

## SYLLABUS OF A MODULE

Polish name of a module	Metodyka i metodologia badań naukowych
English name of a module	Methodology of scientific research
ISCED classification - Code	0619
ISCED classification - Field of study	<i>Computer Science</i>
Languages of instruction	<i>English</i>
Level of qualification:	2
Number of ECTS credit points	3
Examination:	A
Available in semester:	S

### Number of hours per semester:

Lecture	Exercises	Laboratory	Seminar	E-learning	Project
15	0	15	0	0	0

### **MODULE DESCRIPTION**

#### **MODULE OBJECTIVES**

- O1. Obtaining knowledge in the area of scientific research.
- O2. Familiar with methods of obtaining scientific material, providing its deeply analysis and formulate conclusions.
- O3. Acquisition by students skills to work independently and in a team, develop reports, analyze the results, etc.

#### **PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Basic knowledge of computer architecture and operating systems.
2. Basic knowledge of the theory of algorithms and data structures.
3. Ability of C++ and Java programming.
4. Ability to use different sources of information and technical documentation.
5. Ability to work independently and in a group.

6. Ability to correctly interpret and present their own activities.

### LEARNING OUTCOMES

LO 1 – has competences to work individually and in a team, has the ability to estimate the time required to perform ordered tasks.

LO 2 – has ordered, theoretically founded knowledge including methods of conducting scientific research.

LO 3 – able to plan and conduct research in the field of simple research problems.

### MODULE CONTENT

<b>Lectures</b>	<b>Number of hours</b>
Lect. 1 - The difference between science and engineering	1
Lect. 2 - Current challenges facing science	1
Lect. 3 - Introduction to scientific research methodology	1
Lect. 4 - Selected problems and its analysis (in the area of Artificial Intelligence)	1
Lect. 5 - Selected problems and its analysis (in the area of High Performance Computing)	1
Lect. 6 - Selected problems and its analysis (in the area of multimedia processing)	1
Lect. 7 - Performance metrics of research computation – hardware analysis	1
Lect. 8 - Current hardware used in research computation (CPU, GPU, FPGA, ...)	1
Lect. 9 - Performance metrics of research computation – software analysis	1
Lect. 10 - Models of algorithm characteristics and design (Roofline, PCAM, ...)	1
Lect. 11 - Analysis of performance of scientific problems	1
Lect. 12 - Analysis of energy consumption of scientific problems	1

Lect. 13 - Analysis of accuracy results of scientific problems	1
Lect. 14 - Hypothesis, solutions and conclusions formulation for given problems	1
Lect. 15 - Unsolved problems in computer of science	1
<b>Laboratories</b>	<b>Number of hours</b>
Lab. 1 - Introduction to methodology of scientific research	1
Lab. 2 - Tools (software and resources) for computer science researchers	1
Lab. 3 - Data collection methods in scientific research	1
Lab. 4 - Analysis, profiling and optimization of Artificial Intelligence problems	1
Lab. 5 - Analysis, profiling and optimization of High Performance Computing problems	1
Lab. 6 - Analysis, profiling and optimization of problems of multimedia processing	1
Lab. 7 - Hardware analysis – strengths and limitations	1
Lab. 8 - Comparison of different hardware solutions between CPU and GPU	1
Lab. 9 - Algorithm analysis – requirements, bound conditions, methods of development	1
Lab. 10 - Roofline model for selected algorithms and architectures	1
Lab. 11 - Performance evaluation of scientific computing	1
Lab. 12 - Energy consumption of scientific computing	1
Lab. 13 - Analysis of results accuracy in scientific computing	1
Lab. 14 - Hypothesis, solutions and conclusions formulation for given problems	1
Lab. 15 - Summary test	1

## TEACHING TOOLS

1. – multimedial presentations for lectures
2. – instructions for laboratories
3. – wide range of algorithm and programming tools
4. – workplaces for students equipped with workstations

## WAYS OF ASSESSMENT ( F – FORMATIVE, S – SUMMATIVE

F1. – one exam for laboratory
F2. – one take-home quiz
S1. – the final grade is based on the knowledge and skills gained from lectures and laboratories

\*) warunkiem uzyskania zaliczenia jest otrzymanie pozytywnych ocen ze wszystkich ćwiczeń laboratoryjnych oraz realizacji zadania sprawdzającego

## STUDENT'S WORKLOAD

L.p.	Forms of activity	Average number of hours required for realization of activity
<b>1. Contact hours with teacher</b>		
1.1	Lectures	15
1.2	Tutorials	
1.3	Laboratory	15
1.4	Seminar	
1.5	Project	
1.6	Consulting teacher during their duty hours	1
1.7	Examination	
Total number of contact hours with teacher:		31
<b>2. Student's individual work</b>		
2.1	Preparation for tutorials and tests	10
2.2	Preparation for laboratory exercises, writing reports on laboratories	10
2.3	Preparation of project	
2.4	Preparation for final lecture assessment	10

2.5	Preparation for examination	
2.6	Individual study of literature	14
Total number of hours of student's individual work:		44
Overall student's workload:		75
<b>Overall number of ECTS credits for the module</b>		3
Number of ECTS points that student receives in classes requiring teacher's supervision:		1.24
Number of <b>ECTS</b> credits acquired during practical classes including laboratory exercises and projects :		1.1

### **BASIC AND SUPPLEMENTARY RESOURCE MATERIALS**

1. - C. Wohlin et al., Experimentation in Software Engineering, Springer, 2012
2. - E.R Khan et al., Research Methods of Computer Science, Laxmi Publications, 2015

### **MODULE COORDINATOR (NAME, SURNAME, DEPARTMENT, E-MAIL ADDRESS)**

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