COURSE DESCRIPTION CARD - SYLLABUS

Course name
numerical methods and statistics

Course

Field of study
Environmental Engineering

Year/Semester
I/1

Area of study (specialization)
Water supply, water and soil protection

Profile of study
general academic

Level of study
Second-cycle studies

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
18	10	
Tutorials	Projects/seminars	

Number of credit points

Lecturers

Responsible for the course/lecturer:
dr inż. Anna Andruch-Sobiło

Responsible for the course/lecturer:

Prerequisites

The student should:

a) have basic knowledge of matrix calculus, differential and integral calculus, combinatorics and probability,

b) have the ability to acquire teaching materials from the indicated sources (library, bookstore, internet)

c) have the ability to read in Polish,

d) have the ability to logically interpret read content, draw conclusions from it and formulate opinions,

e) be aware of the importance of mathematics in the description of scientific and engineering problems,

f) understand the needs of training,

Course objective

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To provide students with basic and intermediate knowledge of the concepts of numerical analysis, probability theory and statistics, as well as selected numerical methods and techniques for statistical processing of data, which concepts and techniques are used in issues considered by theoreticians and practitioners of environmental engineering.

Course-related learning outcomes

Knowledge

Student:

1. has knowledge of the concepts of numerical analysis and selected numerical methods,

2. knows the basic concepts of probability theory and statistics as well as selected techniques for statistical processing of data.

Skills

Student:

1. has the ability to use the introduced mathematical concepts in the field of numerical methods and statistics, knows selected numerical algorithms and statistical quantities

2. knows the application of selected numerical methods,

3. is able to solve the problem in writing, using the numerical and statistical calculation methods discussed,

4. understands the content of calculation program implemented in MatLab,

5. is able to handle the MatLab calculation program, in the scope of the discussed calculation methods, using previously written programs

6. knows how to solve any task from numerical methods and statistics in the field of discussed calculation algorithms.

Social competences

Student:

1. understands the need to use numerical methods

2. understands the role of mathematical modeling of natural and technical phenomena occurring in considerations typical of environmental engineering

3. understanding of the need for further training, also in mathematics

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Lecture - acquired knowledge is verified on the basis of the project (report) prepared independently (outside of the class). The report should provide a solution to three tasks in the field of issues discussed. The content of the issues is determined by the teacher.

Assessment method: correct description and solution of one task - dst assessment, two tasks - db assessment, three tasks - very good assessment.

2. Laboratory - final test consisting of 4 tasks. Tasks are solved by operating the Matlab program. The previously implemented (during laboratory classes) programs are used. Tasks are scored differently or evenly (teacher's decision). The pass threshold is 50% of the points or 2 tasks correctly solved.

3. Both forms of teaching require participation in classes, attendance is checked and student activity is observed. Absence should be justified.

Programme content

Numerical Methods:

1. Decimal and binary numbers. Fixed and floating point records.

2. Stability, conditioning, correctness and effectiveness of the account.

3. Numerical solution of algebraic equations (methods: fixed point, tangent).

4. Polynomial (Lagrange) interpolation.

5. Average square approximation of a set of points and functions.

Statistics:

1. Random sample and its statistical description (descriptive statistics).

2. Pearson and Spearman correlation coefficients.

3. Classic and geometric probability. Kolmogorov's axiomatic probability.

4. Random variable and its characteristics (density, cumulative distribution function, expected value, standard deviation; moment generating function). Functions of a random variable (linear combination, power, exponential).

Teaching methods

1. Lecture: multimedia presentation illustrated with examples and solution of tasks given by the teacher - practical and complementary exercises.

2. Laboratory: implementation in MatLab of numerical algorithms and statistical issues discussed in the lecture. Conversion of tasks given by the teacher.

Bibliography

Basic

1. A.Marlewski, Podstawowe metody numeryczne dla studentów kierunków inżynierskich, PWSZ Piła 2008

2. R.Szymkiewicz, Metody numeryczne w inżynierii wodnej, Wyd.Politechniki Gdańskiej 2012

3. M.Liskowski, Podstawy statystyki praktycznej, WSHiG Poznań 2003

Additional

1. Z.Fortuna, B.Macukow, J.Wąsowski, Metody numeryczne, WNT (liczne wydania)

2. G.I.Marczuk, Modelowanie matematyczne problemów środowiska naturalnego, PWN 1985

Breakdown of average student's workload

	Hours	ECTS
Total workload	78	3,0
Classes requiring direct contact with the teacher	28	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	50	2

[1] delete or add other activities as appropriate