

COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Department of Computer Engineering and Informatics		
LEVEL OF STUDIES	Undergraduate Core Elective		
COURSE CODE	NE489	SEMESTER	Spring
COURSE TITLE	Wireless and Mobile Communications		
INDEPENDENT TEACHING ACTIVITIES <i>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</i>	WEEKLY TEACHING HOURS	CREDITS	
Lectures and Tutorials	3	3	
Laboratory Exercises	2	2	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>	SUM:	5	
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Specialized general knowledge skills development		
Q	Recommended prerequisite courses: "Signals and Systems" (NY282) "Digital Communications" (NY384)		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek In the case that foreign students take the course, material in English is available. Also, in this case, the examination of the laboratory exercises and the rest oral examinations take place in English.		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://eclass.upatras.gr/courses/CEID1024/		

(2) LEARNING OUTCOMES

<p>Learning outcomes <i>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.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> • <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> • <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> • <i>Guidelines for writing Learning Outcomes</i>
<p>A. Theory Upon successful completion of the course a student will be able to:</p> <ul style="list-style-type: none"> • describe the basic structure and the subsystems of a Mobile Communications System • describe the particularities of the mobile communication channel and understand how it is affected by various parameters • understand the basic signal processing stages at the physical layer • describe the design choices concerning the various digital modulation techniques • implement basic techniques for channel equalization and be able to select which one is more suitable for each application at hand • describe the design choices concerning the various multiplexing methods • understand the process of error detection and error correction • describe the basic structure and operation of a MIMO system <p>B. Laboratory Exercise Upon successful completion of the laboratory part of the course a student will be able to:</p> <ul style="list-style-type: none"> • simulate and study basic processes of the physical layer of a mobile communications system, such as: <ul style="list-style-type: none"> ○ channel equalization

- digital modulation
- OFDM transmission
- channel coding
- study a subject of interest and make a scientific report about that subject (after conducting a thorough research in approved sources of the international literature)

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?

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

(3) SYLLABUS

A. Lectures

Among other issues, the course covers the following:

- Introductory concepts to mobile communication systems. General architecture of the system.
- Description of the basic characteristics of the wireless channel. Large-scale and small-scale phenomena. Types of mobile channels. Basic limitations.
- Digital modulation and transmission techniques adapted to the particularities of the mobile channel.
- Advanced source coding techniques. Speech coding methods used in mobile communication systems.
- Interference mitigation, channel equalization and adaptive channel equalization.
- Multiple access systems (FDMA, TDMA, CDMA, SDMA).
- Multi-carrier transmission techniques – OFDM systems.
- Space diversity techniques. MIMO systems. Smart antenna systems.
- Error control coding in wireless digital communications.

B. Laboratory exercises

- Selection of laboratory exercises from the following (indicative) list:
 - Exercise 1: Implementation and comparative performance study of selected digital modulation techniques.
 - Exercise 2: Implementation and performance study of an OFDM system.
 - Exercise 3: Implementation and performance study of channel equalization methods.
 - Exercise 4: Implementation of transmission systems utilizing multiple antennas at the receiver and/or the transmitter (MIMO systems).
 - Exercise 5: Implementation and performance study of channel coding algorithms.
- Literature review based project (selection from a wide range of subjects)

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	<p>The course makes heavy use of ICT, in particular:</p> <ul style="list-style-type: none"> ● The e-class page for the course offers material about the lectures, the tutorial exercises and the laboratory exercises. ● The course makes use of a forum facility, where questions and answers can be posted. ● Communication with the students is carried out either via the forum or via e-mail.

	<ul style="list-style-type: none"> • All announcements are posted and sent electronically. • Supplementary material is available via open e-class. 														
<p style="text-align: center;">TEACHING METHODS</p> <p><i>The manner and methods of teaching are described in detail.</i></p> <p><i>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.</i></p> <p><i>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</i></p>	<table border="1"> <thead> <tr> <th><i>Activity</i></th> <th><i>Semester workload</i></th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td>26 hours</td> </tr> <tr> <td>Tutorials (exercises)</td> <td>13 hours</td> </tr> <tr> <td>Study during the semester</td> <td>26 hours</td> </tr> <tr> <td>Laboratory exercises</td> <td>60 hours</td> </tr> <tr> <td>Examinations and respective preparation</td> <td>25 hours</td> </tr> <tr> <td style="text-align: right;">Total:</td> <td>150 hours</td> </tr> </tbody> </table>	<i>Activity</i>	<i>Semester workload</i>	Lectures	26 hours	Tutorials (exercises)	13 hours	Study during the semester	26 hours	Laboratory exercises	60 hours	Examinations and respective preparation	25 hours	Total:	150 hours
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<p>STUDENT PERFORMANCE EVALUATION</p> <p><i>Description of the evaluation procedure</i></p> <p><i>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</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p>	<p>Performance evaluation includes:</p> <ul style="list-style-type: none"> • A written or oral examination (50% of the final score) • Laboratory exercises (25% of the final score) • Project (25% of the final score) 														

(5) ATTACHED BIBLIOGRAPHY

<p>Suggested bibliography:</p> <ul style="list-style-type: none"> • E. Varvarigos, k. Berberidis, "Mobile Communication Networks, U of Patras Press 2008 (in Greek, part A, available via e-class). • T. Rappaport, "Wireless communications: Principles and practice", Dorling Kindersley, 2009. • D. Tse, P. Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2012. <p>Relative scientific journals and conferences</p> <ul style="list-style-type: none"> • IEEE Transactions on Wireless Communications • IEEE Communications Magazine • IEEE Signal Processing Magazine • EURASIP Journal on Wireless Communications and Networking • ICC, GLOBECOM, ICASP, Eusipco.
