COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Physics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**10ΕΛΕ21**	**SEMESTER**	**8**
COURSE TITLE	**INFORMATION THEORY AND CODING**		

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	4	6

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General Knowledge
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	
COURSE WEBSITE (URL)	https://eclass.uoa.gr/modules/course_info/index.php?course=DI576

(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*

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

(3) SYLLABUS

- C.E. Shannon: His life, work and influence on modern communications.
- Information measures and basic properties: Entropy, reciprocal information, KL divergence, convexity.
- Typicality and asymptotic equipartition property.
- Stationary (ergodic) sources and entropy rate.
- Lossless source compression. Prefix codes. Fundamental compression limits based on the entropy rate. Shannon codes. Hufman codes.
- Channel capacity. Examples (binary symmetric channel, binary erasure channel) and properties. Formulation and proof of the channel coding theorem for discrete memoryless channels. Feasibility. Joint typicality.
- Fano inequality and converse to the coding theorem. Feedback capacity.
- Continuous-time sources and channels. Differential entropy. Reciprocal information and properties. Entropy of a normal random vector.
- The additive gaussian channel. Typicality, coding theorem. AWGN channel capacity. Bandlimited channel capacity.
- Parallel gaussian channels. Channel with colored noise. Power allocation for rate maximization. Water-filling method.
- Sequential source coding. Arithmetic coding and Lempel-Ziv coding.
- Introduction to rate-distortion theory and lossy compression.
- Linear codes. Description and coding. Hamming codes.
- Convolutional trellis codes. Viterbi algorithm and decoding.
- Turbo codes. Iterative decoding and BCJR algorithm.
- LDPC codes. Factor graphs and Tanner graphs. Decoding with the message-passing algorithm.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	
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*	
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.*	

Activity	Semester workload
Lectures	52
Individual Study	98
Course total	**150**

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- T.M. Cover, J.A. Thomas, Στοιχεία της Θεωρίας Πληροφορίας, ΙΤΕ Πανεπιστημιακές Εκδόσεις Κρήτης, 2014.
- J.G. Proakis, M. Salehi, Συστήματα Τηλεπικοινωνιών, Εκδόσεις Γ.Χ. Φούντας, 2015.