INSTITUTION	NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS						
SCHOOL	SCHOOL OF SCIENCE						
DEPARTMENT	INFORMATICS AND TELECOMMUNICATIONS						
COURSE LEVEL	UNDERGRADUATE						
COURSE TITLE	**Real-Time Digital Signal Processing Systems**						
COURSE CODE	**ΕΠ11**		**Semester**	**7**	**ECTS**	**6**	
TEACHING HOURS per week	**THEORY**	**2**	**SEMINAR.**	**0**	**LABORATORY**	**2**	
COURSE TYPE	**Select one of the following and delete the rest** Electives (ΠΜ) **K** / **E1** / **E2** / **E3** / **E4** / **E5** / **E6** K: B; E4: B *Fill the table as in the curriculum:* Track (A-Computer Science, B- Computer Engineering) / Specialization Compulsory (Y) / Core Specialization (B)/ Elective Specialization (E)						
URL	https://eclass.uoa.gr/courses/D70/						
EXPECTED PRIOR KNOWLEDGE/ PREREQUISITES AND PREPARATION:	Course K11						
TEACHING AND EXAMINATIONS LANGUAGE:	GREEK						
THE COURSE IS OFFERED TO ERASMUS STUDENTS	NO						

K	**E1**	**E2**	**E3**	**E4**	**E5**	**E6**
B				B		

COURSE CONTENT
Real-time Digital Signal Processing theory and systems architecture. Computer and analog world interconnection. Signal preprocessing. Sensors and transducers (input and output). Digital to analog conversion. Analog to digital conversion. Data acquisition and control systems. Virtual instruments for measurements, filters, window functions, data conditioning. Programming and software development techniques in G language (LabVIEW environment) for a) process control, b) test and measurement applications, c) scientific calculations, d) digital signal processing, and e) measurements and control virtual instruments creation.

STUDENT LEARNING OBJECTIVES
Teaching-Learning Goals Goals include students' familiarization with handling natural signals through rapid prototyping of special software applications using the LabVIEW (Laboratory Virtual Instrument Engineering Workbench) platform, which is an application development environment based on programming language G. Using LabVIEW students learn to solve problems, develop, debug, and test virtual instruments, use modular programming practices, select, create, and leverage common data structures, use data acquisition and instrument control in LabVIEW applications, and effectively use a state-machine architecture. **Expected Learning Outcomes** Upon successful completion of the course the student will be able to: • Recognize the main components of the LabVIEW environment and create a new project and VI. • Use Express VIs to produce a project and simple VI that acquires and analyzes data and then displays the results. • Fix a broken VI, debug incorrect results and behavior of a running VI, and display errors generated by functions while a VI is running. • Recognize the different components of a LabVIEW loop structure and apply a For Loop or a While Loop appropriately. • Create, manipulate and use arrays, clusters, and type definition controls for data access and analysis. • Learn to create different decision-making structures and be able to identify applications where using these structures can be beneficial. • Recognize the benefits of reusing code and create a subVI with a properly configured connector pane, meaningful icon, documentation, and error handling. • Explain how LabVIEW connects to hardware to get real-world measurements. • Describe the basic concept of file I/O and apply the appropriate File I/O functions to a given scenario. • Recognize the benefits of sequential and state-based algorithms and apply techniques in LabVIEW to enforce sequential or state execution.

TEACHING AND LEARNING METHODS - ASSESSMENT	
TEACHING METHOD	In class through lectures and slides, and in the laboratory through task (exercises) completion (face to face),
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	Learning process supported by the eClass platform (basic and supplementary educational material delivery, announcements, task assignments and submissions, project assignment and submission, course information, calendar, messages). Email communication. Use of specialized data acquisition cards (PCI hardware) http://www.ni.com/pdf/manuals/370719c.pdf and educational portable data acquisition cards (USB hardware) http://www.ni.com/en-us/shop/select/mydaq-student-data-acquisition-device. Utilization of specialized software: LabVIEW (Laboratory Virtual Instrument Engineering Workbench) https://en.wikipedia.org/wiki/LabVIEW.

	Utilization of NI Online Training educational environment that also offers the ability to track recorded lectures http://ni.learn.com.
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*	Theory is presented through lectures and slides. The programming environment is presented in the laboratory. Students have access to online educational material in the form of slides, manuals, laboratory exercises, videos, and to educational self-assessment activities like quizzes and multiple-choice questions. During lab training, each student works alone, and is assigned to a workstation, equipped with specialized data acquisition and measurements hardware, and with the specialized LabVIEW environment installed. Students' attendance to laboratory exercises is obligatory and only one absence is allowed. Students can also train at home, on their personal computer, since they have access to online lectures and tutorials, free license to use LabVIEW software, and the possibility to borrow portable data acquisition cards (hardware) for their training and for assisting the completion of their final project. The final project is implemented individually, and, during its development, the whole software development life cycle is followed; it involves the submission by the students of two intermediate reports (functional and technical specifications), and one final technical report (design, implementation, testing).

Activity	***Student Workload*** *(hours)*
Lectures	26
Laboratory	26
Laboratory exercises	32
Project	66
Total Course (25 hours of workload per unit of credit)	***150***

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.*	Assessment of students is based on grading 16 laboratory exercises that students submit to eClass on predefined deadlines, and the final project. The final project is graded based on the two intermediate reports, the final technical report, and the project's source code that are submitted to eClass. Students present their projects to their examiners and their fellow students. The final project's application (software created by the student) is only evaluated if it runs in real time, and, during its presentation, the oral examination takes place. The final project is assessed using fully defined evaluation criteria that have been announced to students. The chance to complain and ask for re-rating is given to the students.

Assessment methods	***Number***	***Percentage***
Laboratory exercises	16	20%
Final project technical report – intermediate reports – source code – public presentation – oral examination	1	80%

LITERATURE AND STUDY MATERIALS / READING LIST
• G. Kouroupetroglou "Real-time digital signal processing lessons" (in Greek), Athens, 2004. • S. Sumathi, P. Surekha "LabVIEW based Advanced Instrumentation Systems", Springer-Verlag Berlin Heidelberg, 2007. • K. Kalovrektis "LabVIEW for Engineers" (in Greek) 3rd edition, A. Tziolas Publications, 2013 (in Greek)