STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Numerical Analysis and Statistics**		Code **1010102211010342018**
Field of study **Environmental Engineering Second-cycle**	Profile of study (general academic, practical) **(brak)**	Year /Semester **1 / 1**
Elective path/specialty **Heating, Air Conditioning and Air Protection**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **15** Laboratory: **-** Project/seminars: **-**		No. of credits **2**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **2 100%** **2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	student knows - within the scope embraced by the mathematical training at the undergraduate level - the concepts in matrix algebra, in differential and integral calculus, and in differential equations
2	**Skills**	student knows how to 1) solve arbitrary systems of linear algebraic equations, 2) calculate derivatives and simple integrals, 3) produce analytical solutions to basic differential equations.
3	**Social competencies**	student 1) is aware of the importance of mathematics in the description of scientific and engineering problems, 2) understands the need for learning - both of these features already established during undergraduate studies.

Assumptions and objectives of the course:

1) to familiarize students with the terminology and methods for the numerical solution of mathematical problems and statistical description of phenomena,

2) to show the specificity of numerical calculations and that of statistical elaborations,

3) show the area where the above applies.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. student knows basic concepts in numerical analysis and basic numerical methods - [X2A_W02, X2A_W03,X2A_W04]

2. student knows basic concepts in descriptive and mathematical statistics; in particular, knows how to formulate hypotheses and to verify them - [X2A_W02, X2A_W03,X2A_W04]

3. student has a broader and deeper mathematical knowledge which is appropriate for issues found in environmental engineering - [T2A_W01]

4. student knows basic methods, techniques, tools and materials which are necessary to treat complex engineering tasks in the field (s)he is being educated - [T2A_W07]

Skills:

1. a critical evaluation of the results obtained in theoretical considerations and in calculations, including these produced by computers - [X2A_U02]
2. the ability to find information in the literature and in the Internet - [X2A_U03]
3. ability to apply the adquired knowledge in environmental engineering issues - [X2A_U04]
Social competencies:
1. student is aware of the importance of mathematics in the description of scientific and engineering problems - [-]
2. student understands the need in continuous education - [X2A_K01, T2A_K01]
3. student understands the importance of precision, especially when (s)he is involved in any co-operation - [X2A_K02, T2A_K03]

Assessment methods of study outcomes
Marks which are issued during cab classes (classes realized in a traditional way, with a chalk and blackboard) on the basis of homework and in the exam (in normal mode: written exam; in the re-sit mode: written and oral).
Course description
Revision 2017 Applied methods of education: lectures and practical lessons. Lecture with multimedia presentation (including: drawings, photos) supplemented by examples given on the board. Interactive lectures with problems and questions for students. The activity of students is taken into account in valuation of them. Discussion during lectures is expected. Connections with others mathematical subjects are indicated. Practical lessons. Solving of exemplary exercises on a blackboard. Discussion of solutions with relative comments. 1) floating-point arithmetics, stability, conditioning, correctness, efectivity result, 2) polynomial collocation and least-square approximation, 3) methods to numerical find zeros of nonlinear algebraic equations, 4) numerical differentation and quadratures, 5) numerical treatment of ordinary differential equations, 6) statistical description of random samples, incl. linear correlation and Pearson coeffcient, 7) theoretical discrete distributions (Binomial, Geometrical, Poisson), 8) theoretical continuous distributions, statistical hypotheses.
Basic bibliography:
1. Z.Fortuna, B.Macukow, J.Wąsowski, Metody numeryczne, WNT (liczne wydania)
2. M.Liskowski, Podstawy statystyki praktycznej, WSHiG Poznań 2003
Additional bibliography:
1. A.Bjorck, G.Dahlquist, Metody numeryczne, PWN 1987
2. G.I.Marczuk, Modelowanie matematyczne problemów środowiska naturalnego, PWN 1985

Result of average student's workload

Activity	Time (working hours)
1. participation in classes, self-study and preparation of reports	120

Student's workload

Source of workload	hours	ECTS
Total workload	60	2
Contact hours	50	1
Practical activities	20	1