# COURSE OUTLINE

## (1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>Engineering</th>
</tr>
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<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>Department of Computer Engineering &amp; Informatics</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>CEID_NE579</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Digital Signal Processing Applications</td>
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</tbody>
</table>

### INDEPENDENT TEACHING ACTIVITIES

If credits are awarded for separate components of the course, e.g., lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits

<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures and tutorials, Laboratory exercises</td>
<td>3, 2</td>
<td>5</td>
</tr>
</tbody>
</table>

Add rows if necessary. The organisation of teaching and the teaching methods use are described in detail at (d).

<table>
<thead>
<tr>
<th>COURSE TYPE</th>
<th>Specialised general knowledge</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Skills development</td>
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</table>

### PREREQUISITE COURSES:

- Signal and Systems Theory (NY282)
- Digital Signal Processing (NY381)

### LANGUAGE OF INSTRUCTION and EXAMINATIONS:

Greek

### IS THE COURSE OFFERED TO ERASMUS STUDENTS

No

### COURSE WEBSITE (URL)

https://eclass.upatras.gr/courses/CEID1117/

http://xanthippi.ceid.upatras.gr/people/psarakis/courses/DSP/dspapl.php

## (2) LEARNING OUTCOMES

### Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

The goal of the elective course is the students to acquire the knowledge required to create an appropriate background that could potentially be used in modern applications of signal processing and machine learning. Upon successful completion of the course a student will be able to:

- become familiar with the major technical approaches involved in the modern applications of digital signal processing
- understand fundamental problems related to those applications
- use mathematical models and algorithms to solving them
- become familiar with the advantages of sparse representations
- understand via specific applications the basic principles of machine learning and the use of neural networks for their implementation
- implement the algorithms in the environment of MATLAB and Tensorflow

### General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

- Search for, analysis and synthesis of data and information, with Project planning and management
- the use of the necessary technology Respect for difference and multiculturalism
- Adapting to new situations Respect for the natural environment
- Decision-making Showing social, professional and ethical responsibility and sensitivity
- Working independently to gender issues
- Team work Criticism and self-criticism
- Working in an international environment Production of free, creative and inductive thinking
- Working in an interdisciplinary environment
Production of new research ideas

Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

(3) SYLLABUS

A. Theory
- Multirate signal processing, Sampling subsampling, multistage systems implementation, multiphase analysis, filterbanks, perfect reconstruction filters
- Stochastic signals and their linear estimators, Wiener filters, adaptive filters, applications of adaptive filters, filter Kalman
- Eigen filters and eigen analysis
- Face recognition based on low rank modeling
- Image classification techniques based on generative neural networks
- Sparse representations and signal processing

B. Laboratory Exercises
- Six (6) cutting-edge techniques, which refer to applications belonging to the above-mentioned topics and analyzed in detail in the course, are implemented

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY
Face-to-face, Distance learning, etc.

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students

The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.
The student’s study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
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</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>26 hours</td>
</tr>
<tr>
<td>Tutorials</td>
<td>13 hours</td>
</tr>
<tr>
<td>Study</td>
<td>65 hours</td>
</tr>
<tr>
<td>Laboratory preparation</td>
<td>20 hours</td>
</tr>
<tr>
<td>Laboratory practice</td>
<td>25 hours</td>
</tr>
<tr>
<td>Exams</td>
<td>1 hour</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>150 hours</strong></td>
</tr>
</tbody>
</table>

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure
The evaluation is performed in Greek language and is based on two independent parts. Specifically, a final written test that includes multiple choice questions and problem solving, and an oral one with short-answer questions.

Sample solutions to the written test are announced to provide students with a reference point for their marking. After the test marks are announced the students have the opportunity to see their mistakes and even to their grade.

The evaluation of the laboratory part is based on a face to face examination of the functionality of the algorithms that students develop and implement in the MATLAB and Python Tensorflow environment.

- ATTACHED BIBLIOGRAPHY

- **Suggested bibliography**:
  - A. Papoulis and S Pillai, Probability, Random Variables and Stochastic processes, Mcgraw Hill, 2002

- Related academic journals and conferences:
  - IEEE Transactions on Signal Processing
  - IEEE Transactions on Image Processing
  - IEEE Transactions on Pattern Analysis and Machine Intelligence
  - Elsevier Pattern Recognition Letters
  - ICASP, Eusipco, CVPR, ICCV, ECCV, ACCV, NIPS