

## COURSE DESCRIPTION

### 1. Program identification information

1.1 Higher education institution	POLITEHNICA University of Bucharest
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Department of Applied Electronics and Information Engineering
1.4 Domain of studies	Electronics and Telecommunications Engineering
1.5 Cycle of studies	License
1.6 Program of studies/Qualification	Applied Electronics

### 2. Course identification information

2.1 Name of the course				Advanced Mathematics			
2.2 Lecturer				Assoc. Prof. Dr. Irina Meghea			
2.3 Instructor for practical activities				Assoc. Prof. Dr. Irina Meghea			
2.4 Year of studies	I	2.5 Semester	II	2.6 Evaluation type	Exam	2.7 Course choice type	Compulsory

### 3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week, out of which	4	3.2 course	3	3.3 practical activities	1
3.4 Total hours in the curricula, out of which	56	3.5 course	42	3.6 practical activities	14
Distribution of time					hours
Study according to the manual, course support, bibliography and hand notes					40
Supplemental documentation (library, electronic access resources, in the field, etc)					3
Preparation for practical activities, home works, essays, portfolios, etc.					15
Tutoring					0
Examinations					3
Other activities					0
3.7 Total hours of individual study		58			
3.9 Total hours per semester		114			
3.10 Number of ECTS credit points		3			

### 4. Prerequisites (if applicable)

4.1 curricular	Basic notions of mathematical analysis and linear algebra studied in the first year, first semester
4.2 competence-based	No appropriate

### 5. Requisites (if applicable)

5.1 for running the course	No appropriate
5.2 for running of the applications	No appropriate

### 6. Specific competences

Professional competences	Accumulation of knowledge on advanced mathematics, especially Probability, Statistics with their use and interpretation, notions of distribution theory and Fourier transform need to the technical higher education, particularly notions need to provide a deeper understanding of specialty disciplines.
Transversal competences	Development skills to approach and solve any scientific problems by widening horizon and reasoning capacity conferred by mathematics on an early development stage of the student.

### 7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	Fundamental discipline need in approaching any specialty approaching. Presentation of main chapters of probability, statistics, distributions and Fourier transform with focus on further specialization.
7.2 Specific objectives	Ability to use the abstract reasoning and of calculus techniques with accent on its correct finalization, not only to have an idea about it, since an engineer should to solve a problem until the end.

### 8. Content

8.1 Lectures	Teaching techniques	Remarks
Sample space and events. Probability. Conditional probability and Bayes formula	Teaching is based on presentations at the blackboard, in a permanent discussion with the students in order to involve them in clarification of notions and applications. Lecture materials are the notes and the presentations and books of theory and solved and proposed problems. Use of the video projector to present the programs for statistics.	3 hours
Random variables. Cumulative distribution functions. Probability density functions. Moments. Mean and variance		3 hours
Random vectors. Covariance, correlation coefficient. Regression line		3 hours
Classical probability density functions and joint probability distributions		3 hours
Marginal probability distributions. Conditional probability distributions. Independent random variables. Functions of random variables		3 hours

Sequences of random variables. Law of big numbers. Central limit theorem		3 hours
Random processes. Markov chains		3 hours
Random sampling and data description. Unbiased estimations. Confidence intervals		3 hours
Linear regression and correlation. Design of experiments with several factors. Use and interpretation programs		3 hours
Verification of statistical hypotheses. Statistical tests		3 hours
Distributions		3 hours
Discrete Fourier transform. Fourier series		3 hours
Fourier transform		3 hours
Wavelets and the reconstruction of the signals		3 hours

**Bibliography:**

1. Irina Meghea, *Matematici speciale. Teorie și aplicații*. Editura POLITEHNICA Press, București, 2011
2. Irina Meghea, Zaharoula Andreopoulou, Mihaela Mihai, “*Applied Statistics for Engineers. Using MATLAB and other specific programs*”, Ed. POLITEHNICA Press, București, in print
3. Douglas Montgomery, George Runger, “*Applied Statistics and Probability for Engineers*”, John Wiley and Sons, Inc., 2003
4. David Bourg, “*Excel Scientific and Engineering Cookbook*”, O’Reilly Publisher, 2006
5. Joaquim Marques de Sá, “*Applied Statistics. Using SPSS, STATISTICA, MATLAB and R*”, Springer Verlag, Berlin, Heidelberg, 2007
6. George Morgan, Nancy Leech, Gene Gloeckner, Karen Barrett, “*SPSS for introductory statistics. Use and interpretation*”, LEA Publishers, London, 2004
7. Nancy Leech, Karen Barrett, George Morgan, “*SPSS for intermediate statistics. Use and interpretation*”, LEA Publishers, London, 2005

8.2 Practical applications	Teaching techniques	Remarks
Sample space and events. Probability. Conditional probability and Bayes formula	Propose problems, explain the calculus methods and involve the students in discussions and the solutions of the exercises by work to the blackboard.	2 hours
Random variables. Cumulative distribution functions. Probability density functions. Moments. Mean and variance	Give homework with solved and proposed problems.	2 hours

Random vectors. Covariance, correlation coefficient. Regression line	Learning materials: three books which present and explain the theory, containing solved and proposed exercises.	2 hours
Classical probability density functions and joint probability distributions. Independent random variables. Functions of random variables		2 hours
Random sampling and data description. Unbiased estimations. Confidence intervals		2 hours
Verification of statistical hypotheses. Statistical tests		2 hours
Fourier transform		2 hours
<b>Bibliography</b> <ol style="list-style-type: none"> <li>1. Irina Meghea, <i>Matematici speciale. Teorie și aplicații</i>. Editura POLITEHNICA Press, București, 2011</li> <li>2. Irina Meghea, Zaharoula Andreopoulou, Mihaela Mihai, “<i>Applied Statistics for Engineers. Using MATLAB and other specific programs</i>”, Ed. POLITEHNICA Press, București, in print</li> <li>3. Douglas Montgomery, George Runger, “<i>Applied Statistics and Probability for Engineers</i>”, John Wiley and Sons, Inc., 2003</li> </ol>		

**9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program**

As a result of modern evolution in sciences and techniques, in natural sciences and generally in any modeling of real phenomena, mathematics is compulsory. Contribution of this discipline should be considered as fundamental and have to be highlighted the way how the specialty study is necessary and how it complies with specific elements of training in this faculty.

**10. Evaluation**

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures	- to know the fundamental theoretical notions - the capacity to apply the theoretical knowledge in problems	- partial verification (weight 20%) established from the beginning of the semester - final exam (written), weight 50% The subjects to both verifications cover all the matter.	80%

		- homework (weigh 10%)	
10.5 Practical applications	Starting from a summary of the notions and basic results, apply them in exercises and solve problems	- a verification test (10%) - a permanent quantification of the student activity at practical applications (10%)	20%
10.6 Minimal performance standard			

Date	Lecturer	Instructor for practical activities
12.10.2015	Assoc. Prof. Dr. Irina Meghea	Assoc. Prof. Dr. Irina Meghea
.....	.....	.....

Date of department approval	Director of Department,
.....	.....