**Zał. nr 3 do ZW 25/2019**

**Attachment no. …. to Program of Studies**

**DESCRIPTION OF THE PROGRAM OF STUDIES**

**1.** **General description**

|  |  |
| --- | --- |
| *1.1 Number of semesters:* **7** | *1.2 Total number of ECTS points necessary to complete studies at a given level:* **210** |
| *1.3 Total number of hours:* **2475** | *1.4 Prerequisites (particularly for second-level studies):*Qualification for first-cycle studies is based on the results of the matriculation examination, in accordance with the terms and recruitment policy adopted for a given academic year by the Senate of the Wrocław University of Science and Technology. |
| *1.5 Upon completion of studies graduate obtains**professional degree of:* **ENGINEER (INŻYNIER)** | *1.6 Graduate profile, employability:*A graduate of the 1st-degree studies program in Applied Computer Science has qualifications covering knowledge, skills and engineering competences in the scope of:• Architecture and organization of computers and programming of low-level devices, including elements of the Internet of Things,• Programming languages, algorithms and data structures, programming paradigms and effective programming techniques,• Computer networks, system administration, and cybersecurity,• Databases and data warehouses, including database design• Software design and programming project management,• Advanced methods and programming tools, artificial intelligence and knowledge engineering, mobile applications and distributed systems• Different aspects of multimedia• Development trends in IT.The graduate also has knowledge of basic sciences: mathematical analysis, algebra with analytic geometry, logics, discrete mathematics, probability and statistics, and physics, which are necessary from the point of view of solving engineering problems and possible continuation of studies at the second level studies. The knowledge about the foundations of entrepreneurship and social and professional IT problems is a very important component of the IT engineer education. In addition, the graduate knows English to an extent that allows him to freely express, also in writing, on topics related to the work performed.A lot of role in educating IT engineers is also attached to soft skills, such as the ability to present, e.g. the results of their own work and the ability to work in a team.A graduate of the first-cycle degree in Computer Science can be employed in IT companies and IT departments of banks and financial institutions, enterprises and economic institutions in Wrocław, as well as throughout Poland or abroad. They graduates are employed in the positions of software designers, programmers, software testers, service technicians, system administrators or specialists in digital security. |
| *1.7 Possibility of continuing studies:*Completion of the first-cycle studies entitles a student to apply for admission to the second degree studies. | *1.8 Indicate connection with University’s mission and its development strategy:*The first level education program for Applied Computer Science at the Faculty of Computer Science and Management is fully consistent with the mission of the Wrocław University of Science and Technology and its strategy of development.The program provides the opportunity to acquire diverse knowledge, skills, engineering competencies and social skills necessary for a modern IT engineer. The compulsory courses and modules of elective courses offered as part of the education program meet the requirements of the Polish Qualifications Framework and, in accordance with the University's mission, they meet the dynamically changing needs of the socio-economic environment.This is expressed, inter alia, through:• involvement of the members of the Department's Convention composed of representatives of leading IT companies in the region in the work on the education program,• participation of highly qualified specialists from outside the University in conducting didactic classes, especially those of a practical nature,• offering opportunities to implement compulsory student internships in companies or IT departments.Practical classes take place in specialized laboratories equipped with modern telecommunications equipment, unique equipment, and software, regularly developed and modernized.Acting in accordance with the strategy of the Wrocław University of Science Technology in the field of internationalization, the Faculty of Computer Science and Management offers first-cycle studies in Applied Computer Science also in English for candidates from Poland and for foreigners. In addition, students have the opportunity to participate in international exchange programs (e.g. ERASMUS +). |

1. **Detailed description**

**2.1 Total number of learning outcomes in the program of study: W (knowledge) = 22, U (skills) = 22, K (competences) = 4, W + U + K = 48**

**2.2 For the main field of study assigned to more than one discipline - the number of learning outcomes assigned to the discipline:
 D1 (major) ......... (this number must be greater than half the total number of learning outcomes)
 D2 ......... ..
 D3 ......... ..
 D4 ......... ..**

**2.3 For the field of study assigned to more than one discipline - percentage share of the number of ECTS points for each discipline:
 D1 ......... ..% ECTS points
 D2 ......... ..% ECTS points
 D3 ......... ..% ECTS points
 D4 ......... ..% ECTS points**

**2.4a. For the general academic profile field of study – the number of ECTS points assigned to the classes related to the University's academic activity in the discipline or disciplines to which the faculty is assigned (must be greater than 50% of the total number of ECTS points from 1.1):**

**116 ECTS points**

**2.4b. For the practical profile field of study - the number of ECTS points assigned to the classes shaping practical skills (must be greater than 50% of the total number of ECTS points from 1.1):**

**2.5 Concise analysis of compliance of the assumed learning outcomes with the needs of the labor market**

The assumed learning outcomes correspond to the needs of:

a) institutions and companies engaged in production, commercial, service or research activities for IT departments dealing with the maintenance/development of IT tools or supporting this activity,

b) developers of various information systems (software designers, programmers, testers, administrators),

c) companies designing, implementing and maintaining computer systems and networks in various economic or community organizations both public and private

**2.6. The total number of ECTS points that a student must obtain in classes requiring direct participation of academic teachers or other persons conducting classes and students** (enter the sum of ECTS points for courses / groups of courses marked with the BK1 code) **210** ECTS

**2.7.** **Total number of ECTS points, which student has to obtain from basic sciences classes**

|  |  |  |
| --- | --- | --- |
| Number of ECTS points for obligatory subjects  | **39** |  |
| Number of ECTS points for optional subjects  | **0** |  |
|  Total number of ECTS points | **39** |  |

**2.8.** **Total number of ECTS points, which student has to obtain from practical classes, including laboratory classes** (enter total number of ECTS points for courses/group of courses denoted with code P)

|  |  |  |
| --- | --- | --- |
| Number of ECTS points for obligatory subjects  | **40** |  |
| Number of ECTS points for optional subjects  | **43** |  |
|  Total number of ECTS points | **83** |  |

**2.9.** **Minimum number of ECTS points, which student has to obtain doing education blocks offered as part of university-wide classes or other main field of study** (enter number of ECTS points for courses/groups of courses denoted with code OG)

**35** ECTS points

**2.10.** **Total number of ECTS points, which student may obtain doing optional blocks (min. 30% of total number of ECTS points)**

**70** ECTS points

**3.** **Description of the process leading to learning outcomes acquisition:**

The proces leading to learning outcomes acquisition includes active participation in classes organized at the University: lectures, exercises, laboratories, projects and seminars as well as self studies that provide reinforcement, completion and increasing knowledge. It is possible for students to benefit from individual tutorials if necessary. The learning outcomes in the field of skills are additionally developped during obligatory students’ practical training.

**4.** **List of education blocks:**

**4.1. List of obligatory blocks:**

**4.1.1 List of general education blocks**

**4.1.1.1 *Liberal-managerial subjects* block***(min.* ***6*** *ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Basics of entrepreneurship | 2 |  |  |  |  | K1INF\_W19 | 30 | 60 | 2 | 1,2 | T | Z |  |  | KO | Ob. |
|  |  | Presentation Techniques  |  |  |  |  | 2 | K1INF\_U18 | 30 | 60 | 2 | 1,2 | T | Z |  |  | KO | Ob. |
|  |  | IT Social and Professional Problems | 2 |  |  |  |  | K1INF\_W20K1INF\_W22 | 30 | 60 | 2 | 1,2 | T | Z |  |  | KO | Ob. |
|  | Total | 4 |  |  |  | 2 |  | 90 | 180 | 6 | 3,6 |  |  |  |  |  |  |

**4.1.1.4 *Information technologies* block***(min.* ***9*** *ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Computer System Organization (GK) | 2 | 1 |  |  |  | K1INF\_W06 | 45 | 90 | 3 | 1,8 | T | Z (w) |  |  | PD | Ob. |
|  |  | Structural and Object oriented Programming (GK) | 2 | 2 |  |  |  | K1INF\_W03K1INF\_U01K1INF\_U02 | 60 | 120 | 4 | 2,4 | T | E (w) |  |  | PD | Ob. |
|  |  | Structural and Object oriented Programming |  |  | 2 |  |  | K1INF\_W03K1INF\_U01K1INF\_U02 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | PD | Ob. |
|  | Total | 4 | 3 | 2 |  |  |  | 135 | 270 | 9 | 5,4 |  |  |  | 2 |  |  |

**Altogether for general education blocks**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Total number of hours | Total number ofZZUhours | Total number of CNPS hours | Total number of ECTS points | Number of ECTS points for BK classes1 |
| lec | cl | lab | pr | sem |  |  |  |  |
|  |  |  | 8 | 3 | 2 |  | 2 | 225 | 450 | 15 | 9 |

**4.1.2 List of basic sciences blocks**

**4.1.2.1 *Mathematics* block** *(min.* ***29*** *ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Algebra and Analytic Geometry (GK) | 2 | 2 |  |  |  | K1INF\_W01 | 60 | 180 | 6 | 3,6 | T | E (w) | O |  | PD | Ob. |
|  |  | Mathematical Analysis I (GK) | 2 | 2 |  |  |  | K1INF\_W01 | 60 | 180 | 6 | 3,6 | T | E (w) | O |  | PD | Ob. |
|  |  | Mathematical Analysis II (GK) | 2 | 1 |  |  |  | K1INF\_W01 | 45 | 150 | 5 | 3 | T | E (w) | O |  | PD | Ob |
|  |  | Discrete Mathematics (GK) | 2 | 2 |  |  |  | K1INF\_W01 | 60 | 150 | 5 | 3 | T | Z (w) |  |  | PD | Ob |
|  |  | Theory of Probabilistic and Statistics (GK) | 2 | 2 |  |  |  | K1INF\_W01 | 60 | 200 | 7 | 4,2 | T | E (w) |  |  | PD | Ob. |
|  | Total | 10 | 9 |  |  |  |  | 285 | 860 | 29 | 17,4 |  |  |  |  |  |  |

**4.1.2.2 *Physics* block** *(min.* ***10*** *ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | General Physics I (GK) | 2 | 1 |  |  |  | K1INF\_W02 | 45 | 120 | 4 | 2,4 | T | Z (w) | O |  | PD | Ob. |
|  |  | General Physics II (GK) | 2 | 1 |  |  |  | K1INF\_W02 | 45 | 120 | 4 | 2,4 | T | E (w) | O |  | PD | Ob |
|  |  | General Physics II |  |  | 1 |  |  | K1INF\_W02 | 15 | 60 | 2 | 1,2 | T | Z | O | P (2) | PD | Ob. |
|  | Total | 4 | 2 | 1 |  |  |  | 105 | 300 | 10 | 6 |  |  |  | 2 |  |  |

**Altogether for basic sciences blocks:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Total number of hours | Total number ofZZUhours | Total number of CNPS hours | Total number of ECTS points | Number of ECTS points for BK classes1 |
| lec | cl | lab | pr | sem |  |  |  |  |
|  |  |  | 14 | 11 | 1 |  |  | 390 | 1160 | 39 | 23,4 |

**4.1.3 List of main-field-of-study blocks**

**4.1.3.1 *Obligatory main-field-of-study* blocks** *(min.* ***86*** *ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Logic for IT Specialists (GK) | 2 | 2 |  |  |  | K1INF\_W01 | 60 | 150 | 5 | 3 | T | E (w) |  |  | K | Ob. |
|  |  | Data Structures and Algorithms |  |  | 2 |  |  | K1INF\_W03K1INF\_U01 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Data Structures and Algorithms (GK) | 2 | 1 |  |  |  | K1INF\_W03K1INF\_U01 | 45 | 120 | 4 | 2,4 | T | E (w) |  |  | K | Ob |
|  |  | Computer Architecture | 2 |  |  |  |  | K1INF\_W06K1INF\_U04K1INF\_U05 | 30 | 60 | 2 | 1,2 | T | Z |  |  | K | Ob. |
|  |  | Computer Architecture |  |  | 2 |  |  | K1INF\_W06K1INF\_U04K1INF\_U05 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Operating Systems | 2 |  |  |  |  | K1INF\_W08K1INF\_U06 | 30 | 60 | 2 | 1,2 | T | Z |  |  | K | Ob. |
|  |  | Operating Systems |  |  | 2 |  |  | K1INF\_W08K1INF\_U06 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob |
|  |  | Computer Networks | 3 |  |  |  |  | K1INF\_W09K1INF\_U07 | 45 | 110 | 4 | 2,4 | T | E |  |  | K | Ob. |
|  |  | Computer Networks |  |  | 2 |  |  | K1INF\_W09K1INF\_U07 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Effective Programming Techniques | 1 |  |  |  |  | K1INF\_W03K1INF\_U01 | 15 | 60 | 2 | 1,2 | T | Z |  |  | K | Ob. |
|  |  | Effective Programming Techniques |  |  | 2 |  |  | K1INF\_W03K1INF\_U01 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Programming paradigms |  |  | 2 |  |  | K1INF\_W04K1INF\_U02 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Programming paradigms (GK) | 2 | 1 |  |  |  | K1INF\_W04K1INF\_U02 | 45 | 140 | 5 | 3 | T | E (w) |  |  | K | Ob. |
|  |  | Data Bases |  |  | 1 |  |  | K1INF\_W12K1INF\_U03K1INF\_U04 | 15 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Data Bases (GK) | 2 | 1 |  |  |  | K1INF\_W12K1INF\_U03K1INF\_U04 | 45 | 115 | 4 | 2,4 | T | E(w) |  |  | K | Ob. |
|  |  | Systems Analysis and Decision Support Methods |  |  | 1 |  |  | K1INF\_W11K1INF\_U06 | 15 | 50 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Systems Analysis and Decision Support Methods | 2 | 1 |  |  |  | K1INF\_W11K1INF\_U06 | 45 | 140 | 5 | 3 | T | E(w) |  |  | K | Ob. |
|  |  | Introduction to IoT | 2 |  |  |  |  | K1INF\_W09K1INF\_U04K1INF\_U07 | 30 | 60 | 2 | 1,2 | T | E |  |  |  | Ob. |
|  |  | Introduction to IoT |  |  | 2 |  |  | K1INF\_W09K1INF\_U04K1INF\_U07 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Basics of Software Engineering |  |  | 1 |  |  | K1INF\_W05K1INF\_U03 | 15 | 30 | 1 | 0,6 | T | Z |  | P (1) | K | Ob. |
|  |  | Basics of Software Engineering | 1 | 2 |  |  |  | K1INF\_W05K1INF\_U03 | 45 | 90 | 3 | 1,8 | T | Z(w) |  |  | K | Ob. |
|  |  | Cybersecurity | 2 |  |  |  |  | K1INF\_W10K1INF\_U08 | 30 | 90 | 3 | 1,8 | T | E |  |  | K | Ob. |
|  |  | Cybersecurity |  |  | 2 |  |  | K1INF\_W10K1INF\_U08 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Script Languages | 2 |  |  |  |  | K1INF\_W03K1INF\_U01 | 30 | 85 | 3 | 1,8 | T | E |  |  | K | Ob. |
|  |  | Script Languages |  |  | 2 |  |  | K1INF\_W03K1INF\_U01 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Software Engineering | 2 |  |  |  |  | K1INF\_W14K1INF\_U03K1INF\_U04K1INF\_U21 | 30 | 90 | 3 | 1,8 | T | E |  |  | K | Ob. |
|  |  | Software Engineering |  |  |  | 2 |  | K1INF\_W14K1INF\_U03K1INF\_U04K1INF\_U21 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3)  | K | Ob. |
|  |  | Artificial intelligence and knowledge engineering | 2 |  |  |  |  | K1INF\_W13K1INF\_U06 | 30 | 60 | 2 | 1,2 | T | E |  |  | K | Ob. |
|  |  | Artificial intelligence and knowledge engineering |  |  | 2 |  |  | K1INF\_W13K1INF\_U06 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Data Warehouses | 2 |  |  |  |  | K1INF\_W12K1INF\_U06 | 30 | 60 | 2 | 1,2 | T | E |  |  | K | Ob. |
|  |  | Data Warehouses |  |  | 2 |  |  | K1INF\_W12K1INF\_U06 | 30 | 60 | 2 | 1,2 | T | Z |  | P (3) | K | Ob. |
|  | Total | 64 | 8 | 25 | 2 |  |  | 990 | 2530 | 86 | 51,6 |  |  |  | 36 |  |  |

**Altogether (for main-field-of-study blocks):**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Total number of hours | Total number ofZZUhours | Total number of CNPS hours | Total number of ECTS points | Number of ECTS points for BK classes1 |
| lec | cl | lab | pr | sem |  |  |  |  |
|  |  |  | 64 | 8 | 25 | 2 |  | 990 | 2560 | 86 | 51,6 |

**4.2 List of optional blocks**

**4.2.1 List of general education blocks**

**4.2.1.1 Liberal-managerial subjects blocks***(min. 3 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Humanistic subject 1 | 2 |  |  |  |  | K1INF\_W21 | 30 | 90 | 3 | 1,8 | T | Z | O |  | KO | W |
|  |  | Humanistic subject 2 | 2 |  |  |  |  | K1INF\_W21 | 30 | 90 | 3 | 1,8 | T | Z | O |  | KO | W |
|  | Total | 2 |  |  |  |  |  | 30 | 90 | 3 | 1,8 |  |  |  |  |  |  |

**4.2.1.2 *Foreign languages* block** *(min. 5 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Foreign Language I |  | 2 |  |  |  | K1INF\_U19 | 30 | 60 | 2 | 1,2 | T | Z | O |  | KO | W |
|  |  | Foreign Language II |  | 4 |  |  |  | K1INF\_U19 | 60 | 90 | 3 | 1,8 | T | Z | O |  | KO | W |
|  | Total |  | 6 |  |  |  |  | 90 | 150 | 5 | 3 |  |  |  |  |  |  |

**4.2.1.3 Sporting classes block** *(0. ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Zajęcia sportowe I |  | 2 |  |  |  |  | 30 | 30 | 0 | 0 | T | Z | O |  | KO | W |
|  |  | Zajęcia sportowe II |  | 2 |  |  |  |  | 30 | 30 | 0 | 0 | T | Z | O |  | KO | W |
|  | Total |  | 4 |  |  |  |  | 60 | 60 | 0 | 0 |  |  |  |  |  |  |

**Altogether for general education blocks:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Total number of hours | Total number ofZZUhours | Total number of CNPS hours | Total number of ECTS points | Number of ECTS points for BK classes1 |
| lec | cl | lab | pr | sem |  |  |  |  |
|  |  |  | 2 | 10 |  |  |  | 180 | 300 | 8 | 4,8 |

**4.2.3 List of main-field-of-study blocks**

**4.2.3.1 Group of optional courses M1 – Administration of Computer Systems** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Linux Server Administration (GK) | 2 |  | 2 |  |  | K1INF\_W08K1IN\_U14 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Microsoft Systems Administration (GK) | 2 |  | 2 |  |  | K1INF\_W08K1IN\_U14 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Routing and Switching in Computer Networks (GK) | 2 |  | 2 |  |  | K1INF\_W08K1IN\_U14 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2)  | K | W |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  | 2 |  |  |

**4.2.3.2 Group of optional courses M2 – Web Technologies** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Web Systems Programming (GK) | 2 |  | 2 |  |  | K1INF\_W07K1INF\_U11 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Developing Web Applications with .NET (GK) | 2 |  | 2 |  |  | K1INF\_W07K1INF\_U11 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  | 2 |  |  |

**4.2.3.3 Group of optional courses M3 – Database Design** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Database Systems Engineering (GK) | 1 |  |  | 2 |  | K1INF\_W14K1INF\_U03K1INF\_U04 | 45 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Oracle Database – Programming (GK) | 1 |  |  | 2 |  | K1INF\_W14K1INF\_U03K1INF\_U04 | 45 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Database Design (GK) | 1 |  |  | 2 |  | K1INF\_W14K1INF\_U03K1INF\_U04 | 45 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  | Total | 1 |  |  | 2 |  |  | 45 | 120 | 4 | 2,4 |  |  |  | 2 |  |  |

**4.2.3.4 Group of optional courses M4 – Mobile applications** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Mobile Applications for Android (GK) | 2 |  | 2 |  |  | K1INF\_W07K1INF\_U11 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Mobile Applications for IOS (GK) | 2 |  | 2 |  |  | K1INF\_W07K1INF\_U11 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  |  |  |  |

**4.2.3.5 Group of optional courses M5 – Project Management Basics** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Introduction to IT Project Management (GK) | 1 |  | 2 |  | 1 | K1INF\_W17K1INF\_U09K1INF\_U16K1INF\_U18 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob. |
|  |  | Support for IT Project Management (GK) | 1 |  | 2 |  | 1 | K1INF\_W17K1INF\_U09K1INF\_U16K1INF\_U18 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob |
|  |  | IT Project Process Management (GK) | 1 |  | 2 |  | 1 | K1INF\_W17K1INF\_U09K1INF\_U16K1INF\_U18 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob. |
|  | Total | 1 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  |  |  |  |

**4.2.3.6 Group of optional courses M6 – Distributed Systems** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Distributed Information Systems (GK) | 2 |  | 2 |  |  | K1INF\_W07K1INF\_U11K1INF\_U16 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob. |
|  |  | Programming on Microsoft Azure (GK) | 2 |  | 2 |  |  | K1INF\_W07K1INF\_U11K1INF\_U16 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  |  |  |  |

**4.2.3.7 Group of optional courses M7 – Programming Tools and Technologies** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Software Development in .NET Environment (GK) | 2 |  | 2 |  |  | K1INF\_W16K1INF\_U13 | 60 | 110 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob. |
|  |  | Games Programming (GK) | 2 |  | 2 |  |  | K1INF\_W16K1INF\_U13 | 60 | 110 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob |
|  |  | Advanced Web Technologies (GK) | 2 |  | 2 |  |  | K1INF\_W16K1INF\_U13 | 60 | 110 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob. |
|  | Total | 1 |  | 2 |  |  |  | 60 | 110 | 4 | 2,4 |  |  |  |  |  |  |

**4.2.3.8 Group of optional courses M8 – Multimedia** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Computer Graphics GK) | 2 |  | 2 |  |  | K1INF\_W15K1INF\_U12 | 60 | 120 | 4 | 2,4 | T | E (w) |  | P (2) | K | Ob. |
|  |  | Programming Multimedia Applications (GK) | 2 |  | 2 |  |  | K1INF\_W15K1INF\_U12 | 60 | 120 | 4 | 2,4 | T | E (w) |  | P (2) | K | Ob |
|  |  | Digital Media Processing Techniques (GK) | 2 |  | 2 |  |  | K1INF\_W15K1INF\_U12 | 60 | 120 | 4 | 2,4 | T | E (w) |  | P (2) | K | Ob. |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  |  |  |  |

**4.2.3.9 Group of optional courses M9 – Current trends in Computer Science** *(min. 4 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Data Science (GK) | 2 |  | 2 |  |  | K1INF\_W18K1INF\_U10 | 60 | 150 | 5 | 3 | T | Z (w) |  | P (3) | K | W |
|  |  | Neural Networks (GK) | 2 |  | 2 |  |  | K1INF\_W18K1INF\_U10 | 60 | 150 | 5 | 3 | T | Z (w) |  | P (3) | K | W |
|  |  | Metaheuristics in Problems Solving (GK) | 2 |  | 2 |  |  | K1INF\_W18K1INF\_U10 | 60 | 150 | 5 | 3 | T | Z (w) |  | P (3) | K | W |
|  |  | User – Computer Interaction (GK) | 2 |  | 2 |  |  | K1INF\_W18K1INF\_U10 | 60 | 150 | 5 | 3 | T | Z (w) |  | P (3) | K | W |
|  | Total | 2 |  | 2 |  |  |  | 60 | 150 | 5 | 3 |  |  |  |  |  |  |

**4.2.3.10 Optional courses** *(min. 20 ECTS points):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Learning effect symbol | Number of hours | Number of ECTS points | Form2 of course/group of courses | Way3 of crediting | Course/group of courses |
| lec | cl | lab | pr | sem | ZZU | CNPS | total | BK classes1 | university-wide4 | practical5 | kind6 | type7 |
|  |  | Team Project (GK) |  |  |  | 8 | 1 | K1INF\_U10K1INF\_U17K1INF\_U20K1INF\_U21K1INF\_U22K1INF\_K01K1INF\_K02K1INF\_K03K1INF\_K04 | 135 | 600 | 20 | 12 | T | Z |  | P (19) | K | W |
|  | Total |  |  |  | 8 | 1 |  | 135 | 600 | 20 | 12 |  |  |  |  |  |  |

**Altogether for main-field-of-study blocks:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Total number of hours | Total number ofZZUhours | Total number of CNPS hours | Total number of ECTS points | Number of ECTS points for BK classes1 |
| lec | cl | lab | pr | sem |  |  |  |  |
|  |  |  | 16 |  | 18 | 10 | 2 | 660 | 1830 (*practical training 160 CNPS hours included*) | 62 (*practical training 5ECTS points included*) | 37,2 (*practical training 3 ECTS points for BK classes included*) |

**4.3** **Training block - concerning principles of training crediting – attachment no. …**

**Faculty Council resolution (for programs adopted to September 30, 2019) / recommendation of the program's Faculty Committee (for programs adopted after September 30, 2019)\***

|  |  |
| --- | --- |
| **Name of training** |  |
| **Number of ECTS points** | **Number of ECTS points for BK classes1** | **Training crediting mode** | **Code** |
| **5** | **3** | **Z** |  |
| **Training duration** | **Training objective** |
| **4 weeks** | Attainment ofKnowledge about: IT Business or IT department functioning; designing, programming, testing and implementing professional IT solutions and systems administration. Accomplishment of a simple practical task that take the advantage of the skills acquired so far. The task should also develop social competences, esspecialy ability to work in a group. |

**5. Ways of verifying assumed learning outcomes**

|  |  |
| --- | --- |
| **Type of classes** | **Ways of verifying assumed learning outcomes** |
| lecture | e.g. examination, progress/final test |
| class | e.g. progress/final test |
| laboratory | e.g. pretest, report from laboratory, evaluation of a laboratory task solution regarding its correctness and quality |
| project | e.g. project defence |
| seminar | e.g. participation in discussion, topic presentation, essay |
| training | e.g. report from training |

**6.** **Range of diploma examination**

1. Basic Digital Circuits: Logic Gates, Switches, Sequential Cirquites.
2. Binary Arithmetics, Boolean Functions, Karnaugh table
3. Structural programming - principles. Review of structural instructions.
4. Obiect-oriented programming - basic concepts, applications.
5. Basic operations on sets, functions and relations. Sentence calculus. Calculus of quantifiers.
6. Deterministic Finite State Automata – definitione, applications.
7. Examples of computer architectures: von Neumana, Princeton, Harvard.
8. RISC and CISC processors - characteristics, differences.
9. Graphs. Spanning trees. Euler and Hamilton cycles. Cohesion. Graph traversal algorithms.
10. The concept of the algorithm. Sorting algorithms. Search algorithms.
11. Basics of algorithm analysis. Computational complexity.
12. The layered structure of operating system, the concept of the system kernel.
13. OSI layered model.
14. Data link layer protocols. Ethernet network. A stack of TCP / IP Internet protocols.
15. Application layer protocols.
16. Techniques for effective programming - examples.
17. Memory management. Typical problems. Pointers.
18. Selection of programming paradigms to solve IT problems.
19. Functional programming vs imperative programming.
20. Abstract data types and their implementation in programming languages.
21. Algorithms for identifying static objects. Analytical and numerical optimization methods.
22. The specificity of the Internet of Things, application areas, solving problems with addressing a large number of devices, their dispersion and a very large amount of generated data.
23. Hardware solutions supporting communication and communication protocols used in embedded hardware and the Internet of Things
24. Database models. Relational database. Normalization. Transactions.
25. SQL language. Characteristic. Sublanguages.
26. Software life cycle models.
27. Software development processes.
28. The use of lists, collections and dictionaries in Python.
29. Differences and similarities of Java and Python languages.
30. Python Principles of parallel programming in the Python scripting language.
31. UML as the language of the project specification. Diagrams and their application.
32. Architectural and design patterns - classification, examples, applications.
33. Data protection methods.
34. Basic cryptographic algorithms.
35. Multidimensional data modeling (transactional and analytical data systems, types of multidimensional OLAP structures).
36. ETL process
37. Expressions and MDX directives.
38. Methods of knowledge processing in expert systems.
39. Inference in non-monotonic logic - a planning task.

**7.** **Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular blocks**

|  |  |  |  |
| --- | --- | --- | --- |
| *No.* | *Course / group of courses code* | *Name of course / group of courses* | *Crediting by deadline of... (number of semester)* |
|  | Wć | General Physics I (GK) | 5 |
|  | Wć | Computer System Organization (GK) | 3 |
|  | Wć | Structural and Object oriented Programming (GK) | 3 |
|  | L | Structural and Object oriented Programming  | 3 |
|  | Wć | Logic for IT Specialists (GK) | 5 |
|  | Wć | Algebra and Analytic Geometry (GK) | 5 |
|  | Wć | Mathematical Analysis I (GK) | 5 |
|  | L | Data Structures and Algorithms  | 6 |
|  | Wć | Data Structures and Algorithms (GK) | 6 |
|  | W | Computer Architecture | 6 |
|  | L | Computer Architecture | 6 |
|  | W | Operating Systems  | 6 |
|  | L | Operating Systems | 6 |
|  | L | General Physics II | 5 |
|  | Wć | General Physics II (GK) | 5 |
|  | Wć | Discrete Mathematics (GK) | 5 |
|  | Wć | Mathematical Analysis II (GK) | 5 |
|  | W | Basics of entrepreneurship | 6 |
|  | W | Computer Networks | 6 |
|  | L | Computer Networks | 6 |
|  | W | Effective Programming Techniques | 6 |
|  | L | Effective Programming Techniques | 6 |
|  | L | Programming paradigms | 6 |
|  | Wć | Programming paradigms (GK)  | 6 |
|  | Wć | Theory of Probabilistic and Statistics (GK) | 5 |
|  | Ć | English I | 5 |
|  | Ć | Sports | 6 |
|  | L | Data Bases | 6 |
|  | Wć | Data Bases (GK) | 6 |
|  | L | Systems Analysis and Decision Support Methods | 6 |
|  | Wć | Systems Analysis and Decision Support Methods (GK) | 6 |
|  | W | Introduction to IoT | 6 |
|  | L | Introduction to IoT | 6 |
|  | L | Basics of Software Engineering | 5 |
|  | Wć | Basics of Software Engineering | 5 |
|  | Ć | English II | 6 |
|  | S | Presentation Techniques | 6 |
|  | W | Cybersecurity | 6 |
|  | L | Cybersecurity | 6 |
|  | W | Script Languages | 6 |
|  | L | Script Languages | 6 |
|  | W | Software Engineering | 6 |
|  | P | Software Engineering | 6 |
|  | W | Artificial intelligence and knowledge engineering | 6 |
|  | L | Artificial intelligence and knowledge engineering | 6 |
|  | W | Data Warehouses | 6 |
|  | L | Data Warehouses | 6 |
|  | W | IT Social and Professional Problems | 6 |

**9.** **Plan of studies (attachment no. ……)**

Approved by faculty student government legislative body:

................... ................................................................................

Date, name and surname, signature of student representative

................... ................................................................................

Date, Dean’s signature

\*delete as appropriate