

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Numerical Methods in Technology		Code 1010615321010650404
Field of study Transport	Profile of study (general academic, practical) (brak)	Year /Semester 1 / 2
Elective path/specialty Refrigerated Transport	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: Second-cycle studies	Form of study (full-time, part-time) part-time	
No. of hours Lecture: 9 Classes: 9 Laboratory: - Project/seminars: -		No. of credits 3
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 %) 3 100% 3 100%
Responsible for subject / lecturer: dr hab. inż. Witold Stankiewicz email: Witold.Stankiewicz@put.poznan.pl tel. 665 2167 Faculty of Transport Engineering ul. Piotrowo 3 60-965 Poznań		Responsible for subject / lecturer: dr inż. Krzysztof Kotecki email: Krzysztof.Kotecki@put.poznan.pl tel. 665 2101 Faculty of Transport Engineering ul. Piotrowo 3 60-965 Poznań
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge of mathematics and computer science, as for all graduates of Transportation (first degree)
2	Skills	Basic skills in mathematics and computer science, as for all graduates of Transportation (first degree)
3	Social competencies	Student is able to cooperate in a group, taking the different roles. Student is able to set priorities important to solve given tasks. The student demonstrates self-reliance in solving problems, acquiring and improving his knowledge and skills.
Assumptions and objectives of the course: Learning advanced numerical methods, particularly useful in technology. Familiarization with examples of practical applications. Acquiring the ability to select and use known methods and numerical tools in engineering problems.		
Study outcomes and reference to the educational results for a field of study		
Knowledge: 1. knows advanced methods, techniques and tools used to solve complex engineering tasks and conduct research in a selected area of transport - [T2A_W06] 2. has advanced detailed knowledge of selected issues in the field of transport engineering - [T2A_W03] 3. has advanced and in-depth knowledge in the field of transport engineering, theoretical foundations, tools and means used to solve simple engineering problems - [T2A_W01]		
Skills: 1. can acquire information from literature, databases and other sources (in Polish and English), integrate them, make their interpretation and critical evaluation, draw conclusions and formulate and justify opinions - [T2A_U01] 2. can plan and carry out experiments, including measurements and simulations, interpret the results obtained and draw conclusions and formulate and verify hypotheses related to complex engineering problems and simple research problems - [T2A_U03] 3. can use analytical, simulation and experimental methods to formulate and solve engineering tasks and simple research problems - [T2A_U04]		
Social competencies:		

<p>1. understands the importance of using the latest knowledge in the field of transport engineering in solving research and practical problems - [T2A_K02]</p> <p>2. understands the importance of popularizing activities regarding the latest achievements in the field of transport engineering - [T2A_K03]</p>

Assessment methods of study outcomes		
Colloquia. Individual assessment of the performed tasks.		
Course description		
Interpolation methods. Numerical integration: the trapezoidal rule; Simpson; Romberg. Direct and iterative methods for solving algebraic equations. Methods for determination of matrix eigenvalues and eigenvectors. Algorithms for solving ordinary differential equations. Solving partial differential equations using finite difference and finite element methods.		
Basic bibliography:		
<p>1. Fortuna Z., Macukow B. Wąsowski J.: Metody numeryczne. WNT Warszawa 2006</p> <p>2. Jankowscy J. i M.: Przegląd metod i algorytmów numerycznych. WNT 1988</p> <p>3. Stoer J., Bulirsch R.: Wstęp do metod numerycznych. PWN Warszawa 1980</p>		
Additional bibliography:		
<p>1. Press W.H., Flannery B.P., Teukolsky S.A., Vetterling W.T.: Numerical Recipes: The Art of Scientific Computing. Cambridge Press, 1986</p> <p>2. Saad Y.: Iterative methods for sparse linear systems. PWS publishing company Boston, 1996</p> <p>3. Saad Y.: Numerical Methods for Large Eigenvalue Problems, Manchester Univ. Press, 1992</p> <p>4. Pozrikidis C.: Numerical Computation in Science and Engineering. Oxford University Press 1998</p>		
Result of average student's workload		
Activity	Time (working hours)	
1. Participation in the lecture	9	
2. Consolidation of the lecture	5	
3. Preparation to pass (lecture)	8	
4. Preparation for classes	10	
5. Participation in the classes	9	
6. Consolidation of content of the classes	12	
7. Consultations	8	
8. Preparation to pass	10	
Student's workload		
Source of workload	hours	ECTS
Total workload	71	3
Contact hours	26	1
Practical activities	49	2