Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Applied Electronics and Information Engineering**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Masters
1.6 Programme of studies	Electric Vehicle Propulsion and Control

2. Date despre disciplină

2.1 Course name (ro) (en)				Prelucrarea statistică a semnalelor şi teoria estimării Statistical Signal Processing and Estimation Theory			
2.2 Course Lecturer				Conf. Dr. Ing. Madalin Frunzete			
2.3 Instructor for practical activities				S.l./Lect. Dr. Alexandru DINU			
2.4 Year of studies	1	2.5 Semester	I	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		S	2.9 Course code	2		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	2	Out of which: 3.2 course	1.00	3.3 seminary/laboratory	1
3.4 Total hours in the curricula	28.00	Out of which: 3.5 course	14	3.6 seminary/laboratory	14
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					25
Tutoring					5
Examinations					5
Other activities (if any):					5

3.7 Total hours of individual study	72.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Probability concepts, random variables, random processes

4.2 Results of learning	Basic programming knowledge

5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	Not applicable
5.2 Seminary/ Laboratory/Project	Not applicable

6. General objective *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

This course is part of the field of **Electronics Engineering, Telecommunications, and Information Technologies** and aims to enable students to master statistical methods used in the analysis of experimental data: decision making, formulating answers with statistical error control, developing the ability to design probabilistic experiments, and processing experimental data in order to obtain results with reliable statistical error control.

The course specifically addresses topics such as the acquisition of experimental data for statistical processing; determining the appropriate volume of experimental data to ensure proper statistical control (statistical confidence, response accuracy, and monitoring of the two types of statistical errors in hypothesis testing). It also emphasizes the understanding and rigorous use of common statistical parameters: mean, variance, probability, signal-to-noise ratio, and correlation coefficient.

7. Competences *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

Specific Competences	Application of fundamental and specialized knowledge for solving complex technical problems specific to the field of Information Engineering and Computer Systems. Application of fundamental knowledge in information engineering: statistical models and methods, advanced processing of random processes (including natural language, dynamic systems, images, studies in psychology, sociology, etc.).
Transversal (General) Competences	Responsible execution of tasks within a multidisciplinary team, with the ability to assume roles at different hierarchical levels. Identification and awareness of the need for lifelong learning and the effective use of information sources and professional communication and training resources (Internet portals, specialized software applications, databases, online courses, etc.), both in Romanian and in an international language.

8. Learning outcomes *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)*

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* • List the most important stages that have marked the development of the field of statistics and statistical testing. • Define specific concepts of the field. • Describe/classify concepts, processes, phenomena, and structures. • Highlight consequences and relationships.
Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* • Select and group relevant information within a given context. • Apply specific principles with well-reasoned arguments for a given purpose. • Work productively in a team. • Experimentally verify identified solutions. • Solve practical applications. • Properly interpret causal relationships. • Analyze and compare theoretical results with those obtained experimentally. • Identify solutions and develop plans of action/projects. • Formulate conclusions based on the experiments carried out.

Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* • Select appropriate bibliographic sources and analyze them. • Respect the principles of academic ethics by correctly citing the bibliographic sources used. • Demonstrate openness to new learning contexts. • Collaborate with colleagues and teaching staff in carrying out academic activities. • Demonstrate autonomy in organizing the learning context or the problem-solving situation. • Acknowledge the value of their contribution in engineering to identifying viable and sustainable solutions that address problems in social and economic life (social responsibility). • Analyze and capitalize on business or entrepreneurial opportunities in the field of specialization. • Demonstrate management skills in real-life situations (time management, collaboration vs. conflict).

9. Teaching techniques *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

Teaching is primarily based on oral communication methods and written explanations/demonstrations on the board (the expository method and the problem-posing method, applied in a frontal manner). The course materials consist of lecture notes and two books authored by the course holder, which also include illustrative examples written in MATLAB. All materials are available in the laboratory, both in printed form and in electronic format (scanned copies).

10. Contents

COURSE		
Chapter	**Content**	**No. hours**

1	Random variables Law of large numbers Central limit theorem Chebyshev's inequality Estimation and hypothesis testing for the mean Probability Variance Goodness-of-fit tests with a given distribution Applications in cryptography, psychology, and natural language processing (NLP)	14
	Total:	14

Bibliography:

1. Adriana Vlad, Modele şi Metode Statistice în Ingineria Informaţiei, suport de curs electronic, Moodle - https://curs.upb.ro/2022
2. Adriana Vlad, B. Badea şi M. Mitrea, Metode Statistice în Prelucrarea Informaţiei. Compendiu şi Aplicaţii, Ed. Metropol, Bucureşti, 1999.
3. Adriana Vlad şi B. Badea, Metode Statistice în Prelucrarea Datelor. Estimare Statistică, Ed. Paideia, Bucuresti, 2002.
4. V. Craiu, Verificarea ipotezelor statistice, Ed. Didactică şi Pedagogică, Bucureşti, 1972.
5. M. Iosifescu, C. Moineagu, V.Trebici şi Emiliana Ursianu, Mică Enciclopedie de Statistică, Ed. ştiinţifică şi Enciclopedică, Bucureşti, 1985.
6. R.E. Walpole and R.H.Myers, Probability and Statistics for Engineers and Scientists, 6th ed., MacMillan Publishing Comp., New York, 2015.
7. Adriana Vlad, A. Mitrea şi M. Mitrea, Limba română scrisă ca sursă de informaţii, Ed. Paideia, Bucureşti, 2003
8. A. DINU, A. VLAD, B. HANU and A. MITREA, "The Statistical Independence for Words in Printed Romanian Language," 2020 13th International Conference on Communications (COMM), 2020, pp. 319-324, doi: 10.1109/COMM48946.2020.9142045.

SEMINARY

Crt. no.	Content	No. hours
1	The seminary will naturally complete the course and follow the same topics and structure.	14
	Total:	14

Bibliography:
1. Adriana Vlad, Modele şi Metode Statistice în Ingineria Informaţiei, suport de curs electronic, Moodle - https://curs.upb.ro/2022
2. Adriana Vlad, B. Badea şi M. Mitrea, Metode Statistice în Prelucrarea Informaţiei. Compendiu şi Aplicaţii, Ed. Metropol, Bucureşti, 1999.
3. Adriana Vlad şi B. Badea, Metode Statistice în Prelucrarea Datelor. Estimare Statistică, Ed. Paideia, Bucuresti, 2002.
4. V. Craiu, Verificarea ipotezelor statistice, Ed. Didactică şi Pedagogică, Bucureşti, 1972.
5. M. Iosifescu, C. Moineagu, V.Trebici şi Emiliana Ursianu, Mică Enciclopedie de Statistică, Ed. ştiinţifică şi Enciclopedică, Bucureşti, 1985.
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11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	Understanding of fundamental theoretical concepts and knowledge of how to apply theory to specific problems.	Mini tests during the semester	20
	Understanding of fundamental theoretical concepts and knowledge of how to apply theory to specific problems.	Final exam	30
11.5 Seminary/laboratory/project	Knowledge of the statistical procedure to be followed in the case of an application. Knowledge of how to implement it in MATLAB code (including comparative graphical representations).	Mini test and final exam during the lab	50
11.6 Passing conditions			
>50% of the total grade			

12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)

Through the activities carried out, students develop the ability to provide solutions to problems and to propose ideas for improving existing situations in the field of applied statistics in engineering.

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Date	Course lecturer	Instructor(s) for practical activities
30.09.2025	Conf. Dr. Ing. Madalin Frunzete	S.l./Lect. Dr. Alexandru DINU

Date of department approval	Head of department

Date of approval in the Faculty Council	Dean