STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Numerical methods	**1010342621010340026**

Field of study	Profile of study (general academic, practical)	Year /Semester
Mathematics	**general academic**	**1 / 2**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-**	**6**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**100 6%**
Technical sciences	**100 6%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	The student has an extended and in-depth knowledge of: * Mathematics (in terms of material studies grade 1, and the initial and boundary value problems for ordinary and partial differential equations) * Numerical methods (in terms of material studies grade 1) * Computer Science (programming in high level language).
2	**Skills**	The student is able to solve math problems in material studies degree 1. The student is able to implement the algorithm in high-level programming. Student uses at least one commercial computer package for solving the basic numerical methods.
3	**Social competencies**	The student is aware of the validity of the effects of mathematical calculations. The student understands the need for learning.

Assumptions and objectives of the course:

Learning advanced numerical methods and apply them to solve complex mathematical and engineering problems. Supporting math and engineering relevant IT tools.

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

Knowledge:

1. The student is able to choose and apply numerical methods for solving mathematical tasks formulated in technical issues - [K_W07, K_W10,]
2. The student knows advanced computational techniques to support the work the math and understand their limitations - [K_W08, K_W11]

Skills:

1. The student is able to choose and apply appropriate computational methods to solve mathematical tasks formulated in other fields of science - [K_U10, K_U16]
2. Student can correctly construct numerical algorithms for solving complex mathematical problems - [K_U19, K_U20]
3. The student is able to carry out measurements and tests computer complex mathematical problems, interpret the results and draw conclusions - [K_U16, K_U20]

Social competencies:

1. The student understands the necessity of systematic work on complex projects - [K_K03]
2. The student knows the limitations of their knowledge and understands the need for further education - [K_K01]
3. The student can independently search for information in the literature - [K_K06]

Assessment methods of study outcomes

Lecture

* Assess the knowledge and skills shown on the written test,
* Control of perception during lectures.

Laboratory exercises:

* Tests and rewarding knowledge necessary to perform laboratory tasks.
* Continuous assessment, for each course - rewarding gain skills they met the principles and methods
* Assess the knowledge and skills related to the implementation of the tasks of exercises, evaluation reports performed exercise

Recovery points for additional activity in the classroom, and in particular for:

* Propose to discuss additional aspects of the subject;
* The effectiveness of the application of acquired knowledge when solving a given problem;
* Comments relating to the improvement of teaching materials;
* Aesthetic diligence reports and jobs - in the framework of self-study.

Course description

Numerical differentiation of functions of several variables,
Initial-value problems for ordinary differential equations:
(Higher-order equations and systems of differential equations; Multistep methods)
Boundary value problems for ordinary differential equations,
Boundary and initial-boundary value problems for partial differential equations - difference methods,
Numerical solutions of nonlinear systems of equations,

Basic bibliography:

1. Kincaid, Cheney, Analiza numeryczna, WNT, Warszawa,
2. Burden, Faires, Numerical analysis, Prindle, Weber&Schmidt, Boston,
3. Kącki, Równania różniczkowe cząstkowe w zagadnieniach fizyki i techniki, WNT, Warszawa
4. Rosłoniec, Wybrane metody numeryczne z przykładami zastosowań w zadaniach inżynierskich, Oficyna Wydawnicza Politechniki Warszawskiej,

Additional bibliography:

1. Zarowski, An introduction to numerical analysis for electrical and computer engineers, Wiley
2. Silverster P.P., Ferrari R.L., Finite elements for electrical engineers, Cambridge Univ. Press

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in laboratory classes	30
3. Participation in consultations	10
4. implementation and verification the programs (time outside of the classroom laboratory)	8
5. preparation for laboratory classes	8
6. Preparing to pass laboratories	12
7. familiarization with the indicated literature and teaching materials	20
8. final exam preparation and participation in the final exam	20

Student's workload

Source of workload	hours	ECTS
Total workload	138	6
Contact hours	73	3

Practical activities	63	3