#### card of course

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| Subject name | Embedded Systems |

1. The placement of the subject in the study system

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| --- | --- |
| 1.1. Field of study | Computer science |
| 1.2. Form and path of study | Full-time/Part-time |
| 1.3. Level of education | First-cycle studies |
| 1.4. Study profile | Practical |

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| --- | --- |
| 1. 5. Specialty | - |
| 1.6. Subject Coordinator | Dr Michał Kalisz |

2. General characteristics of the subject

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| 2.1. Belonging to a subject group | Directional/Practical |
| 2.2. Number of ECTS | 3 |
| 2.3. Language of lectures | Polish |
| 2.4. Semesters in which the subject is taught | V |
| 2.5.Criteria for selecting course participants | - |

1. Learning outcomes and course delivery
   1. Subject Objectives

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| No. | Subject Objectives |
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| C1 | Presentation of the possibilities of using microcomputer systems to control devices, objects and processes. |
| C2 | Learning process automation methods using computer techniques. |
| C3 | Learning the components of embedded systems and methods of programming them. |
| C4 | Acquiring the skills necessary to develop your own embedded system solution and formulate design proposals. |

* 1. Subject-specific learning outcomes, divided into knowledge , skills and competences , with reference to the directional learning outcomes

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| --- | --- | --- | --- | --- | --- | --- |
| No. | Description of subject  learning outcomes | Reference to  directional effects  learning (symbols) | Method of implementation (mark "X") | | | |
| ST | | NST | |
| Classes at the University | Activities on  the platform | Classes at the University | Activities on  the platform |
| After passing the course, the student knows and understands **the knowledge** | | | | | | |
| W1 | Knows the types of IT system architecture, their functionalities and trends in the development of embedded system technologies. | INF\_W05  INF\_W06 INF\_W19 |  | X |  | X |
| W2 | Understands control mechanisms in automation systems, including the principles of operation of programmable logic controllers and basic elements of digital technology. |  | X |  | X |
| W3 | Possesses knowledge of the use of tools for computer modeling and simulation of real systems and their limitations. |  | X |  | X |
| W4 | Understands the design stages of embedded systems, including requirements analysis, technology selection, and the implementation process. |  | X |  | X |
| After passing the course, the student is **able** to: | | | | | | |
| U1 | Is able to design basic electrical systems, taking into account functional and environmental requirements, using signal processing techniques. | INF\_U03 INF\_U04 INF\_U05 INF\_U20  INF\_U22 | X |  | X |  |
| U2 | Is able to integrate microcomputer systems in the designs of simple electrical circuits and systems, taking into account their technical specifications. | X |  | X |  |
| U3 | Is able to conduct experimental research and computer simulations, analyze the results and formulate design conclusions based on them. | X |  | X |  |
| U4 | Independently creates simple embedded systems using design standards and current technical and engineering guidelines. | X |  | X |  |
| After completing the course, the student is ready to take part in **social competences.** | | | | | | |
| K1 | Expanding knowledge and skills through self-education and exchanging experiences with others | INF\_K01 | X |  | X |  |
| K2 | Constantly updating their knowledge and skills, is aware of the importance of IT knowledge in solving everyday problems | X |  | X |  |

3.3. Forms of teaching and their number of hours - Full-time studies (ST), Part-time studies (NST)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Path | Lecture | Exercises | Design | Workshop | Laboratory | Seminar | Lecturer | Classes conducted using distance learning methods and techniques in the form of a lecture. | Other | **ECTS points** |
| **ST** |  |  | 30 |  |  |  |  | 15 |  | 3 |
| **NST** |  |  | 15 |  |  |  |  | 10 |  | 3 |

3.4. Content of education (separately for each form of classes: (W, ĆW, PROJ, WAR, LAB, LEK, OTHER). It should be marked (X) how the given content will be implemented (classes at the university or classes on the e-learning platform conducted using distance learning methods and techniques)

TYPE OF CLASS: LECTURE

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| --- | --- | --- | --- | --- | --- | --- |
| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | Basics of control and regulation | W1 |  | X |  | X |
| 2. | Computer as a control device | W2 |  | X |  | X |
| 3. | Automation Channel - Output Circuits | W2 |  | X |  | X |
| 4. | Automation Channel - Input Systems | W2 |  | X |  | X |
| 5. | Computer control system software | W3 |  | X |  | X |
| 6. | Building systems – characteristics and definitions | W1, W4 |  | X |  | X |
| 7. | Microprocessor techniques | W1 |  | X |  | X |
| 8. | Microcontrollers | W4 |  | X |  | X |
| 9. | ECAD/EDA software | W3 |  | X |  | X |
| 10. | Real-time systems | W1, W4 |  | X |  | X |
| 11. | PCB boards | W4 |  | X |  | X |
| 12. | PLC Controllers – Structures, Software, Programming Principles | W2 |  | X |  | X |
| 13. | Electronic components in digital technology | W2 |  | X |  | X |
| 14. | Workshop tools and measuring instruments | W3 |  | X |  | X |
| 15. | Summary of classes and discussion of grades. |  |  | X |  | X |

TYPE OF CLASS: PROJECT

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| --- | --- | --- | --- | --- | --- | --- |
| No. | Content of the course | Reference to subject-specific learning outcomes | Method of implementation (mark "X") | | | |
| ST | | NST | |
| **Classes at the University** | **Activities on  the platform** | **Classes at the University** | **Activities on  the platform** |
| 1. | Exercises on the basics of control and regulation | U1 | X |  | X |  |
| 2. | Computer as a control device - tasks | U2 | X |  | X |  |
| 3. | Automation Channel - Output Systems - Tasks | U1 | X |  | X |  |
| 4. | Automation Channel - Input Systems - Tasks | U1 | X |  | X |  |
| 5. | Exercises using computer control system software | U3, K2 | X |  | X |  |
| 6. | Analysis and Characterization of Embedded Systems | U2, U4, K2 | X |  | X |  |
| 7. | Microprocessor Techniques Overview | U4, K1 | X |  | X |  |
| 8. | Microcontrollers - construction, creation of simple programs | U2, U4, K2 | X |  | X |  |
| 9. | Real-time systems - analysis, examples, exercises | U2, U3, K1 | X |  | X |  |
| 12. | PLC Controllers - Tasks | U3 | X |  | X |  |
| 13. | Electronic components in digital technology - creating diagrams | U1, U4 | X |  | X |  |
| 14. | Workshop tools and measuring instruments - practical exercises using tools | U3, K1 | X |  | X |  |
| 15. | Summary of classes and discussion of grades. |  | X |  | X |  |

3.5. Methods of verifying learning outcomes (indication and description of methods of conducting classes and verification of achievement of learning outcomes and method of documentation)

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| --- | --- | --- | --- |
| Subject Effects | Teaching methods | Methods of verifying learning outcomes | Documentation methods |
| KNOWLEDGE | | | |
| W1-W4 | Conservatory lecture, lecture with the use of multimedia, discussion, case study . | Exam. Test containing a set of 20 questions worth 1 point each  Grade 3 (sufficient): 11 – 12 points  Grade 3.5 (sufficient plus): 13 – 14 points  Rating 4 (good): 15 – 16 points  Rating 4.5 (good plus): 17 – 18 points  Rating 5 (very good): 19 – 20 points | Graded exam |
| SKILLS | | | |
| U1-U4 | Performing exercises, group work, individual work, project preparation, case study, discussion. | Final project – embedded system project – development and presentation of own solution which is an embedded system | Archived project |
| SOCIAL COMPETENCES | | | |
| K1-K2 | Performing exercises, group work, individual work, project preparation, case study, discussion. | Final project – embedded system project – development and presentation of own solution which is an embedded system | Archived project |

3.6. Assessment criteria for the achieved learning outcomes

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| Learning effect | For a grade of 3 or "pass."  the student knows and understands/is able to/is ready to | For a grade of 3.5, the student knows and understands/is able to/is ready to | For a grade of 4, the student knows and understands/is able to/is ready to | For a grade of 4.5, the student knows and understands/is able to/is ready to | For a grade of 5, the student knows and understands/is able to/is ready to |
| W | 51-60% of knowledge indicated in learning outcomes | 61-70% of knowledge indicated in learning outcomes | 71-80% of knowledge indicated in learning outcomes | 81-90% of knowledge indicated in learning outcomes | 91-100% of knowledge indicated in learning outcomes |
| U | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |
| K | 51-60% of skills indicated in learning outcomes | 61-70% of skills indicated in learning outcomes | 71-80% of skills indicated in learning outcomes | 81-90% of skills indicated in learning outcomes | 91-100% of skills indicated in learning outcomes |

3.7. Literature

**Basic**

*Lacamera Daniele; Embedded Systems Architecture: Explore architectural concepts, pragmatic design patterns, and best practices to produce robust systems; Packt Publishing; Birmingham 2018*

Ball S.R., *Embedded Microprocessor Systems: Real World Design*, Elsevier Science, 2002

Sanchez J., Canton M.P., *Embedded Systems Circuits and Programming*, CRC Press, 2012

**Supplementary**

Vahid F., Givargis T., *Embedded System Design: A Unified Hardware/Software Introduction*, Wiley, 2002.

Bis M., *Linux w systemach embedded*, Wydawnictwo BTC, Legionowo 2011

4. Student workload - ECTS points balance

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| --- | --- | --- |
| **Types of student activity** | **Student Load** | |
| **ST** | **NST** |
| **Classes requiring direct contact between the student and the academic teacher at the university premises** | **45** | **25** |
| Classes included in the study plan | 45 | 25 |
| **Student's own work** | **30** | **50** |
| Ongoing preparation for classes, preparation of project work/presentations/etc. | 15 | 25 |
| Preparation for passing classes | 15 | 25 |
| **TOTAL STUDENT HOURLY LOAD** | **75** | **75** |
| **Number of ECTS points** | **3** | **3** |

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| Last change date | 30/09/2024 |
| The changes were introduced | INF Education Quality Team |
| The changes were approved | Arkadiusz Gwarda, M.A. |