COURSE OUTLINE

(1) GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Informatics and Computer Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE		**SEMESTER**	**6**
COURSE TITLE	Digital Communications		

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	2	
Practices exercises	1	
Laboratory exercises	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	4	5

COURSE TYPE general background, special background, specialised general knowledge, skills development	general background, skills development
PREREQUISITE COURSES:	Computer Networks I, Signals and Systems
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	

(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 course aims to cultivate the knowledge of students in physical layer technologies of modern communication systems which are taught to the students in the context of the courses Computer Networks I, II. The objective of the course is to highlight the fundamental structure of modern digital communication systems by analyzing their operation and the respective performance in different types of channels (copper, optical fibre, wireless environment, etc.).

Upon successful completion of the course, the student will be able to:

- describe the basic structure of a telecommunication system and understand the key advantages and disadvantages of various design options of the system
- understand the basic concepts that determine the performance of a digital communication system (information entropy, noise, bandwidth, rate, error rate, spectral efficiency, channel capacity)
- understand the fundamental methods regarding the system modulation, source and channel coding
- distinguish the main characteristics of amplitude, phase and frequency modulation techniques as well as their multi-level variations (M-ary ASK , PSK , FSK , PAM , QAM).
- utilize basic simulation tools for the modelling of digital communication systems.
- analyze and calculate the performance of digital communications systems

intercorrelating the channel quality, spectral efficiency and error detection/correction requirements
- utilize basic laboratory equipment (oscilloscope, spectrum analyzer, communications analyzer, arbitrary signal generator, error rate analyzer, etc.) to verify the performance of digital transmission systems.

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 Respect for difference and multiculturalism Respect for the natural environment
Adapting to new situations	Showing social, professional and ethical responsibility and sensitivity to gender issues
Decision-making	Criticism and self-criticism
Working independently	Production of free, creative and inductive thinking
Team work	……
Working in an international environment	Others…
Working in an interdisciplinary environment	…….
Production of new research ideas	

- Working independently
- Teamwork
- Production of free, creative and inductive thinking
- Work in an interdisciplinary environment

(3) SYLLABUS

Regarding the Lectures syllabus, the following topics are covered, among others:

- Introduction to Digital Communications Principles – Telecommunication System-Layer Diagram.
- Temporal and spectral analysis of telecommunication signals.
- Sampling and quantization.
- Pulse Code Modulation, Delta Modulation.
- Information Theory Fundamental Concepts - Source Coding.
- Channel Capacity – Noise – Signal to Noise Ratio – Spectral Efficiency.
- Modulation and Detection Techniques (PSK , ASK , FSK and QAM variants, coherent, noncoherent signal detection).
- Channel Coding - Error Protection, Linear and Convolutional Error detection/correction Codes
- Overview of modern digital communication systems (xDSL , optical fibre transmission , 10G , 100G Ethernet , wireless links).
- System performance analysis based on the above.

Regarding the Course Laboratory syllabus, the following topics are covered, among others:

- Design and implementation of quantization and sampling units.
- Delta modulation.
- Source code simulation – Huffman coding.

- Telecommunication system performance analysis (noise effect, eye diagram, error rate).
- Design and implementation of linear block codes.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

Use of ICT in teaching, laboratory education, communication with students</td><td>• Using transceiver systems simulator in MatLab. Use of laboratory equipment in some exercises.
• Learning support process through the e-learning platform of the University.</td></tr>
<tr><td>TEACHING METHODS
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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Practices exercises</td><td>13</td></tr>
<tr><td>Laboratory exercises</td><td>13</td></tr>
<tr><td>Independent and team course exercises</td><td>25</td></tr>
<tr><td>Independent Study</td><td>48</td></tr>
<tr><td>Course total</td><td>125</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>I. Hand-written final exam (70%) which includes:
- Short answer questions
- Multiple-choice questions
- Problem solving
II. Elaboration of laboratory exercises and final lab (hand-written or oral) exam (30%)</td></tr>
<tr><td></td><td></td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

(1) J. Proakis, M. Salehi, Telecommunication Systems, EADPPA, (2003).
(2) B. Andy, Digital Communications, Tziola publications, (2000).
(3) X. Vasilopoulos, D. Kotoulas, D. Xenikos, P. Vouddas, G. Heliotis, G. Agapiou, T. Doukoglou: Next generation networks, Klidarithmos publications, (2010).
(4) B. Sklar, N. Mitrou, Digital Communications, Papasotiriou publications, (2011)
(5) K. Sam Shanmugam, Digital and Analog Communication Systems, Pneumatikos publications, (2003).