# STUDY MODULE DESCRIPTION FORM

| Name of the module/subject | Code |
|---|---|
| **Numerical linear algebra** | **1010341731010340006** |

| Field of study | Profile of study (general academic, practical) | Year /Semester |
|---|---|---|
| **Mathematics in Technology** | **general academic** | **2 / 3** |
| Elective path/specialty | Subject offered in: | Course (compulsory, elective) |
| **-** | **Polish** | **obligatory** |

| Cycle of study: | Form of study (full-time,part-time) |
|---|---|
| **First-cycle studies (Polish Qualifications Framework level six)** | **full-time** |

| No. of hours | No. of credits |
|---|---|
| Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **-** | **4** |

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

| Education areas and fields of science and art | ECTS distribution (number and %) |
|---|---|
| **The sciences** | **4 100%** |
| **Mathematical sciences** | **4 100%** |

**Responsible for subject / lecturer:**

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**Responsible for subject / lecturer:**

**Prerequisites in terms of knowledge, skills and social competencies:**

| | | |
|---|---|---|
| 1 | **Knowledge** | 1. Basic course of linear algebra.<br>2. Algorithms of linear algebra.<br>3. Numerical Methods.<br>[K_W01 (P6S_WG)], [K_W03 (P6S_WG)], [K_W06 (P6S_WG)] |
| 2 | **Skills** | Computer programming in high-level languages.<br>[K_U01 (P6S_UW)], [K_U03 (P6S_UW)], [K_U09 (P6S_UW)], [K_U13 (P6S_UK)], [K_U15 (P6S_UU)] |
| 3 | **Social competencies** | Ability to work in a group. Mandatory and punctuality in performing the tasks entrusted.<br>[K_K02 (P6S_KK)], [ K_K03 (P6S_KO)] |

**Assumptions and objectives of the course:**

1. learning practical computer algorithms that are used to solve a number of tasks through the use of linear algebra,
2. acquisition of the ability to solve systems of equations, through calculations efficiently and accurately, with the proper selection of an algorithm (adequate to the problem being solved),
3. acquisition of the ability to use numerical methods for advanced calculations in the field of engineering calculations (as applications of mathematics in technology)
4. the lecture series is intended for advanced students and young scientists in the field of mathematics, computer science, engineering and all other disciplines using numerical methods.

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

**Knowledge:**

1. Student has extended and in-depth knowledge of various branches of higher mathematics and detailed knowledge of the use of mathematical methods and tools in technical sciences [K_W01 (P6S_WG)]
2. Student has ordered knowledge of terminology in the field of mathematics and selected issues in the field of technical sciences related to the field of study, also in a foreign language [K_W03 (P6S_WG)]
3. Student has ordered and theoretically founded knowledge in computer science, including numerical methods; knows at least one software package or programming language [K_W06 (P6S_WG)]

**Skills:**

1. Student is able to use knowledge in higher mathematics [K_U01 (P6S_UW)]
2. Student is able to construct an algorithm for solving a simple engineering task and implement it and test it in a chosen programming environment [K_U04 (P6S_UW)]
3. Student is able to use equipment, tools, etc. in accordance with general requirements and technical documentation; knows how to apply the principles of health and safety at work [K_U09 (P6S_UW)]
4. Student is able to use a foreign language to a degree sufficient to communicate, as well as reading comprehension of mathematical texts, technical documentation and similar documents [K_U13 (P6S_UK)]
5. Student is able to independently plan and implement self-education in order to raise and update their competences [K_U15 (P6S_UU)]

**Social competencies:**

1. Student is aware of deepening and expanding knowledge to solve newly created technical problems [K_K02 (P6S_KK)]
2. Student is able to work as a team; understands the need for systematic work on any projects that have a long-term nature. [K_K03 (P6S_KO)]

## Assessment methods of study outcomes

1. homework
2. programs
3. final test

## Course description

Update 2018/2019

1. Fundamentals (matrix algebra).
2. Direct methods for Solving Linear Systems.
3. QR Factorization and Discrete Least Squares Approximation.
4. Conditioning and Stability of Numerical Algorithms.
5. Eigenvalues and Eigenvectors.

## Basic bibliography:

1. A.Kiełbasiński A., Schwetlick H. Numeryczna algebra liniowa: wprowadzenie do obliczeń zautomatyzowanych, Warszawa : Wydaw. Nauk. -Techn., 1992.
2. Golub G.H, i Van Loan C.F. Matrix Computation 4ed., J. Hopkins UP., 2013
3. A Maćkiewicz , Algorytmy algebry liniowej. Metody bezpośrednie, Wydawnictwo Politechniki Poznańskiej, Poznań 2002.

## Additional bibliography:

1. Allaire G. Kaber S. , Numerical Linear Algebra, Springer 2002.
2. J. Stoer, R. Bulirsch, Introduction to Numerical Analysis, Second Edition, Springer 1992.
3. L. Trefethen, David Bau, III, Numerical Linear Algebra, SIAM, Philadelphia, 1997.
4. Watkins D., Fundamentals of Matrix Computation 3rd ed., J. Wiley, 2010.

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| 1. Lectures | 30 |
| 2. Classes | 30 |
| 3. Preparing for classes | 30 |
| 4. Consultations | 2 |

## Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 102 | 4 |
| Contact hours | 62 | 2 |
| Practical activities | 30 | 1 |