COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	2605001	**SEMESTER**	5
COURSE TITLE	Stochastic Signals and Systems		

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 (ECTS)**
Lectures	2	4
Laboratory	2	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background Course
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (in English)
COURSE WEBSITE (URL)	http://multicom.teipir.gr/stochastic.html

(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*

Upon successful completion of this course module students possess advanced knowledge, skills and competences in the subject of Stochastic Signals and Systems that enable them to:

- model and analyze random phenomena using probability theory and statistics,
- calculate probabilities of random events and moments of random variables,
- find the cumulative distribution function and the probability density function of a function of a random variable,
- calculate probabilities and moments of jointly distributed random variables,
- simulate discrete and continuous random variables,
- analyze the transmission of random signals through linear and time invariant systems,

- estimate the mean, autocorrelation function and power spectral density of random signals,
- evaluate the performance of communication systems in the presence of noise.

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

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Team work
- Production of free, creative and inductive thinking

(3) COURSE CONTENT

Lectures:

1. Axioms of probability, conditional probability and independence
2. Combinatorial analysis
3. Discrete and continuous random variables
4. Moments and characteristic functions
5. Functions of one random variable
6. Jointly distributed random variables
7. Sequences of random variables and limit theorems
8. Description of random signals and statistical averages
9. Stationary signals and linear systems
10. Random signals in the frequency domain
11. Gaussian and white signals
12. Bandpass random signals

Laboratory Experiments:

1. MATLAB overview
2. Simulation of a discrete random variable
3. Discrete random variables A, Bernoulli trials and Binomial distribution
4. Discrete random variables B, geometric and Poisson distributions
5. Simulation of a continuous random variable
6. Continuous random variables A, uniform and exponential distributions
7. Continuous random variables B, Gaussian and Rayleigh distributions
8. Jointly Gaussian random variables
9. Autocorrelation function and power spectral density
10. Bandpass random signals

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face to face lectures</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of electronic presentation with multimedia content in class,
• Student support through the course webpage and the departmental e-learning platform,
• Electronic communication of instructors and students, through the course webpage and by e-mail.
• Use of systems simulation software in the lab.</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>Lectures, Laboratory experiments, study.

<table><tr><th>Activity</th><th>Semester workload (hours)</th></tr><tr><td>Lectures</td><td>26</td></tr><tr><td>Study for lectures</td><td>52</td></tr><tr><td>Laboratory experiments - software</td><td>26</td></tr><tr><td>Study and preparation for exams</td><td>16</td></tr><tr><td>Course Total</td><td>120</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>Student evaluation is performed in the language of instruction.

Final course grade = Lectures part grade x 60% + Laboratory part grade x 40%

<u>Lectures part grade:</u>
• Midterm Exam (25%)
• Final written exam (75%)

Final written exam includes development questions and problem solving questions. Students are provided with a concise mathematic formulae consultation list.

<u>Laboratory part grade:</u>
• Oral evaluation in the lab, on a weekly basis (10%)
• Midterm project evaluation (45%)
• End of term project evaluation (45%)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Essential reading

1. Papoulis, A., *"Probability, Random Variables and Stochastic Processes", 4th Edition,* McGraw-Hill.
2. Ross, S., "*Introduction to Probability and Statistics for Engineers and Scientists",* Academic Press.

Recommended Books

1. Bertsekas, D. and Tsitsiklis, J., "*Introduction to Probability",* 2nd Edition, Athena Scientific, 2008.
2. Stark, H. and Woods, J., "*Probability, Random Processes, and Estimation Theory for Engineers",* 2nd Edition, Prentice Hall, 1994.
3. Feller, W., "*An Introduction to Probability Theory and Its Applications",* 3rd Edition, Wiley, 1968.