**Zał. nr 2 do ZW 64/2012**

**Attachment no. …. to Programme of Education**

**PROGRAMME OF STUDIES**

**1.** **Description**

|  |  |
| --- | --- |
| *Number of semesters:* **7** | *Number ECTS points necessary to obtain qualifications:* **210** |
| *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 Faculty Council and the Senate of the Wrocław University of Technology. | *Upon completion of studies graduate obtains**professional degree of:* **Engineer (inż)***1st/2nd\* level qualifications* |
| *Possibility of continuing studies*:Completion of the first cycle studies entitles a student to apply for admission to the second degree studies. | *Graduate profile, employability:*A graduate of the 1st-degree studies program. 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, logic, 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, eg 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 are employed in the positions of software designers, programmers, software testers, service technicians, system administrators or specialists in digital security. |
| *Indicate connection with University’s mission and its development strategy:* | *The first level education program for 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. On the one hand, they meet the requirements of the Polish Qualifications Framework, on the other hand, 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 Technology in the field of internationalization, the Faculty of Computer Science and Management offers first-cycle studies in Computer Science also in English for candidates from Poland and for foreigners. In addition, students have the opportunity to participate in international exchange programs (eg. ERASMUS +).* |

**2.** **Fields of science and scientific disciplines to which educational effects apply:**

Field of Science: Technical sciences, Scientific Discipline of Computer Science

**3.** **Concise analysis of consistency between assumed educational effects and labour market needs**

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

**4.** **List of education modules:**

**4.1. List of obligatory modules:**

**4.1.1 List of general education modules**

**4.1.1.1 *Liberal-managerial subjects* module***(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 | Field-of-study educational 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\_W20 | 30 | 60 | 2 | 1,2 | T | Z |  |  |  |  |
|  |  | Presentation Techniques |  |  |  |  | 2 | K1INF\_U11 | 30 | 60 | 2 | 1,2 | T | Z |  |  |  |  |
|  |  | IT Social and Professional Problems | 2 |  |  |  |  | K1INF\_W21 | 30 | 60 | 2 | 1,2 | T | Z |  |  |  |  |
|  | Razem | 4 |  |  |  | 2 |  | 90 | 180 | 6 | 3,6 |  |  |  |  |  |  |

**4.1.1.4 *Information technologies* module***(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 | Field-of-study educational 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\_W07 | 45 | 90 | 3 | 1,8 | T | Z (w) |  |  |  |  |
|  |  | Structural and Object oriented Programming (GK) | 2 | 2 |  |  |  | K1INF\_W04K1INF\_U01K1INF\_U02 | 60 | 120 | 4 | 2,4 | T | E (w) |  |  |  |  |
|  |  | Structural and Object oriented Programming |  |  | 2 |  |  | K1INF\_W04K1INF\_U01K1INF\_U02 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) |  |  |
|  | Total | 4 | 3 | 2 |  |  |  | 135 | 270 | 9 | 5,4 |  |  |  | 2 |  |  |

**Altogether for general education modules**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | 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 modules**

**4.1.2.1 *Mathematics* module** *(min. 29 ECTS):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Field-of-study educational 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\_W02 | 60 | 150 | 5 | 3 | T | Z (w) |  |  | PD | Ob |
|  |  | Theory of Probabilistic and Statistics (GK) | 2 | 2 |  |  |  | K1INF\_W02 | 60 | 200 | 7 | 4,2 | T | E (w) |  |  | PD | Ob. |
|  | Total | 10 | 9 |  |  |  |  | 285 | 860 | 29 | 17,4 |  |  |  |  |  |  |

**4.1.2.2 *Physics* module** *(min. 10 ECTS):*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Field-of-study educational 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\_W03 | 45 | 120 | 4 | 2,4 | T | Z (w) | O |  | PD | Ob. |
|  |  | General Physics II (GK) | 2 | 1 |  |  |  | K1INF\_W03 | 45 | 120 | 4 | 2,4 | T | E (w) | O |  | PD | Ob |
|  |  | General Physics II |  |  | 1 |  |  | K1INF\_W03 | 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 modules:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | 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 modules**

**4.1.3.1 *Obligatory main-field-of-study* modules** *(min. 85 ECTS)*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No.. | Course/group of courses code | Name of course/group of courses (denote group of courses with symbol **GK**) | Weekly number of hours | Field-of-study educational 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\_W02 | 60 | 150 | 5 | 3 | T | E (w) |  |  | K | Ob. |
|  |  | Data Structures and Algorithms |  |  | 2 |  |  | K1INF\_W04K1INF\_U01 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Data Structures and Algorithms (GK) | 2 | 1 |  |  |  | K1INF\_W04K1INF\_U01 | 45 | 120 | 4 | 2,4 | T | E (w) |  |  | K | Ob |
|  |  | Computer Architecture | 2 |  |  |  |  | K1INF\_W07K1INF\_U06 | 30 | 60 | 2 | 1,2 | T | Z |  |  | K | Ob. |
|  |  | Computer Architecture |  |  | 2 |  |  | K1INF\_W07K1INF\_U06 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Operating Systems | 2 |  |  |  |  | K1INF\_W09K1INF\_U07 | 30 | 60 | 2 | 1,2 | T | Z |  |  | K | Ob. |
|  |  | Operating Systems |  |  | 2 |  |  | K1INF\_W09K1INF\_U07 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob |
|  |  | Computer Networks | 3 |  |  |  |  | K1INF\_W10K1INF\_U08 | 45 | 110 | 4 | 2,4 | T | E |  |  | K | Ob. |
|  |  | Computer Networks |  |  | 2 |  |  | K1INF\_W10K1INF\_U08 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Effective Programming Techniques | 1 |  |  |  |  | K1INF\_W04K1INF\_U01 | 15 | 60 | 2 | 1,2 | T | Z |  |  | K | Ob. |
|  |  | Effective Programming Techniques |  |  | 2 |  |  | K1INF\_W04K1INF\_U01 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K |  |
|  |  | Programming paradigms |  |  | 2 |  |  | K1INF\_W05K1INF\_U02 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K |  |
|  |  | Programming paradigms (GK) | 2 | 1 |  |  |  | K1INF\_W05K1INF\_U02 | 45 | 140 | 5 | 3 | T | E (w) |  |  | K |  |
|  |  | Data Bases |  |  | 1 |  |  | K1INF\_W13K1INF\_U03K1INF\_U04 | 15 | 60 | 2 | 1,2 | T | Z |  | P (2) | K |  |
|  |  | Data Bases |  |  | 1 |  |  | K1INF\_W13K1INF\_U03K1INF\_U04 | 15 | 60 | 2 | 1,2 | T | Z |  | P (2) | K |  |
|  |  | Systems Analysis and Decision Support Methods |  |  | 1 |  |  | K1INF\_W12K1INF\_U07 | 15 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Systems Analysis and Decision Support Methods | 2 | 1 |  |  |  | K1INF\_W12K1INF\_U07 | 45 | 150 | 5 | 3 | E (w) | T |  |  | K | Ob. |
|  |  | Introduction to IoT | 2 |  |  |  |  | K1INF\_W04K1INF\_U01 | 30 | 90 | 3 | 1,8 | T | E |  |  |  | Ob. |
|  |  | Introduction to IoT |  |  | 2 |  |  | K1INF\_W04K1INF\_U01 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Basics of Software Engineering |  |  | 1 |  |  | K1INF\_W06K1INF\_U03 | 15 | 30 | 1 | 0,6 | T | Z |  | P (1) | K | Ob. |
|  |  | Basics of Software Engineering | 1 | 2 |  |  |  | K1INF\_W06K1INF\_U03 | 45 | 90 | 3 | 1,8 | Z (w) | T |  |  | K | Ob. |
|  |  | Cybersecurity | 2 |  |  |  |  | K1INF\_W11K1INF\_U09 | 30 | 90 | 3 | 1,8 | T | E |  |  | K | Ob. |
|  |  | Cybersecurity |  |  | 2 |  |  | K1INF\_W11K1INF\_U09 | 30 | 60 | 2 | 1,2 | T | Z |  | P (2) | K | Ob. |
|  |  | Script Languages | 2 |  |  |  |  | K1INF\_W04K1INF\_U01 | 30 | 60 | 2 | 1,2 | T | E |  |  | K | Ob. |
|  |  | Script Languages |  |  | 2 |  |  | K1INF\_W04K1INF\_U01 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Software Engineering | 2 |  |  |  |  | K1INF\_W15K1INF\_U03K1INF\_U04K1INF\_K04 | 30 | 90 | 3 | 1,8 | T | E |  |  | K | Ob. |
|  |  | Software Engineering |  |  |  | 2 |  | K1INF\_W15K1INF\_U03K1INF\_U04K1INF\_K04 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3)  | K | Ob. |
|  |  | Artificial intelligence and knowledge engineering | 2 |  |  |  |  | K1INF\_W14K1INF\_U07 | 30 | 60 | 2 | 1,2 | T | E |  |  | K | Ob. |
|  |  | Artificial intelligence and knowledge engineering |  |  | 2 |  |  | K1INF\_W14K1INF\_U07 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  |  | Data Warehouses | 2 |  |  |  |  | K1INF\_W13K1INF\_U07 | 30 | 60 | 2 | 1,2 | T | E |  |  | K | Ob. |
|  |  | Data Warehouses |  |  | 2 |  |  | K1INF\_W13K1INF\_U07 | 30 | 90 | 3 | 1,8 | T | Z |  | P (3) | K | Ob. |
|  | Total | 29 | 7 | 26 | 2 |  |  | 960 | 2530 | 85 | 51 |  |  |  | 38 |  |  |

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | 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 |  |  |  |  |
|  |  |  | 29 | 7 | 26 | 2 |  | 960 | 2530 | 85 | 51 |

**4.2 List of optional modules**

**4.2.1 List of general education modules**

**4.2.1.1 Liberal-managerial subjects module M10 – Humanistic Subject***(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 | Field-of-study educational 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\_W22 | 30 | 90 | 3 | 1,8 | T | Z | O |  | KO | W |
|  |  | Humanistic Subject 2 | 2 |  |  |  |  | K1INF\_W22 | 30 | 90 | 3 | 1,8 | T | Z | O |  | KO | W |
|  | Razem | 2 |  |  |  |  |  | 30 | 90 | 3 | 1,8 |  |  |  |  |  |  |

**4.2.1.2 *Foreign languages* module** *(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 | Field-of-study educational 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 |
|  |  | English I |  | 2 |  |  |  | K1INF\_U17 | 30 | 60 | 2 | 1,2 | T | Z | O |  | KO | W |
|  |  | English II |  | 4 |  |  |  | K1INF\_U17 | 60 | 90 | 3 | 1,8 | T | Z | O |  | KO | W |
|  | Razem |  | 6 |  |  |  |  | 90 | 150 | 5 | 3 |  |  |  |  |  |  |

**4.2.1.3 Sporting classes module (min. 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 | Field-of-study educational 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 |
|  |  | Sports |  | 2 |  |  |  |  | 30 | 30 | 0 | 0 | T | Z | O |  | KO | W |
|  | Total |  | 2 |  |  |  |  | 30 | 30 | 0 | 0 |  |  |  |  |  |  |

**Altogether for general education modules:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | 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 | 8 |  |  |  | 150 | 240 | 9 | 4,8 |

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

**4.2.3.1 Module of optional courses M1 - Administration of Computer Systems (minimum 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 | Field-of-study educational 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 |
| 1. |  | Linux server administration (GK) | 2 |  | 2 |  |  | K1INF\_W09K1IN\_U21 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
| 2. |  | Microsoft systems administration (GK) | 2 |  | 2 |  |  | K1INF\_W09K1IN\_U21 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  |  |  |  |

**4.2.3.2 Module of optional courses M2 – Web Technologies (minimum 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 | Field-of-study educational 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\_W08K1INF\_U18 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | .NET Web Applications (GK) | 2 |  | 2 |  |  | K1INF\_W08K1INF\_U18 | 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 Module of optional courses M3 – Database Design (minimum 45 hours in semester, 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 | Field-of-study educational 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\_W15K1INF\_U03K1INF\_U04K1INF\_K03 | 45 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Oracle Databases – programming (GK) | 1 |  |  | 2 |  | K1INF\_W15K1INF\_U03K1INF\_U04K1INF\_K03 | 45 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Database Design (GK) | 1 |  |  | 2 |  | K1INF\_W15K1INF\_U03K1INF\_U04K1INF\_K03 | 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 Module of optional courses M4 – Mobile Applications (minimum 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 | Field-of-study educational 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 |
|  |  | Developing mobile applications for Android Platform(GK) | 2 |  | 2 |  |  | K1INF\_W08K1INF\_U18 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Developing mobile applications for IOS Platform (GK) | 2 |  | 2 |  |  | K1INF\_W08K1INF\_U18 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  | 2 |  |  |

**4.2.3.5 Module of optional courses M5 – Project Management Basics (minimum 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 | Field-of-study educational 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\_W18K1INF\_U10K1INF\_U11K1INF\_U12 | 60 | 90 | 3 | 1,8 | T | Z (w) |  | P (1) | K | Ob. |
|  |  | IT Project Management Support (GK) | 1 |  | 2 |  | 1 | K1INF\_W18K1INF\_U10K1INF\_U11K1INF\_U12 | 60 | 90 | 3 | 1,8 | T | Z (w) |  | P (1) | K | Ob |
|  |  | Process - Based Management of IT Project (GK) | 1 |  | 2 |  | 1 | K1INF\_W18K1INF\_U10K1INF\_U11K1INF\_U12 | 60 | 90 | 3 | 1,8 | T | Z (w) |  | P (1) | K | Ob. |
|  | Total | 1 |  | 2 |  | 1 |  | 60 | 90 | 3 | 1,8 |  |  |  | 1 |  |  |

**4.2.3.6 Module of optional courses M6 – Distributed Systems (minimum 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 | Field-of-study educational 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 Computer System (GK) | 2 |  | 2 |  |  | K1INF\_W08K1INF\_U11K1INF\_U18 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob. |
|  |  | Programming Microsoft Azure (GK) | 2 |  | 2 |  |  | K1INF\_W08K1INF\_U11K1INF\_U18 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  | 2 |  |  |

**4.2.3.7 Module of optional courses M7 – Programming Tools and Technologies (minimum 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 | Field-of-study educational 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 |
|  |  |  .NET Software Development (GK) | 2 |  | 2 |  |  | K1INF\_W17K1INF\_U20 | 60 | 110 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob. |
|  |  | Computer Game Programming (GK) | 2 |  | 2 |  |  | K1INF\_W17K1INF\_U20 | 60 | 110 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob |
|  |  | Advanced Web Technologies (GK) | 2 |  | 2 |  |  | K1INF\_W17K1INF\_U20 | 60 | 110 | 4 | 2,4 | T | Z (w) |  | P (2) | K | Ob. |
|  | Total | 2 |  | 2 |  |  |  | 60 | 110 | 4 | 2,4 |  |  |  | 2 |  |  |

**4.2.3.8 Module of optional courses M8 – Multimedia (minimum 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 | Field-of-study educational 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\_W16K1INF\_U19 | 60 | 120 | 4 | 2,4 | T | E (w) |  | P (2) | K | Ob. |
|  |  | Programming Multimedia Applications (GK) | 2 |  | 2 |  |  | K1INF\_W16K1INF\_U19 | 60 | 120 | 4 | 2,4 | T | E (w) |  | P (2) | K | Ob |
|  |  | Digital Media Processing Techniques (GK) | 2 |  | 2 |  |  | K1INF\_W16K1INF\_U19 | 60 | 120 | 4 | 2,4 | T | E (w) |  | P (2) | K | Ob. |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,4 |  |  |  | 2 |  |  |

**4.2.3.9 Module of optional courses M9 – Current trends in Computer Science (minimum 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 | Field-of-study educational 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\_W19K1INF\_U16 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Neural Networks (GK) | 2 |  | 2 |  |  | K1INF\_W19K1INF\_U16 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Problem Solving Using Metaheuristics (GK) | 2 |  | 2 |  |  | K1INF\_W19K1INF\_U16 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  |  | Human-Computer Interaction (GK) | 2 |  | 2 |  |  | K1INF\_W19K1INF\_U16 | 60 | 120 | 4 | 2,4 | T | Z (w) |  | P (2) | K | W |
|  | Total | 2 |  | 2 |  |  |  | 60 | 120 | 4 | 2,,4 |  |  |  | 2 |  |  |

**4.2.3.10 Optional Courses (minimum 21 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 | Field-of-study educational 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 |  |  |  | 6 |  | K1INF\_U05K1INF\_U14K1INF\_U16K1INF\_K01K1INF\_K03K1INF\_K04 | 90 | 420 | 14 | 8,4 | T | Z |  | P (14) | K | W |
|  |  | Diploma Seminar |  |  |  |  | 2 | K1INF\_U11K1INF\_U12K1INF\_U13 | 30 | 60 | 2 | 1,2 | T | Z |  |  | K | W |
|  |  | Diploma Thesis |  |  |  | 3 |  | K1INF\_U05K1INF\_U11K1INF\_U13K1INF\_U15K1INF\_K01 | 45 | 150 | 5 | 3 | T | Z |  | P (5) | K | W |
|  |  | Practical Training |  |  |  |  |  |  |  | 160 | 5 | 3 |  |  |  |  |  |  |
|  | Total |  |  |  | 9 | 2 |  | 165 | 790 | 26 | 15,6 |  |  |  | 19 |  |  |

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | 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 |  | 16 | 11 | 3 | 690 | 1840 (160 hours of practical training included) | 61 (5 ECTS of practical training included) | 36,6 (3 ECTS of practical training included) |

**4.3** **Training module (Faculty Council resolution on principles of crediting training – attachment no. …)**

|  |  |
| --- | --- |
| **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. |

**4.4** **Diploma dissertation module**

|  |  |
| --- | --- |
| **Type of diploma dissertation** | Licencjat / inżynier / magister / magister inżynier |
| **Number of diploma dissertation semesters** | **Number of ECTS points** | **Code** |
| **1** | **5** | **1** |
| **Character of diploma dissertation** |
| **Literature survey, project, computer program, etc.** |
| **Number of BK1 ECTS points 3** | Analysis of solutions, project, project documentation |

**5. Ways of verifying assumed educational effects**

|  |  |
| --- | --- |
| **Type of classes** | **Ways of verifying assumed educational effects** |
| lecture | e.g. examination, progress/final test |
| class | e.g. progress/final test |
| laboratory | e.g. pretest, report from laboratory |
| project | e.g. project defence |
| seminar | e.g. participation in discussion, topic presentation, essay |
| training | e.g. report from training |
| diploma dissertation | prepared diploma dissertation |

**6. Total number of ECTS points, which student has to obtain from classes requiring direct academic teacher-student contact (enter total** of ECTS points for courses/groups of courses denoted with code BK1)

**210 ECTS**

**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** |

**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 ……. | **38** |
| Number of ECTS points for optional subjects …. | **36** |
| Total number of ECTS points | **74** |

**9.** **Minimum number of ECTS points, which student has to obtain doing education modules 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

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

**74** ECTS points

**11.** **Range of diploma dissertation**

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.

**12.** **Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular modules**

|  |  |  |  |
| --- | --- | --- | --- |
| *No.* | *Course code* | *Name of course* | *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 |

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

Approved by faculty student government legislative body:

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

Date, name and surname, signature of student representative

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

Date, Dean’s signature