**COURSE OUTLINE**

## (1) GENERAL

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|---|---|---|---|
| **SCHOOL** | Engineering | | |
| **ACADEMIC UNIT** | Department of Computer Engineering & Informatics | | |
| **LEVEL OF STUDIES** | Undergraduate | | |
| **COURSE CODE** | CEID_NY282 | **SEMESTER** | 4th |
| **COURSE TITLE** | Signals and Systems Theory | | |

| **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* | **WEEKLY TEACHING HOURS** | **CREDITS** |
|---|---|---|
| Lectures and tutorials | 5 | 5 |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* | ***Total*** | **5** |

| | |
|---|---|
| **COURSE TYPE** *general background, special background, specialised general knowledge, skills development* | Specialised general knowledge |
| **PREREQUISITE COURSES:** | · Mathematics I (NY101)<br>· Mathematics II (NY102)<br>· Linear Algebra (NY110)<br>· Circuits Theory (NY182) |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No |
| **COURSE WEBSITE (URL)** | http://xanthippi.ceid.upatras.gr/people/psarakis/courses/SP/signalnew.php<br><br>https://eclass.upatras.gr/modules/document/file.php/CEID1115/ |

## (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 course is the students to acquire the knowledge required to create an appropriate background that could potentially be used in the fields of computer science, computer technology and communications. Upon successful completion of the course a student will be able to:

- understand the signal spaces as generalizations of the well-known vector spaces and to analyse /compose continuous and discrete time signals by using appropriate bases of signals,
- understand the physical meaning of normed spaces and especially the inner product spaces,
- classify the systems by using the superposition and time invariance principle,
- understand the vital role of the complex exponential signals into analysis of LTI systems,
- obtain mathematical and physical inside of the generalized functions in both time and frequency domain,
- understand the meaning of impulse, frequency response and transfer function of a LTI system,
- understand the state space and the internal description of LTI systems,
- obtain inside of controllability, observability and asymptotic stability of a system,
- learn when a system is unstable and how it can be stabilized.

**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 the use of the necessary technology* | *Project planning and management* |
| *Adapting to new situations* | *Respect for difference and multiculturalism* |
| *Decision-making* | *Respect for the natural environment* |
| *Working independently* | *Showing social, professional and ethical responsibility and sensitivity 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* | *Others…* |
| | *…….* |
| Working independently | |
| Team work | |
| Working in an international environment | |
| Working in an interdisciplinary environment | |
| Production of new research ideas | |

**(3) SYLLABUS**

- Introduction to signal and systems theory
- Continuous and Discrete time linear systems, Impulse response, Linear Time Invariant (LTI) systems, lineal convolution
- Fourier series, and the family of complex exponentials signals, the complex exponential signals as eigensignals of LTI systems, Continuous and Discrete time Fourier Transform, Cosine and Sine transform, Frequency response, LTI systems as solvers of ordinary differential equations
- Distribution functions, regular and singular distribution functions, generalized Fourier transform
- Laplace Transform, Z-transform, Transfer function, BIBO stability of Continuous and Discrete time LTI systems
- State space, States, State equations, Controllability, Observability, Asymptotic stability, Stabilization of unstable systems, State feedback
- Partial Differential Equations and their solution by separation of variables

**(4) TEACHING and LEARNING METHODS - EVALUATION**

| | |
|---|---|
| **DELIVERY**<br>*Face-to-face, Distance learning, etc.* | Face-to-face |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**<br>*Use of ICT in teaching, laboratory education, communication with students* | Wide use of ICT and more specifically :<br>· The course is backed up by a web page providing all course material. This page is duly updated. In this page, there is also a number of videos where exercises are exemplary solved<br>· The preferred communication method with the students is email. |
| **TEACHING METHODS**<br>*The manner and methods of teaching are described in detail.*<br>*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.*<br>*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* | |
| **STUDENT PERFORMANCE EVALUATION**<br>*Description of the evaluation procedure*<br><br>*Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other*<br><br>*Specifically-defined evaluation criteria are given, and if and where they are accessible to students.* | 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.<br><br>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. |

| ***Activity*** | ***Semester workload*** |
|---|---|
| Lectures | 39 hours |
| Tutorials | 26 hours |
| Study | 80 hours |
| Exams | 2 hours |
| ***Course total*** | ***147 hours*** |

**(5) ATTACHED BIBLIOGRAPHY**

*- Suggested bibliography:*

- *Signal Processing & Linear Systems, B.P. Lathi,* ISBN-13: 978-0195158335
- *Signal Analysis, Time, Frequency, Scale and Structure, R. L. Allen and D. W. Mills,* ISBN-13: 978-0471234418

*- Related academic journals and conferences:*

- IEEE Transactions on Signal Processing
- IEEE Transactions on Circuits and Systems
- Elsevier Signal Processing
- ICASP, Eusipco