Subject (course) name: **Numerical Methods**		
Programme: **Automation And Robotics** Specialty:		Subject code: **11K**
		Title graduate: **Engineer**
Type of course: **obligatory**	Course level: **First-cycle studies**	Year: **II** Semester: Semester: **spring**
Form of classes: **Lectures, Classes, Labs, Seminar, Project**	Number of hours per week: **1L, 0, 2Lab, 0, 0**	Credit points: **5 ECTS**

GUIDE TO SUBJECT

SUBJECT OBJECTIVES

C1. Acquisition general knowledge in using the basic numerical methods.

C2. Acquisition general knowledge needed to solve the technical problems by using the theory of numerical computational procedures.

C3. Acquisition of skills in using the basic numerical methods for the analysis of electrical

and computer engineering problems.

C4. Acquisition of skills in using the basic numerical methods to describe and solve common tasks and problems of technical subject

SUBJECT REQUIREMENTS

1. General knowledge of mathematics that can be used in formulating and solving simple engineering problems connected with computer science.

2. General ability to identify, formulate, and solve electrical and computer engineering problems.

3. General ability to independently search in literature

LERNING OUTCOMES

EK 1 - Student knows the basic numerical algorithms and is able to use them in calculations.

EK 2 - Student will be able to characterize the basic numerical methods and to describe problems of technical subject.

EK3 - Student will be able to implementation of numerical algorithms in a problem solving environment to the analysis of electrical and computer engineering problems.

EK4 - Student will be able to use Scilab as tool to solve the problems of technical subject using the different numerical methods.

SUBJECT CONTENT
Form of classes - lectures

Topic	Hours
W1 – Introduction to numerical methods. Basic terms. Introduction to Scilab programming	1
W2 – Solving system of linear equations	2
W3 – Numerical solution of nonlinear equations	2
W4 – Approximation	2
W5 – Interpolation	2
W6 – Numerical integration and differentiation	2

W7 – Ordinary Differential Equations	**2**
W8 – Partial differential equations	**1**
Final test	**1**
Total	**15**

Form of classes – laboratory

Topic	Hours
L1 – Introduction to Scilab programming - Scilab as tool to solve the problems of technical subject	2
L2 – Solving system of linear equations	4
L3 – Numerical solution of nonlinear equations	4
L4 – Approximation	4
L5 – Interpolation	4
L6 – Numerical integration	2
L7 – Numerical differentiation	2
L8 – Ordinary Differential Equations	4
L9 – Partial differential equations	2
Examination of programming tasks	2
Total	**30**

STUDY METHODS

1. Lectures using multimedia presentations
2. Discussion during the course and in addition during individual consultations
3. Laboratory – Independent work at the computer workstation

EDUCATIONAL TOOLS

1. Audiovisual equipment, black(white)board, lectures in electronic version
2. Textbook with exercises of numerical methods
3. Dedicated software for presentation of chosen aspects discussed during lectures
4. Scilab - tool to solve the problems of technical subject

METHODS OF ASSESSMENT (F – Forming, P – Summary)

F1. assessment of self preparation for laboratory classes – oral answer
F2. assessment of the results - presentation in electronic form
P1. lecture – written test on the theory of numerical methods
P2. laboratory – test on programming tasks

STUDENT WORKLOAD

Form of activity		Averaged workload (hours)		
		[h]	$\sum$ [h]	ECTS
Participation in class activities	lecture	15	48	5
	laboratory	30		
	consultation	3		
Preparation for tutorials (reading literature)		10	42	2
Preparation for tests		15		
Preparation for laboratory classes		15		
Familiarizing yourself with the educational software		2		
Total			**90**	**7**

A. BASIC READING

1. Steven C. Chapra Raymond P. Canale.: Numerical Methods for Engineers, sixth edition, The McGraw-Hill Companies, New York, 2010.
2. Richard L. Burden, J. Douglas Faires.: Numerical Analysis, ninth edition, Brooks/Cole, Cengage Learning, Canada, 2010.
3. Rosłoniec S.: Fundamental Numerical Methods for Electrical Engineering Springer-Verlag Berlin Heidelberg 2008

B. FURTHER READING

| 1. P. Moin.: Fundamentals of numerical analysis, Cambridge University Press, New York, 2010. |
| 2. M. Affouf.: Scilab by Example. ISBN: 978-1479203444, 2012. |
| 3. Gaby Alez.: Scilab: Introduction, License, Applications, and More. ISBN: 978-1276223935, 2012 |

Learning objectives	In relation to the learning outcomes specified for the field of study	Subject objectives	Study methods	Methods of assessment
EK1	KAR1A_W04	C1	lecture	P1
EK2	KAR1A_W04	C1,C2	lecture	P1
EK3	KAR1A _U08	C2,C3	laboratory	F1,F2,P2
EK4	KAR1A _U08	C3	laboratory	F2,P3

II. EVALUATION

Grade	Outcome
EK1	**Student knows the basic numerical algorithms and is able to use them in calculations.**
2 (F)	Student doesn't know the basic numerical algorithms and is not able to use them in calculations.
3 (E)	Student knows the basic numerical algorithms.
4 (C)	Student knows the basic numerical algorithms and knows tools to solve the problems of technical subject
5 (A)	Student knows the basic numerical algorithms and is able to use them in calculations.
EK2	**Student is able to characterize the basic numerical methods to describe problems of technical subject.**
2 (F)	Student is not able to characterize the basic numerical methods to describe problems of technical subject.
3 (E)	Student is able to characterize the basic numerical methods
4 (C)	Student is able to characterize the basic numerical methods and to give examples.
5 (A)	Student is able to characterize the basic numerical methods to describe problems of technical subject.
EK3	**Student is able to implementation of numerical algorithms in a problem solving environment to the analysis of electrical and computer engineering problems.**
2 (F)	Student is not able to implementation of numerical algorithms in a problem solving environment to the analysis of electrical and computer engineering problems.
3 (E)	Student knows tool to solve the problems of technical subject.
4 (C)	Student is able to implementation of simple numerical algorithms in a problem solving environment to the analysis of electrical and computer engineering problems.
5 (A)	Student is able to implementation of numerical algorithms in a problem solving environment to the analysis of electrical and computer engineering problems.
EK4	**Student is able used Scilab as tool to solve the problems of technical subject using different numerical methods.**
2 (F)	Student is not able used Scilab as tool to solve the problems of technical subject using different numerical methods.
3 (E)	Student is able used Scilab as tool to solve the simple problems of technical subject.
4 (C)	Student is able used Scilab as tool to solve the problems of technical subject using selected numerical methods.
5 (A)	Student is able used Scilab as tool to solve the problems of technical subject using different numerical methods.

III. OTHER USEFUL INFORMATION

1. All information for students on the schedule are available on the notice board and on the website: https://we.pcz.pl/
2. Information on the consultation shall be provided to students during the first lecture and will be placed on the website https://we.pcz.pl/
3. Terms and conditions of credit courses will be provided to students during the first lecture