1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Activation of application on computing cluster

Module code: 08-IN-IIN-S2-UANKO

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
UANKO _K_1	Student understands the need of constant education and is aware of responsibility for his own work and work of his team.	K_U02 K_U05	1 1
UANKO _K_2	Student should possess the skill to solve physical and technical problems independently, or in a team using acquired knowledge and practical skills.	K_U02	1
UANKO _U_1	Student can compile and activate application parallel on the computing cluster.	K_U13	1
UANKO _U_2	Student can create parallel tasks (distributed job). Performs problem graduation – activation of application on a cluster.	K_U03 K_U13	1 1
UANKO _W_1	Student has knowledge in the field of computing clusters and technology of their construction. Can discuss systems of files used in clusters, can compare clusters. Student knows the basic constructions in parallel programming.	K_W04 K_W07	1 1

3. Module description

Description	Aim of classes in this module is presenting the basic concepts of computing clusters functioning. The idea of computing cluster and difference of cluster and the idea of workstation are discussed. During the classes, the teacher explains clusters division according to their purpose and according to architecture. Features of cluster software are discussed.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
UANKO _w_1	Control tests	Checking level of preparation for work using the computing cluster.	UANKO _U_1, UANKO _U_2, UANKO _W_1
UANKO _w_2	Group project	Executing a project covering issue of activating application on the computing cluster.	UANKO _K_1, UANKO _K_2, UANKO _U_1, UANKO _U_2

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
UANKO _fs_1	laboratory classes	Detailed preparation of the students to solve tasks indicating procedure methodology, indicating sequence of proceedings.	30	Realization of the program in virtual environment at home or using the computers made available by the Department to students for individual work.	30	UANKO _w_1, UANKO _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Advanced algorithm and data structures

Module code: 08-IN-S2-ZAiSD

1. Number of the ECTS credits: 5

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZAiSD -K_10	Is aware of substantial importance of algorithm features (complexity, correctness) on which there are components constructed (modules, functions, procedures) of bigger software systems for final efficiency, operation correctness and security of these systems.	K_K01	1
ZAiSD -U_6	Can designate computational complexity of recurrent algorithms and record their complexity , e.g. in the form of recurrent equation and solve such an equation.	K_U01 K_U07 K_U08	1 1 1
ZAiSD -U_7	Can choose and implement an appropriate, basic or advanced paradigm of algorithm construction for solution of a given problem. Can justify his choice.	K_U12 K_U15	4 1
ZAiSD -U_8	Can choose and implement an appropriate text algorithm for a given problem taking into account requirements as to search time and memory consumption.	K_U12 K_U15	4 1
ZAiSD -U_9	Can choose and implement an appropriate algorithm for a given graph problem and design sufficient data structure representing problem modeling graph.	K_U12 K_U15	4 1
ZAiSD -W_1	Has knowledge in the field of advanced methods of determining the computational complexity of algorithms. Knows and understands classes of algorithms complexity.	K_W02 K_W03	1 2
ZAiSD -W_2	Has knowledge in the field of advanced paradigms of algorithms constructing, among others: exhaustive search, greedy strategies. Knows and understands basics of operation and advantages and disadvantages of these algorithms.	K_W09	4
ZAiSD -W_3	Has knowledge in the field of graph algorithms.	K_W02 K_W09	1 4

ZAiSD -W_4	Has knowledge in the field of text algorithms.	K_W09	4
ZAiSD -W_5	Has knowledge in the field of approximation algorithms.	K_W09	4

3. Module description	
Description	Aim is to introduce the student into advanced issues of algorithms, data structures and techniques of designing algorithms.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ZAiSD _w_1	Written exam	Verification of knowledge basing on content presented during lectures. Exam is composed of open theoretical questions and at least two tasks of content.	ZAiSD -K_10, ZAiSD -U_6, ZAiSD -W_1, ZAiSD -W_2, ZAiSD -W_3, ZAiSD -W_4, ZAiSD -W_5
ZAiSD _w_2	Reports credit	Elaborating reports in writing and their verbal crediting in a fixed time as a verification of skills acquired while problem solving.	ZAiSD -K_10, ZAiSD -U_6, ZAiSD -U_7, ZAiSD -U_8, ZAiSD -U_9

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ZAiSD _fs_1	lecture	Presenting educational content in verbal form with use of audio-visual aids and other written education aids. Focusing on issues difficult to understand and these with deeper theoretical bases. Elicitation of students by asking questions concerning presented content.	30	Exam preparation.	30	ZAiSD _w_1
ZAiSD _fs_2	laboratory classes	Detailed preparation of the students for solving tasks indicating proceeding methodology and proceedings sequence.	30	Laboratory class preparation. Individual solution of tasks given during the laboratory class, elaboration of reports.	60	ZAiSD _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Advanced methods of image processing and analysis

Module code: 08-IN-S2-ZMPiAO

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZMPiAO -K_6	Performs individual and team works.		
ZMPiAO -K_7	Demonstrates responsibility for tasks realized together in a team.	K_K01	1
ZMPiAO -U_4	Solves tasks covering image recognition.	K_U01	3
ZMPiAO -U_5	Classifies existing IT solutions: applications, algorithms, etc.	K_U05	1
ZMPiAO -W_1	Classifies knowledge in the field of mathematics and digital signal processing.	K_W01	1
ZMPiAO -W_2	Explains basic methods, techniques, tools and materials uses in image recognition	K_W08	2
ZMPiAO -W_3	Classifies information from literature and other sources referring to image recognition.	K_W15	2

3. Module description

Description	Content of the module: advanced methods of image processing and analysis requires assimilation and understanding of theoretical bases and acquiring practical skills of this knowledge use. Theoretical bases are, among others – assimilation and understanding of basic notions connected with the subject, acquiring aptitude to associate and use of the discussed issues. It is also the skill of sufficiently effective and fast finding of the required information in literature. Practical skills are gained through analysis of example algorithms and individual tasks solving. Thus, the module constitutes a link between theoretical knowledge, general examples and the skill of the chosen methods (issues) and knowledge profiling in practical use.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
ZMPiAO _w_1	Test	Within the module, three tests will be effected concerning subsequent stages of familiarizing with the module – neural networks, - distributed algorithms, - statistical methods. The student during all the three tests performs practical implementation of four given algorithms in Matlab environment.	ZMPiAO -W_1, ZMPiAO -W_2
ZMPiAO _w_2	Short test	Before classes, the student solves a given problem verifying assimilation of knowledge of the previous class.	ZMPiAO -U_4, ZMPiAO -W_2
ZMPiAO _w_3	Project	Within the module, three individual projects will be executed, which will refer to three basic sections: neural networks, distributed algorithms and statistical methods used in image recognition.	ZMPiAO -K_6, ZMPiAO -K_7, ZMPiAO -U_5, ZMPiAO -W_1, ZMPiAO -W_2, ZMPiAO -W_3
ZMPiAO _w_4	Credit	Credit in the form of test covering issues discussed during lectures and laboratory classes.	ZMPiAO -K_6, ZMPiAO -K_7, ZMPiAO -U_5, ZMPiAO -W_1, ZMPiAO -W_2, ZMPiAO -W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
ZMPiAO _fs_1	lecture	Discussing the basic methods of image recognition with special focus on methods using neural networks, distributed algorithms, statistical methods. Implementation of the chosen neural networks in Matlab software and execution of their accurateness verification. Creating a diagnostic pattern and discussing problems arising while comparing qualities of the obtained results. Implementation in Matlab software of the algorithm recognizing specific disease entities on the chosen image types.	15	Student's work with indicated field literature and lecture materials covering practical algorithms implementation and necessary theoretical bases. It concerns individual assimilation of the knowledge discussed during lecture.	15	ZMPiAO _w_2, ZMPiAO _w_3, ZMPiAO _w_4
ZMPiAO _fs_2	laboratory classes	The teacher, together with students analyzes algorithms discussed during lectures in practical implementation. The students individually solve the given problems referring to medical images recognition. During chosen classes, the student working in groups of three or four, obtains instructions to execute three projects.	30	Student is obliged to be prepared of theoretical knowledge acquired during lectures and present in gathered literature. Student executes three project tasks in a group, connected with practical algorithm implementation in Matlab software.	30	ZMPiAO _w_1, ZMPiAO _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Advanced object disigning

Module code: 08-IN-IJO-S2-ZPOB

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZPOB -K_5	Student can co-operate in a team while developing software and share his tasks with executive team.	K_U02	1
ZPOB -K_6	Student can report, evaluate and discuss the design patterns used and software architecture.	K_K01 K_K04	1 1
ZPOB -U_3	Student can develop software using design patterns and cover the ready code with unit tests.	K_U05 K_U12 K_U13	1 1 1
ZPOB -U_4	Student can differentiate software architecture and use it as well as write his own concept of software architecture.	K_U12 K_U15	1 1
ZPOB -W_1	Student has knowledge in the field of advanced object programming together with standardized and non-standardized design patterns.	K_W06 K_W09 K_W10	1 1 1
ZPOB -W_2	Student has knowledge in the field of software architectures, unit tests and creating libraries supporting software, e.g. in automatic conversion of tables record into object model.	K_W06 K_W10 K_W12	1 1 1

3. Module description

Description	

	Aim of the classes described in this module is familiarizing the students with issues of object programming at advanced level. Lectures topics are based on object patterns, software architectures and examples of their use. Also discussed is unit testing. Laboratory classes concentrate on analyses of popular solutions and attempt at developing own software architecture. As a result, the students learn the newest trends in software development and will develop more complex programming solutions at faster pace.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ZPOB _w_1	Project implementation	Realization of the agreed project thematic in the form taking advantage of author's model of software architecture. The project has to use the chosen design patterns of the ones learned during classes. The project has to be complete together with user interface.	ZPOB -K_5, ZPOB -K_6, ZPOB -U_3, ZPOB -U_4, ZPOB -W_1, ZPOB -W_2
ZPOB _w_2	Documentation	Presenting project documentation concentrated on use of patterns and software architectures.	ZPOB -K_5, ZPOB -U_4, ZPOB -W_1, ZPOB -W_2
ZPOB _w_3	Control tests	Partial programs checking the knowledge of the discussed software architecture models and design patterns.	ZPOB -K_6, ZPOB -U_3, ZPOB -W_1

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ZPOB _fs_1	lecture	Presenting educational content in verbal form, with use of content visualization. Presenting theoretical and practical issues connected with software architecture models, unit testing and design patterns.	0	Familiarizing with issues presented during lectures sand preparation for laboratory class connected with lectures.	0	ZPOB _w_1, ZPOB _w_2
ZPOB _fs_2	laboratory classes	Detailed discussing of developing software architecture together with acquiring knowledge of built-in supporting libraries mechanisms. Discussing on the examples of unit tests and design patterns.	30	Detailed familiarization with programs discussed during laboratory classes and project execution. Complete execution of programming project according to division of responsibilities agreed by the group.	15	ZPOB _w_1, ZPOB _w_2, ZPOB _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Advanced object oriented programming

Module code: 08-IN-IJO-S2-ZPO

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZPO -K_7	Can work in team of two and executes proper work division.	K_U02	1
ZPO -U_4	Can create application according to pattern “model-view=controller” and its variations.	K_U12 K_U15	2 1
ZPO -U_5	Knows principles concerning software testing and can use automated mechanisms of testing in the process of software developing.	K_U02 K_U03 K_U14 K_U19	2 1 1 1
ZPO -U_6	Has knowledge about ways of dependency injection and is able to use them in the developed software.	K_U12	1
ZPO -W_1	Has knowledge about parameterized types and reflection mechanisms in the chosen programming languages.	K_U13 K_W06	1 2
ZPO -W_2	Can indicate advantages and disadvantages of inheritance in object programming as well as advantages and disadvantages of composition as alternative to inheritance.	K_W06 K_W10	3 1
ZPO -W_3	Has knowledge about basic design patterns and their use in the created software.	K_W06 K_W10	2 1

3. Module description

Description	

	The aim is to present the students with the chosen issues concerning object programming at advanced level. Especially, the presented methods aim at facilitating designing and implementation of complex IT systems thanks to modern object programming languages.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ZPO_w_1	Control tests	Test checking level of knowledge referring to content presented during lectures and laboratory classes.	ZPO -U_4, ZPO -U_5, ZPO -U_6, ZPO -W_1, ZPO -W_2, ZPO -W_3
ZPO_w_2	Design implementation	Evaluation of the completed application design executed in object technology, especially with use of design patterns. The grade takes into account correctness and level of developed software complexity.	ZPO -K_7, ZPO -U_5, ZPO -U_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ZPO_fs_1	lecture	Presenting educational content in verbal form, with use of content visualization. Discussing the chosen theoretical issues concerning object programming at advanced level.	15	Familiarizing with content presented during lectures and preparing for laboratory classes connected with the lectures.	2	ZPO_w_1
ZPO_fs_2	laboratory classes	Preparing the students for practical use of the presented issues concerning object programming.	30	Solving tasks of subsequent topics together with analysis of the already existing solutions. Executing programming project using methods presented during lectures.	13	ZPO_w_1, ZPO_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Advanced programming techniques

Module code: 08-IN-BIO-S2-ZTP

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZTP -U_3	Extracts information from literature, Internet resources and from other sources ; uses advanced algorithms including these using artificial intelligence.	K_U01 K_U16	1 2
ZTP -U_4	Can use software supporting programmer’s work, such as integrated programming environments, code repositories, debuggers, etc.	K_U20	4
ZTP -U_5	Can work in a several person team and divides work appropriately.	K_U02	1
ZTP -W_1	Revives knowledge in the field of network and concurrent programming, operating streams and files and advanced algorithms.	K_W07 K_W18	3 1
ZTP -W_2	Has basic knowledge in the field of software testing at the implementation stage.	K_W10	3

3. Module description

Description	Aim of classes in this module is preparing the students to independent implementation of the chosen algorithms in a possibly most effective way with use of generally accepted good practices. This involves assimilation of knowledge about design patterns and obtaining skills of practical use in appropriate conditions. Moreover, the students have to know programmer’s workshop, which is composed of multiple tools used as well for programs development, as for testing. The aim of classes in this module is also preparing the students for concurrent programming and familiarizing them with restrictions and problems connected with it. Subjects of the classes are also streams, methods of data processing by streams, files co-operation and application internationalization. The students take advantage of knowledge and skills obtained during the previous module, developing skills of unit tests used in the programmers work and co-operation in several person group in works with code.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
ZTP _w_1	Test	Checking the skill of programming at the computer.	ZTP -U_3, ZTP -U_4, ZTP -U_5, ZTP -W_1, ZTP -W_2

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
ZTP _fs_1	laboratory classes	Preparing the students to take advantage of advanced programming techniques and presenting design patterns on examples. Solving advanced programming tasks.	45	Individual preparation for laboratory classes and applications implementation.	15	ZTP _w_1

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Artificial intelligence algorithms

Module code: 08-IN-ISI-S2-ASI

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ASI -U_5	Can design IT systems supported by artificial intelligence algorithms.	K_U08 K_U16 K_U17	2 1 2
ASI -U_6	Is able to calculate the degree of membership in a diffused series and to correctly identify certain type of membership function taking advantage of mathematical notation	K_U08 K_U17	1 2
ASI -U_7	Can use naïve Bayes classifier and k?nearest neighbors algorithm for defined problems at given limitations.	K_U08 K_U16 K_U17	1 2 1
ASI -W_1	Possesses basic knowledge from the field of artificial intelligence algorithms	K_W08	5
ASI -W_2	Has basic knowledge from the field of diffused logics, knows basic logic operations in reference to diffused series and differentiates basic types of membership functions.	K_W08	3
ASI -W_3	Possesses basic knowledge from the field of machine learning (chosen methods of controlled and uncontrolled learning)	K_W08 K_W18	2 2
ASI -W_4	Possesses basic knowledge from the field of genetic algorithms	K_W08	1

3. Module description

Description	The aim of classes in this module is making student familiar with chosen techniques and methods of artificial intelligence, with special emphasis on classification methods. Another important aspect undertaken during the module is concluding making use of diffused logics, when input concepts are not

	directly and unambiguously defined. Moreover, the student gets knowledge and skills from the field of neural networks, which can be used to solve complex optimization tasks or to context recognition.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ASI _w_1	Exam	The goal is to verify theoretical knowledge gained during lectures and practical skills gained during laboratory classes. The exam in the form of test includes variety of closed multiple? choice question and practical tasks.	ASI -W_1, ASI -W_2, ASI -W_3, ASI -W_4
ASI _w_2	Control tests	Tests after presentation of subsequent techniques or group of issues concerning artificial intelligence.	ASI -U_5, ASI -U_6, ASI -U_7
ASI _w_3	Group reports	Use of the acknowledged artificial intelligence methods to classification tasks or in the process of concluding, taking advantage of data acquired from repository: Machine Learning Repository, or artificially generated by the student.	ASI -U_5, ASI -U_6, ASI -U_7, ASI -W_1, ASI -W_2, ASI -W_3, ASI -W_4

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ASI _fs_1	lecture	Providing content of education in verbal form, using content visualization. Concentrating on conceptually difficult issues.	10	Familiarizing with subject of the lecture.	10	ASI _w_1
ASI _fs_2	laboratory classes	Detailed preparation to solve problems stressing methodology of proceedings, pointing sequence of proceedings. Solving tasks of content. Quizzes and multiple choice tests together with group discussion over possible answers.	20	Solving tasks from subsequent topics together with analyses of the existing solutions (available on the teacher's websites). Applying knowledge concerning artificial intelligence, gained during lectures and laboratory classes, on the basis of data generated by students, which allows its ordering.	20	ASI _w_2, ASI _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Automation in the process of software development

Module code: 08-IN-IJO-S2-AwPTO

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
AwPTO -K_7	Student is able to refer his work referring to software testing, assess his own mistakes and present the ways to correct them.	K_K01 K_K04	1 1
AwPTO -U_4	Student can assess automated tests resistance to changes and as a result, their maintenance.	K_U10 K_U12	1 1
AwPTO -U_5	Student can use tools to distributed testing and understands how they work.	K_U01 K_U05 K_U09	1 1 1
AwPTO -U_6	Student can use regular expressions.	K_U12 K_U13	1 1
AwPTO -W_1	Student has grounded knowledge in the field of well designed and implemented unit test.	K_W01	1
AwPTO -W_2	Student has knowledge referring to patterns Given-When-Then and Arrange-Act-Assert in unit tests implementation.	K_W06	1
AwPTO -W_3	Student has grounded knowledge about test class in unit tests and about use of its elements.	K_W10	1

3. Module description

Description	Aim of the classes in this module is familiarizing the students with the issue of unit testing and explaining problems arising during testing. During the class, there will be presented issues facilitating constructing own unit tests and examples of so called, Behavior Driven Development and the issue of specification by examples.

Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
AwPTO _w_1	Test	Solving tasks of content and test solving which refers to theoretical questions.	AwPTO -K_7, AwPTO -U_4, AwPTO -W_1, AwPTO -W_2, AwPTO -W_3
AwPTO _w_2	Practical project	Grade on the basis of project and tested unit tests.	AwPTO -U_4, AwPTO -U_5, AwPTO -U_6, AwPTO -W_1, AwPTO -W_2, AwPTO -W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
AwPTO _fs_1	lecture	Presenting educational content in verbal form, using content visualization. Presenting theoretical and practical issues connected with the subject.	15	Familiarizing with subject matter presented during the lecture and preparation to laboratory class connected with the lecture.	15	AwPTO _w_1
AwPTO _fs_2	laboratory classes	Detailed fine-tuning of elements connected with testing and automation during testing process. Analysis of the unit tests and their preparation.	30	Detailed analysis of the unit tests, elaborating and testing the chosen tests.	30	AwPTO _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Basics of biometric systems development

Module code: 08-IN-S2-PPSB

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PPSB _K_7	Student understands the need for constant education and is aware of his responsibility for his own work and the work of his team.		
PPSB _K_8	Student should possess the skill of individual and team solving of physical and technical problems taking advantage of the acquired knowledge and practical skills.		
PPSB _U_4	Student can implement a complete process of biometric data analysis.	K_U12	1
PPSB _U_5	Student can use the chosen computational tools to analyze biometric data. Student is able to use the chosen devices used in issues of biometric verification and identification.	K_U08 K_U14 K_U18	1 1 1
PPSB _U_6	Student can elaborate and present materials concerning specific biometric issues in the form of a report and presentation. Student can prepare complete project documentation.	K_U04	1
PPSB _W_1	Student possesses knowledge in the field of biometric identification and verification.	K_W08 K_W19 K_W20	1 1 1
PPSB _W_2	Student has knowledge in the field of biometric data acquisition and processing.	K_W08 K_W15	1 1
PPSB _W_3	Student knows operation of the chosen methods and algorithms used for biometric verification and identification.	K_W03 K_W09	1 1

3. Module description	
Description	Aim of the subject is introduction into biometrics. During the classes, the basics of digital image processing, biometric systems operation and the methods of acquisition, processing and classification of physical and behavioural biometrics will be discussed.
Prerequisites	brak

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PPSB _w_1	Control tests	Checking the level of knowledge concerning the chosen biometric features, their analysis and recognition. Evaluation of biometric systems development skills.	PPSB _U_4, PPSB _U_6, PPSB _W_1, PPSB _W_2, PPSB _W_3
PPSB _w_2	Group project	Elaborating a project covering biometric system development basing on the project assumptions.	PPSB _K_7, PPSB _K_8, PPSB _U_4, PPSB _U_5, PPSB _U_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PPSB _fs_1	lecture	Presenting educational content in verbal form, using content visualization. Focusing on conceptually complex material and indicating websites addresses and e-learning package.	15	Familiarizing with lecture content using the existing methods package: script and websites and e-learning package.	10	PPSB _w_1
PPSB _fs_2	laboratory classes	Detailed preparation of the students to solve tasks with indicating methodology and sequence of proceedings.	30	Realization of program at home or using computers made available by the Institute for their own work.	35	PPSB _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Computational geometry

Module code: 08-IN-GWK-S2-GO

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
GO -K_7	Can work individually and in a team.	K_U02	1
GO -K_8	Can think and act creatively.	K_K03	1
GO -U_4	Can implement the learned algorithms in the chosen programming language.	K_U07 K_U08 K_U12	1 1 1
GO -U_5	Can obtain information about computational geometry from literature, databases and other sources.	K_U01 K_U05 K_U06	1 1 1
GO -U_6	Can prepare and present a paper on execution of project task.	K_U02 K_U03 K_U04	1 1 1
GO -W_1	Knows and understands mathematical notions used in computational geometry, especially: vector product, scalar product, convex hull, Voronoi diagram.	K_W01	1
GO -W_2	Knows and understands basic algorithms used in computational geometry.	K_W02	1
GO -W_3	Knows and understands basic principles of geometrical algorithms creating.	K_W02	1

3. Module description	
Description	Aim of the classes is familiarizing the students with foundations of computational geometry. Geometric problems occurring in practice, e.g. in robotics, GIS systems, computer games will be presented as well as ways of their effective solving (algorithms, and dedicated data structures). During the course, the students will prepare projects in teams of maximum two and present results of their work in the form of presentation in front of the group.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
GO _w_1	Project	Preparing the project and presentation of the chosen topic connected with computational geometry.	GO -K_7, GO -K_8, GO -U_4, GO -U_5, GO -U_6, GO -W_1, GO -W_2, GO -W_3
GO _w_2	Reports	Solving sets of tasks.	GO -K_7, GO -K_8, GO -U_4, GO -W_1, GO -W_2, GO -W_3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
GO _fs_1	lecture	Presenting educational content in verbal form, using content visualization. Presenting theoretical and practical issues connected with the subject.	10	Independent preparation for the lectures.	10	GO _w_1, GO _w_2
GO _fs_2	laboratory classes	Detailed preparation of the students to use of geometry algorithms in practice. Solving programming tasks.	20	Familiarizing with subject of the laboratory. Solving tasks from subsequent topics. Familiarizing with subject of the project and preparing it in a team. Preparing a presentation of the project.	20	GO _w_1, GO _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Computer graphics and multimedia

Module code: 08-IN-BIO-S2-GKiM

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
GKiM -K_6	Calculates and interprets discreet signals parameters.		
GKiM -K_7	Performs individual and team works.	K_K01	1
GKiM -U_4	Solves tasks covering the range of signals processing.	K_U01	1
GKiM -U_5	Justifies obtained results.	K_U05	2
GKiM -U_8	Programs and activates programs in Matlab package.	K_U01	4
GKiM -W_1	Differentiates and classifies signals.	K_W01	2
GKiM -W_2	Explains basic methods, techniques, tools and materials used in signals processing.	K_W03 K_W08	2 2
GKiM -W_3	Classifies literature data and other information from various sources referring to signals analysis.	K_W15	1

3. Module description

Description	Material from the module: Computer Graphics and Multimedia requires knowledge and understanding of theoretical bases and gaining practical skills of this knowledge use. Theoretical bases are mostly assimilation and understanding of basic notions connected with the subject, acquisition of associating skills and using the discussed issues. It is also the skill of sufficiently effective and fast finding of the required information in literature. Practical skills are acquired by analysis of the example algorithms and independent tasks solving. Thus, the module constitutes a connection between theoretical knowledge, general examples and the skill of the chosen methods (issues) profiling in practical use.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
GKiM _w_1	Test	Within the module, three tests will be effected, which will refer to subsequent stages of module assimilation: - definitions, signals classifications, Fourier series and signals frequency analysis; - parametrical and non-parametrical window functions and FIR and IIR filters; - advanced methods of signals frequency analysis. During all the tests, the student performs practical implementation of 4 given algorithms in Matlab environment.	GKiM -K_6, GKiM -U_4, GKiM -U_5, GKiM -U_8, GKiM -W_1, GKiM -W_2
GKiM _w_2	Short test	Before classes, the student solves the given problem verifying assimilation of knowledge from the previous class.	GKiM -U_4, GKiM -W_1, GKiM -W_2
GKiM _w_3	Project	Within the module, three independent projects will be executed by the student which will be connected with three major sections: Fouries series, FIR filters and advanced frequency analysis.	GKiM -K_6, GKiM -K_7, GKiM -U_5, GKiM -U_8, GKiM -W_1, GKiM -W_2, GKiM -W_3
GKiM _w_4	Credit	Credit in the form of a test covering issues discussed during lectures and laboratory classes.	GKiM -K_6, GKiM -K_7, GKiM -U_4, GKiM -U_5, GKiM -U_8, GKiM -W_1, GKiM -W_2, GKiM -W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
GKiM _fs_1	lecture	Presenting methods of digital signals analysis and processing in Matlab software with special emphasis on their practical implementation. Discussing definitions and signals classification, ways of their representation, Fourier series, frequency parametrical and non-parametrical window functions, FIR and IIR digital filters and advanced methods of signals analysis.	15	Students' work with indicated literature of subject and lecture materials covering practical implementation of algorithms and necessary theoretical foundations. The work is individual assimilation of knowledge discussed during lectures.	5	GKiM _w_4
GKiM _fs_2	laboratory classes	The teacher analyzes together with students algorithms and signals analysis methods in practical implementation, which were discussed during lectures. The students individually solve the given problems from the range of signals analysis.	45	Student is obliged to be prepared by assimilating theoretical knowledge presented during the lecture and by reading literature. Student executes in a team three project tasks connected with practical implementation of the signals analysis algorithm in Matlab software.	25	GKiM _w_1, GKiM _w_2, GKiM _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Computer systems security

Module code: 08-IN-BIO-S2-BSK

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
BSK -U_3	Can independently fill the knowledge gaps, use and understand example solutions presented in the form of application source code.	K_U01	1
BSK -U_4	Can construct algorithm solving a given algorithmic problem and record it in the chosen programming language.	K_U12	2
BSK -U_5	Can practically use methods and techniques of security implemented and learned during classes.	K_U18	2
BSK -W_1	Understands problem of security in IT systems, knows methods of protection of certain elements in IT system.	K_W20	2
BSK -W_2	Understands basic programming principles enabling implementation of the indicated solutions in the chosen programming language.	K_W06	1

3. Module description

Description	Aim of the class is familiarizing the students with typical kinds of protection used in modern computer systems. Techniques connected with data security, functionality and communication between computer system elements will be presented. The issues will cover the chosen methods of data encoding, application signing, defining authorization and the right to application. Typical mechanisms of authentication, authorization and integrity will be discussed.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
BSK _w_1	Control tests	Written tests (including performed with use of computer during classes).	BSK -U_3, BSK -U_4, BSK -U_5, BSK -W_1, BSK -W_2

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
BSK _fs_1	laboratory classes	Detailed preparation of the students to solve tasks, indication of proceedings methodology, sequence of proceedings. Designing algorithms and their computer implementation.	45	Solving tasks of subsequent topics together with analysis of the already existing solutions in the script or on websites. Revision of material discussed during lectures and exercised during laboratory classes.	15	BSK _w_1

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Concurrent programming

Module code: 08-IN-IJO-S2-PW

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PW_1	He knows and can use mechanisms such as thread, atomic variable and atomic instruction, semaphore, monitor in the implementation of concurrent programs.	K_U12 K_W06	2 2
PW_2	Can decompose the problem in question into components that allow for the development of a parallel algorithm.	K_U12 K_W06	2 2
PW_3	Has knowledge about parallel computing models.	K_U12 K_W06	1 3
PW_4	Can evaluate the efficiency of parallel algorithms using basic measures such as speedup, cost and efficiency. Can assess the speedup under the laws of Amdahl and Gustavson.	K_W07 K_W09	1 1
PW_5	Has knowledge about GPU architecture and tools facilitating the development of dedicated software.	K_K01 K_W04 K_W07 K_W15	2 2 2 1
PW_6	Has knowledge of communication patterns and typical group operations in parallel programs with a special focus on the GPU. He knows parallel algorithms such as reduction, prefix sum, histogram, and sorting algorithms.	K_U12 K_W06	1 3
PW_7	Can solve the problem of mutual exclusion in a distributed environment, and implement a distributed handshake algorithm.	K_U12 K_W13	1 1
PW_8	Can work in the team of two and properly divides work.	K_K01	1

		K_U02	1

3. Module description	
Description	Aim of the class is preparing the students to design and implement correct and efficient concurrent algorithms with special focus on programmable GPU and parallel processors with distributed memory. During the class the students will acquire knowledge about tyical problems connected with designing correct and efficient parallel programs and methods of solving them. Additionally, the students will gain necessary knowledge concerning basics of efficient parallel algorithms designing.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PW _w_1	Control test	At least one test checking knowledge of lecture content and realized during laboratory classes.	PW_1, PW_2, PW_3, PW_4, PW_5, PW_6, PW_7
PW _w_2	Projekt programistyczny	Programming project/projects realization allowing to verify practical knowledge and skills concerning concurrent programming, special emphasis put on GPU programming and processors with distributed memory.	PW_5, PW_6, PW_7, PW_8
PW _w_3	Exam	Test composed of multiple choice questions and open tasks concerning topics discussed during lectures and laboratory classes.	PW_1, PW_2, PW_3, PW_4, PW_5, PW_6, PW_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PW _fs_1	lecture	Presenting educational content in verbal form with use of content visualization. Discussing important theoretical and practical issues referring to concurrent programming, with special attention to parallel programming.	15	Familiarizing with content presented during lectures, including compulsory reading and additional reading.	15	PW _w_1
PW _fs_2	laboratory classes	Detailed preparation of the students to create concurrent applications in modern programming languages. Presentation and discussion over tools supporting concurrent software realization.	30	Solution of practical tasks of subsequent topics together with analysis of the already existing solutions. Effecting programming project using the methods presented during lectures.	30	PW _w_2, PW _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Configuration and administration of hybrid networks

Module code: 08-IN-IIN-S2-KiASH

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
KiASH -K_8	Can define non-technical aspects of the proposed solution and its impact on company performance.	K_K02 K_K03	1 1
KiASH -U_4	Adapts network architecture to the defined demands and services.	K_W09	1
KiASH -U_5	Can skillfully connect multiple architectures and network protocols in an efficient hybrid network.	K_U08 K_U14	1 1
KiASH -U_6	Administers hybrid network and is able to find bottlenecks.	K_U14	1
KiASH -U_7	Can work in a small team preparing a network design, skillfully presents it and is able to defend the worked out solutions.	K_U01 K_U02 K_U04	1 1 1
KiASH -W_1	Characterizes basic topologies, network protocols and is able to indicate their utility.	K_W02 K_W11 K_W19	1 1 1
KiASH -W_2	Describes basic network devices present in hybrid networks.	K_W11 K_W13	1 1
KiASH -W_3	Possesses knowledge concerning architecture and ways of constructing hybrid networks and understands processes occurring at the interface of two networks.	K_W11 K_W13 K_W14	1 1 1

3. Module description

Description	Aim of the module is familiarizing with the field of hybrid networks, their topology, protocols used for data transfer and methods of adapting network structure to timely requirements. The student constructs and configures his own hybrid networks choosing available network devices. Administers the networks ensuring their stable work.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
KiASH _w_1	Credit test	Checking the level of assimilation and understanding of the studied material concerning used hybrid typologies, operation of protocols at the network interfaces and possible practical uses.	KiASH -W_1, KiASH -W_2, KiASH -W_3
KiASH _w_2	Project	Checks practical skills acquired during solving tasks in groups of two and ability to present and defend the proposed solution.	KiASH -K_8, KiASH -U_4, KiASH -U_5, KiASH -U_6, KiASH -U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
KiASH _fs_1	laboratory classes	Exercises in the form of tasks to solve, with use of simulators and network devices. The classes are preceded by substantive introduction and discussion over possible solutions.	30	Searching for information covering classes content in databases, studying the prepared e-learning course and students' own work with network stimulators to elaborate the project.	60	KiASH _w_1, KiASH _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Data analysis in business

Module code: 08-IN-ISI-S2-ADwB

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ADwB -U_3	Student can obtain information from literature, databases and other properly selected sources, can integrate the information obtained, interpret them, draw conclusions and formulate and justify the opinions.	K_U01	2
ADwB -U_4	Student can provide a mathematical description of a selected technical indicator for data analysis.	K_U07	1
ADwB -U_5	Student can use the available programs to perform data exploration.	K_U17 K_U21	4 1
ADwB -W_1	Student has knowledge of average measure, measure of variability and measure of asymmetry to perform descriptive analysis of business data. The student uses issues of interdependence analysis and correlation and regression analyses to study dependencies occurring in business data.	K_W03	2
ADwB -W_2	Student is knowledgeable about preliminary data preparation and application of classifier k nearest neighbors, naive Bayesian classifier, classifier classification and regression classifier, neural networks, basket analysis and data analysis sequences.	K_W17	4

3. Module description

Description	Analysis of business data aims at developing skills of using statistical population characteristics and constructing and using data mining for data analysis. The goal of the subject is also perfecting the knowledge of classic and modern techniques of data analysis on the example of financial data. The following topics are planned to realize: 1. Gathering, development and graphic presentation of data. 2. Elements of business data descriptive analysis. 3. Analysis of phenomena interdependence, correlation and regression. 4. Use of technical and fundamental analyses for financial data analysis. 5. Use of issues connected with Fibonacci and Pivot levels.

	6. Use of neural networks for business data analysis. Aim of the classes is educating students' skills of using the most important methods used in data mining.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ADwB _w_1	Continuous assessment	Verifying according to answers to the asked questions concerning lectured topics and knowledge of homeworks solutions	ADwB -U_3, ADwB -U_4, ADwB -U_5, ADwB -W_1, ADwB -W_2
ADwB _w_2	Written tests	Verification of skills on the basis of solved tasks analysis during written tests with use of computer.	ADwB -U_3, ADwB -U_4, ADwB -U_5, ADwB -W_1, ADwB -W_2
ADwB _w_3	Written elaboration	Skills verification through written elaboration of the material connected with performing data set analysis and interpretation of obtained results	ADwB -U_3, ADwB -U_4, ADwB -U_5, ADwB -W_1, ADwB -W_2

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ADwB _fs_1	lecture	Lecture presenting notions and facts from the range of program content mentioned in module description and illustrating the content with numerous examples	10	Independent study of lectures and ancillary literature indicated in the syllabus	10	ADwB _w_1, ADwB _w_2, ADwB _w_3
ADwB _fs_2	laboratory classes	A laboratory where students perform exercises with skill-building exercises listed in the module learning outcomes.	20	Self-improvement skills listed in the effects set	20	ADwB _w_1, ADwB _w_2, ADwB _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Data base programming

Module code: 08-IN-ISI-S2-PBD

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PBD _K6	Student is able to work on solving the problem on his own and in a team. Student can present the results of his work	K_K01 K_U02	1 1
PBD _U4	Student Can design and implement IT using technology depending on the type and volume of data needed to store in the database.	K_U12 K_U13 K_U14 K_U19	2 2 2 1
PBD _U5	Student can implement database queries in various tools and languages.	K_U12 K_U13 K_U14 K_U19	1 1 1 1
PBD _W1	Has knowledge in the field of creating advanced commands in SQL, has knowledge of programming in PL/SQL. Knows principles of query optimization and refactoring of data bases.	K_W06 K_W09 K_W10 K_W14	1 2 2 1
PBD _W2	Student has knowledge in the field of semantic data modeling in accordance with the principles of XML.	K_W06 K_W09 K_W10 K_W14	1 1 1 1

PBD _W3	Has knowledge in the field of designing and implementing data bases different than relational (NoSQL).	K_W06 K_W09 K_W10 K_W14	1 1 1 1

3. Module description	
Description	The module's goal is to teach the student to develop software that provides complete communication with relational architecture databases and so-NoSQL. The challenge is to create systems that use different platforms and programming standards. Emphasis will be placed on the use of databases, depending on the type of data - structural, semistructural and nonstructural - and the creation of applications created in different programming languages, including Java. Student will prototype the application.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PBD _w_1	Reports (documentation of the performed tasks)	Students' task will be preparing the documentation containing description of the exercises performed during laboratory classes.	PBD _K6, PBD _U4, PBD _U5, PBD _W1, PBD _W2, PBD _W3
PBD _w_2	Discussion with assesement	In order to select and work out the best solutions accepted by the group in the classes will be conducted discussions in the form of so. brainstorming during which the facilitator will have the opportunity to observe and evaluate the knowledge and involvement of students.	PBD _K6, PBD _U4, PBD _U5, PBD _W1, PBD _W2, PBD _W3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PBD _fs_1	lecture	Presenting contents of the module in the verbal form, discussing modeling principles, presenting typical problems and methods of their solving, debate over possible variants of solutions. Discussing the most important trends and solutions suggested all over the world.	10	Deepening the content delivered verbally by analyzing additional content provided through the module's website and other portals indicated.	10	PBD _w_1
PBD _fs_2	laboratory classes	Systematic development of skills and competences in the field of modeling under surveillance and support of teachers, basing on the knowledge gained. Discussion over the prepared projects.	20	Implement projects that develop skills and competencies in programming and group work. Group participation, module discussion, individual and group consultations.	20	PBD _w_1, PBD _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Data mining

Module code: 08-IN-ISI-S2-ED

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ED _K_10	Is able to formulate opinions on various issues concerning current state and developmental trends in analysis and data mining.	K_K01	2
ED _K_9	Can work on various tasks and realize them on time; knows how to co-operate in several persons team, undertaking different roles.	K_U02	1
ED _U_5	Can acquire information from literature, data bases and other appropriately chosen sources, also in English in the field of data mining; can integrate obtained information, perform critical analysis and evaluation and also, draw conclusions and formulate opinions.	K_U01 K_U17	3 2
ED _U_6	Is able to identify and formulate specification of tasks from the field of data mining; can differentiate main stages in discovering knowledge from data.	K_U17	5
ED _U_7	Can choose appropriate methods of data mining and choose algorithms solving the given problem. Is able to evaluate the obtained results (patterns).	K_U03 K_U17 K_U21	1 5 1
ED _U_8	Is able to take advantage of available programs in order to perform analysis process.	K_U02 K_U17	1 5
ED _W_2	Knows main methods of data mining including: discovering association, classification (prediction), grouping, singular points discovering. Knows fields of various data mining methods usage.	K_W03 K_W09 K_W17	1 1 5
ED _W_3	Knows software used in data mining.	K_W09 K_W17	1 5

ED _W_4	Possesses knowledge of developmental trends and most important new achievements in the field of discovering knowledge from data.	K_W14 K_W17	2 5
ED_W_1	Has knowledge from the field of basic notion of data mining and discovering knowledge from data.	K_W17	5

3. Module description	
Description	The purpose of this module is to prepare students to use various methods (algorithms) in data mining, used in practice, implemented in different systems (programs) supporting the process of knowledge discovery from data. This allows the student to demonstrate a full understanding of the subject matter of data mining, in particular he should know the role of data mining in the process of acquiring knowledge from the data. The result will be the ability to use the most important methods used in data mining. Student should be able to select the appropriate algorithms for a specific data analysis task. In order to be able to efficiently perform the data mining process, software is needed to support this process. As a result, the student should use the data mining programs without problems, with special attention paid to the programs distributed free of charge, RapidMiner, RSES and Weka.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ED _w_1	Written test in lecture knowledge	Assessment of the student's knowledge of the content of lectures through the solution of the test	ED _W_2, ED _W_3, ED _W_4, ED_W_1
ED _w_2	Preparing projects/programs	Preparing a project/program in a group of 1-3 students, which realizes the process of discovering knowledge from data, taking advantage of available programs.	ED _K_10, ED _K_9, ED _U_5, ED _U_6, ED _U_7, ED _U_8, ED _W_2, ED _W_3, ED _W_4, ED_W_1
ED _w_3	Reports	Preparation of project reports, describing the results obtained and sending them electronically within a specified time frame	ED _K_10, ED _K_9, ED _U_5, ED _U_6, ED _U_7, ED _W_2, ED _W_3, ED_W_1

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ED _fs_1	lecture	Giving educational content orally, with use of content visualization. Drawing attention to material conceptually complex and indicating additional material.	10	Familiarizing with topic of the lecture, taking advantage of: lectures electronic version, websites, recommended literature.	20	ED _w_1
ED _fs_2	laboratory classes	Designed for students' detailed preparation to realize assigned projects indicating methodology of proceedings, pointing the sequence of performed activities.	20	Preparation for laboratory class Individual projects preparation, effecting reports on the realized projects and sending them on the fixed time.	40	ED _w_2, ED _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Data warehouses

Module code: 08-IN-ISI-S2-HD

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
HD _K5	Can work over a problem solution individually and in a team. Can present results of his work.	K_K01 K_U02	1 1
HD _U4	Can develop and implement an IT system (data warehouse) using technology according to type and volume of data necessary to store in the base.	K_U12 K_U13 K_U14 K_U19	2 2 2 1
HD _W1	Has knowledge in the field of data warehouses architecture, advanced SQL commands used in data warehouses implementation.	K_W06 K_W09 K_W10 K_W14	1 2 2 1
HD _W2	Has knowledge in the field of chips modelling and semi-structural data according to XML language.	K_W06 K_W09 K_W10 K_W14	1 1 1 1
HD _W3	Has knowledge of development and implementation of other than relational data models (NoSQL) ensuring gathering unstructured data.	K_W06 K_W09 K_W10 K_W14	1 1 1 1

3. Module description

Description	The goal of the module is to teach the student to design and implement a data warehouse that holds different types of data. The challenge is to create systems that use different platforms and programming standards. Emphasis will be placed on the use of tools according to the type of data - structural, semistructural and nonstructural. Student will prototype the application.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
HD _w_1	Reports (documentation of the performed tasks)	Students will be required to complete documentation including a description of the exercises they are doing in the lab. Programming tasks in SQL, PL / SQL, Java (other languages are also possible).	HD _K5, HD _U4, HD _W1, HD _W2, HD _W3
HD _w_2	Discussion	In order to select and work out the best solutions accepted by the group in the classes will be conducted discussions in the form of so. brainstorming during which the facilitator will have the opportunity to observe and evaluate the knowledge and involvement of students.	HD _K5, HD _U4, HD _W1, HD _W2, HD _W3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
HD _fs_1	lecture	Presenting module content in verbal form, discussing modelling principles, presentation of typical problems and solutions, discussing possible solution variant. Explaining the most important trends and solutions suggested all over the world.	10	Deepening of the verbally presented content with analysis of additional materials available on module website and other indicated portals.	10	HD _w_1, HD _w_2
HD _fs_2	laboratory classes	Systematic development of skills and competences in the field of modleing under supervision and with support of the teachers basing on the knowledge acquired. Discussing the executed projects.	20	Realization of projects developing skills and competences in the field of programming and teamwork. Participation in the group, discussion on the module forum.	20	HD _w_1, HD _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Decision support systems

Module code: 08-IN-ISI-S2-SWD

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
SWD -U _7	Can construct decision support systems on the Genie platform basing on the Bayes simple and dynamic networks, can implement a decision support system in Java language, using SMILE library.	K_U12 K_U16 K_U17	1 2 1
SWD -U _8	Can construct complex decision support systems realized with use of KNIME package, including time series prediction.	K_U12 K_U16 K_U17	1 2 1
SWD -W _2	Possesses basic knowledge in the field of utility theory, use of deterministic criteria (by Hurwicz, Laplace) and non-deterministic ones (e.g. maximum of expected utility) in decision support systems.	K_W18	1
SWD -W _3	Has basic knowledge in the field of Bayes networks and their use in decision support systems.	K_W08 K_W18	1 2
SWD -W _4	Has basic knowledge in the field of decision rules and their use in decision support systems.	K_W18	1
SWD -W _5	Possesses basic knowledge in the field of sequence patterns and their use in decision support systems.	K_W18	1
SWD -W _6	Possesses basic knowledge in the field of time series prediction as an element of a decision support system.	K_W18	1
SWD -W_1	Possesses basic knowledge in the field of decision support systems	K_W18	1

3. Module description

Description	Aim of classes in this module is preparing the students to design and realize decision support systems basing on Bayes networks and other methods of

	knowledge representation.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
SWD _w_1	Credit	Solving three theoretical tasks, also with computable character.	SWD -W _2, SWD -W _3, SWD -W _4, SWD -W _5, SWD -W _6, SWD -W_1
SWD _w_2	Presentation of independently implemented decision support system	Effecting a decision support system using the chosen platform:1)Genie+Java+SMILE 2)Java +R 3) KNIME	SWD -U _7, SWD -U _8

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
SWD _fs_1	lecture	Presenting educational content in verbal form with use of content visualization. Focusing on conceptually complex material.	30	Familiarizing with lecture thematic.	10	SWD _w_1
SWD _fs_2	laboratory classes	Realization of project tasks using software packages Genie, KNIME	30	Analysis of the existing decision support systems. Implementation of the decision support system.	50	SWD _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Declarative languages

Module code: 08-IN-IJO-S2-JD

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
JD_U_5	Is able to implement algorithms by means of the Prolog language	K_U12 K_U13 K_U14	1 1 1
JD_U_6	Is able to implement algorithms according to functional and object-oriented paradigms in the FSharp language	K_U12	1
JD_U_7	Is able to code an optimization problem in the GNU MathProg language and solve it	K_U12 K_U13	1 1
JD_U_8	Is able to code an optimization problem in the OML language and solve it by means of a spreadsheet or a program written in the Fsharp language	K_U12 K_U13 K_U16	1 1 1
JD_W_1	Have a knowledge on programming in logic and is able to characterise this kind of coding	K_W10 K_W17	1 2
JD_W_2	Have a knowledge on functional programming and is able to characterise this kind of coding	K_W06 K_W10	2 2
JD_W_3	Have a knowledge on integer linear programming	K_W06 K_W09	1 2
JD_W_4	Have a knowledge on mathematical modelling (linear and non-linear programming, CSP systems)	K_W03 K_W09	1 2

3. Module description

Description	The objective is to prepare students for solving combinatorial optimization and other sorts of problems by means of declarative languages. Based on selected examples both programming in logic (Prolog) and functional programming (Fsharp) techniques have been presented. As regards mathematical modelling two languages have been described: the GNU MathProg for linear programming and the Optimization Modeling Language (OML) to linear, non-linear and constraint satisfaction problems. The course must be completed using the university e-learning platform.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
JD_w_1	Credit test	Test with multi-choice questions with single correct answer involving whole material (a quiz on the Moodle platform).	JD_W_1, JD_W_2, JD_W_3, JD_W_4
JD_w_2	Control tests	Writing and submitting programs for selected exercises from e-learning tutorials.	JD_U_5, JD_U_6, JD_U_7, JD_U_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
JD_fs_1	lecture	E-books (one for every theme) containing theoretical background, examples, and exercises (through the university e-learning platform).	15	Reading e-books and getting familiar with specified software.	15	JD_w_1
JD_fs_2	laboratory classes	Solving exercises from the e-books and submitting them though the university e-learning platform	15	Analyse of examples and solving exercises (mainly requiring coding)	15	JD_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Development and configuration of computer networks

Module code: 08-IN-S2-PiKSK

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PiKSK -K_12	Presents his own solutions and configurations to the group.	K_K02 K_U04	1 1
PiKSK -K_13	Estimates costs of computer network design.	K_K01 K_K03	1 1
PiKSK -U_10	Uses basic diagnostic mechanisms for network testing.	K_U11 K_U18	3 1
PiKSK -U_11	Uses network simulator to network designing and testing.	K_U11 K_U14 K_U18 K_U20	2 1 1 1
PiKSK -U_6	Can join hosts in a local network using various transmission media using point-point topologies and joining into infrastructure. Tests advanced media and links.	K_U01 K_U08 K_U10 K_U11	1 1 1 1
PiKSK -U_7	Can configure a switch as an access layer device.	K_U08 K_U11	1 3
PiKSK -U_8	Can configure router as a core layer device. Constructs a network comprising sub-nets of L3 layer. Designs vertical and horizontal cablings.	K_U08	1

		K_U09 K_U10 K_U11 K_U14	1 1 1 1
PiKSK -U_9	Configures VLAN networks and routing between such networks.	K_U03 K_U11 K_U18	1 2 1
PiKSK -W_1	Understands the need to use layered network model OSI-7 for description of phenomena occurring in computer networks. Understands divisions within TCP/IP stock of phenomena occurring in the Internet.	K_W04 K_W05 K_W11 K_W13 K_W19	1 1 3 1 1
PiKSK -W_2	Characterizes network devices, such as: network card, switch, router, host. Can describe issues connected with switching frames and routing packets.	K_W11 K_W14 K_W20	1 1 1
PiKSK _W_3	Characterizes limitations of transmission media used in local network and ways of addressing. Understands threats resulting from use of excessive broadcast domains of L2 layer. In wireless networks is able to explain phenomena connected with overlapping of transmission channels.	K_W11 K_W14 K_W20	3 1 1
PiKSK -W_4	Understands the need to use 3 layer model to design a local network.	K_W11 K_W17	1 1
PiKSK -W_5	Characterizes threats connected with discontinuous network addressing and understands the need of dividing big networks of 3L layer into smaller ones.	K_W11 K_W13	1 1

3. Module description	
Description	Aim of the module is familiarizing with issues connected with designing, implementation and diagnostics of a local computer network. The module deals with issues connected with process of information transfer in three lowest layers of reference model OSI-7.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PiKSK _w_1	Module credit	Questions from lecture subject matter.	PiKSK -W_1, PiKSK -W_2, PiKSK -W_4, PiKSK -W_5, PiKSK _W_3
PiKSK _w_2	Short tests	Checking the level of understanding of issues concerning computer network development and routing.	PiKSK -W_1, PiKSK -W_2, PiKSK -W_4, PiKSK -W_5

PiKSK _w_3	Conversation during tasks crediting	Checks the skill of generalizing knowledge acquired during tasks solving.	PiKSK -K_12, PiKSK -K_13, PiKSK -U_10, PiKSK -U_11, PiKSK -U_6, PiKSK -U_7, PiKSK -U_8, PiKSK -U_9

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PiKSK _fs_1	lecture	Content available in the form of multimedia transfer.	15	Preparing for credit.	15	PiKSK _w_1
PiKSK _fs_2	laboratory classes	Exercises referring to networks joining and LAN networks configuring.	30	Designing own networks with use of Packet Tracer.	45	PiKSK _w_2, PiKSK _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Development of 3D graphical engines

Module code: 08-IN-GWK-S2-PSG3D

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PSG3D -U_4	Can effect level items using technique CSG	K_U03 K_U14	1 1
PSG3D -U_5	Can model landform.	K_U14	1
PSG3D -U_6	Can use ready objects as level elements.	K_U14	1
PSG3D -U_7	Can prepare and give a presentation about realization of the project task.	K_U01 K_U02 K_U03 K_U04 K_U05 K_U06	1 1 1 1 1 1
PSG3D -W_1	Knows and understands principles of 3D object designing.	K_W15	1
PSG3D -W_2	Knows and can explain principles of modeling techniques Constructive Solid Geometry (CSG)	K_W03 K_W15	1 1
PSG3D -W_3	Knows and understand physics laws describing models lighting and shading.	K_W03	1

3. Module description

Description	

	Aim of the class is familiarizing the students with principles of creating static levels for the needs of video games basing on the acquired knowledge. The environment Unreal Development Kit will be used for this. During the classes the students will prepare individual projects and will present the results of their work in the form of presentation in front of the group.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PSG3D _w_1	Credit test	Checking learned theory from the lecture and laboratory class.	PSG3D -W_1, PSG3D -W_2, PSG3D -W_3
PSG3D _w_2	Evaluation of laboratory works effects	Use of 3D graphic engines taking advantage of CSG technology and ready models.	PSG3D -U_4, PSG3D -U_5, PSG3D -U_6, PSG3D -U_7, PSG3D -W_1, PSG3D -W_2, PSG3D -W_3
PSG3D _w_3	Project	Preparing the project with use of three dimensional static and dynamic models.	PSG3D -U_4, PSG3D -U_5, PSG3D -U_6, PSG3D -W_1, PSG3D -W_2, PSG3D -W_3
PSG3D _w_4	Presentation	Preparing a presentation and presenting in front of the group.	PSG3D -U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PSG3D _fs_1	lecture	Presenting educational content with use of audio-visual aids.	15	Individual studying of lectures subject matter and advised literature.	5	PSG3D _w_1
PSG3D _fs_2	laboratory classes	Detailed preparation of students to design 3D models and graphic engines use.	15	Individual preparation for laboratory classes . Executing an individual project. Preparing a presentation describing the project subject matter.	25	PSG3D _w_2, PSG3D _w_3, PSG3D _w_4

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Development of web-based solutions

Module code: 08-IN-ISI-S2- PRI

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PRI -K_6	Can plan work schedule for the created solution, effectively manages his time. Can acquire the users' needs in Internet applications, prepares, effects and sums up tests with a user's participation.	K_K02 K_U02 K_U03	1 1 1
PRI -U_4	Can create and publish a functional, principles-consistent, validating Internet application basing on ASP.NET technology. Is able to connect the application to a data base and equip it with necessary validating elements. Has ability to design and create applications in MVC model.	K_U02 K_U03 K_U13 K_U14 K_U15	2 2 3 3 3
PRI -U_5	Can look for information in programming services, uses MSDN.	K_U01 K_U05 K_U06	4 5 4
PRI -W_1	Has knowledge in the field of constructing a team building Internet applications. Knows how to create useful service, knows tools for its verification and distinguishing the users' needs.	K_W10 K_W12	2 1
PRI -W_2	Knows available techniques for creating, testing and publishing Internet applications and network services in the Visual Studio environment. Knows necessary constructions of language, base classes, ASP.NET components, data access technologies, AJAX technology and other modern technologies supporting building Internet solutions, including mobile ones.	K_W12 K_W13 K_W14	3 3 1
PRI -W_3	Knows components of MCV pattern and principles of creating applications with its use.	K_W14	2

3. Module description

Description	The goal of the course is to provide the ability to build web applications primarily in Visual Studio. Designed and implemented solutions can be based on ASP.NET Webforms. Students will learn how to create, publish and use web services. A separate part will be a block of activities related to creating applications based on an MVC pattern. The next group of issues presented within the subject is the study and design of functional websites.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PRI _w_1	Passing laboratory exercises	Verification of correctness of the exercises and projects covering subsequent thematic parts. Certificate of participation in the course “Internet Applications” within the IT Local Academy.	PRI -U_4, PRI -W_2
PRI _w_2	Project credit	Students design Internet service using MVC model. Previously, they analyze needs of the service users. Functionality of the service and pattern use correctness is evaluated.	PRI -K_6, PRI -U_4, PRI -W_1, PRI -W_3
PRI _w_3	Lecture credit	Students prepare analysis of Internet services functionality, usefulness.	PRI -U_5, PRI -W_1

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PRI _fs_1	lecture	Presenting the issues connected with programming, publishing of the Internet applications, their utility	0	Deepening knowledge basing on lecture materials and compulsory literature.	0	PRI _w_3
PRI _fs_2	laboratory classes	Implementing course workouts as web applications, designing further elements of the application using MVC	45	Preparing extended solutions for selected course workouts. Based on the lecture materials and available tools, the student prepares a document analyzing the usability of the selected website. Preparing an individual project based on the functionality expected by the user	45	PRI _w_1, PRI _w_2, PRI _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Elements of Software Testing

Module code: 08-IN-S2-APTWMZ

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
APTWMZ_K_5	Is able to effectively work and communicate within project team	K_U02	1
APTWMZ_K_6	Is able to effectively prioritize and solve problems, precisely prepare and provide feedback	K_K01	4
APTWMZ_U_4	Is able to configure different automation environments and Is capable of using test automation techniques in practice	K_U14	4
APTWMZ_W_1	Has knowledge: different types of software testing, test case design methodologies and automation techniques	K_W14	3
APTWMZ_W_2	Has knowledge on the quality aspects of agile projects	K_W07 K_W09	2 2
APTWMZ_W_3	Has knowledge on specific test automation techniques	K_W10	4

3. Module description

Description	The objective is to familiarize students with software test automation processes, especially in Agile projects, as well as with automation influence on overall software quality. Within this module students would gather knowledge on advanced software test automation techniques and would have an opportunity to turn this knowledge into practical skills.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
APTWMZ_w_1	Realization of individual/group tasks	Configuration of specified automation environment Code coverage with unit tests Requirement coverage with test cases Automated test case structure and logic verification Knowledge of Agile terminology Group communication, formulating feedback	APTWMZ_K_5, APTWMZ_K_6, APTWMZ_U_4, APTWMZ_W_1, APTWMZ_W_2, APTWMZ_W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
APTWMZ_fs_1	laboratory classes	Task (projects) to complete individually or in groups	30	Code analysis, reading, scripts design	90	APTWMZ_w_1

1.	**Field of study**	**Computer Science**
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Front-end and back-end applications security

Module code: 08-IN-IIN-S2-BA:FEBE

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
BA:FEBE -K_8	Is aware of costs connected with data leakage or loss in a company.	K_K02 K_K03	1 1
BA:FEBE -U_4	Can create an interface secured against SQL injection attacks.	K_U05 K_U18	1 1
BA:FEBE -U_5	Uses documentation to specify database users privileges.	K_U01 K_U06 K_U18	1 1 1
BA:FEBE -U_6	Creates application interfaces immune to attacks of XSS attacks.	K_U12 K_U13 K_U18	1 1 4
BA:FEBE -U_7	Configures server for cryptographic data transfer protection.	K_U12 K_U14 K_U18 K_U20	1 1 3 1
BA:FEBE -W_1	Describes databases protection methods.	K_W10 K_W13 K_W20	1 1 1

BA:FEBE -W_2	Characterizes properties of cryptographic data protection means.	K_W01 K_W02 K_W03 K_W20	2 3 2 1
BA:FEBE -W_3	Enumerates sources of threats for Internet applications.	K_W06 K_W13 K_W20	1 1 1

3. Module description	
Description	Aim of the class is deepening students' knowledge and skills in the field of Internet application security in two important aspects: front-end (layer of view) and back-end (layer of controller and layer of data access). After the classes are completed, the students should be able to design an Internet database application taking into account security aspects, should implement it and deploy on the network applications server.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
BA:FEBE _w_1	Exam	Answers on several questions chosen from thematic groups, covering sections discussed during classes.	BA:FEBE -K_8, BA:FEBE -U_6, BA:FEBE -U_7, BA:FEBE -W_1, BA:FEBE -W_2, BA:FEBE -W_3
BA:FEBE _w_2	Thematic tasks	Realization of thematic tasks during laboratory classes.	BA:FEBE -U_4, BA:FEBE -U_5, BA:FEBE -U_6, BA:FEBE -U_7, BA:FEBE -W_1, BA:FEBE -W_2, BA:FEBE -W_3
BA:FEBE _w_3	Project task	Evaluation of the project.	BA:FEBE -U_4, BA:FEBE -U_5, BA:FEBE -U_6, BA:FEBE -W_1

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
BA:FEBE _fs_1	lecture	Verbal presentation of theoretical content of module with support of multimedia materials and materials available on the Internet.	15	Studying lecture contents basing on books and Internet materials.	5	BA:FEBE _w_1
BA:FEBE _fs_2	laboratory classes	Introduction to practical aspects of the module. Explaining problems. Supporting the	30	Introductory preparation for classes content. Solving practical tasks given by the teacher.	40	BA:FEBE _w_2, BA:FEBE _w_3

		students in tasks realization. Discussing the project contents and support during their execution.		Execution of the given project with use of distributed documentation sources and laboratory examples.		

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: General-Purpose computing on Graphics Processing Units

Module code: 08-IN-GWK-S2-PKG

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PKG -K_7	Can work individually or in a team, understands the meaning of intellectual honesty in his own and others activities, acts ethically. Understands the need of constant improving his competences.	K_K04 K_U02 K_U05	1 1 1
PKG -K_8	Can think creatively, formulate opinions about basic issues, current state and developmental trends in IT and understands non-technical issues of professional activities.	K_K01 K_K02 K_K03	1 1 1
PKG -U_4	Can estimate time and memory complexity of parallel algorithms, can transform the chosen sequential algorithms into parallel ones, knows and understands problems connected with processing parallel calculations.	K_U12 K_U13	1 1
PKG -U_5	Can design a parallel algorithm structure, understands properties of parallel algorithms, their limitations and knows tasks scheduling mechanisms.	K_U13 K_U19 K_U20	1 1 1
PKG -U_6	Can develop software taking advantage of CUDA C, Thrust, DirectCompute or OpenCL. Can use literature resources and skillfully interpret acquired information.	K_U01 K_U02 K_U03 K_U05 K_U06 K_U13	1 1 1 1 1 1
PKG -W_2	Knows properties of parallel algorithms, understands techniques of computational parallelization at the instruction level, data and		

	tasks.	K_W01 K_W09	1 1
PKG -W_3	Knows principles of programming GPU processors using CUDA C and Thrust C++ library, knows and understands functionality of DirectCompute library and OpenCL language in parallel processing. Understands trends in IT development and methods of software engineering.	K_W06 K_W07 K_W14	1 1 1
PKG-W_1	Knows hardware architecture of GPU processors and graphic cards, knows mechanisms and communication structures CPU-GPU.	K_W04	1

3. Module description	
Description	Aim of the subject is making the student familiar with parallel computing technique on GPU graphic processors. The course covers basics of C++, DirectCompute and OpenCL together with hardware aspects of graphic cards calculations.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PKG _w_1	Reports	Systematic execution of the laboratory works course connected with the executed project.	PKG -K_7, PKG -K_8, PKG -U_4, PKG -U_5, PKG -U_6
PKG _w_2	Project	Executing a semester project in the range of educational effects accepted in the module.	PKG -K_7, PKG -K_8, PKG -U_4, PKG -U_5, PKG -U_6, PKG -W_2, PKG -W_3, PKG-W_1
PKG _w_3	Presentation	Giving audio-visual presentation in front of the group, discussing assumptions and accepted method of specific problem solution, analysis and evaluation of the project goal.	PKG -K_7, PKG -K_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PKG _fs_1	lecture	Presenting educational content with use of audio-visual aids.	15	Individual studying of lectures subject matter and advised literature.	5	PKG _w_1, PKG _w_2, PKG _w_3
PKG _fs_2	laboratory classes	Practical realization of the educational content, consisting on, among others, acquiring the skill and experience in efficient use of CUDA C, Thrust, DirectCompute or OpenCL libraries. The classes are held using computer stations and appropriate software.	30	Individual preparation for laboratory classes and periodical reports of project works proceedings. Systematic execution of reports of project works proceedings. Individual or in several person group, execution of the project and its documentation.	40	PKG _w_1, PKG _w_2, PKG _w_3

				Preparing an audio-visual presentation about executed project and presenting it in front of the group.		

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Graphics in mobile devices

Module code: 08-IN-GWK-S2-GwUM

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
GwUM -K_7	Can work individually and in a team.	K_U02	1
GwUM -K_8	Can think and act creatively.	K_K03	1
GwUM -U_4	Can implement the learned algorithm in a mobile device interface.	K_U12	1
GwUM -U_5	Can acquire information about graphic application implementation in the mobile device interface from literature, databases and other sources.	K_U01	1
GwUM -U_6	Is able to prepare and present application exhibiting realization of the project task.	K_U02 K_U03 K_U04	1 1 1
GwUM -W_1	Knows and understands the notions of raster and vector graphics and the algorithms used in raster and vector graphics.	K_W01	1
GwUM -W_2	Knows and understands purpose of the basic graphic interface elements.	K_W02 K_W12	1 1
GwUM -W_3	Knows and understands basic principles for creating graphics in a mobile device interface. Understands trends in IT development and in software engineering.	K_W02 K_W10 K_W14	1 1 1

3. Module description

Description	

	Aim of classes is to familiarize the students with graphic interface of a mobile device. Presenting basic components of the interface on the example of GIS system, computer game. During the classes, the students prepare projects in teams of maximum two and present results of their work in the form of application.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
GwUM _w_1	Project	Preparing a project and application from the chosen topic connected with graphic interface of a mobile device.	GwUM -K_7, GwUM -K_8, GwUM -U_4, GwUM -U_5, GwUM -U_6, GwUM -W_1, GwUM -W_2, GwUM -W_3
GwUM _w_2	Reports	Description of the realized project.	GwUM -K_7, GwUM -K_8, GwUM -U_4, GwUM -W_1, GwUM -W_2, GwUM -W_3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
GwUM _fs_1	lecture	Presenting educational content with use of audio-visual aids.	15	Individual preparation for the lectures.	5	GwUM _w_1, GwUM _w_2
GwUM _fs_2	laboratory classes	Detailed preparation of the students to use programming environment and graphic components of the interface. Solving programming tasks.	30	Individual preparation for the laboratory classes. Familiarizing with project thematic and execution of the project individually or in teams of two. Preparing description showing issue of the project.	40	GwUM _w_1, GwUM _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Hardware construction and diagnostics

Module code: 08-IN-BIO-S2-BiDSK

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
BiDSK -K_8	Is aware of responsibility for team works and tasks executed together.		
BiDSK -U_4	Can solve typical tasks of hardware diagnostics.	K_U05 K_U14	3 3
BiDSK -U_5	Is able to interpret state of hardware operation and on this basis, plan and execute repair and maintenance works.	K_U09 K_U14	2 2
BiDSK -U_6	Can analyze hardware functioning on the basis of system data and technical documentation.	K_U05 K_U06	2 2
BiDSK -U_7	Can work individually and in a team.	K_U02	2
BiDSK -W_1	Has elementary knowledge in the field of digital technology, computer architecture, operating systems and computer networks.	K_W04 K_W20	1 1
BiDSK -W_2	Knows basic methods, techniques and tools used to solve simple tasks of hardware diagnostics.	K_W04 K_W11	2 2
BiDSK -W_3	Classifies and interprets information of hardware construction and documentation acquired from Internet, literature and other sources.	K_W17	2

3. Module description

Description	Aim of the classes from the module Hardware Construction and Diagnostics is preparing the students for exploitation, maintenance and execution of basic repair works of hardware. Module content refers both to theoretical bases in the field of hardware and software configuration and practical use of

	this knowledge. Skill of acquiring information and, especially, using software and hardware components technical documentation is of crucial importance. Practical skills can be gained from tasks realization, which consist in independent analysis and solutions of the typical hardware problems.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
BiDSK _w_1	Written tests	Within the module, two tests concerning theoretical bases of the module content will be effected. The grade will depend on knowledge in the field of diagnostic programming tools and hardware configuration and diagnostics.	BiDSK -W_1, BiDSK -W_2, BiDSK -W_3
BiDSK _w_2	Project	Within the module, an individual project will be executed, which will cover practical use of theoretical knowledge. Practical aspects of the project will refer both to hardware and software.	BiDSK -U_4, BiDSK -U_5, BiDSK -U_6, BiDSK -W_1, BiDSK -W_2
BiDSK _w_3	Brainstorming	Solving a technical problem from the field of hardware diagnostics within the frames of brainstorming.	BiDSK -K_8, BiDSK -U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
BiDSK _fs_1	laboratory classes	The teacher, together with students analyzes theoretical content and performs practical tasks in the field of hardware diagnostics. The students realize classes schedule in groups of several persons and actively solve technical problems during brainstorming.	45	Student is obliged to familiarize with theoretical material in the form of software and hardware documentation. Student independently prepares documentation for the project task, using a computer and diagnostic software. Additionally he acquires information from various sources and analyzes its usefulness for the executed project. Quality of content included in documentation will be basis for obtaining a positive grade of the module.	15	BiDSK _w_1, BiDSK _w_2, BiDSK _w_3

1.	**Field of study**	**Computer Science**
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Haskell programming language

Module code: 08-IN-S2-JP-H

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
JP-H -U_5	Can implement numeric algorithms using Haskell language.	K_U12 K_U13 K_U14	1 1 1
JP-H -U_6	Can practically realize parsing analysis and the structured text processing.	K_U12	1
JP-H -U_7	Can implement chosen algorithms of discreet mathematics with use of Haskell.	K_U12 K_U13 K_U14	1 1 1
JP-H -U_8	Can compile programs written in Haskell and work in interactive environment.	K_U12 K_U13 K_U14	1 1 1
JP-H -W_1	Has knowledge in the field of working principles for Glasgow Haskell Compiler software and can characterize basic types and type classes in Haskell.	K_W10	2
JP-H -W_2	Has knowledge in the field of standard functions in Haskell and can characterize expedience of their use.	K_W10	1
JP-H -W_3	Has knowledge in the field of defining own functions, including recursive functions and higher order functions.	K_W09 K_W10	1 1
JP-H -W_4	Has knowledge in the field of parsing realization and declaring own data types.	K_W09 K_W10	1 1

3. Module description

Description	Aim of classes in this module is preparing the students to solve numerical tasks, tasks of discreet mathematics and also to process texts with use of Haskell language. As a result, the student should exhibit complete understanding of mathematics connected with developing and encoding algorithms in a functional language. The consequence should be deepening knowledge in the field of programming methodologies and developing the skill of algorithms implementation so as they work infallibly, fast and could be easily analyzed and expanded.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
JP-H -w_1	Lecture credit	Solving tasks of content, one after each of the sections discussed during lecture.	JP-H -W_1, JP-H -W_2, JP-H -W_3, JP-H -W_4
JP-H -w_2	Laboratory class credit	Tests after each topic completed during classes together with theoretical knowledge of lecture subject matter control.	JP-H -U_5, JP-H -U_6, JP-H -U_7, JP-H -U_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
JP-H -fs_1	lecture	Presenting educational content in verbal form, with use of content visualization. Focusing on conceptually complex material and indicating website addresses.	15	Presenting educational content in verbal form, with use of content visualization. Focusing on conceptually complex material and indicating website addresses.	10	JP-H -w_1
JP-H -fs_2	laboratory classes	Detailed preparation of the students to solve tasks, indication of proceedings methodology, sequence of proceedings. Solving tasks of content.	30	Solving tasks of subsequent topics (mainly connected with implementation) together with analysis of the already existing solutions in the script and on websites.	35	JP-H -w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Industrial property protection

Module code: 08-IN-S2-OWP

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
OWP -K_5	Discuss the importance of industrial property security in economy.	K_K02	1
OWP -K_6	Solves the problems connected with industrial property trading and violation of industrial property rights.	K_K02 K_K04	1 2
OWP -U_3	Prepares documentation of industrial property items.	K_U10	2
OWP -U_4	Follows the process of realization in procedures connected with industrial property protection.	K_U10	2
OWP -W_1	Explains basic notions and principles in the field of industrial property protection.	K_W22	4
OWP -W_2	Interprets rules connected with procedure of obtaining and executing security rights for items of industrial property.	K_W22	4

3. Module description

Description	Realization of module requires in its theoretical part, basic issues concerning industrial property, that is: inventions protection, utility models, trademarks, geographical indications, and integrated circuits topography. Practical aim Is familiarizing the students with procedures of preparing documentation to obtain security rights for industrial property items.
Prerequisites	Brak.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
OWP _w_1	Written test	Within the module, a test will be effected covering basic issues of the industrial property	

		protection.	OWP -K_5, OWP -K_6, OWP -U_3, OWP -U_4, OWP -W_1, OWP -W_2
OWP _w_2	Project	Within the module, the students will realize a project consisting in preparing documentation of industrial property item to be protected.	OWP -U_3, OWP -U_4, OWP -W_1, OWP -W_2
OWP _w_3	Brainstorming	Solving problems connected with industrial property protection in groups.	OWP -K_5, OWP -K_6, OWP -U_4

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
OWP _fs_1	lecture	The lecture refers to the chosen issues in the range of industrial property protection. Didactic methods: informing lecture, problem lecture.	10	Work with the chosen literature and legal laws covering individual assimilation of knowledge referring to the issues indicated.	20	OWP _w_1
OWP _fs_2	laboratory classes	Student obtains instructions for project preparation. Method giving task explanation, brainstorming. The student discusses topics concerning industrial property protection. He identifies such problems and attempts at solving them: program method with use of computer, subject exercises, brainstorming.	20	Student is obliged to be prepared for class of theoretical knowledge. Students execute project in group, using computer and solve problem tasks.	60	OWP _w_2, OWP _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Information systems administration

Module code: 08-IN-BIO-S2-ASI

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ASI -U_4	Can define components of IT system and characterize their importance and develop such a system according to assumptions accepted.	K_U01 K_U03	1 1
ASI -U_5	Can install, activate and use typical server solutions used in IT systems.	K_U11 K_U19	1 2
ASI -U_6	Can install and activate applications influencing IT system security (firewall, antivirus etc.)	K_U18	1
ASI -W_1	Understands the problem of security in IT systems, knows methods of protecting specific IT system elements.	K_W20	2
ASI -W_2	Knows capabilities of typical solutions (applications) improving the IT systems administration (resource management, communication with user).	K_W14	1
ASI -W_3	Understands mechanisms of IT system elements concurrence, together with client?server architecture use.	K_W13	2

3. Module description

Description	Aim of the classes is making the students familiar with issues connected with complex process of IT administration. Issues discussed will be: works of an administrator at the network, server and users application levels. The crucial role of security in IT systems and methods of its ensuring will be presented. Example tools and applications improving the administrator work will be characterized.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
ASI _w_1	Control tests	Written tests in the form of a test and open questions.	ASI -U_4, ASI -U_5, ASI -U_6
ASI _w_2	Presentation	Multimedia presentation covering issues discussed during lectures and laboratory classes.	ASI -U_4, ASI -U_5, ASI -U_6, ASI -W_1, ASI -W_2, ASI -W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
ASI _fs_1	lecture	Presenting educational content in verbal form, with use of content visualization. Focusing on conceptually complex material and indicating sources. Illustrating the content by examples.	15	Familiarizing with lecture content using existing methods packages: textbooks, scripts, websites, etc.	10	ASI _w_2
ASI _fs_2	laboratory classes	Detailed preparation of the students to solve tasks, indication of proceedings methodology, sequence of proceedings. Tasks with use of the chosen applications and technologies.	30	Solving tasks of subsequent topics together with analysis of the already existing solutions. Revision of material discussed during lectures and exercised during laboratory classes.	35	ASI _w_1, ASI _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Intelligent computer graphics

Module code: 08-IN-GWK-S2-IGK

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
IGK -K_7	Can work individually or in a team, understands meaning of intellectual honesty in his own and other people activities, acts ethically. Understands the need of constant improvement of his competences.	K_K04 K_U02 K_U05	1 1 1
IGK -K_8	Can think creatively, formulate opinions about basic issues, current state and developmental trends in IT and understands non-technical issues of professional activity.	K_K01 K_K02 K_K03	1 1 1
IGK -U_4	Can define a problem, find a solution, elaborate mathematical model, use chosen artificial intelligence algorithms.	K_U01 K_U02 K_U03 K_U07 K_U08 K_U16 K_U17	1 1 1 1 1 1 1
IGK -U_5	Can properly model 3D scene and visualize simulated physical processes in virtual space.	K_U08 K_U12 K_U13	1 1 1
IGK -U_6	Is able to acquire meta-information from the image, can use data mining and data exploitation algorithms.	K_U12 K_U13	1 1

		K_U16 K_U17	1 1
IGK -W_1	Knows evolutionary algorithms, neural networks and methods of machine learning, understands issues of control optimization.	K_W01 K_W03 K_W08 K_W09	1 1 1 1
IGK -W_2	Knows principles of 3D scene modeling, issue of physical environment simulation, movement planning, object detection, collision avoidance.	K_W15	1
IGK -W_3	Knows the issues of events prediction, data mining and data exploitation, acquisition of meta-information from the image. Understands trends in IT development and methods of software engineering.	K_W14 K_W17 K_W18	1 1 1

3. Module description	
Description	Aim of the subject is making the student familiar with issues connected with use of artificial intelligence in computer graphics.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
IGK _w_1	Exam	Checking theoretical knowledge of the module. Final grade constitutes arithmetic average from grades of exam test.	IGK -W_1, IGK -W_2, IGK -W_3
IGK _w_2	Reports	Systematic execution of reports of laboratory proceedings connected with executed project.	IGK -K_7, IGK -K_8, IGK -U_4, IGK -U_5, IGK -U_6
IGK _w_3	Project	Effecting semester project in the range of accepted in the module education effects.	IGK -K_7, IGK -K_8, IGK -U_4, IGK -U_5, IGK -U_6, IGK -W_1, IGK -W_2, IGK -W_3
IGK _w_4	Presentation	Giving an audio-visual presentation in front of the group, discussion over assumptions and accepted method of a given problem solution, analysis and evaluation of the project goal.	IGK -K_7, IGK -K_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
IGK _fs_1	lecture	Educational content of the module presented with use of audio-visual aids.	15	Individual studying of lectures subject matter and advised literature.	5	IGK _w_1
IGK _fs_2	laboratory classes	Practical realization of educational content in the form of tasks solving. Classes are	30	Systematic preparation of reports of project works proceedings.	40	IGK _w_1, IGK _w_2, IGK _w_3, IGK _w_4

		effected with use of computer stations and appropriate software.		Individual or in a group of several persons, executing of the project and its documentation. Preparing audio-visual presentation concerning the executed project and presenting it in front of the group.		

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Intelligent Data-driven Systems

Module code: 08-IN-ISI-S2-TiWO

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
K_8	The student understands the necessity of self-learning ando developing IT skills with the use of modern teaching techniques	K_K01 K_U05	1 2
U_4	The Student is able to use current BI tools , design, develop and implement dashboards that suits certain needs	K_W08 K_W21	3 4
U_5	The Student is able to design and develop dashboards, using a wide range of of methods: statistical, data mining and artificial intelligence. Student is also able to make appropraite visual analytics design (graphical design, chart type, fact sheets.	K_U10 K_W08	2 2
U_6	The Student is able to choose appropriate software and tools for dashboards creation for certain needs, is able to describe user needs with the use of user stories, and use them to design data flow and data presentation	K_W08 K_W14	3 1
U_7	The Student is able to load data to dashboard from local and remote data sources	K_W08	3
W_1	The student knows the idea of BI systems, their application and tools for their creation. Knows the rules of its usage, rules of dashboards design taking into acount pronciples of data visualization, storytelling and reports design.	K_W08 K_W19	4 3
W_2	The student is aware of importance of supporting processes and business decisions and tuning dashboards to user needs	K_W08	3
W_3	The student knows tha basis of statistical analyses, chart types, AI algorithms and data mining approach.	K_W08	3

3. Module description

Description	During classes and assignments student gains knowledge, competncies and skills necessary for dashboards designing and developing for the purpose od decission support in the enterprise. During classes student acquaints the principles and approaches allowing to create dashboards with different tools.

Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
TiWO -w_1	Scored final project, project presentation and defence	Designing and developing data-driven project with dashboard interface.	K_8, U_4, U_5, U_6, U_7, W_1, W_2, W_3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
TiWO -fs_1	laboratory classes	Recall and completion general knowledge concerning statistical analyses, artificial intelligence and data mining. Labs in a form of a workshop with gradually increasing difficulty level, with collaterally introduced additional theoretical informations. Basic info about user stories. Pointing the specific needs of business problems. Analysing and discussing issues appearing during project. Knowledge transfer with the support of distance-learning system (Moodle)	30	Self-study, reading additional resources, scripting, hands-on with tools, preparing reports and essays, final project design and development.	30	TiWO -w_1

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Interactive computer graphics

Module code: 08-IN-S2-IGK

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
IGK _K _8	Can work in a team preparing a project.	K_U02	1
IGK _K _9	Presents the group with his own ideas for realization of tasks and algorithms connected with interactive computer graphics.	K_U04	1
IGK _U _6	Creates documentation of his own multimedia projects.	K_U03	1
IGK _U _7	Creates own interactive multimedia programs and games.	K_U12 K_U15	1 1
IGK _U_5	Takes advantage of technical documentation of the chosen tools.	K_U01	1
IGK _W _2	Demonstrates advantages of interactive computer graphics.	K_W15 K_W16	1 1
IGK _W _3	Describes functions of interactive computer graphics.	K_W16	1
IGK _W _4	Develops multimedia presentations and games using chosen tools.	K_W16	1
IGK _W_1	Defines notions connected with interactivity.	K_W14 K_W15	1 1

3. Module description

Description	Aim of classes is familiarizing the students with developing and programming interactive graphic applications, such as multimedia presentations and games. The student is able to develop and execute a project of interactive multimedia application in the chosen environment or programming language. Additionally he can perform a detailed analysis of the written program operation.

Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
IGK -w_1	Written credit	Theoretical questions concerning the issues discussed during lecture.	IGK _W _2, IGK _W _3, IGK _W _4, IGK _W_1
IGK -w_2	Programming-project task	Individually executed, short programming-project task.	IGK _U _7, IGK _U_5, IGK _W _4
IGK -w_3	Team project	Checking the level of the students' preparation for execution of bigger team projects.	IGK _K _8, IGK _K _9, IGK _U _6, IGK _U _7, IGK _U_5

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
IGK _fs_1	lecture	Content available in the form of multimedia broadcast. Example project tasks presented.	15	Familiarizing with issues defined during the lecture. Preparation for credit.	15	IGK -w_1
IGK _fs_2	laboratory classes	Configuring and preparing project tools. Practical implementation of the tasks specified by the teacher.	30	Realization of the project at home or using the computers made available to students for their own work by the Institute.	30	IGK -w_2, IGK -w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Internet protocols

Module code: 08-IN-IIN-S2-PI

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PI-K_12	Presents the group with his own configuration solutions.	K_K02 K_U04	1 1
PI-K_13	Estimates costs of computer network design.	K_K01 K_K03	1 1
PI-U_10	Creates the routing static table for a simple LAN network with Internet access.	K_U11 K_U18	1 1
PI-U_11	Configures dynamic routing protocol distance-vector for a simple network.	K_U11	1
PI-U_6	Appropriately selects sufficient protocols of application layer and configures them according to his needs.	K_U01 K_U06 K_U11 K_U14 K_U18	1 1 1 1 1
PI-U_7	Divides big LAN networks into subnet of L3 layer, eliminating excessive number of layer L2 divulgations, selects and configures appropriate hardware devices.	K_U03	1
PI-U_8	Uses network simulator to test operation of L2 and L3 layers protocols.	K_U08 K_U09 K_U10 K_U11	1 1 1 1

		K_U14 K_U20	1 1
PI-U_9	Uses network packet scanner to verify operation of protocols in the network.	K_U03 K_U11 K_U14	1 1 1
PI-W_1	Understands the need to use the layer network model OSI-7	K_W04 K_W05 K_W09 K_W11 K_W13	1 1 1 1 1
PI-W_2	Characterizes TCP/IP protocol stock and understands the need of standardization of Internet layers and application operation.	K_W07 K_W09 K_W11 K_W20	1 1 1 1
PI-W_3	Characterizes the need to use physical and logical addressing in LAN and WAN networks. Understands the need of migration from IPv4 to IPv6 protocols. Understands threats resulting from this migration. Explains necessity of tunneling IPv4 to IPv6 in the transition period.	K_W05 K_W10 K_W11 K_W14 K_W20	1 1 1 1 1
PI-W_4	Understands theoretical bases of routing distance-vector algorithms operation and link status.	K_W11 K_W17	1 1
PI-W_5	Understands the need to use and characterizes mechanisms of encryption in the application layer protocol.	K_W11 K_W13	1 1

3. Module description	
Description	Aim of the module is familiarizing with issues of need to use network protocols of L2 and L3 layers and OSI-7 model.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PI_w_1	Lecture credit	Questions from the lectures subject matter.	PI-W_1, PI-W_2, PI-W_3, PI-W_4, PI-W_5
PI_w_2	Module tests CISCO CCNA	Checking level of understanding of issues concerning designing the computer network and routing protocols.	PI-W_1, PI-W_2, PI-W_4, PI-W_5

PI_w_3	Conversation during tasks crediting	Checks the skill of generalizing knowledge acquired during tasks solution.	PI-K_12, PI-K_13, PI-U_10, PI-U_11, PI-U_6, PI-U_7, PI-U_8, PI-U_9

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PI_fs_1	lecture	Content available in the form of multimedia transfer.	15	Preparation for the exam.	5	PI_w_1
PI_fs_2	laboratory classes	Blackboard exercises referring to network addressing and practical exercises referring to routers configuring, reports, CSCO module tests.	30	Designing student’s own network, using Packet Tracer.	10	PI_w_2, PI_w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Intra- and Internet services development

Module code: 08-IN-BIO-S2-TSIiI

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
TSIiI -K_5	Competently organizes a team developing an Internet service indispensable for information society.		
TSIiI -U_3	Skillfully installs software necessary to develop Internet services.	K_U14	4
TSIiI -U_4	Skillfully configures and manages CMS systems and can manage content in a relational database.	K_U02	4
TSIiI -W_1	Classifies methods and techniques of Internet services installation.	K_W13	2
TSIiI -W_2	Classifies software to develop and manage Internet services.	K_W19	2

3. Module description

Description	Learning the material from the module: Intra- and Internet services development will enable the student achieving the following module goals: acquiring knowledge about methods of Internet services software installation, mastering the issue of relational databases and communication based on HTTP protocol, getting to know principles of Internet service administration, getting to know methods of installation and configuration of CMS systems.
Prerequisites	brak

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
TSIiI _w_1	Tasks evaluation	Current evaluation of tasks ascribed to students. The student is graded of the performed tasks, on the e-learning platform.	TSIiI -K_5, TSIiI -U_3, TSIiI -U_4, TSIiI -W_1, TSIiI -W_2

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
TSIiI _fns_1	lecture	On the e-learning platform the student obtains materials necessary to familiarize with material needed for preparing IT project.	15	Student practices self-education.	15	TSIiI _w_1
TSIiI _fns_2	laboratory classes	On the e-learning platform the student obtains instructions to execute tasks connected with IT project.	30	Student attempts at executing the tasks individually (or with help of the teacher) and in micro-teams. At the end of classes, the micro-team is obliged to present the results of its work.	30	TSIiI _w_1

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: IT systems utility

Module code: 08-IN-S2-USI

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
USI _U_1	Has knowledge in the field of programming in the chosen object language.	K_U15	4
USI _U_2	Has knowledge in the field of data bases in the chosen database engine.	K_W20	2
USI _U_3	Can present functional requirements of the project.	K_U02	5
USI _U_4	Learns various communication protocols used for IT systems integration.	K_U01 K_U10	3 5
USI _U_5	Learns the characteristics of teamwork.	K_U02	5
USI _U_6	Can present project schedule and act accordingly.	K_U16	4
USI _U_7	Learns techniques of developing a user interface (in context of user-friendliness and intuitiveness).	K_U03	3
USI _W_1	Has knowledge in the field of UML programming and tools used to develop them.	K_W10	2
USI _W_2	Can use available tools for team co-operation for his own sake.	K_W12	2
USI _W_3	Acquires knowledge of various techniques of IT systems integration.	K_W12	1
USI _W_4	Can visualize application design and present its operation scheme together with appropriate UML diagrams.	K_U04 K_W17 K_W22	2 1 3
USI _W_5	Gets to know work in task system and communication with a person responsible for project management.	K_U01	4
USI _W_6	Acquires good practices in code development, such as: its clarity, commentaries, descriptions.	K_W10	4

USI _W_7	Can use technical documentation prepared by another person.		
USI _W_8	Learns good practices in preparation of technical documentation.	K_W12	3
USI _W_9	Can use known to himself and to other team members IT technologies and integrate them in the form of IT system.	K_U03 K_W07 K_W13 K_W23	2 1 5 3

3. Module description	
Description	The aim is to introduce the student into advanced issues of application development, project schedule, IT systems integration and teamwork.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
USI _Z_1	Written exam	Verification of knowledge basing on lectures subject matter. The exam is composed of theoretical open questions and at least two tasks of content.	USI _W_1, USI _W_2, USI _W_3, USI _W_4, USI _W_5, USI _W_6, USI _W_7, USI _W_8, USI _W_9
USI _Z_2	Laboratory class credit	Elaborating It system from its development to implementation and testing. Verification of the skills acquired during problem solving. Credit grade is the result of partial grades obtained during the semester and grade of the project presentation.	USI _U_1, USI _U_2, USI _U_3, USI _U_4, USI _U_5, USI _U_6, USI _U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
USI _FS_1	lecture	Presenting educational content in verbal form with use of audio-visual and other, written educational aids. Drawing attention to issues difficult to understand and these with deeper theoretical foundations. Activation of the students by asking questions concerning presented content.	15	Preparation for the exam. Individual solving of tasks given during laboratory class. Individual, practical use of knowledge acquired during laboratory class.	30	USI _Z_1, USI _Z_2
USI _FS_3	laboratory classes	Detailed preparation of students to solve tasks, indicating proceedings methodology and sequence. Supervising the students' project works and support in solving complex project problems. Supervision over realization of work schedule created by the students.	30	Preparation for class.	30	USI _Z_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Java language programming

Module code: 08-IN-BIO-S2-PwJJ

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PwJJ -U_3	Creates algorithms realizing specific programming tasks and can implement them.	K_U12	1
PwJJ -U_4	Uses the chosen programming languages.	K_U13	2
PwJJ -U_5	Can develop software with given utility.	K_U15	4
PwJJ -W_1	Defines notions connected with object programming techniques.	K_W06	4
PwJJ -W_2	Defines notions connected with algorithmics and data structures.	K_W02 K_W09	2 2

3. Module description

Description	Aim of the class is familiarizing the students with programming applications in Java language. The students assimilate various notions connected with programming, which will enable them to implementation of their own programming code and its testing. Especially, they will be able to skillfully use object programming language, will know streaming operations and functions, file operations and exceptions. During classes, the students will solve tasks sets. The results of work will be evaluated on the basis of tasks and tests.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PwJJ _w_1	Test	Checking skill of programming at the computer.	PwJJ -U_3, PwJJ -U_4, PwJJ

			-U_5, PwJJ -W_1, PwJJ -W_2
PwJJ _w_2	Exam	Checking knowledge acquired during lectures and classes.	PwJJ -U_3, PwJJ -U_4, PwJJ -U_5, PwJJ -W_1, PwJJ -W_2

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PwJJ _fs_1	lecture	Presenting educational content with use of content visualization.	15	Individual studying of the lecture content and advised literature.	15	PwJJ _w_2
PwJJ _fs_2	laboratory classes	Preparing the students to application development. Solving programming tasks.	45	Individual preparation for laboratory classes and applications implementation.	15	PwJJ _w_1, PwJJ _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Machine learning algorithms

Module code: 08-IN-IJO-S2-AUM

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
AUM _K10	Is able to work in several person team and properly divide tasks into subtasks.	K_K03 K_K04	1 1
AUM _U09	Can independently formulate a problem.	K_U01	1
AUM _U5	Can use the methods and formalized models to modeling tasks and algorithms of machine learning, including techer=? participated and unsupervised learning in IT systems and in software.	K_U01 K_U12 K_U14 K_U15 K_U17 K_U21	1 1 1 1 1 1
AUM _U6	Can assess utility of various paradigms and machine learning methods and programming environments connected with them to solve practical conceptual and technical problems of different types.	K_U01 K_U08 K_U10 K_U14	1 1 1 1
AUM _U7	Is able to construct algorithms using algorithmic techniques from the field of machine learning, including symbolic and numeric representations.	K_U04 K_U14 K_U15 K_U16	1 1 1 1
AUM _U8	Can analyse facultative system concerning appropriately used machine learning algorithm.		

		K_U08 K_U10 K_U14 K_U15	1 1 1 1
AUM _W1	Has knowledge in the field of mathematics covering linear algebra, elements of probability calculus, discrret mathematics and numerical methods necessary to modeling problems in the sphere of machine learning.	K_W01 K_W02 K_W03	1 1 1
AUM _W2	Has widened knowledge about various paradigms, methods and algorithms of machine learning, including teacher?participated learning and unsupervised learning.	K_W01 K_W09 K_W12 K_W14	1 1 1 1
AUM _W3	Has deepened and structured knowledge in the field of programming in declarative, imperative and functional programming languages used to implement machine learning algorithms.	K_W01 K_W09 K_W10 K_W18	1 1 1 1
AUM _W4	Understands the current state and newest achievements and IT developmental trends including artificial intelligence, artificial life and methods of machine learning in the areas of their use in IT and technology.	K_W14 K_W17 K_W18	1 1 1

3. Module description	
Description	Lecture is destined for IT students. Its aim is to familiarize the students with algorithms of machine learning. Presented will be various methods of learning with supervision and without it with special emphasis on reinforced learning methods Using time differences in reinforcements updates is to be verified in application prepared by the students, dedicated to artificial life technology.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
AUM _w_1	Exam	Solving tasks of content, one after each section discussed during the lecture.	AUM _W1, AUM _W2, AUM _W3, AUM _W4
AUM _w_2	Control tests	Tests after each topic discussed during classes including control of theoretical knowledge from the lecture.	AUM _U5, AUM _U6, AUM _U7, AUM _U8
AUM _w_3	Group reports	Solving tasks given in thematic sets, grouped into 5, 7 tasks in each set.	AUM _K10, AUM _U09

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
AUM _fs_1	lecture	Presenting educational content in verbal form, using content visualization. Focusing on conceptually complex material and indicating additional material – own elaborations. These will constitute basis for credit tests.	15	Familiarizing with lecture content using the existing methods packets: individual elaborations, websites.	15	AUM _w_1
AUM _fs_2	laboratory classes	Students get acquainted with mathematical models of machine learning and solve tasks from this field.	30	Solving tasks of subsequent topics together with the existing solutions analyses – in elaborations and on websites. Analysis and electronic description of the learning system, it s verification in an environment specified by the teacher.	30	AUM _w_2, AUM _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Management of IT projects

Module code: 08-IN-S2-ZPI

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZPI _K5	Works in a team, analyzes (case study) the realized IT enterprises described in foreign branch portals.	K_K01 K_K02	4 1
ZPI _U3	Can plan a schedule of project resources exploitation, properly manage critical path resources.	K_U02 K_U19	4 1
ZPI _U4	Can use available IT tools supporting planning, performing and reporting of project realization.	K_U01 K_U03 K_U04 K_U06 K_U20	1 3 1 3 4
ZPI _W2	Knows available IT tools supporting project management and its realization.	K_W14 K_W23	2 1
ZPI_W1	Knows various methodologies of management of IT enterprises, especially management of the project resources, risks, efficiency and quality.	K_W10 K_W24	4 1

3. Module description

Description	In the module the issues of enterprises management methodologies are covered, in management terms. The content especially refers to IT enterprises management methodologies – starting with project components, its resources. Special stress in put on planning, scheduling, risk, efficiency, quality

	management. The available IT solutions – especially project management packages (depending on license availability – for example MS Project 2013) will be used during laboratory classes – as a tool supporting a complex project management.
Prerequisites	brak

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ZPI _w_1	Task realization card	Program of a specific task realization elaborated in the form of a task card will require the student to document execution of each instruction point; task realization will be described in the card, which will be the basis of class crediting.	ZPI _U3, ZPI _U4, ZPI _W2
ZPI _w_2	Team project	Practical task realized in a project team, with roles indication, schedule, report preparation.	ZPI _K5, ZPI _U3
ZPI _w_3	Lecture credit	Case study showing realization of the IT enterprise referring to all the discussed project resources.	ZPI _K5, ZPI_W1

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ZPI _fs_1	lecture	Presenting the chosen issues with use of audio-visual aids.	10	Studying additional literature.	5	ZPI _w_3
ZPI _fs_2	laboratory classes	Classes taught in the form of workshops with specifying subsequent tasks to be performed. The project task executed by project teams, discussion, results presentation.	20	Preparing practical information necessary to realize the project in a working team. Searching the Internet for information – preparing case study.	25	ZPI _w_1, ZPI _w_2, ZPI _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Managing computer networks and servers

Module code: 08-IN-BIO-S2-ZSKiS

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZSKiS -K_5	Works individually and in a team.		
ZSKiS -U_3	Extracts information from literature, Internet resources and from other sources.	K_U01 K_U06	1 1
ZSKiS -U_4	Can use software tools enabling computer networks and servers managing.	K_U18	1
ZSKiS -W_1	Revives knowledge in the field of managing computer networks and servers.	K_W11 K_W13	1 1
ZSKiS -W_2	Has basic knowledge in the field of computer networks designing.	K_W07 K_W12	1 1

3. Module description

Description	Aim of classes in this module is preparing the students for computer networks and servers managing. During the classes the students will learn techniques of complex computer networks development and preparation of tools necessary to manage networks. Will get to know principles of configuring network servers and ways of their managing. Besides knowledge about network hardware and software architecture, the students will acquire the skill of using tools used during network software development, its testing and implementation.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
ZSKiS _w_1	Test	Two tests are scheduled: one of computer networks management development, the second of networks servers installation and management.	ZSKiS -U_3, ZSKiS -W_1, ZSKiS -W_2
ZSKiS _w_2	Presentation	Within the module, an individual presentation of the chosen theoretical topic will be executed, accompanied by practical exercises for the other students.	ZSKiS -K_5, ZSKiS -U_4

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
ZSKiS _fs_1	lecture	Lecture introducing understanding of the most important issues connected with networks and servers management is illustrated with a slideshow and presentation of work methods with use of computer performed by the teacher.	15	Work with indicated field literature and materials made available, covering individual knowledge assimilation referring to the basic, indicated subjects.	15	ZSKiS _w_1, ZSKiS _w_2
ZSKiS _fs_2	laboratory classes	The teacher leads and instructs the students working individually. In case of more complex issues, the teacher suggests optimum solutions. Besides individual work, the students solve problems during brainstorming.	30	Student is obliged to be prepared of theoretical knowledge on the basis of lectures and materials made available for each class. Preparing a presentation of the chosen topic together with practical exercises aims at knowledge consolidation.	30	ZSKiS _w_1, ZSKiS _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Managing IT projects and teams

Module code: 08-IN-S2-ZZP

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZZP_K7	Student works in a team, analyzes (case study) realized IT projects described in foreign trade portals.	K_K01 K_K03 K_U01 K_U02 K_U04 K_U06	4 3 5 4 3 3
ZZP_U4	Student can create and use the tools available to analyze team members' competencies in leadership styles, team roles, social and professional competencies, employee assessment.	K_U01 K_U05	5 3
ZZP_U5	Can use available IT tools to assist in planning, managing and reporting project implementation.	K_U03 K_U20	3 4
ZZP_U6	Can schedule a project schedule, including the work of the project team, report its progress, produce reports.	K_U02 K_U19 K_W24	4 1 1
ZZP_W1	Student knows the various methods of managing IT projects, primarily project team management, resources, risks, efficiency and quality.	K_K02 K_W10	1 4
ZZP_W2	Student knows basic issues related to human resources management, creation and functioning of project teams.	K_W21 K_W23	2 3

ZZP_W3	Student knows the available IT tools to support project management and implementation.	K_W14	2

3. Module description	
Description	The module includes issues related to project management methodologies and projects. Topics of the subject are project teams, issues of their creation, functioning, development, evaluation and management of their work. In particular, the content concerns IT project management methodologies - starting with the components of the project, its resources. Particular attention is paid to planning, scheduling, risk management, efficiency, quality. Available IT solutions - in particular project management packages (depending on availability of licenses - eg MS Project 2013) will be used during laboratory exercises - as a tool to help manage a complex project.
Prerequisites	brak

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ZZP_w_1	Exercies mark sheet	The specific exercise program developed in the form of an exercise card will require the student to document the performance of each of the instruction points; The tasks will be described on the card, which will be the basis for passing the exercise.	ZZP_U4
ZZP_w_2	Team project	A practical task implemented in the project team, with an indication of roles, schedule, preparation of the report.	ZZP_K7, ZZP_U4, ZZP_U5, ZZP_U6
ZZP_w_3	Preparing the file using computer software to manage project	Students will learn about the features of the project management program. They perform the exercises in accordance with the instructions, as a result prepare a file (eg in MS Project), which is the basis for verification of the correct exercise.	ZZP_U5
ZZP_w_4	Lecture credit	Written work (combination of open and closed questions).	ZZP_W1, ZZP_W2, ZZP_W3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ZZP_fs_1	lecture	Presenting the chosen issues with use of audio-visual aids.	10	Studying additional literature.	30	ZZP_w_4
ZZP_fs_2	laboratory classes	Classes taught in the form of workshops with specifying subsequent tasks to be performed. The project task executed by project teams, discussion, results presentation.	20	Preparation of practical information necessary for the implementation of the project in the working team. Acquire proficiency in the use of IT tools	60	ZZP_w_1, ZZP_w_2, ZZP_w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Master's seminar I

Module code: 08-IN-S2-SM1

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
SM1-K_8	Student has ability to critically assess his activities to evaluate and improve work effects.	K_K01 K_U01	1 1
SM1-U_1	Student can use literature, including in foreign languages to prepare elaboration referring to Master thesis.	K_U01 K_U06	1 1
SM1-U_2	Student can prepare a plan of work defining timeliness and activities connected with subsequent stages of the thesis writing process.	K_U02	1
SM1-U_3	Student can edit and formulate direct and indirect aims of Master thesis.	K_U01	1
SM1-U_4	Student can summarize basic information connected with the thesis range and describe problem discussed in Master thesis.	K_U05	1
SM1-U_5	Student can present his work and provide its thematic range, emphasizing the most important issues.	K_U04	1
SM1-U_6	Student can answer questions referring to thesis and defend, in confrontation with other students his opinions on subjects discussed in the thesis and the solutions of the problems presented in it.	K_U04 K_U05	1 1
SM1-U_7	Student has ability to negotiate and organize work – ability of self-evaluation and self-organization.	K_U02 K_U05	1 1

3. Module description

Description	Aim of classes is preparing the students to correct planning and executing all the tasks necessary to write Master thesis. As a result, the student should be able to present clearly and justify suggested approach to the described in the thesis problems, including in confrontation with other people.

Prerequisites	brak

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
SM1_w_1	Presentations	Presentations of subsequent stages of Master thesis realization. Periodical reports in the form of presentation will allow systematic verification of the student's work progress.	SM1-K_8, SM1-U_1, SM1-U_2, SM1-U_3, SM1-U_4, SM1-U_5, SM1-U_6, SM1-U_7
SM1_w_2	Articles analyses	Presenting opinions about the chosen scientific articles connected with the thesis topic. It will allow the student to familiarize with different approaches connected with thesis subject and to develop critical insight into the solutions used.	SM1-K_8, SM1-U_1, SM1-U_4, SM1-U_6, SM1-U_7

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
SM1_fs_1	seminar	Detailed specification of the scientific papers writing principles. Discussing and preparing work plan and the way of thesis writing.	15	Insightful work connected with bibliography analysis thematically close to the student's Master thesis. Detailed preparation of the thesis plan and its content and preparing the final version of the thesis. Earnest analysis of the chosen scientific texts. Preparing summary and own conclusions.	105	SM1_w_1, SM1_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Master's seminar II

Module code: 08-IN-S2-SM2

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
SM2-K_8	Student has ability to critically assess his activities to evaluate and improve work effects.	K_K01 K_U01	1 1
SM2-U_1	Student can prepare bibliography and point out general principles of scientific paper writing.	K_U01	1
SM2-U_2	Student can prepare a plan of work defining timeliness and activities connected with subsequent stages of the thesis writing process.	K_U02	1
SM2-U_3	Student can edit and formulate direct and indirect aims of Master thesis.	K_U01	1
SM2-U_4	Student can summarize basic information connected with the thesis range and describe problem discussed in Master thesis.	K_U05	1
SM2-U_5	Student can present his work and provide its thematic range, emphasizing the most important issues.	K_U04	1
SM2-U_6	Student can answer questions referring to thesis and defend, in confrontation with other students his opinions on subjects discussed in the thesis and the solutions of the problems presented in it.	K_K03 K_U04	1 1
SM2-U_7	Student has ability to negotiate and organize work – ability of self-evaluation and self-organization.	K_U02 K_U05	1 1

3. Module description

Description	Aim of classes is preparing the students to correct planning and executing all the tasks necessary to write Master thesis. As a result, the student should be able to present clearly and justify suggested approach to the described in the thesis problems, including in confrontation with other people.
Prerequisites	brak

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
SM2_w_1	Presentations	Presentations of subsequent stages of Master thesis realization. Periodical reports in the form of presentation will allow systematic verification of the student's work progress.	SM2-K_8, SM2-U_1, SM2-U_2, SM2-U_3, SM2-U_4, SM2-U_5, SM2-U_6, SM2-U_7
SM2_w_2	Articles analyses	Presenting opinions about the chosen scientific articles connected with the thesis topic. It will allow the student to familiarize with different approaches connected with thesis subject and to develop critical insight into the solutions used.	SM2-K_8, SM2-U_1, SM2-U_4, SM2-U_6, SM2-U_7

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
SM2_fs_1	seminar	Detailed specification of the scientific papers writing principles. Discussing and preparing work plan and the way of thesis writing.	30	Insightful work connected with bibliography analysis thematically close to the student's Master thesis. Detailed preparation of the thesis plan and its content and preparing the final version of the thesis. Earnest analysis of the chosen scientific texts. Preparing summary and own conclusions.	70	SM2_w_1, SM2_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Master's seminar II - preparation of master thesis

Module code: 08-IN-S2-SM3

1. Number of the ECTS credits: 10

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
SM3 -U_4	Student can answer questions referring to thesis and defend, in confrontation with other students his opinions on subjects discussed in the thesis and the solutions of the problems presented in it.	K_U04 K_U05	1 1
SM3-K_5	Student understands importance of intellectual honesty in his own activities and in activities of others, acts ethically.	K_K04	1
SM3-K_6	Student understands the need of presenting achievements in the field of IT by editing and publishing his Master thesis.	K_K02	1
SM3-K_7	Student has ability to critically assess his activities to evaluate and improve work effects.	K_K01	1
SM3-U_1	Student can present a full written elaboration concerning Master thesis.	K_U01	1
SM3-U_2	Student can summarize basic information connected with the thesis range and describe problem discussed in Master thesis.	K_U05	1
SM3-U_3	Student can present his work and provide its thematic range, emphasizing the most important issues.	K_U04	1

3. Module description

Description	Aim of classes is preparing the students to correct planning and executing all the tasks necessary to write Master thesis. As a result, the student should be able to present clearly and justify suggested approach to the described in the thesis problems, including in confrontation with other people.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
SM3_w_1	Presentations	Presentations of subsequent stages of Master thesis realization. Periodical reports in the form of presentation will allow systematic verification of the student's work progress.	SM3 -U_4, SM3-K_5, SM3-K_7, SM3-U_2, SM3-U_3
SM3_w_2	Master thesis	Skills verification by writing elaboration of Master thesis.	SM3-K_5, SM3-K_6, SM3-U_1

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
SM3_fs_1	seminar	During the classes there are discussions held, presentations given and the knowledge of preparing Master theses is grounded.	30	Studying materials connected with Master thesis thematic, presentation elaboration and preparing the final version of Master thesis. Preparing for the discussion.	260	SM3_w_1, SM3_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Master's workshop I

Module code: 08-IN-S2-PM1

1. Number of the ECTS credits: 5

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PM1-K_6	Student can present results connected with work to a group of people. Exhibits abilities of creative thinking while solving encountered problems.	K_K01 K_U04	1 1
PM1-U_1	Student can define requirements referring to Master thesis in the range of its form and technical editing.	K_U01	1
PM1-U_2	Student can prepare documentation connected with Master thesis.	K_U02 K_U03	1 1
PM1-U_3	Student can use IT tools for correct edition of Master thesis, understands the need of making thematic and graphic juxtapositions.	K_U14	1
PM1-U_4	Student can use statistical methods for verification of hypotheses presented in Master thesis.	K_U08	1
PM1-U_5	Student can use IT techniques in the specified area of use in Master thesis or in the realized project.	K_U12 K_U14	1 1

3. Module description

Description	Aim of the class is preparing the students for correct edition of Master thesis and preparing its technical part. The student should be able to appropriately present his thesis documentation and used the techniques learnt to compare to other, known solutions similar to questions analyzed in the thesis. Moreover, he should know the principles of correct Master thesis edition and IT tools supporting this process.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
PM1_w_1	Presentation	Presentations of subsequent stages of Master thesis realization. Periodical reports in the form of presentation will allow systematic verification of the student's work progress.	PM1-K_6, PM1-U_1, PM1-U_3, PM1-U_4, PM1-U_5
PM1_w_2	Additional project	Additional project with related topic to Master thesis subject. During its realization, the student will be able to exhibit the skill of self-organizing and timeliness and will acquire knowledge necessary to write Master thesis.	PM1-K_6, PM1-U_2, PM1-U_3, PM1-U_4, PM1-U_5

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
PM1_fs_1	laboratory classes	Detailed specification of technical aspects connected with Master thesis writing. Review of the most popular tools helpful while Master thesis editing and preparing thesis and project documentation.	30	Familiarizing with the learned tools and their use in the process of Master thesis writing, projects creating and preparing presentations.	100	PM1_w_1, PM1_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Master's workshop II

Module code: 08-IN-S2-PM2

1. Number of the ECTS credits: 6

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PM2-K_6	Student can present results connected with work to a group of people. Exhibits abilities of creative thinking while solving encountered problems.	K_K01 K_U04	1 1
PM2-U_1	Student can define requirements referring to Master thesis in the range of its form and technical editing.	K_U01	1
PM2-U_2	Student can prepare documentation connected with Master thesis.	K_U02 K_U03	1 1
PM2-U_3	Student can use IT tools for correct edition of Master thesis, understands the need of making thematic and graphic juxtapositions.	K_U14	1
PM2-U_4	Student can use statistical methods for verification of hypotheses presented in Master thesis.	K_U08	1
PM2-U_5	Student can use IT techniques in the specified area of use in Master thesis or in the realized project.	K_U12 K_U14	1 1

3. Module description

Description	Aim of the class is preparing the students for correct edition of Master thesis and preparing its technical part. The student should be able to appropriately present his thesis documentation and used the techniques learnt to compare to other, known solutions similar to questions analyzed in the thesis. Moreover, he should know the principles of correct Master thesis edition and IT tools supporting this process.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
PM2_w_1	Presentations	Presentations of subsequent stages of Master thesis realization. Periodical reports in the form of presentation will allow systematic verification of the student's work progress.	PM2-K_6, PM2-U_1, PM2-U_3, PM2-U_4, PM2-U_5
PM2_w_2	Documentation	Presentation of full documentation of the application if there is such in the thesis, documentation of experiments carried out or other examinations carried out tithing the frames of Master thesis.	PM2-K_6, PM2-U_2, PM2-U_4

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
PM2_fs_1	laboratory classes	Detailed specification of technical aspects connected with Master thesis writing. Review of the most popular tools helpful while Master thesis editing and preparing thesis and project documentation.	45	Familiarizing with the learned tools and their use in the process of Master thesis writing.	120	PM2_w_1, PM2_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Methods of analysis and modeling systems

Module code: 08-IN-ISI-S2-MAiMS

1. Number of the ECTS credits: 1

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
MAiMS -K_7	Can work and communicate in multiple team and divides tasks properly	K_K01	1
MAiMS -U_5	Can use techniques of system analysis and modeling	K_U07 K_U08 K_U10 K_U19	4 4 1 5
MAiMS -U_6	Can use programs supporting system modeling	K_U13 K_U14 K_U15 K_U20	1 4 1 4
MAiMS -W_1	Has basic knowledge of system analysis methods	K_W01 K_W03 K_W10	1 3 3
MAiMS -W_2	Has basic knowledge of structural and object modeling	K_W06 K_W10	2 3
MAiMS -W_3	Has basic knowledge of business processes modeling	K_W14 K_W21 K_W23	3 2 2

MAiMS -W_4	Has basic knowledge of system dynamics modeling	K_W01 K_W14	3 3

3. Module description	
Description	The aim of classes in this module is making the students prepared to modeling complex systems. Thanks to the class, the student should exhibit knowledge of modern analysis and modeling. Should be acquainted with issues concerning management of project works. Classes in this module prepare to work in multiple teams of analysts.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
MAiMS _w_1	Credit test	Solving tasks of content referring to the chosen issues in the field of analysis and modeling of example systems	MAiMS -K_7, MAiMS -U_5, MAiMS -U_6, MAiMS -W_1, MAiMS -W_2, MAiMS -W_3, MAiMS -W_4
MAiMS _w_2	Current evaluation	Practical problem solving during laboratory class	MAiMS -K_7, MAiMS -U_5, MAiMS -U_6

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
MAiMS _fs_1	laboratory classes	Detailed students' preparation for realizing process of analysis and modeling of a complex system in a several persons team.	30			MAiMS _w_1, MAiMS _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Methods of computational intelligence

Module code: 08-IN-IJO-S2-MIO

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
MIO -K_8	Can divide project tasks and co-operates in several person group.	K_U02	1
MIO -U_4	Uses swarm displacement equations in simple swarm implementations concerning obstacles bypassing.	K_U01 K_U02 K_U03	1 2 1
MIO -U_5	Deploys the methods known in PSO algorithm implementations retaining volumes of parameters influencing obtaining optimum of the function optimizated.	K_U01 K_U02 K_U03	1 2 1
MIO -U_6	Can select and bring up to date the values of parameters in various approaches concerning swarm particles optimization (PSO),canonical model with inertia weight and in a model with preload.	K_U01 K_U02 K_U03	1 2 1
MIO -U_7	Verifies and designs swarm intelligence model accordin to the analyzed problem and communication topology used.	K_U01 K_U02 K_U03	1 2 1
MIO -W_1	Characterizes swarm behaviors by Boids C. Reynolds algorithm.	K_W02 K_W06 K_W08 K_W09	1 1 2 1

		K_W14 K_W16	1 1
MIO -W_2	Explains displacement rules on the basis of basic patterns drawn from particles swarm optimization.	K_W02 K_W06 K_W08 K_W09 K_W14 K_W16	1 1 2 1 1 1
MIO -W_3	Selects appropriate PSO model on the basis of the analyzed problem and describes influence of parameters on the way the swarm operates.	K_W02 K_W06 K_W08 K_W09 K_W14 K_W16	1 1 2 1 1 1

3. Module description	
Description	Swarm behavior algorithms constitute a part of artificial life and computational intelligence. The aim of the student is acquiring the skill of selecting swarm optimization technique appropriate for the group of optimization problems analyzed, including simulation and behavior analysis algorithms. Proper PSO selection depends on communication topology, interaction between particles and the role of a leader, or the algorithm of particle grouping.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
MIO _w_1	Exam	Written work indicating the level of understanding of the lecture content.	MIO -W_1, MIO -W_2, MIO -W_3
MIO _w_2	Control tests	Written knowledge verification of the subsequent topics realized during laboratory classes.	MIO -W_1, MIO -W_2, MIO -W_3
MIO _w_3	Group project	Implementation of swarm intelligence algorithm in a specific use in several person group.	MIO -K_8, MIO -U_4, MIO -U_5, MIO -U_6, MIO -U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
MIO _fs_1	lecture	Presenting educational content verbally with use of the content visualization. Focusing on	15	Familiarizing with lecture thematics with use of the existing method packages: a script,	15	MIO _w_1

		conceptually complex material and indicating website addresses and e-learning package.		websites, e-learning package.		
MIO _fs_2	laboratory classes	Detailed preparation of the students for algorithms implementation indicating methodology and sequence of proceedings.	30	Independent execution and elaboration for laboratory class credit tests. Execution of the project – implementation of the given system in a several person group.	30	MIO _w_2, MIO _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Microcomputers and network couplers

Module code: 08-IN-IIN-S2-MiSS

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
MiSS -K_12	Independently gets acquainted with issues beyond the field of study, which enable to realize interdisciplinary projects.	K_K02 K_U05	1 1
MiSS -K_13	Presents his own project.	K_K01	1
MiSS -U_10	Designs and implements simple drivers using microcontrollers.	K_U09	4
MiSS -U_11	Selects appropriate instructions and addressing modes to optimize the control program.	K_U13	1
MiSS -U_7	Uses runtime systems for microcomputers.	K_U14 K_U20	2 2
MiSS -U_8	Programs microcontrollers in the chosen programming language.	K_U12 K_U13 K_U15	2 2 1
MiSS -U_9	Enters the program in internal memory of the microcontroller and deploys it stepwise.	K_U09 K_U20	3 1
MiSS -W_1	Characterizes processor and internal peripheral systems of microcontroller.	K_W04	1
MiSS -W_2	Describes advantages of MCU microcomputer Harvard architecture and reduced instruction set.	K_W04 K_W07	1 1
MiSS -W_3	Understands the need to use microcomputers in everyday life.	K_W13 K_W14	1 1

MiSS -W_4	Presents various concepts of microcontrollers networks.	K_W04 K_W13 K_W14	1 1 1
MiSS -W_5	Understands technical documentation and instruction set of microcontrollers.	K_W07	1
MiSS -W_6	Understands threats connected with maintenance-free control of manufacturing processes.	K_W20	1

3. Module description	
Description	The goal of the module is to familiarize the student with current trends in the use of microprocessors in designing the controllers and authoring devices. Aim of the module is to present the concept of communicating and cooperating microcontrollers networks. The student gets to know two families of microcontrollers and justifies the choice of optimum solutions after analyzing a widely perceived cost of the solution (equipment cost, energy consumption, simplicity of implementation, etc.).
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
MiSS _w_1	Lecture credit	Questions from the lecture subject matter.	MiSS -W_1, MiSS -W_2, MiSS -W_3, MiSS -W_4, MiSS -W_5, MiSS -W_6
MiSS _w_2	Conversation during crediting tasks	Verifies the ability to generalize the skills acquired while implementing and documenting the program created in groups of two students	MiSS -K_12, MiSS -K_13, MiSS -U_10, MiSS -U_11, MiSS -U_7, MiSS -U_8, MiSS -U_9

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
MiSS _fs_1	lecture	Content available in the form of multimedia transfer.	15	Preparing to laboratory classes and to lecture credit.	30	MiSS _w_1
MiSS _fs_2	laboratory classes	Implementing simple programs for microcomputer using the chosen programming language and runtime environment. Designing and activating microcomputer-controlled devices.	30	Implementing and running programs dedicated to the designed microcomputer-based device. Preparing specification for the designed device.	15	MiSS _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Mobile and web technologies

Module code: 08-IN-BIO-S2-TMiW

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
TMiW -K_6	Executes individual and team works.		
TMiW -U_3	Extracts information from literature, Internet resources and other sources.	K_U01 K_U06	1 1
TMiW -U_4	Can use software tools enabling mobile devices programming and software testing.	K_U20	1
TMiW -U_5	Can develop a mobile application with the given utility, choosing appropriate technology and tools.	K_U12 K_U13 K_U15	1 1 1
TMiW -W_1	Possesses knowledge in the field of hardware and software architectures of the chosen mobile devices.	K_W04 K_W05 K_W10	1 1 1
TMiW -W_2	Has basic knowledge in the field of programming and developing applications for mobile devices.	K_W06 K_W12 K_W16	1 1 1

3. Module description

Description	Aim of the classes in this module is preparing the students to develop mobile and web applications for portable devices, such as smart phones and tablets. Besides presenting knowledge in the field of hardware and software architecture of such devices, the students acquire skills of using the tools needed for software development and its testing and deployment.

Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
TMiW _w_1	Test	Two tests are scheduled: one of mobile devices systems and construction, the second of mobile devices chosen elements programming.	TMiW -U_3, TMiW -W_1, TMiW -W_2
TMiW _w_2	Project	Within the module, one project will be executed by a student (working in a team).	TMiW -K_6, TMiW -U_4, TMiW -U_5
TMiW _w_3	Brainstorming	Suggesting a solution or solving a given problem by all the students from the group during brainstorming.	TMiW -K_6, TMiW -U_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
TMiW _fs_1	lecture	Lecture introducing to understanding the most important issues connected with mobile systems and applications illustrated with slideshow and work methods presentation with use of computer performed by the teacher.	15	Work with indicated field literature, materials made available, covering individual assimilation of knowledge referring to indicated basic issues.	20	TMiW _w_1, TMiW _w_3
TMiW _fs_2	laboratory classes	The teacher leads and instructs the students working individually. In case of more complex issues, the teacher suggests optimum solutions. Besides individual work, the students solve problems during brainstorming.	30	Student is obliged to be prepared of theoretical knowledge on the basis of lectures and materials made available for each class. Student performs a programming task in a team, with use of computer and software supporting programming, developing and testing. Next, he presents the report of the executed project together with demonstration.	25	TMiW _w_1, TMiW _w_2, TMiW _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Modern mobile technologies

Module code: 08-IN-IIN-S2-NTM

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
NTM -K_7	Works in a team of two and effects proper work division.	K_U02	1
NTM -K_8	Independently gets acquainted with issues beyond the field of study, which enable to realize interdisciplinary projects.	K_U05	1
NTM -U_4	Can select appropriate language and programming environment for programming the device, operate emulators of mobile devices.	K_U13	1
NTM -U_5	Designs and implements applications for mobile devices characterized by certain utility.	K_U15 K_U19	4 2
NTM -U_6	Uses data transfer in the GSM/GPRS and GPS systems for mobile applications.	K_U11	1
NTM -W_1	Characterizes construction and hardware resources of mobile devices.	K_W04	1
NTM -W_2	Has basic knowledge in the field of graphic interfaces for mobile devices applications.	K_W12 K_W16	1 1
NTM -W_3	Has basic knowledge in the field of mobile devices programming.	K_W06	1

3. Module description

Description	The aim of classes consisting this module is to prepare students to create applications for mobile devices. As a result, the student should exhibit knowledge in the field of construction and hardware capabilities as well as programming capabilities of mobile devices. Moreover, students should be familiar with issues of package (GSM/GPRS) and wireless (WiFi) data transfer and the principles of operating the GPS system. In consequence, this should lead to an acquisition of a complex knowledge enabling to create applications for mobile devices of various types.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
NTM _w_1	Exam	Questions from the lectures subject matter.	NTM -W_1, NTM -W_2, NTM -W_3
NTM _w_2	Conversation during tasks crediting	Questions checking level of understanding issues concerning construction and operating of mobile devices which enable their programming, checking the skill of generalizing competences acquired during tasks solving in groups of two.	NTM -K_7, NTM -K_8, NTM -U_4, NTM -U_5, NTM -U_6

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
NTM _fs_1	lecture	Content available in the form of multimedia.	15	Preparing for the laboratory classes and to pass the exam.	15	NTM _w_1
NTM _fs_2	laboratory classes	Designing and implementation of mobile applications, presenting the effects of work, discussion over the presented solutions.	30	Running and testing the designed and implemented mobile applications.	30	NTM _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Moduł ogólnouczelniany humanistyczny

Module code: 08-IN-S2-MO

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
MO_K_3	Rozumie potrzebę interdyscyplinarnego podejścia do rozwiązywanych problemów, integrowania wiedzy z różnych dyscyplin oraz praktykowania samokształcenia służącego pogłębianiu zdobytej wiedzy.		
MO_U_2	Posiada umiejętność stawiania i analizowania problemów na podstawie pozyskanych treści z zakresu dyscypliny nauki niezwiązanej z kierunkiem studiów.		
MO_W_1	Posiada ogólną wiedzę na temat wybranych metod naukowych oraz zna zagadnienia charakterystyczne dla dyscypliny nauki niezwiązanej z kierunkiem studiów.		

3. Module description

Description	Student dokonuje wyboru modułu(ów) spośród oferty ogólnouczelnianej określonej dla danego kierunku studiów. Celem modułu jest poszerzenie wiedzy, umiejętności i kompetencji społecznych studenta o treści spoza kierunku studiów.
Prerequisites	Rada Wydziału określa dla studentów danego kierunku studiów obowiązującą liczbę modułów (zgodnie z programem kształcenia i planem studiów danego kierunku) oraz ustala semestr rozpoczęcia i zakończenia kształcenia.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
MO_w_1	zaliczenie	weryfikacja na podstawie pracy zaliczeniowej lub weryfikacji ustnej (zgodnie z wymaganiami określonymi w sylabusie)	MO_K_3, MO_U_2, MO_W_1

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
MO_fs_1	lecture	Podanie treści kształcenia w formie werbalnej z wykorzystaniem wizualizacji treści. Skupienie się na materiale trudnym pojęciowo i wskazanie źródeł. Ilustracja treści za pomocą przykładów.	30	Zapoznanie się z tematyką wykładu z wykorzystaniem istniejących pakietów metod: podręczników, skryptów, stron internetowych itp. Przygotowanie się do zaliczenia w zależności od przyjętej formy, określonej szczegółowo w sylabusie realizowanego modułu.	45	MO_w_1

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Monographic lecture

Module code: 08-IN-S2-WMJA

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
WMJA_K_5	Student can see the analogies in the knowledge presented in the lecture, as well as analogies with the concepts taught in other lectures	K_K01	4
WMJA_U_3	Student is able to apply the acquired knowledge in various other IT fields	K_U01	1
WMJA_U_4	Student is able to define and analyze problems based on the theory and presented research techniques	K_U01 K_U04 K_U05	4 2 2
WMJA_U_6	Student can use English literature on an intermediate level and write a short study in this language on the topic discussed in the lecture	K_U06	5
WMJA_W_1	Student has a general knowledge about the methods and techniques discussed in a given monographic lecture	K_W14	5
WMJA_W_2	Student knows in detail the detailed issues defined and described in the lecture.	K_W14	5

3. Module description

Description	1. The role and place of the lectured IT department, the outline of its development. 2. Basic concepts and definitions. 3. The main methods, techniques and examples of these concepts and definitions, their applications and relationships between them.

	4. Relation of the lectured theory to other IT fields. Practical applications. 5. Unsolved problems and perspectives of further theory development.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
WMJA_w_1	Solving the problem	Verification is based on the development of one of the practical problems related to the presented during the lecture	WMJA_U_3, WMJA_U_4, WMJA_U_6
WMJA_w_2	Lecture credit	Verification is based on verbal or written answers	WMJA_K_5, WMJA_W_1, WMJA_W_2

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
WMJA_fs_1	lecture	Providing the lecture in verbal form with additional visualization. Focusing attention on the most difficult parts. Visualization of examples.	30	Individual studying of the subject of the lecture using: textbooks, scripts, websites, etc. Individual work and study concerning the use of lectures ideas in practical aspects.	80	WMJA_w_1, WMJA_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Monographic's lecture

Module code: 08-IN-GWK-S2-WM

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
WM -K_7	Can work individually or in a team.	K_U02	1
WM -K_8	Can think and act creatively.	K_K03	1
WM -U_4	Can create mathematical model of graphic system, verify it of simulate its operation.	K_U07 K_U08 K_U12	1 1 1
WM -U_5	Can implement known algorithms in the chosen programming language or in MAPLE system.	K_U02 K_U03 K_U04 K_U05 K_U12 K_U13 K_U14	1 1 1 1 1 1 1
WM -U_6	Can acquire information about geometrical algorithms, fractal modeling, root-finding, biomorphs, dynamic systems and their visualization and other connected issues from literature, databases and other sources including in English.	K_U01 K_U04 K_U05 K_U06	1 1 1 1
WM -W_2	Knows and understands basic iterative algorithms to generate esthetic patterns, knows issues of image analysis, construction and verification of mathematical models.	K_W01	1

		K_W03	1
WM -W_3	Knows and understands issues connected with MAPLE system programming, knows the basics of visualization.	K_W01 K_W03 K_W06 K_W08	1 1 1 1
WM-W_1	Knows and understands mathematical notions used in geometric modeling, understands the issues connected with iterative processing system, fractal modeling, root-finding, biomorphs, dynamic systems and chaos.	K_W01 K_W03 K_W15	1 1 1

3. Module description	
Description	Aim of the lecture is familiarizing the students with issues connected with computer graphics in the aspect of mathematical formalism, among others, geometric algorithms, fractal modeling, evolutionary generating of utility models, root-finding, iterative processing systems, convergent sequences and basins of attraction visualization, image recognition, creating and verification of mathematical models. Lecture content will be implemented in environment of computation system MAPLE.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
WM _w_1	Credit	Lecture credit is gained on the basis of a project illustrating the chosen lecture issues, executed in the chosen programming environment. The final grade results from the level of mastery in lecture content, skill of appropriate argumentation during reasoning and skill of discussing, creativity, in solving given problems individually or in a group. The grade is also influenced by make use of literature, especially in English.	WM -K_7, WM -K_8, WM -W_2, WM -W_3, WM-W_1
WM _w_2	Project	Lecture credit is gained on the basis of project illustrating the chosen lecture issues, executed in the chosen programming environment individually or in a group.	WM -K_7, WM -K_8, WM -U_4, WM -U_5, WM -U_6, WM -W_2, WM -W_3, WM-W_1
WM _w_3	Presentation	Giving an audio-visual presentation in front of the group, discussion over assumptions and accepted method of a given problem solving, analysis and evaluation of the project goal.	WM -K_7, WM -K_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
WM _fs_1	lecture	Presenting educational content with use of audio-visual aids.	30	Individual preparation for lectures. Studying of the advised literature, creative searching for solutions to defined problems, individually or in a group.	30	WM _w_1, WM _w_2, WM _w_3

				Executing the semester project in the range of accepted education effects, individually or in a group. Giving audio-visual presentation in front of the group, discussion over assumptions and accepted method of solving the defined problem, analysis and evaluation of the project goal fulfillment.		

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Non-photorealistic graphics

Module code: 08-IN-GWK-S2-GN

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
GN -K_7	Can work individually and in a team.	K_U02	1
GN -K_8	Can think and act creatively.	K_K03	1
GN -U_4	Can implement the learned algorithms in the chosen programming language.	K_U12	1
GN -U_5	Can acquire information about non-photorealistic graphics from literature, database and other sources.	K_U01	1
GN -U_6	Can prepare and present a paper about project task realization.	K_U02 K_U03 K_U04	1 1 1
GN -W_2	Knows and understands basic algorithms used in non-photorealistic graphics.	K_W02	1
GN -W_3	Knows and understand basic principles for creating algorithms in non-photorealistic graphics.	K_W02	1
GN-W_1	Knows and understands mathematical notions referring to non-photorealistic graphics.	K_W01	1

3. Module description

Description	Aim of the class is to familiarize students with basics of non-photorealistic graphics. During the classes, the students will prepare projects in teams of maximum two and will present results of their work in the form of presentation in front of the group.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
GN _w_1	Project	Preparing a project and presentation about the chosen topic connected with non-photorealistic graphics.	GN -K_7, GN -K_8, GN -U_4, GN -U_5, GN -U_6, GN -W_2, GN -W_3, GN-W_1
GN _w_2	Reports	Algorithms implementation.	GN -K_7, GN -K_8, GN -U_4, GN -W_2, GN -W_3, GN-W_1

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
GN _fs_1	lecture	Presenting educational content with use of audio-visual aids.	15	Individual preparation for the laboratory classes.	5	GN _w_1, GN _w_2
GN _fs_2	laboratory classes	Detailed students preparation to use of algorithms in non-photorealistic graphics. Algorithms implementation.	30	Individual preparation for the laboratory classes. Familiarizing with project thematic and execution of the project individually or in a team of two. Preparing the presentation describing the project issue.	40	GN _w_1, GN _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Optimization techniques

Module code: 08-IN-IJO-S2-TO

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
TO -K_9	Can co-operate with a partner executing his share of task.	K_U02	1
TO -U_5	Can properly use chosen programming libraries to formulate discreet optimization problems as a task of linear programming (including integer).	K_U01 K_U14	1 1
TO -U_6	Can solve a task of linear programming (including integer)using available libraries in the chosen programming language.	K_U07 K_U12	1 1
TO -U_7	Is able to design and implement distribution and restrictions algorithm and the method of dynamic programming for the given discreet optimization problem.	K_U12 K_U13 K_U14	1 1 1
TO -U_8	Can implement chosen meta-heuristics.	K_U12 K_U14 K_U16	1 1 1
TO -W_1	Has knowledge in the field of formulating discreet optimization tasks using linear, integer and zero-one programming.	K_W09	2
TO -W_2	Possesses knowledge in the field of classic optimization techniques such as method of distribution and restrictions and dynamic programming and can characterize expedience of their use.	K_W09	2
TO -W_3	Has knowledge in the field of chosen meta-heuristics: local browsing, annealing and taboo search.	K_W09	1
TO -W_4	Has knowledge about class of optimization problems and, especially in this aspect can recognize that it is impossible to design polynomial algorithm for a given task.	K_W01 K_W02	1 1

		K_W03	1

3. Module description	
Description	Aim of the classes in this module is preparing the students to solve the tasks of discreet optimization. As a result, the student should exhibit full understanding of issues connected with designing and implementation of classic and modern optimization algorithms. In consequence it should lead to deepening the knowledge of efficient algorithms designing and developing the skill of their implementation.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
TO -w_1	Exam	Solving tasks of content, one after each section discussed during lectures.	TO -W_1, TO -W_2, TO -W_3, TO -W_4
TO -w_2	Laboratory class credit	Tests after each topic completed during classes together with lecture theoretical knowledge control.	TO -K_9, TO -U_5, TO -U_6, TO -U_7, TO -U_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
TO -fs_1	lecture	Presenting educational content in verbal form, with use of content visualization. Focusing on conceptually complex material and indicating website addresses.	15	Familiarizing with lecture content using the existing packages of methods and websites.	15	TO -w_1
TO -fs_2	laboratory classes	Detailed preparation of the students to solve tasks indicating proceedings methodology and sequence of proceeding. Solving tasks of content.	30	Solving tasks (mainly referring to implementation) of subsequent topics together with analysis of the solutions already existing on websites.	30	TO -w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Optimization with computer clusters use

Module code: 08-IN-S2-OzUKK

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
OzUKK -U_5	Can implement parallel clusters on computer clusters using the MPI library in C/C++ language.	K_U12 K_U13 K_U14	1 1 1
OzUKK -U_6	Can practically realize detection of termination of distributed computing.	K_U12	1
OzUKK -U_7	Is able to implement Monte Carlo algorithms using computer clusters in C/C++ language, taking advantage of MPI library.	K_U12 K_U13 K_U16	1 1 1
OzUKK -U_8	Can implement chosen, exact discreet optimization algorithms using computer clusters in C/C++ language and MPI library.	K_U12 K_U13 K_U16	1 1 1
OzUKK -W_1	Has knowledge of designing parallel algorithms and is able to characterize various models of decomposition.	K_W04 K_W06	1 2
OzUKK -W_2	Has knowledge in the field of basic and advanced functions of MPI interface and can characterize expedience of their use.	K_W05 K_W06	1 1
OzUKK -W_3	Possesses knowledge in the field of Monte Carlo methods parallelization, especially can characterize algorithms of simulated annealing and taboo search in this aspect.	K_W06 K_W09	1 1
OzUKK -W_4	Possesses knowledge about realization of parallel computations in discreet optimization tasks, especially in this aspect can	K_W06	1

	characterize backtracking algorithm and the method of division and restrictions.	K_W09	1

3. Module description	
Description	Aim of classes in this module is preparing the students to solve tasks of discreet optimization with use of computer clusters. As a result, the student should exhibit complete understanding of the issues connected with designing and implementation of the classic and modern parallel algorithms. As a consequence it should lead to deepening of knowledge in the field of parallel computing and developing the skill of algorithms implementation so as they could operate on massively parallel processors.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
OzUKK -w_1	Lecture credit	Solving tasks of content, one after each section discussed during the lecture.	OzUKK -W_1, OzUKK -W_2, OzUKK -W_3, OzUKK -W_4
OzUKK -w_2	Laboratory class credit	Tests after each topic completed during classes together with the lecture theoretical knowledge control.	OzUKK -U_5, OzUKK -U_6, OzUKK -U_7, OzUKK -U_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
OzUKK -fs_1	lecture	Presenting educational content in verbal form, using content visualization. Focusing on conceptually complex material and indicating websites addresses.	15	Familiarizing with lecture content using the existing methods package: script and websites.	15	OzUKK -w_1
OzUKK -fs_2	laboratory classes	Detailed preparation of the students to solve tasks with indicating methodology and sequence of proceedings. Solving tasks of content.	30	Solving tasks (mainly connected with implementation) of subsequent topics together with analysis of the already existing solutions – in the script and on websites.	30	OzUKK -w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Parallel computing

Module code: 08-IN-S2-OR

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
OR_K_8	Is able to formulate opinions on the basic issues, contemporary status, and development trends in the area of parallel computing.	K_K01	1
OR_U_5	Is able to carry out the analysis of work and evaluation of metrics that characterize a parallel algorithm, such as time complexity, speedup, cost, and efficiency.	K_U07 K_U12	1 1
OR_U_6	Is able to design and implement an elementary parallel algorithm using the OpenMP interface, and the message passing interface (MPI) library.	K_U07 K_U12	1 1
OR_U_7	Is able to work in a two-member team, and to make a proper division of the workload.	K_U02	1
OR_W_1	Has the knowledge concerning the random access machine (RAM) model.	K_W04 K_W06	1 1
OR_W_2	Has the knowledge concerning the parallel random access machine (PRAM) model.	K_W04 K_W06	1 1
OR_W_3	Has the knowledge concerning the network model of parallel computation with various topologies (multidimensional meshes, hepercube, butterfly network).	K_W04 K_W06	1 1
OR_W_4	Has the knowledge concerning the elementary parallel algorithms to solve sample problems, e.g. reduction problem, prefix computation, sorting, matrix multiplication, for the PRAM model and network models of various topologies.	K_W04 K_W06	1 1

3. Module description

Description	

	The purpose of the course is to introduce students to the basic topics of parallel computing. Students acquire knowledge regarding elementary parallel algorithms designed for various models of parallel computation. In addition, they acquire the ability to implement elementary parallel algorithms.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
OR_w_1	Control test	The written control test to check the knowledge concerning the topics discussed at the lectures, and carried out within the laboratory.	OR_K_8, OR_U_5, OR_U_6, OR_U_7, OR_W_1, OR_W_2, OR_W_3, OR_W_4
OR_w_2	Programming project	Implementation of a simple programming project enabling practical verification of the acquired knowledge and skills related to parallel computing.	OR_K_8, OR_U_5, OR_U_6, OR_U_7
OR_w_3	Homework assignment	Homework assignment on three topics presented at the lecture.	OR_K_8, OR_W_1, OR_W_2, OR_W_3, OR_W_4

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
OR_fs_1	lecture	Oral presentation of education content using the audiovisual media and written didactic materials.	15	Get acquainted with the topics presented during the lectures using the indicated literature references.	30	OR_w_3
OR_fs_2	laboratory classes	Preparing students to create an implementation of elementary parallel algorithms. The presentation of tools that helps to implement the parallel computation.	15	Get acquainted with the documentation of tools for implementing parallel algorithms. Implement a programming project using the presented tools.	60	OR_w_1, OR_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Parallel computing engineering

Module code: 08-IN-IIN-S2-IOR

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
IOR _K_1	Student understands the need of constant education and is aware of his own and group responsibility for work.	K_U05	1
IOR _K_2	Student should have skill of independent, or in a team solving physical and technical problems taking advantage of the acquired knowledge and practical skills.	K_U02	1
IOR _U_1	Knows how to create simple parallel and spread systems in the chosen programming environments.	K_U12 K_U13	1 1
IOR _U_2	Student can activate and analyze execution of programs taking advantage of basic, timely tools for parallel and spread systems creating.	K_U03 K_U08 K_U12 K_U13	1 1 1 1
IOR _W_1	Knows basic and chosen advanced issues connected with parallel and spread systems.	K_W04 K_W06	1 1
IOR _W_2	Knows basic and chosen advanced tools for parallel and spread systems creating.	K_W04	1
IOR _W_3	Understands basic design problems in parallel systems and chosen methods of their solving. The student has knowledge concerning principles of carrying out the basic performance and parallel systems correctness analyses.	K_W07 K_W10	1 1

3. Module description

Description	Aim of classes in this module is presenting basic computational models in computer systems. Basic notions of parallel systems will be discussed, as well as parallelism models, computational performance, basics of processors architecture with parallelism at the instruction level.

Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
IOR _w_1	Group project	Executing a project covering creating an application composed of multiple concurrently and parallel processes basing on project assumptions.	IOR _K_1, IOR _K_2, IOR _U_1, IOR _U_2, IOR _W_1, IOR _W_2, IOR _W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
IOR _fs_1	lecture	Giving educational content in verbal form, with use of content visualization. Focusing on material conceptually complex and indicating website addresses and e-learning package.	10		5	IOR _w_1
IOR _fs_2	laboratory classes	Detailed preparation of the students to solving tasks with indication to performance methodology, and indicating sequence of activities performed.	30	Realization of the program in virtual environment at home, or using computers made available for students’ work by the Department.	15	IOR _w_1

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Programming mobile devices

Module code: 08-IN-ISI-S2-PUM

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PUM _U_4	Can create mobile applications using the chosen programming environments.	K_U13 K_U15	3 4
PUM _U_5	Is able to program using libraries and stock solutions available in the chosen environments.	K_U13 K_U15	4 3
PUM _U_6	Can test and activate applications using tools available in the chosen mobile environments.	K_U03	3
PUM _U_7	Is able to identify current trends in designing and creating applications. Understands needs to develop his competences in the field of programming.	K_U05 K_U13 K_U15	4 3 3
PUM _U_8	Can independently identify problems, look for and select solution methods and systematically create specifications of project tasks.	K_U01 K_U03	4 4
PUM _W_2	Student has knowledge of mobile device programming, architecture, and how the applications work for this type of application.	K_W06 K_W12 K_W15	4 2 1
PUM _W_3	Has knowledge about principles and methods of building, testing and activation for applications in the chosen environments dedicated to mobile platforms.	K_W06 K_W14	4 4
PUM_W_1	Knows the concept of designing and creating applications for mobile platforms, understands application structure organization principles, knows basic programming environments dedicated to such platforms.	K_W06 K_W07	1 4

3. Module description

Description	Aim of education is to prepare students to design and program mobile applications operating in devices like: tablet, cell phone, GPS receivers. During education, the students get acquainted with the chosen programming methods and tools, learn practical skills in their use, get to know techniques characteristic for mobile platforms, learn how to create and program applications, which take advantage of the newest technology achievements. During realization of individual project tasks, the students will develop their competences in the field of identification of programming problems, methods of looking for solutions, their analysis and selection of the most convenient solutions. The students will learn the principles for identification and selection of licensing scheme for the used tools.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PUM _w_1	Exam	Exam in the form of test, tests containing both open and closed questions.	PUM _W_2, PUM _W_3, PUM_W_1
PUM _w_2	Control test	Practical test in the form of practical implementation of the given programs.	PUM _U_4, PUM _U_5, PUM _W_3
PUM _w_3	Individual project	Report containing project specification together with attached program.	PUM _U_6, PUM _U_7, PUM _U_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PUM _fs_1	lecture	Teaching content in verbal form using audio-visual means. Discussion of presented content, analysis and discussion of selected practical cases.	15	In-depth analysis of lecture materials posted on the website of the course.	15	PUM _w_1
PUM _fs_2	laboratory classes	Practical preparation for creating mobile applications, realization of project tasks, discussion over problems, perfecting in methods of the chosen mobile environments use.	30	In-depth analysis of application examples posted on the web site of the subject. Project development, software development, documentation development.	30	PUM _w_2, PUM _w_3

1.	**Field of study**	**Computer Science**
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Programming paradigms

Module code: 08-IN-S2-PP

1. Number of the ECTS credits: 5

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PP _K_7	Can work in a design and programming team.	K_K02 K_U02	1 1
PP _U_4	Can construct solution for the given problem according to defined programming paradigm and record it in the chosen programming language.	K_U01 K_U05 K_U12 K_U13 K_U15	1 1 1 1 1
PP _U_5	Can use object, structural, functional and declarative approach in the chosen programming languages.	K_U15	1
PP _U_6	Can test computer program reliability in the chosen programming environment and document a program.	K_U01 K_U03 K_U05 K_U12 K_U13 K_U15	1 1 1 1 1 1
PP _W_1	Knows programming paradigms: procedural programming, object programming, structural programming, concurrent, imperative programming, functional and declarative and their link with computer architecture (including parallel and multiprocessor ones).	K_W04 K_W06 K_W09 K_W10	1 1 1 1

		K_W12 K_W14	1 1
PP _W_2	Understands basic programming constructions and knows types of given imperative languages characteristic for declarative and functional approaches.	K_W06 K_W09 K_W10 K_W12 K_W14	1 1 1 1 1
PP _W_3	Has knowledge referring to implementation of mechanisms characteristic for a specific programming paradigm in chosen programming languages.	K_W06 K_W09 K_W10 K_W12 K_W14	1 1 1 1 1

3. Module description	
Description	Aim of the class is supplementation of the students' knowledge referring to principles of designing and implementing computer programs and widening the skill of developing legible and effective programs in the chosen languages representing imperative, functional and declarative approaches. The student develop their knowledge and skills of various programming paradigms use.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PP _w_1	Project evaluation	Students individually develop software, whose specification is given by the teacher.	PP _K_7, PP _U_4, PP _U_5, PP _U_6, PP _W_1, PP _W_2, PP _W_3
PP _w_2	Control tests	Written tests (including these executed during the class at the computer.	PP _U_4, PP _U_5, PP _U_6, PP _W_1, PP _W_2, PP _W_3
PP _w_3	Exam	Students design and implement classes/functions/applications according to the given specification.	PP _U_4, PP _U_5, PP _U_6, PP _W_1, PP _W_2, PP _W_3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PP _fs_1	lecture	Presenting educational content in verbal form with use of content visualization. Focusing on	30	Familiarizing with lecture content using existing methods package: textbooks,	15	PP _w_1, PP _w_2, PP _w_3

		conceptually complex material and sources indication. Content illustration on examples.		scripts, websites, etc.		
PP _fs_2	laboratory classes	Detailed students preparation to solving tasks with indication of methodology of proceedings and sequence of proceedings. Designing solutions and their computer implementation.	30	Solving tasks of subsequent topics together with analysis of already existing solutions – in the script or on websites. Preparing issues for discussion or preparing to catch up with the material. Individual execution of software, whose specification was given by the teacher and preparing documentation. Revision of the material presented during classes and exercised during laboratory classes.	75	PP _w_1, PP _w_2, PP _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Programming with use of agile methodologies

Module code: 08-IN-IJO-S2-PzUMZ

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PzUMZ -K_6	The student is able to collaborate with the rest of the team during project implementation and control the process with agile development methods.	K_K02 K_U02	1 1
PzUMZ -K_7	Student can evaluate and report the progress of the development team. The student simultaneously can analyze the current results of work and characterize the most important stages of the work and evaluate the costs involved.	K_K01 K_K03	1 1
PzUMZ -U_3	The student is able to use tools for agile project management, plan the process, and estimate the work in work packages and work breakdown structure of project implementation (according to agile methodology).	K_U02 K_U03 K_U14 K_U19 K_U20	1 1 1 1 1
PzUMZ -U_4	The student is able to cooperate in a team in accordance with the principles of agile software development, he can make decisions related to problems arising in the project. He can manage appropriate changes and prepare solutions.	K_U04 K_U12	1 1
PzUMZ -U_5	The student is able to implement a ready project prepared by a development team based on agile methodologies.	K_U02 K_U03 K_U04 K_U15	1 1 1 1
PzUMZ -W_1	The student is knowledgeable about the principles and features of programming using agile methods and specific iterative (incremental) model of designing and programming models.	K_W10	1
PzUMZ -W_2	The student is knowledgeable about project preparation, defining requirements and agile project management, as well as tools	K_W10	1

	for agile project management and project version control.	K_W14	1

3. Module description	
Description	The purpose of the classes described in this module is to prepare students to work in development teams that work in agile environment. During the course students learn about agile methodologies, their principles and characteristics. They acquire knowledge of specific, most popular iterative (incremental) software development methods. While working on projects, students learn about the most popular agile project management tools and agile based control systems. The teamwork of the selected project, supported by all stages of project management, will deepen the their knowledge of programming in agile teams. Thanks to this, every student should fully understand the ideas associated with agile methodologies and the relevance of using version control systems. Students should be prepared for joint implementation of large programming projects in agile teams.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PzUMZ _w_1	Presentation	Presentations from the implementation of the team project presented in the form of a cyclic report on the work performed - frequency dependent on the agile method selected. Evaluate their implementation, workload and deadlines according to the agreed schedule.	PzUMZ -K_6, PzUMZ -K_7, PzUMZ -U_3, PzUMZ -U_4, PzUMZ -W_1, PzUMZ -W_2
PzUMZ _w_2	Design documentation	Presentation of project documentation prepared in accordance with agile method.	PzUMZ -U_3, PzUMZ -U_5, PzUMZ -W_1
PzUMZ _w_3	Project implementation	Evaluation of the final form of the implemented project (application, program) in terms of systematic use of project management systems and version control. In addition, the assessment of the actual level of project implementation and workload contributed to the project, through its individual members.	PzUMZ -K_7, PzUMZ -U_4, PzUMZ -U_5

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PzUMZ _fs_1	lecture	Presenting educational content in verbal form, with use of content visualization. Presenting theoretical and practical issues connected with work in programming project according to agile methodologies, discussing problems and principles concerning work in agile programming team and indicating most important tools and systems necessary for agile team work.	0	Familiarizing with issues presented during lectures and preparing to laboratory classes connected with lectures.	0	PzUMZ _w_2
PzUMZ _fs_2	laboratory classes	Teaching content in verbal form using content visualization. Presentation of theoretical and practical issues related to working in a programming project, based on	30	Thoroughly familiarize yourself with the programs discussed during the laboratories and prepare a team project. Full implementation of a team development	30	PzUMZ _w_1, PzUMZ _w_2, PzUMZ _w_3

		agile methodologies, discussion of problems and principles of working in an agile team, and identification of the most important tools and systems necessary for agile team work. Detailed refinement of elements related to a team project, based on agile methodologies as well as presentation and discussion of tools necessary for the implementation of a selected project. Meetings organized by agile methods.		project in accordance with the division of responsibilities within the group.		

1.	**Field of study**	**Computer Science**
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: RAD programming environments

Module code: 08-IN-ISI-S2-PwŚRAD

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PwŚRAD _U_4	Can create event-driven applications using chosen environments.	K_U13	4
PwŚRAD _U_5	Is able to program using a library and stock solutions available in chosen environments.	K_U13 K_U15	3 2
PwŚRAD _U_6	Can test and activate applications using tools available in chosen RAD environments.	K_U03	3
PwŚRAD _U_7	Is able to identify current trends in applications designing and creating. Understands need to develop his competences in the field of programming.	K_U05	4
PwŚRAD _U_8	Can independently identify problems, search for and select methods of solving them, create specifications of project tasks in a systematic way.	K_U01 K_U03	4 4
PwŚRAD _W_1	Knows the concept of programming and creating applications with use of RAD environment, understands principles of application structure and organization, knows basic environments of RAD type.	K_W05 K_W06	1 4
PwŚRAD _W_2	Possesses knowledge about event-driven programming, architecture and principles of operation of applications using GUI, knows basic prototype libraries and environments.	K_W06 K_W12 K_W15 K_W16	4 2 2 2
PwŚRAD _W_3	Has knowledge about principles and methods of building, testing and activating of applications in the chosen RAD environments.	K_W06 K_W14	4 4

3. Module description	
Description	The aim of education is preparing the students to design and program applications using modern RAD environments. Within the frames of studies, the students will get acquainted with chosen environments of this type, will gain practical skills of using them, will get to know the concept of event-driven programming, will learn to create and program applications using modern, graphic oriented user interfaces. During performing individual project tasks , the students will develop their competences in the field of identification of programming problems, methods of looking for their solutions, their analysis and selection of the most convenient answers. The students will get familiar with principles of identification and choosing licensing scheme of the tools used.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PwŚRAD _w_1	Control test	Written test in the form of practical tasks solution.	PwŚRAD _U_4, PwŚRAD _W_1, PwŚRAD _W_2
PwŚRAD _w_2	Credit test	Credit test checking knowledge and skills in the field of programming in RAD environments.	PwŚRAD _U_5, PwŚRAD _W_2, PwŚRAD _W_3
PwŚRAD _w_3	Indyviduak project	Reports containing project specification together with the attached program.	PwŚRAD _U_4, PwŚRAD _U_5, PwŚRAD _U_6, PwŚRAD _U_7, PwŚRAD _U_8

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PwŚRAD _fs _1	lecture	Presenting educational content in the verbal form, , with use of content visualization. Discussion over the presented content, analysis of complex material and chosen practical examples.	30	Deepened analysis of lecture materials published in the subject website.	5	PwŚRAD _w_1
PwŚRAD _fs _2	laboratory classes	Practical preparation of students to create applications in RAD environments, project tasks execution, discussing problems, perfecting in methods of the chosen environments use.	30	Deepened analysis of application examples and topics discussed during laboratory classes. Project elaboration, program realization, elaboration of specification, test report	25	PwŚRAD _w_2, PwŚRAD _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Real time graphics

Module code: 08-IN-S2-GCRz

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
GCRz -K_7	Can work individually and in a team.		
GCRz -K_8	Can think and act creatively.	K_K03	1
GCRz -U_4	Can implement the learned algorithms in the chosen programming language.	K_U12	1
GCRz -U_5	Can acquire information about rendering from literature, database and other sources.	K_U01	1
GCRz -U_6	Can prepare and present a paper about project task realization.	K_U04	1
GCRz -W_1	Knows and understands mathematical notions referring to real graphics.	K_W01	1
GCRz -W_2	Knows and understands basic algorithms used in real graphics.	K_W15	1
GCRz -W_3	Knows and understand basic principles for creating algorithms in real graphics.	K_W02	1

3. Module description

Description	Aim of the class is to familiarize students with graphics generated in real time. The library Open GL and GLSL language will be used for this purpose. The students will get to know various mathematical, physical notions as well as algorithms enabling generating various effects. During the classes, the students will prepare projects in teams of maximum two and will present results of their work in the form of presentation in front of the group.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
GCRz _w_1	Project	Preparing a project and presentation about the chosen topic connected with real graphics.	GCRz -K_7, GCRz -K_8, GCRz -U_4, GCRz -U_5, GCRz -U_6, GCRz -W_1, GCRz -W_2, GCRz -W_3
GCRz _w_2	Reports	Solving sets of tasks.	GCRz -K_7, GCRz -K_8, GCRz -U_4, GCRz -W_1, GCRz -W_2, GCRz -W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
GCRz _fs_1	lecture	Presenting educational content with use of audio-visual aids.	15	Individual preparation for the lectures.	5	GCRz _w_1, GCRz _w_2
GCRz _fs_2	laboratory classes	Detailed students preparation to design algorithms of real graphics. Solving programming tasks.	30	Individual preparation for the laboratory classes. Familiarizing with project thematic and execution of the project individually or in a team of two. Preparing the presentation describing the project issue.	40	GCRz _w_1, GCRz _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Security of information systems

Module code: 08-IN-IJO-S2-BSI

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
BSI-K_1	Student can work in co-ordination group.	K_U02	1
BSI-K_2	Student can define tasks necessary to realize data security.	K_K01 K_K03	2 3
BSI-U_1	Student can differentiate various aspects of IT system security.	K_U01 K_U03	2 3
BSI-U_2	Student can acquire information necessary to realize appropriate level of security.	K_U01 K_U10	1 4
BSI-U_3	Student can select correct solution for a specific usage.	K_U08 K_U15	2 1
BSI-U_4	Student can simulate operation of many modern cryptographic algorithms.	K_U08 K_U12 K_U14 K_U18	1 1 1 2
BSI-W_1	Student knows basic terminology in the field of IT systems security.	K_W20 K_W21	3 2
BSI-W_2	Student gets acquainted with professional software methods of authentication.	K_W10 K_W20	2 3

BSI-W_3	Student gets acquainted with other authentication methods – biometrics.	K_W11 K_W12 K_W14	1 2 2
BSI-W_4	Student knows issues connected with allocation of allowances.	K_W10 K_W20	2 3
BSI-W_5	Student gets acquainted with modern cryptography characteristic.	K_W02 K_W03 K_W20	2 2 1
BSI-W_6	Student gets acquainted with mechanisms of managing remote devices in each level of mobile services life-cycle.	K_W01 K_W04 K_W08	2 2 1
BSI-W_7	Student gets acquainted with security audit methods.	K_W01 K_W11	4 1
BSI-W_8	Practical methods of graphic and audio data protection.	K_W02	3
BSI-W_9	Practical methods of multimedia and documents backups in a cloud.	K_W04 K_W11	2 3

3. Module description	
Description	Module enables practical knowledge acquisition with issues of data protection
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
BSI_w_2	Laboratory class credit	Credit grade is the result of partial gardes obtained during a semester from particular tests.	BSI-K_1, BSI-K_2, BSI-U_1, BSI-U_2, BSI-U_3, BSI-U_4, BSI-W_1, BSI-W_2, BSI-W_3, BSI-W_4, BSI-W_5, BSI-W_6, BSI-W_7, BSI-W_8, BSI-W_9
BSI_w_3	Project works	Project tasks sum up the effects of partial works.	BSI-U_3, BSI-U_4, BSI-W_3, BSI-W_7

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
BSI_fs_1	lecture	It is presentation of the newest solutions in the field of data security, with use of audio-visual aids.	0			
BSI_fs_2	laboratory classes	It is a presentation of the newest solutions in the field of data security, with use of audiovisual aids. Realization of practical solutions by groups of students and individually.	30	Independently deepening and consolidating the subject matter of the classes. Solving tasks and work on a security project.	30	BSI_w_2, BSI_w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Security of information systems

Module code: 08-IN-ISI-S2-BSI

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
BSI -K_1	Student is able to work in a co-ordinated group	K_U02	1
BSI -K_2	Student can specify tasks to perform for data protection	K_K01 K_K03	2 3
BSI -U_1	Student can distinguish various aspects of IT system security.	K_U01 K_U03	2 3
BSI -U_2	Student is able to acquire the information necessary to achieve the right level of protection	K_U01 K_U10	1 4
BSI -U_3	Student can choose solutions for a specific application	K_U08 K_U11 K_U15	2 1 2
BSI -U_4	Student can prepare and present the presentation of the operation of many modern cryptographic algorithms	K_U04 K_U08 K_U12 K_U18	1 1 1 2
BSI W_1	Student knows the basic terminology in the security of information systems	K_W20 K_W21	3 2
BSI W_10	Student knows the mechanisms of the shortcut function.	K_W02	5

BSI W_11	Student knows practical methods of protecting graphic and sound data.	K_W02 K_W14	2 3
BSI W_12	Student learns examples of access control attacks	K_W20	5
BSI W_2	Student knows professional software authentication methods.	K_W10 K_W20	2 3
BSI W_3	Student knows other authentication methods.	K_W11 K_W12 K_W14	1 2 2
BSI W_4	Student knows the issues related to the implementation of authorizations.	K_W10 K_W20	2 3
BSI W_5	Student knows classical cryptography.	K_W02 K_W19	3 2
BSI W_6	Student knows the characteristics of contemporary cryptography.	K_W02 K_W03 K_W20	2 2 1
BSI W_7	Student knows the mechanisms of cryptographic algorithms	K_W02 K_W03 K_W20	2 2 1
BSI W_8	Student knows the issues of digital signatures.	K_W03 K_W13 K_W14	1 2 2
BSI W_9	Student learns the basics of cryptanalysis	K_W02 K_W03 K_W18	2 2 1

3. Module description	
Description	The module provides practical insights into data protection issues
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
BSI _w_1	Lecture test	This test verifies your knowledge and, above all, its understanding.	BSI W_1, BSI W_10, BSI W_11, BSI W_12, BSI W_2, BSI W_3, BSI W_4, BSI W_5,

			BSI W_6, BSI W_7, BSI W_8, BSI W_9
BSI _w_2	Laboratory test	Assessment is the result of partial assessments obtained during the semester from relevant tests.	BSI -K_1, BSI -K_2, BSI -U_1, BSI -U_2, BSI -U_3, BSI -U_4
BSI _w_3	Individual project	Design tasks summarize the effects of partial work.	BSI -U_3, BSI -U_4, BSI W_3, BSI W_7, BSI W_9

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
BSI _fs_1	lecture	It is a presentation of the newest solutions in the field of data security with use of audiovisual aids	10	Student has to analyze the presented ideas, verify their utility and use suggestions.	10	BSI _w_1
BSI _fs_2	laboratory classes	This is a realization of practical solutions by student groups and individually	20	The student carries out design and implementation work in class and at home. More complex tasks are performed in groups. Individual or team work, discussion of complex problems related to the topics discussed at the lecture	20	BSI _w_2, BSI _w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Selected methods of data mining

Module code: 08-IN-IIN-S2-WMED

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
WMED -U_7	Using analysis of variance can (test F) asses data community on the basis of sample distribution.	K_U01 K_U04 K_U05 K_U07 K_U08	1 1 1 3 1
WMED -U_8	Can reduce data space dimension.	K_U07 K_U12 K_U16 K_U17	3 1 3 2
WMED -W_1	Has basic knowledge in the field of spectrum analysis. Knows assumptions of direct and inverse discreet Fourier transform.	K_W01 K_W03	3 3
WMED -W_2	Has basic knowledge in the field of DCT, DST, Walsh and Haar transforms.	K_W08 K_W17 K_W18	2 3 3
WMED -W_3	Has basic knowledge concerning application rules of the specific transformations in engineering practice.	K_W17	1
WMED -W_4	Has knowledge concerning principles of two dimensional transformations use taking into account uses in image processing. Knows basic image morphological transformations.	K_W01 K_W15	2 3

		K_W17	1
WMED -W_5	Knows principles of lossy and lossless image compression.	K_W01 K_W03 K_W17	1 1 1
WMED -W_6	Knows basics of Fishera and PCA statistical inference.	K_W01 K_W03	1 1
WMED-K_10	Can present opinions and conclusions concerning theoretical and practical aspects of image compression and statistic inference.	K_K01	1
WMED-K_9	Can execute a group task concerning morphological operations on digital image in order to bring out its qualities in a specific program. Can lossy and lossless compress images realizing the task in the fixed time.	K_K01 K_U02	1 1

3. Module description	
Description	Aim of classes in this module is preparing the students to solve tasks connected with the issue of image processing and methods of statistic inference. As a result, it leads to deepening of knowledge in the field of mathematical foundations of image processing and analysis of multidimensional data.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
WMED -w_1	Credit	Solving tasks of content, one after each section discussed during lecture.	WMED -W_1, WMED -W_2, WMED -W_3, WMED -W_4, WMED -W_5, WMED -W_6
WMED -w_2	Control tests	Tests and quizzes connected with the current topic of laboratory class and checking theoretical knowledge of the lecture.	WMED -U_7, WMED -U_8
WMED -w_3	Programming works in MATLAB environment	Documenting, elaborating and verifying results of tasks solved during laboratory classes.	WMED -U_7, WMED -U_8, WMED-K_10, WMED-K_9

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
WMED _fs_1	lecture	Educational content presented in traditional form and with use of audiovisual aids.	10	Familiarizing with lecture content and individual verification of laboratory class of programming in MATLAB environment solutions.	5	WMED -w_1
WMED _fs_2	laboratory classes	Detailed checking of preparation to solve tasks taking into account methodology of proceedings. Testing correctness of solutions. Presenting principles of project	30	Solving tasks of subsequent subjects together with analysis of the already existing solutions. Comparing obtained results in various groups. Optimization of the program	15	WMED -w_2, WMED -w_3

		documenting.		code. Presenting solutions together with analysis of the already existing ones. Evaluation of the group work.		

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Services servers administration

Module code: 08-IN-IIN-S2-ASU

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ASU-K_7	Is aware of costs connected with transfer of big amounts of data and data security in company	K_K02 K_K03	1 1
ASU-U_3	Can create network services configuration to increase security	K_U01 K_U02 K_U03	1 1 1
ASU-U_4	Uses specification to choose the best software ensuring a network service	K_U01 K_U05	1 1
ASU-U_5	Designs network security tools of Firewall type	K_U11 K_U14	1 1
ASU-U_6	Creates hybrid systems for network traffic management	K_U05 K_U10	1 1
ASU-W_1	Enumerates principles of network services management DNS,DHCP, SSH, WWW, MySQL, FTP, VPN, POP3, SMTP, IMAP, Samba, in GNU Linux operating system.	K_W02 K_W05 K_W13 K_W20	1 1 1 1
ASU-W_2	Describes significance and operation of network traffic management QoS	K_W11 K_W13	1 1

3. Module description

Description	Aim of the subject is making the students acquainted with theoretical and practical aspects of advanced network services management..
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ASU_w_1	Credit test	Solving project tasks	ASU-U_3, ASU-U_4, ASU-W_1
ASU_w_2	Control tests	Control exercises after each topic discussed during classes	ASU-K_7, ASU-U_5, ASU-U_6, ASU-W_1, ASU-W_2

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ASU_fs_1	lecture	Presenting educational content in verbal form, using content visualization. Focusing on material insufficiently described in the available Internet sources and indicating website addresses .	10	Getting acquainted with lecture thematic using the existing method packages: Internet websites and e? learning package.	10	ASU_w_1
ASU_fs_2	laboratory classes	Detailed preparation of the students to solve tasks stressing the tasks describing real problems.	20	Solving tasks of subsequent topics together with analysis of already existing solutions – on websites.	20	ASU_w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialization project I

Module code: 08-IN-GWK-S2-PS1

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PS1-K_8	Can work in a team of two and divides work properly.	K_U02	1
PS1-U_5	Can implement basic algorithms of image processing.	K_U01 K_U12 K_U13 K_U15 K_U19 K_U20	1 1 1 1 1 1
PS1-U_6	Can implement basic algorithms of video image processing.	K_U01 K_U10 K_U12 K_U13 K_U15	1 1 1 1 1
PS1-U_7	Can give a presentation of the executed project.	K_U02 K_U03 K_U04	1 1 1
PS1-W_1	Has basic knowledge of image processing.	K_W03 K_W15 K_W16	1 1 1

PS1-W_2	Has basic knowledge of image segmentation in real time.	K_W15 K_W16	1 1
PS1-W_3	Possesses basic knowledge about lossy and loseless compression.	K_W15 K_W16	1 1
PS1-W_4	Possesses basic knowledge of video coding standards.	K_W10 K_W15 K_W16	1 1 1

3. Module description	
Description	This module enables the student to gain the skill of programming advanced algorithms of multiresolution image processing.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PS1_w_1	Test	Checking theoretical knowledge during laboratory class.	PS1-W_1, PS1-W_2, PS1-W_3, PS1-W_4
PS1_w_2	Project	Preparing the project on the given topic, connected with multiresolution image analysis.	PS1-K_8, PS1-U_5, PS1-U_6
PS1_w_3	Presentation	Preparing and giving the project presentation.	PS1-K_8, PS1-U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PS1_fs_1	laboratory classes	Computer classes in the form of implementation of algorithms for image processing and recognition.	45	Individual preparation for the laboratory class. Familiarizing with project thematic and executing the project individually or in teams of two. Preparing a presentation describing project subject matter.	15	PS1_w_1, PS1_w_2, PS1_w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialization project II

Module code: 08-IN-GWK-S2-PS2

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PS2-K_8	Can work in a team of two and divides work properly.	K_U02	1
PS2-U_5	Can implement basic algorithms of image processing.	K_U01 K_U12 K_U13 K_U15 K_U19 K_U20	1 1 1 1 1 1
PS2-U_6	Can implement basic algorithms of video image processing.	K_U01 K_U10 K_U12 K_U13 K_U15	1 1 1 1 1
PS2-U_7	Can give a presentation of the executed project.	K_U02 K_U03 K_U04	1 1 1
PS2-W_1	Has basic knowledge of image processing .	K_W03 K_W15 K_W16	1 1 1

PS2-W_2	Has basic knowledge of image segmentation in real time.	K_W15 K_W16	1 1
PS2-W_3	Possesses basic knowledge about lossy and loseless compression .	K_W15 K_W16	1 1
PS2-W_4	Possesses basic knowledge of video coding standards.	K_W10 K_W15 K_W16	1 1 1

3. Module description	
Description	This module enables the student to gain the skill of programming advanced algorithms of multiresolution image processing .
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PS2_w_1	Test	Checking theoretical knowledge during laboratory class.	PS2-W_1, PS2-W_2, PS2-W_3, PS2-W_4
PS2_w_2	Project	Preparing the project on the given topic, connected with multiresolution image analysis.	PS2-K_8, PS2-U_5, PS2-U_6
PS2_w_3	Presentation	Preparing and giving the project presentation.	PS2-K_8, PS2-U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PS2_fs_1	laboratory classes	Computer classes in the form of implementation of algorithms for image processing and recognition.	30	Individual preparation for the laboratory class.Familiarizing with project thematic and executing the project individually or in teams of two. Preparing a presentation describing project subject matter.	30	PS2_w_1, PS2_w_2, PS2_w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialization project III

Module code: 08-IN-GWK-S2-PS3

1. Number of the ECTS credits: 1

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PS3-K_8	Can work in a team of two and divides work properly.		
PS3-U_5	Can implement basic algorithms of image processing.	K_U01 K_U12 K_U13 K_U15 K_U19 K_U20	1 1 1 1 1 1
PS3-U_6	Can implement basic algorithms of video image processing.	K_U01 K_U10 K_U12 K_U13 K_U15	1 1 1 1 1
PS3-U_7	Can give a presentation of the executed project.	K_U02 K_U03 K_U04	1 1 1
PS3-W_1	Has basic knowledge of image processing .	K_W03 K_W15 K_W16	1 1 1

PS3-W_2	Has basic knowledge of image segmentation in real time.	K_W15 K_W16	1 1
PS3-W_3	Possesses basic knowledge about lossy and loseless compression .	K_W15 K_W16	1 1
PS3-W_4	Possesses basic knowledge of video coding standards.	K_W10 K_W15 K_W16	1 1 1

3. Module description	
Description	This module enables the student to gain the skill of programming advanced algorithms of multiresolution image processing .
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
PS3_w_1	Test	Checking theoretical knowledge during laboratory class.	PS3-W_1, PS3-W_2, PS3-W_3, PS3-W_4
PS3_w_2	Project	Preparing the project on the given topic, connected with multiresolution image analysis.	PS3-K_8, PS3-U_5, PS3-U_6
PS3_w_3	Presentation	Preparing and giving the project presentation.	PS3-K_8, PS3-U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
PS3_fs_1	laboratory classes	Computer classes in the form of implementation of algorithms for image processing and recognition.	15	Individual preparation for the laboratory class.Familiarizing with project thematic and executing the project individually or in teams of two. Preparing a presentation describing project subject matter.	15	PS3_w_1, PS3_w_2, PS3_w_3

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialized databases and data base systems

Module code: 08-IN-BIO-S2-SBDISBD

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
SBDISBD -U_4	Can justify use of data base servers as basics of specialized data base systems and choose a specific solution.	K_U01	1
SBDISBD -U_5	Can perform substantive analysis of the chosen field and develop appropriate data base structure storing required information.	K_U17 K_U21	3 2
SBDISBD -W_1	Knows and understands the need to use modern IT systems and IT technologies in data access.	K_W17	1
SBDISBD -W_2	Understands data base systems importance in connection with specialized IT systems.	K_W13 K_W19	1 2
SBDISBD -W_3	Can work with typical data base application interface allowing for searching , modification and removal of specific information.	K_W14	2

3. Module description

Description	Aim of the classes is to transfer knowledge concerning use of the known IT technologies in specialized medical systems on the example of hospital IT systems. Possible uses of the chosen data base servers for realization of tasks connected with storing and processing medical and multimedia data will also be presented.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
SBDISBD _w _1	Control tests	Written tests (including these executed during classes, with use of computer).	SBDISBD -U_4, SBDISBD -U_5
SBDISBD _w _2	Exam	Multiple-choice test and several open questions.	SBDISBD -W_1, SBDISBD -W_2, SBDISBD -W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
SBDISBD _fs _1	lecture	Presenting educational content in verbal form with use of content visualization. Focusing on conceptually complex material and indication of sources. Content illustration on examples.	15	Familiarizing with the lecture subject matter using existing methods packages: textbooks, scripts, websites, etc.	15	SBDISBD _w_2
SBDISBD _fs _2	laboratory classes	Detailed preparation of the students to solve tasks indicating proceedings methodology and sequence of works. Designing base structure referring to the issue analyzed.	45	Solving tasks of subsequent issues together with analysis of the already existing solutions. Revision of the material presented during lectures and exercised during laboratory classes.	45	SBDISBD _w_1, SBDISBD _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Specialized systems of data visualization

Module code: 08-IN-GWK-S2-SSWD

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
SSWD -K_7	Student is able to work individually and in a team.	K_U02	1
SSWD -K_8	Student can think and act in a creative way	K_K03	1
SSWD -U_4	A student can implement a scenario of graphic presentation.	K_U12 K_U20	1 1
SSWD -U_5	The student is able to obtain information on making graphic presentations from literature and other sources. He can effectively use different methods of data mining and use of database resources.	K_U01 K_U21	1 1
SSWD -U_6	The student is able to prepare and present the application of the realized task of the project.	K_U02 K_U03 K_U04	1 1 1
SSWD -W_1	Student knows and understands the concept of raster and vector graphics and algorithms used in raster and vector graphics. Student has knowledge of network information systems in application for data visualization.	K_W01 K_W19	1 1
SSWD -W_2	The student knows and understands the purpose of the basic elements of making a graphic presentation.	K_W02	1
SSWD -W_3	Student knows and understands the basic principles of making a graphic presentation.	K_W02	1

3. Module description

Description	Introduction to the graphic presentation systems. Presentation of the basic principles of vector and raster graphics of data visualisation. As part of the classes, students should prepare projects in teams and present the results of their work as an application.

Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
SSWD _w_1	Project	Introduction to the graphic presentation systems. Presentation of the basic principles of vector and raster graphics of data visualisation. As part of the classes, students should prepare projects in teams and present the results of their work as an application.	SSWD -K_7, SSWD -K_8, SSWD -U_4, SSWD -U_5, SSWD -U_6, SSWD -W_1, SSWD -W_2, SSWD -W_3
SSWD _w_2	Report	Description of the realized project.	SSWD -K_7, SSWD -K_8, SSWD -U_4, SSWD -W_1, SSWD -W_2, SSWD -W_3

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
SSWD _fs_1	lecture	Presenting educational content in verbal form with use of content visualization. Focusing on conceptually complex material and indication of sources. Content illustration on examples.	10	Familiarizing with the lecture subject matter using existing methods packages: textbooks, scripts, websites, etc.	5	SSWD _w_1, SSWD _w_2
SSWD _fs_2	laboratory classes	Detailed student preparation to use development environment and graphic interface components. Solving programming tasks indicating proceedings methodology and sequence of works. Designing base program structure referring to the analyzed issue.	20	Solving tasks of subsequent issues together with analysis of the already existing solutions. Revision of the material presented during lectures and exercises during laboratory classes. Get acquainted with the project topics. The project realization in the team. A description of the project preparation.	25	SSWD _w_1, SSWD _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Systems modelling and analysis

Module code: 08-IN-S2-MiAS

1. Number of the ECTS credits: 4

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
MiAS -K_8	Can think and act creatively.	K_K01	2
MiAS -K_9	Can work individually and in a team.	K_U02	1
MiAS -U_4	Can develop a digital system and use procedure of its testing . Can elaborate diagnostic tests, design test generators and data compaction systems. Uses methods and techniques enhancing systems reliability. Uses hardware description languages VHDL or Verilog, can execute digital system operation simulation. Uses tools for programming digital systems, can enhance testability of the developed digital system and takes into account influence of a digital system on its environment.	K_U03 K_U05 K_U06 K_U08 K_U09 K_U10 K_U13 K_U14 K_U20	2 2 1 3 4 4 4 4 3
MiAS -U_5	Can develop, analyze, model test and deploy software. Effectively uses tools for developing, modelling and testing systems. Uses development methodologies and techniques UML, OCL, BPML and BPEL to analyse and model IT systems. Can elaborate system specification and documentation. Can create software source code with desired quality features and use reverse engineering.	K_U02 K_U03 K_U07 K_U12 K_U13 K_U14 K_U15	3 4 2 2 4 4 4

		K_U19 K_U20	3 4
MiAS -U_6	Can design Petri net for modelling for the system generalized modelling, perform the network operation simulation. Can model operation of a concurrent system and solve typical problems of concurrent processing.	K_U07 K_U08	3 3
MiAS -U_7	Can prepare and give a project presentation and elaborate a report.	K_U03 K_U04	3 3
MiAS -W_1	Understands the meaning of reliability, availability, security and protection of systems and knows means ensuring system reliability. Possesses knowledge concerning reliability violations: failures, errors and defects, knows their interrelations. Understands the need to prevent failures, fault tolerance and removal and their prediction. Knows methods and techniques of verification, validation and testing and hardware and software diagnostics. Can describe a digital system in standard languages of hardware description VHDL and Verilog, perform simulation and the process of system testing.	K_W01 K_W04 K_W20 K_W21	4 1 4 2
MiAS -W_2	Knows and uses methods and techniques of development, analysis, modelling, testing and deployment of systems. Understands notation UML, OCL, BPMN and BPEL and uses it in IT and business systems development. Understands code quality meaning in the aspect of software maintenance, uses design patterns, knows object, component and event-driven programming techniques as well as basics of software engineering.	K_W10 K_W12 K_W13 K_W14 K_W20	4 2 2 3 3
MiAS -W_3	Knows Petri net functionality and basics of system modelling using these nets and uses techniques of their simulation. Understands operation of concurrent and parallel systems, problems of multithreading and multiprocessing, access to shared resources, scheduling, thread synchronization techniques and ensuring data integrity. Understands the need for systems functioning optimization and influence of system operation on its environment.	K_W01 K_W03 K_W07 K_W09 K_W21	2 2 3 3 1

3. Module description	
Description	Aim of the subject is making the student familiarize with methods and techniques of developing, analysis, modelling, testing and deployment of digital, IT and business processes systems, especially using hardware description languages VHDL, Verilog, Petri nets and standard notations or software development description languages UML, OCL, BPMN, BPEL and IT systems documentation. Ensuring the systems reliability, availability, security, protection requires knowledge of methods and techniques of verification, validation, testing, diagnostics, systems modelling and analysis which constitute supplement to the course range. The subject thematic covers also concurrent systems modelling, solving typical problems of concurrence and the meaning of software source code quality, maintenance of IT systems and programming engineering.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
MiAS _w_1	Exam	Verification of knowledge in the form of tasks to solve	MiAS -W_1, MiAS -W_2, MiAS -W_3
MiAS _w_2	Control tests	Systematic tests checking knowledge and skills acquired during lectures and laboratory classes.	

			MiAS -U_4, MiAS -U_5, MiAS -U_6, MiAS -W_1, MiAS -W_2, MiAS -W_3
MiAS _w_3	Reports	Systematic execution of reports of laboratory works course.	MiAS -K_8, MiAS -K_9, MiAS -U_4, MiAS -U_5, MiAS -U_6, MiAS -U_7
MiAS _w_4	Project	Executing a semester project in the range of accepted education effects.	MiAS -K_8, MiAS -K_9, MiAS -U_4, MiAS -U_5, MiAS -U_6, MiAS -W_1, MiAS -W_2, MiAS -W_3
MiAS _w_5	Presentation	Giving audio-visual presentation in front of the group, discussion over assumptions and accepted solution method of the given problem, analysis ane evaluation of the project goal.	MiAS -K_8, MiAS -K_9, MiAS -U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
MiAS _fs_1	lecture	Module educational content with use of audio-visual aids.	15	Individual study over lecture subject matter and advised literature.	15	MiAS _w_1
MiAS _fs_2	laboratory classes	Practical realization of the module educational content concerning, among others, acquiring skills and experience of effective use of tools to develop, model and test systems. The classes are held with use of computer workstations and sufficient software.	30	Individual preparation for laboratory classes and periodical reports of the course of project works. Systematic elaboration of reports of subsequent topics realized during laboratory classes. Individual or in a group of several person execution of the project and its documentation. Preparing an audio-visual presentation about the realized project and its effecting in front of the group.	60	MiAS _w_2, MiAS _w_3, MiAS _w_4, MiAS _w_5

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Team project

Module code: 08-IN-IJO-S2-PZ

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
PZ -K_7	Can co-operate in a big team while creating a project.	K_K02	1
PZ -U_4	Is able to use tools for version control.	K_U03 K_U11	3 2
PZ -U_5	Can create business models basing on UML and BPMN notation.	K_U01	2
PZ -U_6	Is able to perform analysis of customer demands.	K_U20	2
PZ -W_2	Has deepened knowledge in the field of work schedules preparation, including division into man-hours.	K_W14	2
PZ -W_3	Student can define and perform the chosen function in a team (including the team leader function)	K_W10	2
PZ-W_1	Has deepened knowledge of team management in basic programming methodologies.	K_W06 K_W18	3 1

3. Module description

Description	Aim of the classes in this module is making the students familiar with issues of designing and analysis of complex IT systems. The subject covers analysis of prerequisites, division of tasks and designing the system. During the classes the students will be informed about the modeling methods and links between organization aims and the goal of IT project. The students will gain the skill of transferring users of specific IT projects demands.
Prerequisites	

4. Assessment of the learning outcomes of the module			
code	**type**	**description**	**learning outcomes of the module**
PZ -w_1	Credit	Elaboration of a complex project in a group, taking into account project schedule and customers demands analysis.	PZ -W_2, PZ -W_3, PZ-W_1
PZ -w_2	Control test	Reports of current works basing on the prepared schedule.	PZ -K_7, PZ -U_4, PZ -U_5, PZ -U_6

5. Forms of teaching						
code	**form of teaching**			**required hours of student's own work**		**assessment of the learning outcomes of the module**
	type	**description (including teaching methods)**	**number of hours**	**description**	**number of hours**	
PZ -fs_1	laboratory classes	During the classes the student will be familiarized with basic issues enabling project execution. Then, the team will be formed, and subsequent stages of the project creation will be organized basing on tasks division.	30		15	PZ -w_1, PZ -w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Team specjalized project

Module code: 08-IN-BIO-S2-ZPS

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
ZPS -U_3	Can use IT methods and tools.	K_U14	1
ZPS -U_4	Can use tools supporting work over IT project.	K_U20	2
ZPS -U_5	Can co-operate and work in a team.		
ZPS -W_1	Defines notions connected with software engineering	K_W10	4
ZPS -W_2	Revives information about the newest developmental trend in IT.	K_W14	2

3. Module description

Description	During the class, the students will acquire knowledge and skills enabling for teamwork over a group IT project. The project may concern an optional issue from the range of topics realized in the course of studies. Evaluated are: skill of working in a team, IT knowledge in the given field and skill of preparing documentation.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
ZPS _w_1	Project	Project evaluation on the basis of demonstration and checking the skill of teamwork.	ZPS -U_3, ZPS -U_4, ZPS -U_5, ZPS -W_1, ZPS -W_2

5. Forms of teaching						
code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
ZPS _fs_1	laboratory classes	Preparing the students to project teamwork. Solving problems.	30	Preparing project on the agreed topic in teams of three or four.	30	ZPS _w_1

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Tools supporting software development

Module code: 08-IN-S2-NWWO

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
NWWO -U_4	Can use methods and tools used in software engineering.	K_U14	2
NWWO -U_5	Can use tools supporting software modelling and development.	K_U20	3
NWWO -W_1	Has basic knowledge in the field of software optimization.	K_W07	1
NWWO -W_2	Revives knowledge in the field of modelling and developing software.	K_W10	2
NWWO -W_3	Possesses knowledge about version control systems and methods and about methods of code sharing.	K_W14	3

3. Module description

Description	The main aim of the module is making the students familiar with modern tools and techniques necessary in the process of development, testing, modifying and maintaining IT systems.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
NWWO _w_1	Test	Tests after each topic completed during classes together with theoretical knowledge of the lecture subject matter control.	NWWO -U_4, NWWO -U_5, NWWO -W_1, NWWO -W_2, NWWO -W_3
NWWO _w_2	Credit	Solving test tasks covering the issues discussed during lectures and classes.	

			NWWO -U_4, NWWO -U_5, NWWO -W_1, NWWO -W_2, NWWO -W_3

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
NWWO _fs_1	lecture	Presenting educational content in verbal form with use of content visualization. Focusing on conceptually complex material and indicating sources.	15	Familiarizing with lecture subject matter using the advised sources.	15	NWWO _w_2
NWWO _fs_2	laboratory classes	Detailed preparation of the students to solve problems indicating proceedings methodology and sequence.	30	Preparing appropriate documentation basing on the lecture content.	30	NWWO _w_1

1.	**Field of study**	**Computer Science**
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Video processing techniques

Module code: 08-IN-GWK-S2-TPV

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
TPV -K_8	Can work in team of two and properly divides work.	K_U02	1
TPV -U_5	Can implement basic video processing algorithms.	K_U01 K_U12 K_U13 K_U15	1 1 1 1
TPV -U_6	Can implement basic algorithms of video processing from infrared cameras.	K_U01 K_U02 K_U03 K_U04 K_U12 K_U13 K_U15	1 1 1 1 1 1 1
TPV -U_7	Can give a presentation of the executed project.	K_U04	1
TPV -W_1	Has basic knowledge about OpenCV library use.	K_W03 K_W15 K_W16	1 1 1
TPV -W_2	Has basic knowledge about video encoding standards.	K_W15	1

		K_W16	1
TPV -W_3	Has basic knowledge about lossy and losless compression.	K_W15 K_W16	1 1
TPV -W_4	Has basic knowledge in the field of video processing, such as filtration, movement detection, object detection.	K_W15 K_W16	1 1

3. Module description	
Description	Module allows the student to acquire skill of programming basic video processing algorithms.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
TPV _w_1	Exam	Checking theoretical knowledge of the module. Final grade is constituted by arithmetic average of grades from tests and laboratory class. Both grades must be positive.	TPV -W_1, TPV -W_2, TPV -W_3, TPV -W_4
TPV _w_2	Tests	Periodical checking of theoretical knowledge during laboratory classes.	TPV -U_5, TPV -U_6, TPV -W_1, TPV -W_2, TPV -W_3, TPV -W_4
TPV _w_3	Project	Preparing a project for the given topic connected with video processing.	TPV -K_8, TPV -U_5, TPV -U_6
TPV _w_4	Presentation	Presenting the project.	TPV -K_8, TPV -U_7

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
TPV _fs_1	lecture	Presenting educational content with use of audio-visual aids.	15	Individual studying of lectures subject matter and advised literature.	5	TPV _w_1
TPV _fs_2	laboratory classes	Computer classes focusing on video processing algorithms implementation.	30	Individual preparation for laboratory classes . Familiarizing with project subject matter and project execution individually or in teams of two. Preparing description presenting project subject matter.	25	TPV _w_2, TPV _w_3, TPV _w_4

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Web applications

Module code: 08-IN-IIN-S2-AI

1. Number of the ECTS credits: 3

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
AI -K_12	Can work independently planning execution of the given tasks.	K_K02	1
AI -K_13	Can work in a team, appropriately planning and dividing parts of given tasks.	K_U02	1
AI -U_10	Use MVC (Model-Viewer-Controller) solution in database projects created in the chosen technology (Java or PHP or ASP .NET)	K_U14 K_U15	1 3
AI -U_11	Uses technical documentation from various sources to solve problems during execution of given tasks.	K_U01 K_U05	1 1
AI -U_6	Uses programming environments to create Internet projects, create applications divided into packets/modules, uses commentaries.	K_U13 K_U15 K_U19 K_U20	1 3 1 1
AI -U_7	Creates controllers (objects of demands services), services demands basing on Get and Post,implements network application at application server and configures server at basic level.	K_U18	1
AI -U_8	Creates network applications basing on the chosen technology (Java or PHP or ASP .NET), uses component libraries, uses cookies and session mechanisms.	K_U15 K_U19	3 1
AI -U_9	Uses libraries/communication modules with data base to implement layers of data, designs and manages the base connection from the Java application and application server level.	K_U17 K_U21	1 3
AI -W_1	Characterizes application solutions in client-server architecture, especially the Internet ones, enumerates the most important elements of the multilayer structure in applications of this type.i	K_W10	1

		K_W16	1
AI -W_2	Defines the notion of network application and application server, characterizes application requirements towards implementation on servers based on different technologies.	K_W04 K_W13 K_W20	1 1 1
AI -W_3	Differentiates and describes elements of Internet technologies on the chosen platform (Java or PHP or ASP .NET)	K_W12	1
AI -W_4	Characterizes principles of connecting and use of relational databases servers in Internet technologies.	K_W13 K_W18	1 1
AI -W_5	Describes MVC (Model-Viewer-Controller) application structure – especially in context of creating database Internet applications	K_W12 K_W13 K_W20	1 1 1

3. Module description

Description	Aim of the class is practical exercising of creating Internet applications in the chosen technology (PHP or Java or ASP .NET). Through practical laboratory class and project realization, the students acquire knowledge, skills and competences connected with the subject thematic. After the classes are completed, the students should be able to design an Internet database application, implement it and deploy on the server of network applications.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
AI _w_1	Credit	Answers on several questions chosen from thematic group, covering all the sections discussed during classes.	AI -W_1, AI -W_2, AI -W_3, AI -W_4, AI -W_5
AI _w_2	Thematic task	Realization of thematic tasks during laboratory classes.	AI -U_10, AI -U_11, AI -U_6, AI -U_7, AI -U_8, AI -U_9
AI _w_3	Project task	Evaluation of project execution.	AI -K_12, AI -K_13, AI -U_10, AI -U_11, AI -U_6, AI -U_7, AI -U_8, AI -U_9

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
AI _fs_1	lecture	Verbal presentation of theoretical module contents with support of multimedia and Internet accessible materials.	10	Studying lecture contents basing on books and Internet materials.	20	AI _w_1, AI _w_2
AI _fs_2	laboratory classes	Introduction to practical aspects of the module field. Explaining problems.	20	Solving practical tasks distributed by the teacher. Executing the given project with use	40	AI _w_2, AI _w_3

		Supporting the students in task realization. Discussing project contents and support during their execution.		of the distributed sources of documentation and laboratory examples.		

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Wireless sensor networks

Module code: 08-IN-IIN-S2-BSS

1. Number of the ECTS credits: 2

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
BSS _K_6	Student can specify non-technical aspects of the proposed solution and its impact on company performance.	K_K02 K_K03	1 1
BSS _U_4	Student can design a wireless sensor network, select a probe and elements of measuring system.	K_U01 K_U11	1 1
BSS _U_5	Student can work in a team preparing sensor network project, can skillfully present it and is able to justify the solution choice.	K_U01 K_U02 K_U04	1 1 1
BSS _W_3	Student has knowledge of choosing a probe for chosen physical volume and about the manner of connecting the probe with the sensor network.	K_W11 K_W14	1 1
BSS_W_1	Student has basic knowledge about sensor net construction, probes and wireless configuration of wireless sensor network.	K_W02 K_W11 K_W19	1 1 1
BSS_W_2	Student characterizes basic data transfer protocols used in wireless sensor networks.	K_W11 K_W13	1 1

3. Module description

Description	

	Aim of the module is presenting basics of knowledge in the field of construction and use of sensor networks made in wireless and spread technologies. The issue discussed concern components of the sensor network, standards and protocols of data transfer and principles of adjusting the network structure to the demand made. The students acquire skills of constructing and configuring the sensor networks, selecting proper probes and network devices.
Prerequisites	

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
BSS _w_1	Credit test	Checks the level of assimilation and understanding of issues concerning wireless networks constructing, measuring systems elements operation and possible practical uses.	BSS _W_3, BSS_W_1, BSS_W_2
BSS _w_2	Project	Checks practical skills acquired during solving problems in groups and skills of presenting and justifying the proposed solution.	BSS _K_6, BSS _U_4, BSS _U_5

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
BSS _fs_1	lecture	Content available in the form of multimedia transfer.	10	Searching for information in knowledge bases covering the classes content, additional reading with e-learning course.	5	BSS _w_1
BSS _fs_2	laboratory classes	Exercises in the form of project tasks to be executed with use of simulators and network devices. The exercises preceded by substantive introduction and discussion over possible solutions.	30	Working with network simulators	15	BSS _w_2

1.	Field of study	Computer Science
2.	Faculty	Faculty of Science and Technology
3.	Academic year of entry	2019/2020 (summer term)
4.	Level of qualifications/degree	second-cycle studies
5.	Degree profile	general academic
6.	Mode of study	full-time

Module: Wychowanie Fizyczne

Module code: 08-IN-S2-WF

1. Number of the ECTS credits: 1

2. Learning outcomes of the module

code	description	learning outcomes of the programme	level of competence (scale 1-5)
WF_K_1	Przestrzega zasad „fair play” na boisku oraz w życiu codziennym.	K_K04	1
WF_K_2	Promuje społeczne i kulturowe znaczenie sportu i aktywności fizycznej oraz pielęgnuje własne upodobania z zakresu kultury fizycznej.	K_K02	1
WF_U_1	Potrafi poprawnie wykonać elementy techniczne z wybranej dyscypliny sportowej; Potrafi z powodzeniem zaliczyć test sprawności ogólnej (test Pilicza, test Coopera).	K_U02	1
WF_U_2	Potrafi zastosować odpowiedni rodzaj treningu w zależności, od celu, jaki chce osiągnąć (poprawę funkcjonowania układu krążenia, poprawa koordynacji ruchowej, wzmocnienie mięśni, poprawa wydolności oddechowej).	K_U05	1
WF_W_1	Zna przepisy z zakresu podstawowych gier zespołowych lub z innej wybranej dyscypliny sportu, a także ma podstawową wiedzę o organizowaniu zawodów sportowych.	K_W21	1
WF_W_2	Posiada podstawową wiedzę o kulturze fizycznej. Zna zależności pomiędzy aktywnością ruchową i właściwym odżywianiem a zdrowiem i komfortem życia w przyszłości. Potrafi wyjaśnić istotę sportu.	K_W21	1

3. Module description

Description	Uczelniana kultura fizyczna winna być integralną i komplementarną częścią ogólnoedukacyjnego programu szkoły wyższej. Na kulturę fizyczna składają się: wychowanie fizyczne, rekreacja, sport i turystyka. Jest jedynym obszarem stwarzającym możliwość realizacji wartości odnoszących się do ciała i zdrowia oraz stanowi przeciwwagę w stosunku do obciążenia młodzieży akademickiej pracą umysłową. Powinna uwzględniać zmieniającą się rzeczywistość i w znacznym stopniu uczestniczyć w procesie przygotowania studenta do dorosłego życia zawodowego oraz w rodzinie i społeczeństwie. Celem zajęć w tym module jest nauczenie elementów technicznych w wybranej dyscyplinie sportowej. Utrwalenie umiejętności nabytych na poprzednim etapie nauczania. Wyposażenie w niezbędny zasób wiedzy o kulturze fizycznej. Poznanie historii oraz przepisów. Zapoznanie z organizacją zawodów oraz imprez rekreacyjnych i turystycznych. Wyrobienie poczucia własnej wartości. Mobilizacja do postaw prozdrowotnych. Współpraca w grupie oraz

	dyscyplina. Pokazać wpływ aktywności ruchowej na organizm człowieka, jego zdrowie i higienę (praca – wypoczynek).
Prerequisites	Dotyczy studentów aktywnie uczestniczących w zajęciach: Głównym wymogiem przyjęcia do grupy jest brak przeciwwskazań zdrowotnych. Posiadanie umiejętności pływania nie jest wymagane.

4. Assessment of the learning outcomes of the module

code	type	description	learning outcomes of the module
WF_w_1	Sprawdzian praktyczny	Ocena studenta na podstawie jego postępów, zaangażowania i aktywności w zajęciach oraz umiejętności w zakresie wybranych dyscyplin sportowych.	WF_K_1, WF_K_2, WF_U_1, WF_U_2, WF_W_1
WF_w_2	Sprawdzian praktyczny	Sprawdzenie wiadomości dot. danej dyscypliny sportu podczas sędziowania i/lub prowadzenia dokumentacji (protokołów) meczy.	WF_K_1, WF_U_1, WF_W_1, WF_W_2
WF_w_3	Mikrolekcja	Ocena wiedzy i praktycznego jej zastosowania w trakcie przeprowadzenia przez studenta fragmentu zajęć.	WF_K_1, WF_K_2, WF_U_1, WF_U_2, WF_W_1
WF_w_4	Rozmowa kontrolna	Ustny sprawdzian wiadomości dotyczących zagadnień kultury fizycznej oraz istoty wychowania fizycznego w trakcie zajęć.	WF_K_2, WF_W_2

5. Forms of teaching

code	form of teaching			required hours of student's own work		assessment of the learning outcomes of the module
	type	description (including teaching methods)	number of hours	description	number of hours	
WF_fs_1	practical classes	Zajęcia prowadzone są z użyciem poniższych metod: 1. Oglądowe (pokaz, obserwacja) 2. Słowne (opis, objaśnienie, wyjaśnienie) 3. Praktycznego działania: - syntetyczna - nauczanie całego ruchu, - analityczna - rozbicie ćwiczenia na fragmenty, - kompleksowa - dzielenie całości na fragmenty i po ich opanowaniu łączenie w całość.	30			WF_w_1, WF_w_2, WF_w_3, WF_w_4