours	60

Coordinator's name	Luis Miguel Pozo Coronado (lm.pozo@upm.es)

Specific course information

Description of course content

The goal of this subject is to provide the student with the mathematical background needed for digital signal processing, and use them in some direct field of application. These mathematical tools are also applied in other fields such as control of systems or image processing. Throughout the subject there will be extensive practical work with mathematical oriented software such as Matlab or Python mathematical libraries.

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List of topics to be covered

1. Introduction to digital signal processing.
2. Signals in discrete time
3. Z transform
4. Fourier analysis (Fourier transform, discrete Fourier transform)
5. Fast Fourier Transform
6. Applications of digital signal processing: A/D and D/A conversion, voice signal processing, etc.
7. Digital filters
8. Adaptive filtering

Prerequisites or co-requisites

Linear algebra, Calculus.

Course category in the program

_ R (required)	**X_ E (elective)** *(elective courses may not be offered every year)*

Specific goals for the course

Specific outcomes of instruction

- Computing and applying z transform for analysis and control of linear systems in discrete time.
- Using Fourier transform properly for signal analysis.
- Representing and analysing signals in time and frequency domains.
- Handling of basic elements of discrete signal treatment.
- Handling of FFT algorithm for efficient computation of discrete Fourier transforms and convolutions.
- Using mathematical software for problem solving.
- Designing and assessing algorithms for signal processing in some field of application.
- Applying data science methods in time-pattern analysis.
- Giving a well-organized short spoken presentation on a given topic.
- Reading a scientific or technical paper of some complexity in an autonomous way.
- Solving open problems: taking into consideration the feasible possible tools and giving a reasoned explanation for the chosen alternative; handling properly the information needed for that alternative; developing an efficient strategy to find a solution; presenting the results and conclusions clearly.

Further reading and supplementary materials

- BRIGHAM, E.O.: The fast Fourier transform and its applications. Prentice-Hall, 1988.
- CARTWRIGHT, M.: Fourier methods for mathematicians, scientists and engineers. Ellis Horwood, 1990.
- OPPENHEIN, A.V.; SCHAFER, R.W. Tratamiento de señales en tiempo discreto. Prentice-Hall, 2000
- OPPENHEIN, A.V; WILLSKY, A.S.; HAMID, S. Signals and systems. Prentice-Hall, 1996.
- Digital Signal Processing. Markus Kuhn (U. of Cambridge) (2009) (http://www.cl.cam.ac.uk/teaching/0910/DSP/)

Teaching methodology

X__ **lectures**	__ **problem solving sessions**	_X_ **collaborative actions**	X__ **laboratory sessions**
Other:			