INSTITUTION	NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS					
SCHOOL	SCHOOL OF SCIENCE					
DEPARTMENT	INFORMATICS AND TELECOMMUNICATIONS					
COURSE LEVEL	GRADUATE					
COURSE TITLE	**Introduction to phonology and digital signal processing**					
COURSE CODE	C32		Semester	1	ECTS	6
TEACHING HOURS per week	THEORY	3	SEMINAR.	0	LABORATORY	0
URL	https://eclass.uoa.gr/courses/DI521/					

COURSE CONTENT
Introduction to the phonetic (sound) system of various languages. Study and analysis of phonetic modifications, phonological rules, syllabic structure, metric / prosodic characteristic words and phrases, with focus on Greek language. Some of the topics under concern are: • the peculiarities and universal characteristics of the phonetic systems of a wide range of languages (mostly Greek), the nature and the field of action of the phonological rules,   • sound as a wave and its digital coding, the perception and characteristics of natural sounds through computer modeling, the digital composition and analysis of linguistic sound and its categorization based on its physical characteristics.

<table>
<tr><th colspan="4">Weekly courses description M904</th></tr>
<tr><th></th><th>Title</th><th>Tutor</th><th>Content</th></tr>
<tr>
<td>Week 1</td>
<td>Phonetics - Phonology, an introduction</td>
<td>DP</td>
<td>Introduction - Familiarity with basic concepts: Comparison and distinction of three different systems, Phonetics, Phonology and Scripture (written representation of spoken speech). Distinction of the three types of Phonetics. Description of the modular system of a speaker.</td>
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<td>Week 2</td>
<td>Phonetics - Articular Phonetics</td>
<td>AD</td>
<td>Voice - Articulate parameters of distinction between consonants and vowels

Voice Transcription - Practice in distinguishing the parameters of the agreements with IPA</td>
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<td>Week 3</td>
<td>Sound as a wave and digitization - introduction</td>
<td>MK</td>
<td>Sound as a wave, sampling and quantization, the concept of frequency, perception of sound (volume and frequency), characteristics (volume, fundamental frequency, hue). Sampling frequency, folding and quantization noise and how it affects sound quality</td>
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<td>Week 4</td>
<td>Acoustic vocal - The sounds of Greek</td>
<td>AD</td>
<td>Theory and practical application using voice analysis software (Praat).

Acoustics of language sounds (wave, frequency, period, volume, etc.), periodic - non-periodic, simple and</td>
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| | | | complex waves, harmonic, resonance, source-filter theory, modulators, acoustic representations, etc.)

Introduction to Praat - Audio visualization and editing, exercises with modulators |
|---|---|---|---|
| Week 5 | Sound Functions - Phonology | DP | From Phonetics to Phonology: Which functions of sounds determine the phonological units (meaning differentiation), which functions of different realizations of the phonological unit (complementary distribution & free variety). |
| Week 6 | Visualization and processing of sound in the field of frequency | MK | Frequency field and discrete Fourier transform, signal spectroscopy. Filters in the time domain and in the frequency domain. The DB scale and its practically useful manifestations in computer applications |
| Week 7 | Phonological Units - Phonological Phenomena | DP | Phonological units of Common Modern Greek. Causes of conversion of the form of phonological units (Phonological phenomena). Sequence of phonological phenomena. |
| Week 8 | Extraction and significance of features from recordings | MK | Extraction of fundamental frequency and modulators, its use for categorization of sounds. |
| Week 9 | Assignment: Instructions for the course work (30% on the grade). - Discussion for writing scientific papers in the context of voice signal processing | AD | Detailed presentation of the course work.

Consolidation of knowledge about academic writing techniques, structure, research questions, bibliographic review, citation of bibliography and bibliographic references, connection of language analysis tools and their use in the context of academic work. |
| Week 10 | Supra-piece Characteristics | AD | Prosody, Intonation, Tone. Experimental studies on supra-piece characteristics.

Praat - Display and processing of utterances of formal and non-formal speech with the aim of analyzing and processing the superfluous features. |
Week 11	Dialectical Variety	DP	Description of phonological phenomena that characterize and differentiate Greek dialects: Cut of the dull loud vowels, elevation of the dull media, uraniumization of the lateral and nasal consonants, buzzing.
Week 12	Introduction to the computer analysis of speech recordings	MK	Introduction and basic techniques of display, classification, clustering of multidimensional data. Application in speech recordings and study of the information obtained
Week 13	Course Overview - Prospects	DP- MK	Discussion for questions in view of the final work and the end of the course. Connection of the course with other courses of the DPMS that follow.

STUDENT LEARNING OBJECTIVES

Some of the main learning objectives of the course are:
• to present the general principles of the scientific fields of Phonetics and Phonology and the basic methodological and analytical tools of their sub-disciplines,
• to bring students in contact with the basic phonological characteristics and phonetic systems of different languages and to acquaint them with their particular phonological structures,
• to provide the necessary theoretical tools required for the phonological description and analysis of natural languages,
• to delve into theoretical and methodological issues of understanding the structure of languages,
• to highlight new fields of connection between Phonetics and Phonology with Physical Voice Processing,
• introduce basic concepts of digital audio coding and • introduce basic concepts and tools for computational audio analysis and processing.

Teaching-Learning Goals-Expected Learning Outcomes
Upon successful completion of the course the student will be able to:

• to describe and analyze the basic phonological structures of Greek and other languages,

• manage and process a wide variety of phonological data,

• perform basic pre-processing of audio data for further analysis and

• apply appropriate computational transformations of audio data for quality analysis (visualization, grouping, clustering)

TEACHING AND LEARNING METHODS - ASSESSMENT

TEACHING METHOD	Remote - online
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	Support for the learning process through the electronic platform e-class, namely: Provision of material - posting presentations and supporting material, Discussions, Announcements, Assignment-Submission of assignments. Communication via email.

TEACHING ORGANIZATION
Describe in detail the way and methods of teaching:
Enhanced Lectures,
Online Lectures,
Seminars,
Tutorial,
Laboratory,
Laboratory Exercise,
Study & analysis of literature,
Practice (Positioning),
Interactive teaching,
Developing a project,
Individual / group work
Telework (reference to tools) etc.

Details of the student's study hours for each learning activity and hours of non-guided study are shown to ensure that the total workload at the semester corresponds to the ECTS

Activity	*Student Workload (hours)*
Lectures	39
Teamwork in a case study	31
Small individual exercises	40
Independent Study	40
Total Course (25 hours of workload per unit of credit)	*150*

ASSESSMENT OF STUDENTS	Describe explicitly methods, evaluation tools and provided feedback.

ASSESSMENT OF STUDENTS
Description of the assessment process

Assessment Methods, Formative or Concluding, Multiple Choice Test, Quick Response Questions, Test Development Questions, Problem Solving, Written Work, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Other / Other

Fully defined evaluation criteria are mentioned and if and where they are accessible to students.

Describe explicitly methods, evaluation tools and provided feedback.
The table below is supplemented accordingly.

Assessment methods	Number	Percentage
Written examination	1	20%
Progress	2	20%
Exercises	3	30%
Final work	1	30%

LITERATURE AND STUDY MATERIALS / READING LIST

Phonology
- Chomsky, N. & M. Halle (1968). The Sound Pattern of English. New York: Harper & Row.
- Goldsmith, J. (1995). The Handbook of Phonological Theory. Cambridge, MA: Blackwell Publishers.
- Gussenhoven, C. & H. Jakobs (2017). Understanding Phonology (4th edn). Abingdon, Oxon & New York, NY: Routledge.
- Hayes, B. (1999). Introductory Phonology. Malden, MA: Wiley-Blackwell
- Kenstowicz, M. (1994). Phonology in Generative Grammar. Cambridge, MA: Blackwell Publishers.
- Kager, R. (1999). Optimality Theory. Cambridge University Press. Ladd, D.R. (1996). Intonational Phonology. Cambridge: Cambridge University Press.
- McCarthy, J. J. (2008). Doing Optimality Theory: Applying Theory to Data. Malden, MA: Blackwell Publishing.
- Roca, I. & W. Johnson (1999). A Course in Phonology. Malden, MA: Blackwell Publishers.

Phonetics
- Clark, J. & C. Yallop. (1995). Introduction to Phonetics and Phonology (2nd edn). Cambridge, MA: Blackwell Publishers.
- Hardcastle, W. and J. Laver (1999). The Handbook of Phonetic Sciences. Oxford: Blackwell.
- Ladefoged, P & K. Johnson. (2014). A Course in Phonetics. 7th ed. Cengage Learning Harcourt Brace College Publishers.
- Ladefoged, P. 2007. Εισαγωγή στη φωνητική. (Μτφρ. Μ. Μπαλτα τζάνη.). Εκδ. Πατάκη.
- Ladefoged, P. & I. Maddieson. (1996). The Sounds of the World's Languages. Cambridge, MA: Blackwell Publishers.
- Pullum, G.K. & W. Ladusaw (1996). Phonetic Symbol Guide (2nd edn). Chicago and London: The University of Chicago Press.

Digital Signal Processing
- Watkinson, J. (2002). An introduction to digital audio. Taylor & Francis.
- Antoniou, A. (2016). Digital signal processing. McGraw-Hill.
- Downey, A. B. (2016). Think DSP: digital signal processing in Python. " O'Reilly Media, Inc.".
- Lyons, R. G. (2004). Understanding digital signal processing, 3/E. Pearson Education India.
- Zölzer, U. (2008). Digital audio signal processing (Vol. 9). New York: Wiley.