UNIVERSITY of INFORMATION TECHNOLOGY and MANAGEMENT
in Rzeszow, POLAND

Erasmus+

# Outline of the Courses for Information Technology

Summer semester

# Bachelor’s degree

## English Language

| English Language (BA degree 6 ECTS) | |
|---|---|
| Foreign language class | - Development of vocabulary resources in accordance with the obligatory textbook at a given level, including vocabulary in the field of learning and disciplines relevant to the field of study.<br>- Grammatical structures in accordance with the obligatory textbook at a given level.<br>-Practical understanding of the written text in accordance with the textbook at a given level, taking into account the field of learning and disciplines relevant to the field of study.<br>- Practice listening comprehension in accordance with the textbook at a given level.<br>- Developing the ability to prepare oral presentations in accordance with the textbook at a given level, taking into account the subject area of learning and disciplines relevant to the field of study.<br>- Development of writing skills in accordance with the textbook at a given level, taking into account the subject area of learning and disciplines relevant to the field of study. |

# Algorithms and Data Structures

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Algorithms and Data Structures |
| Beginning year | 2022/2023 |
| Faculty | Applied Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | --- |

2. PREREQUISITES (resulting from the sequence of courses)
Introduction to IT, Introduction to Programming, Fundamentals of mathematics

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1 Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | Student can discuss, analyze and implement problems in the field of mathematical and algorithmic knowledge necessary for the description, analysis and operation of algorithms. | |
| P_W02 | Can discuss, analyze and use issues in the field of basic algorithmic techniques and the meaning of algorithmic and computational thinking in various areas of human activity | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | Can construct algorithms using basic algorithmic techniques and various data structures. | |
| P_U02 | Can assess the usefulness of algorithms and data structures, in particular graph algorithms for solving simple engineering tasks, typical for real IT problems, and select and apply appropriate methods. | |
| P_U03 | Can estimate the time and memory complexity of the solution using a specific algorithmic techniques and data structures. | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 28 | - | - | 28 | - | - | 4 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Lecture | Informative and problem-based lecture. |
| Laboratory | Laboratory exercises at the computer. During the classes students analyze and implement algorithmic tasks typical for real problems encountered in professional practice of computer scientist. |

3.4. Learning content (separately for each form of classes)

LECTURE

| No. | Learning content |
|---|---|
| L1 | Mathematical foundations of computational complexity of algorithms. |
| L2 | Introduction to the design of algorithms. |
| L3 | Construction and features of data structures: arrays, lists, queues, stacks, graphs. |
| L4 | Methods of designing algorithms: recursion, divide-and-conquer method, dynamic programming, greedy method, return algorithms. Use of algorithms to solve problems. |
| L5 | Estimating the computational complexity (time and memory) algorithms. |
| L6 | Use of searching and sorting algorithms in data processing problems. |
| L7 | Using of graph algorithms in transport problems. |
| L8 | Design problems of concurrent algorithms. |

LABORATORY

| No. | Learning content |
|---|---|

| | |
|---|---|
| Lab1 | Implementation of data structures: arrays, lists, queues, stacks and operations on these structures. |
| Lab2 | Designing and implementing algorithms for sorting and searching for elements in known data structures. Estimating time and memory complexity of individual algorithms. |
| Lab3 | Design and implementation of algorithms based on recursion, the divide and conquer method, dynamic programming and greedy algorithms. Estimating time and memory complexity of individual algorithms. |
| Lab4 | Implementation of graphical representation of graphs and graph searching methods. Estimating time and memory complexity of individual algorithms. |
| Lab5 | Advanced methods of operations on graphs and their implementation. |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Open question exam | Lecture |
| P_W02 | Open question exam | Lecture |
| P_U01 | practical task | Laboratory |
| P_U02 | practical task | Laboratory |
| P_U03 | practical task | Laboratory |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2 the student cannot | For grade 3 the student can | For grade 4 the student can | For grade 5 the student can |
|---|---|---|---|---|
| P_W01 | discuss, analyze or interpret issues of mathematical knowledge necessary to describe and analyze algorithms. | Discuss or analyze issues of mathematical knowledge necessary to describe and analyze algorithms. | discuss and analyze issues in the field of mathematical knowledge necessary to describe and analyze algorithms. | discuss, analyze and implement issues of mathematical knowledge necessary to describe and analyze algorithms. |
| P_W02 | discuss, analyze or use issues related to basic algorithmic techniques. | discuss or analyze issues related to basic algorithmic techniques. | discuss and analyze issues related to basic algorithmic techniques. | discuss, analyze and use issues related to basic algorithmic techniques. |
| P_U01 | design or implement a simple search or sort algorithm for any data structure. | design and implement simple search or sorting algorithms for various data structures using known techniques. | design and implement complex search or sorting algorithms for various data structures using known techniques. | design and implement complex search and sorting algorithms for various data structures using known techniques. |
| P_U02 | choose and implement any algorithm to solve a simple engineering problem, typical for computer science. | choose and implement a basic graph algorithm to solve a simple engineering problem, typical for computer science. | choose implement and modify a basic graph algorithm to solve a simple engineering problem, typical for computer science. | choose, implement and modify a complex graph algorithm to solve an engineering problem typical for computer science. |
| P_U03 | estimate the computational complexity of any IT problem. | estimate the computational complexity of simple IT problems. | estimate the computational complexity of different solutions to the same IT problem and choose the better one. | estimate the computational complexity of complex IT problems. |

3.7. Literature

| Obligatory literature |
|---|
| Shaffer, Clifford A, A practical introduction to data structures and algorithm analysis, Shaffer, Clifford A 2001 |
| Johnsonbaugh, Richard , Schaefer, Marcus: Algorithms, Upper Saddle River, NJ : Pearson Education 2004. |

| Supplementary literature |
| --- |
| Dobrushkin, Vladimir A, Methods in algorithmic analysis, Boca Raton, Fla : Chapman & Hall/CRC 2010 |
| Miller, Russ, Algorithms sequential and parallel : a unified approach, Upper Sadle River : Prentice Hall, 2000 |
| Materials from the lecture. |

# Physics

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Physics |
| Beginning year | 2022/2023 |
| Faculty | Applied Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (RESULTING FROM THE SEQUENCE OF COURSES)

| |
|---|
| NONE |

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1 Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | The student can explain fundamental laws of physics | |
| P_W02 | The student can describe basic phenomena present in electronic systems and components. | |
| P_W03 | The student can explain the laws of physics related to electromagnetic fields and waves. | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | The student can perform measurements with the help of an universal meter. | |
| P_U02 | The student can describe measurement methods of basic physical quantities in the form of theoretical introduction to the report. | |
| P_U03 | The student can prepare a report concerning the performed experiment. | |
| After completing the training, the student has the following social competences | | |
| P_K01 | The student can carry out the project according to the schedule, both individually and within a group. | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 15 | - | - | 15 | - | - | 4 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Lecture | Informative (conventional) lecture<br>- During the lectures, the instructor presents physical issues and laws along with examples of their application.<br>- The initial time of each lecture is designed to test the students' knowledge of memorization and understanding of the content provided in previous lectures. |
| Laboratory | Laboratory, experiment - "instructions to the laboratory"<br>- Practical implementation of simple physical experiments - work in groups in the physics laboratory. |

| | |
|---|---|
| | - Within the framework of each exercise, the so-called "instruction to the laboratory" is available for students, containing, among others: the topic of the exercise, a list of concepts and physical laws needed to understand the exercise being performed, a description of the next steps to be taken by students while performing the exercise, a bibliography.<br>- Students who complete a given exercise perform subsequent actions described in the instruction. In order for the work to run smoothly, students must be prepared for classes, for this purpose they should analyze the instruction before classes, understand the physical laws that they will use in the exercise.<br>- As part of each laboratory (exercise), students prepare (in the form of a short report):<br>a) theoretical introduction to the given exercise<br>b) a report on the exercise performed<br>- Students have a template of the theoretical introduction, as well as a template of the report.<br>- Theoretical introduction, report on the completed exercise, as well as the student's independent work (assessment method: observation) during the classes are subject to the teacher's evaluation. |

3.4. Learning content (separately for each form of classes)

LECTURE

| No. | Learning content |
|---|---|
| L1 | Mathematical description of motion and its characteristics, types of motion. |
| L2 | Newton’s laws, conservation of energy, momentum and angular momentum. |
| L3 | Periodic and harmonic motion, artificial Earth satellites, Solar System model. |
| L4 | Electric field, Coulomb’s law, electric field of point charges, dipoles. |
| L5 | Electric current, Ohm’s law, work and power of an electric current. |
| L6 | Magnetic field and its interaction with electric charge, relation with electrical conductors. |
| L7 | Electromagnetic induction, Faraday’s law, mutual inductance, self-inductance. |
| L8 | Alternating current circuits, RLC circuits, generation of electromagnetic waves. |
| L9 | Electromagnetic waves and their spectra, selected applications |

LABORATORY

| No. | Learning content |
|---|---|
| Lab1 | Introduction to laboratory: preparing a report covering conducted experiment, measurement uncertainty analysis. |
| Lab2 | Measurement of basic electric quantities (equivalent resistance by various methods, verification of Ohm’s law). |
| Lab3 | Measurement of refractive index of glass with the help of an optical spectrometer. |
| Lab4 | Measurement of specific heat of water. |
| Lab5 | Measurement of the speed of sound in air. |
| Lab6 | Measurement of density of solids. |
| Lab7 | Measurement of wavelength with the use of diffraction gratings. |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01<br>P_W02<br>P_W03 | Test / exam – open questions | Lecture |
| P_U01 | Observations / report | Laboratory |
| P_U02 | Report | |
| P_K01 | Observation / report | |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2<br>the student cannot | For grade 3<br>the student can | For grade 4<br>the student can | For grade 5<br>the student can |
|---|---|---|---|---|
| P_W01<br>P_W03 | explain laws of physics | explain laws of physics on examples chosen by the student | explain laws of physics on provided examples | explain laws of physics using advanced mathematical methods |
| P_W02 | describe basic phenomena present in electronical components and systems | describe basic phenomena present in electronical components and systems on examples chosen by the student | describe basic phenomena present in electronical components and systems on provided examples | describe basic phenomena present in electronical components and systems using advanced mathematical methods |
| P_U01 | measure basic quantities with the help of a universal meter | measure basic quantities with the help of a universal meter | measure electronic systems with the help of a universal meter | measure electronic systems with the help of a universal meter with providing measurement uncertainties |
| P_U02 | prepare individually a theoretical introduction to the report, including the list of notions and laws of physics relevant to the exercise | prepare individually a theoretical introduction to the report, including the list of devices necessary to perform the exercise as well as the list of physical laws and phenomena that characterize the exercise | prepare individually a theoretical introduction to the report, describing physical phenomena and the working principles of devices used in the exercise, as well as providing a formula necessary to calculate the value of searched physical quantity with explanation of other quantities involved | prepare individually a theoretical introduction to the report, involving the working principles of devices used in the exercise based on appropriate laws of physics, as well as derivation of formulas necessary to calculate the values of physical searched quantities |
| P_K01 | Prepare a report containing results of performed measurements and values of searched physical quantities | Prepare a report containing results of performed measurements and values of searched physical quantities | Prepare a report containing results of performed measurements and values of searched physical quantities, as well as an information about the agreement of results with accepted literature data | Prepare a report containing results of performed measurements and values of searched physical quantities, as well as providing measurement uncertainties and an information about the agreement of results with accepted literature data |

3.7. Literature

| Obligatory literature |
|---|
| D. Halliday, R. Resnick, J. Walker, *Fundamentals of Physics*, Wiley, 2004.<br>Narciso Garcia, Arthur Damask , *Physics for computer science students : with emphasis on atomic and semiconductor physics,* New York, 1986 |
| K.A. Tsokos, *Physics for the IB Diploma,* New York, 2010 |

| Supplementary literature |
|---|
| W. Heisenberg , *Physics and philosophy : the revolution in modern science*, N.Y, 1999 |

# Mathematics

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Mathematics |
| Beginning year | 2022/2023 |
| Faculty | Applied Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)

Fundamentals of mathematics

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1 Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | Reference to learning outcomes for the field of study |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | Explain the basic concepts and methods of linear algebra | K_W01 |
| P_W02 | Explain the basic concepts and methods of calculus | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | Perform operation on matrices. | K_U20 |
| P_U02 | Solve systems of linear equations. | |
| P_U03 | Calculate the derivative of a function and use it to find the local extrema, monotonicity intervals and concavity. | |
| P_U04 | Calculate the indefinite and definite integrals and use the definite integral to calculate the areas of plane surfaces | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 16 | - | 18 | - | - | - | 4 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Lecture | Informative and problematic lecture: The lecturer introduces the necessary concepts and discusses the issue. Suggesting to students the main problems, he discusses with them possible ways of solving tasks. He presents examples and tasks, which are considered and solved in cooperation with students. |
| Recitation | Exercise - practical: The student constructs his own solution methods on the basis of previously acquired knowledge and skills. He indicates similarities and differences with methods used in other branches of mathematics. Moreover, he/she enriches his/her abilities by practicing the skills on the basis of knowledge acquired during lectures. In particular, uses indicated fragments of literature and own studies. Working in small groups, they exchange experience and learn to cooperate. |

3.4. Learning content (separately for each form of classes)

LECTURE

| No. | Learning content |
|---|---|
| L1 | Vectors. A linear independence of vectors. Bases |
| L2 | Matrix algebra. |
| L3 | Determinants. The inverse of a matrix. |
| L4 | Linear equations in linear algebra. Kronecker-Capelli theorem. |
| L5 | Limit of a Function and Limit Laws. |
| L6 | Derivative of a function and its interpretation. |
| L7 | Application of derivatives. Extreme values of function. Monotonic functions. Concavity and curve sketching. |
| L8 | Indefinite integral. |
| L9 | Definite integral. Application of definite integrals. |
| L10 | Functions of several variables. Partial Derivatives. |

RECITATION CLASS

| No. | Learning content |
|---|---|
| RC1 | Linear combination of vectors. Linear independence of vectors. Bases. |
| RC2 | Matrix algebra. |
| RC3 | Determinants. Properties of determinants. |
| RC4 | The inverse of a matrix. Dimension and rank. |
| RC5 | Linear equations in linear algebra. Number of solutions to systems of linear equations. |
| RC6 | Limit of a Function and Limit Laws. |
| RC7 | Derivatives. |
| RC8 | Application of derivatives. Extreme values of function. Monotonic functions. Concavity and curve sketching. |
| RC9 | Indefinite integral. |
| RC10 | Definite integral. Application of definite integrals (area between curves). |
| RC11 | Partial derivatives of a function of two variables. |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | test open questions | Lecture |
| P_W02 | test open questions | Lecture |
| P_U01 | test open questions | Recitation Class |
| P_U02 | test open questions | Recitation Class |
| P_U03 | test open questions | Recitation Class |
| P_U04 | test open questions | Recitation Class |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2 the student cannot | For grade 3 the student can | For grade 4 the student can | For grade 5 the student can |
|---|---|---|---|---|
| P_W01 | Select the correct answers in more than 50% of the questions in the field of linear algebra | Select the correct answers in more than 50% of the questions and less than 70% of the questions in the field of linear algebra | Select the correct answers in more than (or equal to) 70% of the questions and less than 85% of the questions in the field of linear algebra | Select the correct answers in more than (or equal to) 85% of the questions in the field of linear algebra |
| P_W02 | Select the correct answers in more than 50% of the questions in the field of calculus | Select the correct answers in more than 50% of the questions and less than 70% of the questions in the field of calculus | Select the correct answers in more than (or equal to) 70% of the questions and less than 85% of the questions in the field of calculus | Select the correct answers in more than (or equal to) 85% of the questions in the field of calculus |
| P_U01 | perform any matrix operation correctly | perform simple matrix operations | perform all matrix operations with minor errors | perform all matrix operations |
| P_U02 | solve any system of linear equations nor determine the number of solutions | solve simple systems of linear equations or determine the number of solutions | solve simple system of linear equations and determine the number of solutions | solve all systems of linear equations and determine the number of solutions |
| P_U03 | neither calculate derivatives of functions, nor use derivatives to determine local extremes values, test monotonicity and concavity | calculate simple derivatives of functions or use derivatives to determine local extreme values, test monotonicity and concavity | calculate derivatives of functions and use derivatives to determine local extreme values, test monotonicity and concavity | calculate all derivatives of functions and use derivatives to determine local extreme values, test monotonicity and concavity |
| P_U04 | calculate definite indefinite integraland | indefinite calculateorsimple | calculate indefinite and definite integrals | calculate all indefinite and definite integrals |

| | | | | |
|---|---|---|---|---|
| | | definite integrals | and/or use definite integrals to calculate the area between two lines/curves | and calculate the area between the lines/curves |

3.7. Literature

| Obligatory literature |
|---|
| Lay D., Linear Algebra and Its Applications, 5th Ed., Addison-Wesley, 2016. |
| Thomas, G. B., Weir, M. D., Hass, J., Giordano, F. R., & Korkmaz, R. (2016). Thomas' calculus. Boston, Pearson Education. |

| Supplementary literature |
|---|
| Lipschutz S., Schaum's outline of theory and problems of linear algebra, 3rd ed, McGraw-Hill, 2001. |
| Haeussler E. F., Paul R. S., Wood R. (2005), Introductory Mathematical Analysis, Prentice Hall. |
| Khan Academy materials: https://www.khanacademy.org |

# Fundamentals of statistics

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Fundamentals of statistics |
| Beginning year | 2022/2023 |
| Faculty | Applied Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)
None

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1 Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | Can illustrate the use of the probability calculus methods | |
| P_W02 | Can characterize the descriptive measures in a one- and two-dimensional population | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | Can use the measures of description of one-dimensional population | |
| P_U02 | He can apply the methods of characterizing a two-dimensional population | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 10 | - | - | 14 | - | - | 3 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Lecture | Informative and problem-based, consisting of a presentation of the issues covered in the course and their conditions, procedures for solving and interpretation of results obtained by applying methods of calculus of probability and static methods, taking into account their use in computer science. |
| Laboratory | Case study and problem solving to learn the principles and techniques of calculations using methods of calculus of probability and statistics and interpretation of the results obtained. |

3.4. Learning content (separately for each form of classes)

LECTURE

| No. | Learning content |
|---|---|
| L1 | Random events and probability |
| L2 | Probability distributions of random variables and their parameters |
| L3 | Selected probabilistic models |
| L4 | Parametric description of the distribution in the population |
| L5 | Assessment of interacting variables in statistical processes |

LABORATORY

| No. | Learning content |
|---|---|
| Lab1 | Probability distributions of random variables |
| Lab2 | Measures of location and scale parameters in the population |
| Lab3 | Asymmetry and kurtosis in the population |
| Lab4 | Assessment of the dependence of quantitative variables |
| Lab5 | Methods of describing the dependencies of qualitative variables |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Open test and / or task | lecture |
| P_W02 | Open test | Lecture |
| P_U01 | test | lab |
| P_U02 | test | lab |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2 the student cannot | For grade 3 the student can | For grade 4 the student can | For grade 5 the student can |
|---|---|---|---|---|
| P_W01 | illustrate any of the learned principles of the application of probability methods | to illustrate one of the learned principles of applying the methods of the probability theory | illustrate two of the learned principles of the application of probability methods | illustrate three of the learned principles of the application of probability methods |
| P_W02 | provide at least 50% of correct answers to questions regarding the descriptive measures of unidimensional and multidimensional population | provide 50-75% of correct answers to questions regarding the descriptive measures of unidimensional and multidimensional population | provide 75-90% correct answers to questions regarding the descriptive measures of unidimensional and multidimensional population | provide at least 90% of correct answers to the questions regarding the descriptive measures of unidimensional and multidimensional population |
| P_U01 | determine any of the given measures of the parametric description of the distribution in the population based on the presented data | determine any of the given measures of the parametric description of the distribution in the population based on the presented data | determine and interpret two of the given measures of the parametric description of the distribution in the population based on the presented data -if the results are not interpreted, the grade is reduced by 0.5 | determine and interpret three of the given measures of the parametric description of the distribution in the population based on the presented data - if the results are not interpreted, the grade is reduced by 0.5 |
| P_U02 | determine any of the given measures of variable interconnection in statistical processes based on the data presented | determine any of the provided measures of variable interconnection in statistical processes based on the data provided | determine and interpret two of the given measures of variable interconnection in statistical processes based on the presented data - in the absence of interpretation of the results, the score is lowered by 0.5 points | determine and interpret three of the given measures of variable interconnection in statistical processes based on the presented data - in the absence of interpretation of the results, the score is lowered by 0.5 points |

3.7. Literature

| Obligatory literature |
|---|
| I. Miller, M. Miller, John E. Freund's mathematical statistics : with applications, Prentice Hall, 2003 |
| M. R. Spiegel, et. All: Schaum's outline of theory and problems of probability and statistics. - 2nd ed. – New York : McGraw-Hill, cop. 2000 |

| Supplementary literature |
|---|
| D.Levine et all., Statistics for Managers using Microsoft Excel, Prentice Hall, 2005 |

# Programming

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Programming |
| Beginning year | 2022/2023 |
| Faculty | Applied Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)
Introduction to programming

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1 Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | has knowledge in the field of mathematics necessary for the analysis and development of computer programs and the implementation of algorithms | |
| P_W02 | has structured knowledge in the field of methodology and programming techniques, including algorithmic techniques and the importance of algorithmic and computational thinking in solving problems with computer programs | |
| P_W03 | knows and understands the methods, tools, theories and practices used to design, model and implement software, including the stages of defining requirements, specifications, validation and software testing | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | can effectively use the tools used in the construction and documentation of the software development process, with particular emphasis on software control tools, including the distributed version control system | |
| P_U02 | is able to consciously and effectively use reusable resources in the construction of computer programs | |
| P_U03 | can design, implement, verify the correctness and debug programs in a high-level programming language and implement algorithms, as well as assess their complexity | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 20 | - | - | 20 | 15 | - | 4 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Lecture | Informative and problem-based lecture, combined with elements of demonstration. |
| Laboratory | Laboratory exercises at the computer. During the classes students independently implement and debug computer programs using the integrated environment. |
| Project | Implementation of the program to solve a given problem. The project is carried out in consultation with the teacher. At the end of the semester students present a working solution. |

3.4. Learning content (separately for each form of classes)
LECTURE

| No. | Learning content |
|---|---|
| L1 | Pointers - the role of pointers in the program |
| L2 | Memory management - dynamic memory allocation |
| L3 | Using pointers to work with arrays and to pass arguments to functions |
| L4 | References - using a reference to pass arguments to a function |
| L5 | Pointers to functions |
| L6 | Basic concepts of object oriented programming - class, object, encapsulation |
| L7 | Defining classes and creating objects in an object-oriented programming language, valuable and dynamic objects, structures |

| | |
|---|---|
| L8 | Class components - data fields, methods, constructors |
| L9 | Containers and algorithms in the STL library |
| L10 | Stages of the software development process - requirements specification, design, implementation, testing, implementation, cascade model |

LABORATORY

| No. | Learning content |
|---|---|
| Lab1 | Working with pointers |
| Lab2 | Dynamic memory allocation - dynamic one- and multidimensional arrays |
| Lab3 | Passing arguments to functions - passing by value, pointer, reference |
| Lab4 | Pointers to functions |
| Lab5 | Defining classes and creating objects, header files |
| Lab6 | Access modifiers, data fields, methods |
| Lab7 | Constructors, initialization list, overloading constructors and methods |
| Lab8 | Dynamic objects, arrays of objects |
| Lab9 | Fundamentals of working with containers and algorithms in the STL library |
| Lab10 | Fundamentals of working with the version control system, documenting the code with documenting comments |

PROJECT

| No. | Learning content |
|---|---|
| P1 | Developing project specification |
| P2 | Program implementation |
| P3 | Presentation of the result |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Open or closed question test | L |
| P_W02 | Open or closed question test | L |
| P_W03 | Open or closed question test | L |
| P_U01 | Project presentation | P |
| P_U02 | Practical task | Lab |
| P_U03 | Practical task | Lab |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2 the student cannot | For grade 3 the student can | For grade 4 the student can | For grade 5 the student can |
|---|---|---|---|---|
| P_W01 | demonstrate the knowledge of mathematics necessary for the analysis and development of computer programs | demonstrate basic knowledge of mathematics necessary for the analysis and development of computer programs and the implementation of algorithms | demonstrate at a good level the knowledge of mathematics necessary for the analysis and development of computer programs and the implementation of algorithms | demonstrate at a very good level the knowledge in the field of mathematics necessary for the analysis and development of computer programs and the implementation of algorithms |
| P_W02 | demonstrate knowledge of programming methodology and techniques | demonstrate knowledge of programming methodology and techniques | demonstrate knowledge of programming methodology and techniques, including algorithmic techniques | demonstrate knowledge of programming methodology and techniques, including algorithmic techniques and the importance of algorithmic and computational thinking in solving problems with computer programs |

| | | | | |
|---|---|---|---|---|
| P_W03 | demonstrate knowledge and understanding of the methods, tools, theories and practices used to design, model and implement software | at a basic level, demonstrate knowledge and understanding of the methods, tools, theories and practices used to design, model and implement software, including the stages of requirements definition, specification, validation and software testing | demonstrate the knowledge and understanding of the methods, tools, theories and practices used to design, model and implement software at a good level, including the stages of requirements definition, specification, validation and software testing | at a very good level, demonstrate knowledge and understanding of the methods, tools, theories and practices used to design, model and implement software, including the stages of requirements definition, specification, validation and software testing |
| P_U01 | effectively use the tools used in the construction and documentation of the software development process, with particular emphasis on software control tools, including the distributed version control system | at the basic level, use the tools used in the construction and documentation of the software development process, with particular emphasis on software control tools, including a distributed version control system | use the tools used in the construction and documentation of the software development process at a good level, with particular emphasis on software control tools, including a distributed version control system | use the tools used in the construction and documentation of the software development process at a very good level, with particular emphasis on software control tools, including the distributed version control system |
| P_U02 | use reusable resources in constructing computer programs | at the basic level, use reusable resources in constructing computer programs | at a good level, use reusable resources in constructing computer programs | at a very good level, use reusable resources in constructing computer programs |
| P_U03 | design, implement, validate and debug programs in a high level programming language | design, implement, programs in a high level programming language | design, implement, verify and debug programs in a high level programming language | design, implement, verify the correctness and debug programs in a high-level programming language and implement algorithms, as well as assess their complexity |

3.8. Literature

| Obligatory literature |
|---|
| B. Stroustrup, Programming : Principles and Practice Using C++, Pearson Education, New Jersey, 2015, or newer |
| B. Stroustrup, The C++ Programming Language, Pearson Education, New Jersey, 2013, or newer |
| R. C. Martin, Clean Code : A Handbook of Agile Software Craftsmanship, Pearson Education, Upper Saddle River, 2009 |

| Supplementary literature |
|---|
| D. Vandevoorde , N. M. Josuttis , D. Gregor, C++ Templates : The Complete Guide, Pearson Education, New Jersey,2017 |

# Computer system Architecture

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Computer systems architecture |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)

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3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | Discuss the basics of computer logic and arithmetic. | |
| P_W02 | To characterize the architecture of modern computers and discuss the design and features of embedded systems. | |
| P_W03 | Discuss methods to evaluate and improve the reliability of embedded systems. | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | Design, implement, verify and document a solution to an engineering task that reflects the actual operating conditions of such a solution. | |
| P_U02 | Use computer systems simulators to verify, analyze, test, and to identify and assess the risk of a proposed solution to an engineering task. | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 30 | - | - | 30 | - | - | 5 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Lecture | Informative and problematic lecture - educational content will be provided in an accessible form and IT problems will be discussed along with their solutions. |
| Laboratory | Exercises - individual practical exercises at the computer performed in accordance with the prepared laboratory manual.<br>Teaching based on problem solving - work in groups of several people to solve the task set by the instructor. The task is similar to the task of computer system architects. There are several correct solutions. Presentation of solutions in the laboratory, discussion on the optimal solution. |

3.4. Learning content (separately for each form of classes)

TUTORIAL/LECTURE

| No | Learning content |
|---|---|
| W1 | Computer logic. |
| W2 | Arithmetic of computers. |
| W3 | Classic computer architecture. |
| W4 | Processors. Command lists. Assembler language basics. Organization of computer on assembler language level. |
| W5 | Hierarchy of memory in computer systems. |
| W6 | Interfaces. Magistralls. External devices. |
| W7 | Modern computer architectures. Multiprocessor architectures. |
| W8 | Architectures and features of embedded systems. Microcontrollers. Microcontrollers programming. |

| | |
|---|---|
| W9 | Reliability of computer systems. |

LAB/ RECITATION CLASS

| No | Learning content |
|---|---|
| L1 | Numerical systems, logic gates, design of combination systems. |
| L2 | Implementation of assembler language programs for a PC. |
| L3 | Implementation of assembler language programs for the microcontroller. |
| L4 | Simulation and testing of the operation of a programmable logic controller (PLC). |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Final examination - open questions | Lecture |
| P_W02 | | |
| P_W03 | | |
| P_U01 | Practical tasks | Laboratory |
| P_U02 | | |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2<br>the student cannot | For grade 3<br>the student can | For grade 4<br>the student can | For grade 5<br>the student can |
|---|---|---|---|---|
| P_W01 | Discuss the basics of computer logic (features of combinatorial and sequential circuits). Discuss the basics of computer arithmetic (integer and floating point data types, addition and subtraction operations for these types). | Discuss the basics of computer logic (features of combinatorial and sequential circuits). Discuss the basics of computer arithmetic (integer and floating point data types, addition and subtraction operations for these types). | Discuss the basics of computer logic (features of combinatorial and sequential circuits, methods for designing them). Discuss the basics of computer arithmetic (integer and floating point data types, arithmetic operations for these types). | Discuss the basics of computer logic (features of combinational and sequential circuits, methods of their design, use of digital function blocks). Discuss the basics of computer arithmetic (integer and floating-point data types, arithmetic operations for these types, possibilities for implementing arithmetic operations). |
| P_W02 | Characterize the architectures of modern computer systems and discuss the design and features of embedded systems. | Characterize the architectures of modern computer systems and discuss the design and features of embedded systems. | Characterize the architectures of modern computer systems and discuss the design and features of embedded systems with differences. | Characterize the architectures of modern computer systems and discuss the design and features of embedded systems with an indication of the differences and the resulting implications for applications. |
| P_W03 | Discuss methods and techniques for simulating, testing real computer systems. | Discuss methods and techniques for simulating, testing real computer systems. | Discuss methods and techniques for simulating, testing real computer systems with differences. | Discuss methods and techniques for simulating, testing real computer systems with an indication of the differences and the resulting |

| | | | | |
|---|---|---|---|---|
| | | | | implications for applications. |
| P_U01 | Design, implement, verify and document a solution to a simple engineering task. | Design, implement, verify and document a solution to a simple engineering task. | Design, implement, verify and document one solution to a complex engineering task. | Design, implement, verify and document more than one solution to a complex engineering task. |
| P_U02 | use a computer or embedded system simulator to check the correctness of the proposed engineering task solution | use a computer or embedded system simulator to check the correctness of the proposed engineering task solution | use a computer or embedded system simulator to check the correctness of the proposed solution of the engineering task, indicate places in the code where any errors occurred | use the computer or embedded system simulator to check the correctness of the proposed solution of the engineering task, indicate the places in the code where the errors occurred, indicate the potential places that affect the reliability of the solution |

3.7. Literature

| Obligatory literature |
|---|
| Harris D.M., Harris S.L.: Digital Design and Computer Architecture. Elsevier, 2007. |
| Catsoulis J.: Designing Embedded Hardware. O'Reilly, 2005. |
| Steiner C.: The 8051/8052 Microcontroller. Architecture, Assembly Language, and Hardware Interfacing. Universal Publishers, 2005. |

| Supplementary literature |
|---|
| Abd-El-Barr M., El-Rewini H.: Fundamentals of computer organization and architecture. John Wiley & Sons, 2005. |
| Blum R.: Professional Assembly Language. John Wiley & Sons, 2005. |

# Databases

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Databases |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)

---

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | Can discuss the issues necessary for building and analyzing databases | |
| P_W02 | Can explain information management and processing concepts and rules | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | Can develop a schematic diagram of a relational database based on an entity relationship diagram | |
| P_U02 | Is able to implement a conceptual framework in a relational model | |
| P_U03 | Can formulate simple and complex inquiries into real-life databases using query languages with verification of the inquiry | |
| P_U04 | Able to create selected components of database systems | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 20 | - | - | 20 | - | - | 3 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Lecture | Knowledge transferred in the form of a lecture interspersed with the forms of informative, problem and conversation. In addition, the lecturer asks the topic for independent study in order to broaden knowledge. |
| Laboratory | The course consists in performing experiments related to network traffic analysis and implementing networks reflecting real-world conditions with appropriate protocols and devices. Students receive a set of instructions during the first class which includes basic exercises with step-by-step instructions explaining the tasks to be performed as well as problem exercises in which the goal to be achieved is specified without specifying the method. Classes are conducted using real equipment (typical for production networks) under conditions similar to real network operation. |

3.4. Learning content (separately for each form of classes)

LECTURE

| No. | Learning content |
|---|---|
| L1 | Introduction to the issue of databases. Information models. Data modelling. Database systems |
| L2 | A great database model - definition, structure and ownership. Relationship Algebra |
| L3 | Database query languages. Manipulating data with SQL queries. Extending SQL language with procedural programming mechanisms. |
| L4 | Modeling conceptual and implementation diagrams in a relational model. Standardization of logical database schemas. Organization of files used for data storage. Indexing . |
| L5 | Transactions - ownership, transaction diagrams, isolation, seriality, concurrency handling and management |

| | |
|---|---|
| L6 | Database management system: indexing (construction of dense and rare indices, tree structure B-), query optimization |
| L7 | Scattered databases and client-server architecture. Data warehouses. Non-relational databases |

LABORATORY

| No. | Learning content |
|---|---|
| Lab1 | Constructing simple and complex SQL queries. Verification of results |
| Lab2 | Instructions for manipulating data |
| Lab3 | Implementation of databases. Data import |
| Lab4 | T-SQL language. Declaring variables and constants. Overview of basic control structures of T SQL language. |
| Lab5 | T-SQL Language: Triggers, stored procedures and functions, perspectives, cursors |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Open test | Lecture |
| P_W02 | Open test | Lecture |
| P_U01 | Practical tasks | Laboratory |
| P_U02 | Practical tasks | Laboratory |
| P_U03 | Practical tasks | Laboratory |
| P_U04 | Practical tasks | Laboratory |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2 the student cannot | For grade 3 the student can | For grade 4 the student can | For grade 5 the student can |
|---|---|---|---|---|
| P_W01 | define the basic issues necessary to build and analyze databases | define the basic issues necessary to build and analyze databases | discuss issues necessary for the construction and analysis of databases | discuss issues necessary to build and analyze databases based on practical examples |
| P_W02 | explain the basic concepts and principles of information management and processing | explain basic concepts and principles of information management and processing | correctly use the basic concepts and principles of information management and processing | correctly use the basic concepts and principles of information management and processing while providing alternative solutions to the problem |
| P_U01 | develop a diagram of the entity-substance diagram | develop an entity bond diagram made according to notation, naming entities, attributes and compounds | develop an entity binder diagram made according to notation, naming of entities, attributes and compounds, correct multiplication marks and primary keys | develop a complex enation-beam diagram made according to notation, naming of entions, attributes and compounds, correct multiplication marks and primary keys |
| P_U02 | implement tables based on the conceptual framework | implement tables based on the conceptual framework, correctly define data types | implement tables based on the conceptual schema, correctly define data types and integrity constraints (primary key, unique value, domain constraints, foreign key) | implement tables based on a conceptual schema, correctly define data types, integrity constraints (primary key, unique value, domain constraints, |

| | | | | |
|---|---|---|---|---|
| | | | | foreign key) and interfaces for data presentation, editing and handling |
| P_U03 | formulate simple queries using query languages | formulate simple queries using query languages | formulate simple and complex queries using query languages | formulate and verify simple and complex queries using query languages |
| P_U04 | create basic components of the database system | create basic components of the database system | create selected components of the database system based on simple tasks | create selected components of the database system based on complex tasks |

3.7. Literature

| Obligatory literature |
|---|
| An Introduction to Database System, vol. II, Adison-Wesley Pub. Comp, or newer |
| Abraham Silberschatz, Henry Korth, S. Sudarshan, Database System Concepts, McGraw-Hill Education; 7th edition (April 26, 2019) |

| Supplementary literature |
|---|
| Carlos Coronel, Steven Morris, Database Systems: Design, Implementation, & Management Cengage Learning; 13th edition (January 1, 2018) |

# Software Engineering

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Software engineering |
| Beginning year | 2022/2023 |
| Faculty | Applied Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (RESULTING FROM THE SEQUENCE OF COURSES)

| |
|---|
| PROGRAMMING, OPERATING SYSTEMS |

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1 Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | discuss techniques and methods of software evaluation and testing. | |
| P_W02 | present the methods, tools, theories and practices used for software design and implementation, including the stages of requirements definition, specification, validation and software testing. | |
| P_W03 | discuss the life cycle of devices and their software. | |
| P_W04 | present the principles of software modeling and design, and discuss the importance of trade-offs in the design solution selection phase. | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | estimate the time needed to complete the commissioned programming task in order to develop a work schedule that will ensure that the predefined values of the criterion components of the dependency triangle are maintained. | |
| P_U02 | effectively use the tools used in the construction and documentation of the software development process, with particular emphasis on software control tools, including version control and configuration management. | |
| P_U03 | make the right selection of the environment, programming language best suited to both the type of the project and the related infrastructure. | |
| P_U04 | propose a solution to the defined practical engineering task, comparing the existing solutions, define its specification, compliance with existing standards, assess the positive and negative aspects of the proposed solution, perform a design compliant with the specification and verify the obtained results and present the solution. | |
| After completing the training, the student has the following social competences | | |
| P_K01 | perform the role of a project manager in a small and medium project team and as such is able to define project requirements, conduct a requirements analysis, create its specification and supervise the work of the project team. | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 22 | - | - | 24 | 14 | - | 5 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Lecture | Informative and problem-based lecture, combined with elements of demonstration. |
| Laboratory | Exercise - practical exercises with the use of available CASE tools and dedicated IDE environment with the application of methodology taking into account the real conditions of software engineer's work. |
| Project | Project-implementation of an appropriately defined software project using an iterative and incremental model. |

3.4. Learning content (separately for each form of classes)

LECTURE

| No. | Learning content |
|---|---|
| L1 | Genesis, scope and goals of software engineering. The processes that determine the success of a software project. |
| L2 | Requirements engineering and the process of capturing and formalizing business, functional, and non-functional level requirements, as well as system constraints, integration constraints, and business rules for the software being developed. |
| L3 | Models for managing the phases of the software development process. Software development life cycle. |
| L4 | Static validation and verification, and dynamic verification and validation in the IT product delivery process. |
| L5 | Designing software architecture using UML notation. |
| L6 | Use case, class, state and activity diagrams in relation to the "4+1" model perspectives. |
| L7 | API documentation and the process of creating it. |
| L8 | Automation of activities related to the software development process. |
| L9 | Creational design patterns as a concept for solving repeatedly recurring problems. |
| L10 | Structured design patterns as a concept for solving repeatedly recurring problems. |
| L11 | Activity-based design patterns as a solution concept for repeatedly recurring problems. |

LABORATORY

| No. | Learning content |
|---|---|
| Lab1 | Methods of building module tests with the use of dedicated structural unit testing tools. |
| Lab2 | Verification and validation of the produced software product. |
| Lab3 | Requirements specification. Construction and modeling of software components with the use of use case diagram notation. |
| Lab4 | Building and modeling of the software components using the class diagram notation. |
| Lab5 | Building and modeling of the software components using the activity diagram notation. |
| Lab6 | Building and modeling of the software components using the state diagram notation. |
| Lab7 | Creating API code documentation. |
| Lab8 | Creational design patterns and their implementation. |
| Lab9 | Structured design patterns and their implementation. |
| Lab10 | Activity design patterns and their implementation. |

PROJECT

| No. | Learning content |
|---|---|
| P1 | Development of the SRS document, developing a project dictionary and checking its consistency with the requirements specification; developing a diagram of use cases; selection of the functional implementation module and building interaction; designing classes and interfaces for the indicated functionality; compilation and code implementation; building API documentation and module tests. |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Open question exam | Lecture |
| P_W02 | | |

| | | |
|---|---|---|
| P_W03 | | |
| P_W04 | | |
| P_U01 | Practical task | Laboratory |
| P_U02 | Project evaluation | Project |
| P_U03 | Project evaluation | |
| P_U04 | Practical task | Laboratory |
| P_K01 | Project evaluation | Project |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2<br>the student cannot | For grade 3<br>the student can | For grade 4<br>the student can | For grade 5<br>the student can |
|---|---|---|---|---|
| P_W01 | discuss fundamental software testing rules with relation to its hardware and process specificity, which led to hidden errors elimination | discuss fundamental software testing rules with relation to its hardware and process specificity, which led to so-called hidden errors elimination. | correctly define all test cases and necessary software functionalities list, which have to be tested taking into account the final user requirements. | present a sample test plan to detect hidden errors and errors in the interfaces and interactions between the software components that are subject to the evaluation process. |
| P_W02 | discuss the impact of all known software lifecycle models on its analysis, design, implementation, testing and deployment process. | discuss the impact of all known software life cycle models on its analysis, design, implementation, testing and implementation process. | indicate the area of the software being developed which, depending on the model used and the requirements of the end user, may be subject to potential changes. | formalize, in terms of brevity and accuracy of characteristics, aspects of software design methods taking into account the "top-down" and "bottom-up" approaches. |
| P_W03 | present the life cycle of the device and the software that is dedicated to it. | present the life cycle of the device and the software that is dedicated to it. | characterize the effects as well as documents and products of the implementation of each stage of the IT project life cycle for the model indicated by them. | characterize the effects, documents and products of the implementation of each stage of the IT project life cycle for the model indicated by the teacher. |
| P_W04 | present the basic principles of software modeling taking into account the specificity of the processes and the architectural conditions of the devices for which it will be created. | present the basic principles of software modeling taking into account the specificity of the processes and the architectural conditions of the devices for which it will be created. | discuss the significance of compromises in the phase of choosing the design solution method depending on the conditions resulting from the requirements specification. | choose the right methodology for the type of problems to be solved related to the specificity of the processes and the conditions of the architecture of devices for which the software is dedicated. |
| P_U01 | identify the basic factors that have a major impact on the success of the undertaken project. | identify the basic factors that have a major impact on the success of the project. | estimate the time necessary to implement individual stages and all phases of a programming project. | correctly estimate the time needed for the implementation of the commissioned programming task in the implementation process a work schedule that will ensure the |

| | | | | |
|---|---|---|---|---|
| | | | | maintenance of the predefined values of the criterion components of the dependency triangle. |
| P_U02 | set up and configure a repository of the indicated software version control system, so that it is possible to register changes to the created IT product depending on its version, date and author. | set up and configure a repository of the indicated software version control system, so that it is possible to register changes to the created IT product depending on its version, date and author. | define the file access rules according to the roles of individual development team members of the indicated version control system. | using the available tools, correctly create user documentation and API documentation of the indicated software, so that these documents can be registered using the selected DMS application (Document Management System). |
| P_U03 | choose both the IDE environment and CASE tools in which you can implement a predefined project. | choose both the IDE environment and CASE tools in which you can implement a predefined project. | choose the optimal environment and optimal tools for the assumed software development methodology in the context of the problem domain. | make the right selection of the environment and programming language best suited to both the type of the project and the related infrastructure. |
| P_U04 | present the results of the IT application implementation process in accordance with the assumed project methodology. | present the results of the IT application implementation process in accordance with the assumed project methodology. | present the advantages and disadvantages of the obtained solution designed in accordance with the adopted methodology and implemented software without the ability to properly carry out the process of validation and verification of the application. | present the advantages and disadvantages of the obtained solution designed in accordance with the adopted methodology and implemented software, as well as perform the correct validation and verification process of the final product of the implemented programming project |
| P_K01 | work in the team, showing acquaintance of IT project management fundamental aspects | work in the team, showing acquaintance of IT project management fundamental aspects. | work in the team, showing acquaintance of IT project management fundamental aspects and can define project requirements , conduct requirements analysis, create it specification | perform the manager role in the project small or middle team and can define project requirements, conduct requirements analysis, create it specification and supervise the work of project team |

3.7. Literature

| Obligatory literature |
|---|
| Sommerville I.: *Software Engineering.* Pearson, 2016. |
| Vliet H.: *Software engineering : principles and practice*. John Wiley & Sons, 2008. |

| Supplementary literature |
|---|
| Brooks F. P.: *The mythical man-month. Esseys on sofware engineering*. Addison-Wesley, 2005. |
| Minoli D.: *Enterprise architecture A to Z : frameworks, business process modeling, SOA, and infrastructure technology*. CRC Press, 2008. |
| |

# Programming languages

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Programming Languages |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | Programming |

2. PREREQUISITES (resulting from the sequence of courses)
Algorithms and data structures

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | Analyze the source code of a program and predict its operation | |
| P_W02 | Explain the basic concepts related to programming languages | |
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | Complete the implementation of a simple programming task. | |
| P_U02 | Analyze a small IT problem, design a high-level language program for this problem, implement, remove errors and run the execution tests of the program. | |
| After completing the training, the student has the following social competences | | |
| P_K01 | Prepare the project presentation and discuss on the group forum | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| - | - | - | 32 | 24 | - | 7 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Laboratory | The classes are realized in the laboratory. Students receive instructions on the basis of which they perform exercises to solve programming problems using selected methods and programming languages. |
| Project | The project involves the design and implementation of a computer application in a high-level programming language, preparation of project documentation and a presentation of the work results. The project is carried out in small teams or independently, depending on the complexity of the problem. |

3.4. Learning content (separately for each form of classes)
LAB CLASS

| No | Learning content |
|---|---|
| Lab1 | Familiarization with selected environments, compilers and interpreters of programming languages. |
| Lab2 | Elements of program design in imperative programming |
| Lab3 | Elements of the program design in structural programming |
| Lab4 | Elements of the program design in functional programming |
| Lab5 | Elements of program design in procedural programming |
| Lab6 | Elements of program design in event-driven programming |
| Lab7 | Elements of program design in declarative programming |
| Lab8 | Creating user applications - selected solutions for desktop technologies |
| Lab9 | Selected applications of programming languages - internet applications, data science, computer games |

Project class

| No | Learning content |
|---|---|
| P1 | The subject of the project is to create a small computer application in a chosen language and programming technology. The topic of the implemented application is determined individually with the teacher. The task will be divided into several stages: problem specification, program design, implementation and testing. The completed project must be presented by the realizing team on the group forum. |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Final test consisting of assignments of the analysis and interpretation of program code fragments | Laboratory |
| P_W02 | Final test with open questions | Laboratory |
| P_U01 | Final test consisting of simple programming tasks | Laboratory |
| P_U02 | Evaluation of project documentation and correctness of program implementation | Project |
| P_K01 | Evaluation of the project presentation | Project |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2<br>the student cannot | For grade 3<br>the student can | For grade 4<br>the student can | For grade 5<br>the student can |
|---|---|---|---|---|
| P_W01 | Analyze at least 50% of the source code of the program and predict its operation | Analyze at least 50% of the source code of the program and predict its operation | Analyze at least 70% of the source code of the program and predict its operation | Analyze at least 90% of the source code of the program and predict its operation |
| P_W02 | Explain basic concepts related to programming languages | Explain to a sufficient extent the basic concepts related to programming languages | Explain to a good extent the basic concepts of programming languages | Explain to a very good extent the basic concepts of programming languages |
| P_U01 | Complete implementation of at least 50% of programming tasks specified in the colloquium. | Complete implementation of at least 50% of programming tasks specified in the colloquium. | Complete implementation of at least 70% of programming tasks specified in the colloquium. | Complete implementation of at least 90% of programming tasks specified in the colloquium. |
| P_U02 | Analyze a small IT problem and design a high-level language program for this problem. | Analyze a small IT problem with a low level of sophistication, design a high-level language program for this problem, create the implementation, remove errors and carry out the run-time tests of this program. | Analyze a small IT problem with a mid-level of sophistication, design a high-level language program for this problem, create the implementation, remove errors and carry out the run-time tests of this program. | Analyze a small IT problem with a high level of sophistication, design a high-level language program for this problem, create the implementation, remove errors and carry out the run-time tests of this program. |
| P_K01 | Prepare a project presentation and lead a group discussions | Prepare a project presentation | Prepare a project presentation and conduct it on the group forum | Prepare a project presentation and conduct it on the group forum, and conduct discussion in the group forum |

3.7. Literature

| Obligatory literature |
| --- |
| R. Sebesta, Concepts of Programming Languages, Addison Wesley, 2008. |
| P. Van Roy, S. Haridi, Programming: conceptions, techniques, and models, Helion, Gliwice 2005. |

| Supplementary literature |
| --- |
| M. Summerfield, Python 3: complete introduction to programming, Helion, Gliwice, 2010. |
| P. Blackburn, J. Bos, K. Striegnitz, Learn Prolog Now!, College Publications, 2006. |
| P. Seibel, Practical COMMON LISP, Berkeley, Apress, 2005. |

# Postproduction and special effects

1. BASIC INFORMATION ON THE COURSE

| | | | | | |
|---|---|---|---|---|---|
| COURSE NAME | Postproduction and Special Effects | | | | |
| FACULTY | Faculty of Applied Information Technology | | | | |
| FIELD OF STUDY | Information Technology | | | | |
| CYCLE | first-cycle | | | | |
| EDUCATION PROFILE | practical | | | | |
| SEMESTER (NUMBER) | 6 | ACADEMIC YEAR | 2022/2023 | FORM OF STUDIES | full-time |

| FORM OF CLASSES | FORM OF CREDITS | NUMBER OF HOURS | ECTS CREDITS |
|---|---|---|---|
| Laboratory | Credit with grade | 30 | 8 |
| Project | Credit with grade | 30 | |

2. PREREQUISITES (resulting from course succession)

Raster and vector graphics, Graphic design workshop, Introduction to computer animation

3. COURSE OUTCOMES - KNOWLEDGE, SKILLS AND SOCIAL COMPETENCES

| Item | Description of the learning outcomes for the course<br>On completing the course, the student has the following KNOWLEDGE, SKILLS AND SOCIAL COMPETENCES |
|---|---|
| P_U01 | can use software and hardware proper for edit moving image |
| P_U02 | can implement tasks of the post production process and special effects |
| P_U03 | can create the project taking into account research elements |

4. COURSE CONTENT (separately for each form of classes)

Laboratory

| Item | Course Content |
|---|---|
| L1 | Performing advanced graphic compositions using materials prepared in-house, discussing the tools needed to complete the project. Idea creation. |
| L2 | Realization of the project based on prepared materials in 2D raster graphics software, realization of the idea based on the tools learned. |
| L3 | Preparation of film footage for composition with special effect. Idea creation. |
| L4 | Preparation of a fragment of the film using early prepared materials, composition and advanced post-production functions in special effects software. |

Project

| Item | Course Content |
|---|---|
| P1 | Realization of own concept for the composition of a still or film image based on advanced graphic program functions learned during laboratory classes. Idea creation, material preparation, project realization. |

5. METHODS OF VERIFYING ATTAINING COURSE OUTCOMES

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_U01 | A practical task | Laboratory |
| P_U02 | A practical task | Laboratory |
| P_U03 | Project evaluation | Project |

6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For the grade of 2 the student cannot | For the grade of 3 the student can | For the grade of 4 the student can | For the grade of 5 the student can |
|---|---|---|---|---|
| P_U01 | use software and hardware proper for edit moving image | use software and hardware proper for edit moving image at sufficient level to realize indicated tasks | use software and hardware proper for edit moving image at medium level to realize indicated tasks | use software and hardware proper for edit moving image at high level to realize indicated tasks |
| P_U02 | cannot implement tasks of the post production process and special effects | can implement the most important tasks of the post production process and special effects | can implement more complex tasks of the post production process and special effects | can implement more complex tasks of the post production process and special effects demonstrating proficiency |
| P_U03 | cannot design, create the project taking into account research elements | can take into account simple research element in project | can perform a research experiment in project | can perform a research experiment in project demonstrating independent work |

7. LITERATURE

| Obligatory Reading |
|---|
| Adobe Photoshop CC Classroom in a Book (2018 release) (Classroom in a Book (Ado-be)), Andrew Faulkner and Conrad Chavez, 2018. |
| Adobe After Effects CC Classroom in a Book (2019 Release), Lisa Fridsma , Brie Gyncild, Adobe Press; 1 edition (December 31, 2018) or newer |

| Supplementary Reading |
|---|
| The Anatomy of Design: Uncovering the Influences and Inspirations in Modern Graphic Design, Steven Heller, Mirko Ilic, 2009. |
| The Language of Graphic Design Revised and Updated: An illustrated handbook for understanding funda-mental design principles, Richard Poulin, 2018. |
| The Fantasy Illustrator's Technique Book, Gary A. Lippincott, Barron's Educational Series 2007r. |

# Software development techniques

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Software Development Techniques |
| Beginning year | 2022/2023 |
| Faculty | Applied Information Technology |
| Field of study | Information Technology |
| Education level | First-cycle studies – undergraduate |
| Education profile | Practical |
| Specialty | Programming |

2. PREREQUISITES (resulting from the sequence of courses)
Algorithms and data structures, Fundamentals of programming, Programming languages

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1 Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following SKLILLS | | |
| P_U01 | Prepare the project individually or in a small team to solve a specific real problem; estimate the time consuming and perform it according to a specified schedule in order to be completed within the set deadline | |
| P_U02 | Develop documentation of the project task | |
| P_U03 | Create applications using and integrating various solutions and technologies | |
| P_U04 | Design and implement the application by selecting appropriate technologies and programming methods | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| - | - | - | 30 | 30 | - | 8 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| Laboratory | Practical exercises and problem solving according to the laboratory manual. |
| Project | Design and implementation of a software project involving the development of an application performing a specific task or solving a specific real-world problem. Development of specifications, documentation and presentation of the developed solution. |

3.4. Learning content (separately for each form of classes)
LABORATORY

| No. | Learning content |
|---|---|
| L1 | Application development in selected architectures - development techniques and tools |
| L2 | Application of selected design patterns |
| L3 | Object-relational model for data access |
| L4 | Techniques of implementing business logic components |
| L5 | Mechanisms for maintaining the application status |
| L6 | Techniques of implementation of the presentation and distribution layer |
| L7 | Application integration techniques |
| L8 | Distribution, implementation and maintenance of applications |

PROJECT

| No. | Learning content |
|---|---|
| P1 | Determining the design assumptions of the application - requirements specification.<br>Determining the application architecture and technologies used - preparing the application design.<br>Implementation, launch and testing of applications<br>Post-development documentation (including instructions for installation / deployment).<br>Application presentation |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_U01 | Evaluation of the project implementation | project |
| P_U02 | Evaluation of project documentation | project |
| P_U03 | Practical exam | laboratory |
| P_U04 | Practical exam | laboratory |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2 the student cannot | For grade 3 the student can | For grade 4 the student can | For grade 5 the student can |
|---|---|---|---|---|
| P_U01 | Carry out the project according to the set scope and time | Perform the project in accordance with the established scope and within the set time limit | Complete the individual stages according to the set schedule | Complete individual stages in accordance with the agreed schedule and regularly report the progress of work on the project |
| P_U02 | Make and submit the project documentation / task containing at least the description of the application on time | Make and submit the project / task documentation on time containing at least the description of the application | Make and submit the project / task documentation on time containing at least a description of the solutions used and a description of the application | Make and submit the project / task documentation on time containing at least a description of the solutions used, a description of the application and installation instructions |
| P_U03 | Create a simple application and verify its operation | Create a simple application and verify its operation | Create an application using several different techniques and technologies | Create a complex database application using several different techniques and technologies |
| P_U04 | Apply a predetermined method to solve a given problem according to the design | Apply a predetermined method to solve a given problem according to the design | Design and implement a solution that meets a specific task | Analyze possible solutions and then select the appropriate methods and technologies to design and implement an efficient and effective solution |

3.8. Literature

| Obligatory literature |
|---|
| Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice, Addison-Wesley Professional; 2012, |
| Microsoft Application Architecture Guide (Patterns & Practices), Microsoft Press, 2009 |

| Supplementary literature |
|---|
| Gregor Hohpe, Bobby Woolf, Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions, Addison-Wesley Professional, 2003 |
| Martin Fowler, Patterns of Enterprise Application Architecture, Addison-Wesley Professional, 2002 |
| Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley Professional, 1994 |

# Master's degree

## Business analysis

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Business Analysis |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | Second-cycle – postgraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)

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3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course<br>On completing the course, the student has the following KNOWLEDGE, SKILLS AND SOCIAL COMPETENCES |
|---|---|
| P_W01 | Use the conceptual framework of business analysis, explain the most important goals and discuss typical tasks of the analyst, as well as methods, tools and techniques recommended by the BABOK standard. |
| P_U01 | Perform typical analytical tasks related to selected knowledge areas defined by the BABOK standard, using selected methods and techniques. |
| P_K01 | Explain the importance of business analysis in the context of IT projects and activities to improve the functioning of enterprises. |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 12 | - | - | 14 | - | - | 2 |

3.3. Learning content (separately for each form of classes)

LECTURE

| No. | Learning content |
|---|---|
| Lec1 | Definition of basic concepts related to business analysis, its goals and contexts in which it is used. |
| Lec2 | Characteristics of basic knowledge areas, which includes business analysis, review of techniques, methods and tools as well as required skills. |
| Lec3 | Planning and monitoring business analysis. |
| Lec4 | Strategic analysis. |
| Lec5 | Eliciting requirements and cooperation with stakeholders. |
| Lec6 | Requirements management life cycle - specification, modeling, analysis, verification and validation as well as requirements communication. |

LABORATORY

| No. | Learning content |
|---|---|
| Lab1 | Presentation of the problem domain for which analytical activities will be carried out. |
| Lab2 | Business analysis planning - business analysis activities in the context of project activities |
| Lab3 | Identification of stakeholders and defining business needs and solution vision. |
| Lab4 | Business modeling - scope modeling, process map, business objects modeling. |
| Lab5 | Modeling of business processes - introduction to BPMN notation. |
| Lab6 | Specification of the requirements for the solution. |

3.4. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01, P_K01 | Oral exam - problem and open questions. | Lecture |
| P_U01 | Assessment of gradually acquired skills, based on the results of students' work carried out during the laboratories. | Labs |

3.5. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2<br>the student cannot | For grade 3<br>the student can | For grade 4<br>the student can | For grade 5<br>the student can |
|---|---|---|---|---|
| P_W01 | explain the essence of business analysis, indicate its goals and briefly present the characteristics of knowledge areas defined by the BABOK standard | explain the essence of business analysis, indicate its objectives and briefly present the characteristics of knowledge areas defined by the BABOK standard | indicate selected techniques and methods, explain their application and how to use them in business analysis | selected areas of business analysis in the scope defined by BABOK. |
| P_U01 | apply basic techniques and methods in simple analytical tasks. | apply basic techniques and methods in simple analytical tasks. | apply the indicated techniques and methods in business analysis at an intermediate level of difficulty. | independently choose appropriate techniques and methods for analytical tasks and plan analytical tasks in accordance with the guidelines of the BABOK standard. |
| P_K01 | explain generally the importance of business analysis for the success of IT projects. | explain generally the importance of business analysis for the success of IT projects. | discuss in detail the role of business analysis and its importance for the success of IT projects and activities to improve the functioning of enterprises | point to good practices and standards related to business analysis and their importance in the professional preparation of IT specialists. |

3.6. Literature

| Obligatory literature |
|---|
| International Institute of Business Analysis: BABOK, v3. A guide to the business analysis body of knowledge. IIBA Press, 2015. |
| Wiegers, K.: Software Requirements. Microsoft Press, 2013 |

| Supplementary literature |
|---|
| Brooks F. P.: The mythical man-month. Esseys on sofware engineering. Addison-Wesley, 2005. |
| Minoli D.: Enterprise architecture A to Z : frameworks, business process modeling, SOA, and infrastructure technology. CRC Press, 2008. |

## Infrastructure and electronic services

| Infrastructure of Electronic Services (MA degree - 1 ECTS) | |
|---|---|
| Lecture | - Electronic services - history and new trends;<br>- Trust in the field of electronic communication;<br>- Authentication mechanisms, PKI and its services;<br>- Models and mechanisms of trust, Certificates and their management;<br>- Cryptography - encryption algorithms and protocols<br>Scaled computer networks;<br>- Computer systems virtualization;<br>- Data Centers;<br>- Electronic data flow monitoring. |

## English Language

| English Language (MA degree - 4 ECTS) | |
|---|---|
| Foreign language class | - Development of vocabulary resources in accordance with the obligatory textbook at a given level, including vocabulary in the field of learning and disciplines relevant to the field of study.<br>- Grammatical structures in accordance with the obligatory textbook at a given level.<br>-Practical understanding of the written text in accordance with the textbook at a given level, taking into account the field of learning and disciplines relevant to the field of study.<br>- Practice listening comprehension in accordance with the textbook at a given level.<br>- Developing the ability to prepare oral presentations in accordance with the textbook at a given level, taking into account the subject area of learning and disciplines relevant to the field of study.<br>- Development of writing skills in accordance with the textbook at a given level, taking into account the subject area of learning and disciplines relevant to the field of study. |

# Team Management

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Team management |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | Second-cycle studies – postgraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)

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3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | Reference to learning outcomes for the field of study |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | Describe the role of human factor and HR management in organizational structures and present basic relationships among the structures | K_W04 |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| - | - | - | - | - | 10 | 1 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| E-learning | expository method (didactic film), programmed method (working with teaching materials) |

3.4. Learning content (separately for each form of classes)

E-LEARNING

| No. | Learning content |
|---|---|
| eL1 | Values and strategy of a company |
| eL2 | Management styles |
| eL3 | Motivation and management techniques: supervising, coaching, mentoring and active listening |
| eL4 | Change management and feedback |
| eL5 | Charisma of a leader |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Assessment including open-ended questions with extended answers | eL |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2 the student cannot | For grade 3 the student can | For grade 4 the student can | For grade 5 the student can |
|---|---|---|---|---|
| P_W01 | Describe the role of human factor and HR | Describe in 51-69% the role of human factor and | Describe in 70-94% the role of human factor and | Describe in at least 95% the role of human factor |

| | | | | |
|---|---|---|---|---|
| | management in organizational structures and present basic relationships among the structures | HR management in organizational structures and present 51-69% of basic relationships among the structures | HR management in organizational structures and present 70-94% of basic relationships among the structures | and HR management in organizational structures and present in at least 95% basic relationships among the structures |

3.7. Literature

| Obligatory literature |
|---|
| Management of organization in the age of globalization / ed. by Mirosław K. Szpakowski, Barbara M. Kolbus - Zamość : Knowledge Innovation Center, 2012. |
| Project management : a managerial approach / Jack R. Meredith, Samuel J. Mantel. - 7th ed. - Hoboken, NJ : John Wiley, cop. 2010 |

| Supplementary literature |
|---|
| Goleman Daniel, Leadership that gets results, www.hrb.org |
| Herzberg Frederic, One more time, how do you motivate employees, www.hbr.org |
| Lencioni Patrick, Make your values mean something, www.hbr.org |
| Martin Roger, The big lie of strategic planning, www.hbr.org |

# Sociology

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Sociology |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | Second-cycle studies – postgraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)

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3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course | |
|---|---|---|
| After completing the training, the student has the following knowledge | | |
| P_W01 | Enumerate the types of social groups | |
| P_W02 | Enumerate the types social stratifications | |
| P_W03 | Name the characteristics of contemporary society | |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| - | - | - | - | - | 20 | 1 |

3.3 Teaching delivery methods

| Forms of classes | Delivery method |
|---|---|
| E-learning | Programmed text - a sequence of logically and substantively related pieces of information on a given topic, which is to be assimilated using a computer with Internet access. Each piece of information ends with questions and tasks to be completed, to which the learner formulates answers and receives feedback on the correctness of the answers and a suggestion for the next steps. |

3.4. Learning content (separately for each form of classes)

E-LEARNING

| No. | Learning content |
|---|---|
| eL1 | Module II - Culture |
| eL2 | Module III - Socialization |
| eL3 | Module V - Social Class and Social Stratification |
| eL4 | Module VI - Race and Ethnicity |

3.5. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | 1. Two posts on the forum<br>2. Final test | eL |
| P_W02 | 1. Two posts on the forum<br>2. Final test | eL |
| P_W03 | 1. Two posts on the forum<br>2. Final test | eL |

3.6. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2 the student cannot | For grade 3 the student can | For grade 4 the student can | For grade 5 the student can |
|---|---|---|---|---|
| P_W01 | Has not gained 50% of points on final test, has not posted two posts on the forum | Has gained 50% of points on final test, has posted two posts on the forum | Has gained 70% of points on final test, has posted two posts on the forum | Has gained 90% of points on final test, has posted two posts on the forum |
| P_W02 | Has not gained 50% of points on final test, has not posted two posts on the forum | Has gained 50% of points on final test, has posted two posts on the forum | Has gained 70% of points on final test, has posted two posts on the forum | Has gained 90% of points on final test, has posted two posts on the forum |
| P_W03 | Has not gained 50% of points on final test, has not posted two posts on the forum | Has gained 50% of points on final test, has posted two posts on the forum | Has gained 70% of points on final test, has posted two posts on the forum | Has gained 90% of points on final test, has posted two posts on the forum |

3.7. Literature

| Obligatory literature |
|---|
| P. Berger: Invitation to Sociology: A Humanistic Perspective, Pelica Press, 1966 |
| L.A. Coser: Introduction to Sociology, HBJ, 1991 |

| Supplementary literature |
|---|
| J.M. Henslin: Sociology: a down-to-earth approach, A&B, 1999 |

# Monographic lecture

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Monographic Lecture (Petri Nets) |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | Second-cycle – postgraduate |
| Education profile | Practical |
| Specialty | - |

2. PREREQUISITES (resulting from the sequence of courses)

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3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course<br>On completing the course, the student has the following KNOWLEDGE, SKILLS AND SOCIAL COMPETENCES |
|---|---|
| P_W01 | Showing the algorithms, methods and tools used to develop solutions to computer problems in the lecture topic area |
| P_W02 | Discussing development trends and latest developments in IT applications in science and technology in the lecture topic area |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| 10 | - | - | - | - | - | 1 |

3.3. Learning content (separately for each form of classes)

LECTURE

| No. | Learning content |
|---|---|
| Lec1 | Presentation of selected algorithms, methods and tools for IT problem solving in Petri Nets |
| Lec2 | Use of information technology methods, techniques and tools to solve problems in Petri Nets |
| Lec3 | Identifying developmental trends and key new developments in computer applications for Petri Nets |

3.4. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 – W02 | Colloquium/Open test | Lecture |

3.5. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2<br>the student cannot | For grade 3<br>the student can | For grade 4<br>the student can | For grade 5<br>the student can |
|---|---|---|---|---|
| P_W01 | show selected algorithms, methods, and tools used to develop solutions to IT issues in the lecture topic area | sufficiently demonstrate the selected algorithms, methods and tools used to develop practical solutions to IT problems in the area of lecture topics | present selected algorithms, methods, and tools for developing practical IT solutions for lecture topics | explain in detail the algorithms, methods and tools used to develop practical solutions to IT problems in the area of lecture topics |
| P_W02 | discuss the trends and latest developments in IT applications in lecture topics | discuss basic trends and state-of-the-art developments in IT in lecture topics | discuss superior trends and latest developments in IT applications in lecture topics | discuss in detail the trends and latest developments in IT applications in lecture topics |

3.6. Literature

| Obligatory literature |
| --- |
| D. Rene, A. Hassane, Discrete, continuous and hybrid Petri nets, Heidelberg : Springer Verlag, Berlin 2005 lub nowsze |
| G. Claude, V. Rüdiger, Petri nets for systems engineering : a guide to modeling, verification, and applications, Heidelberg : Springer Verlag, Berlin 2003 lub nowsze |

| Supplementary literature |
| --- |
| I. Koch, et al., Modeling in systems biology the petri net approach. London: Springer, 2011 lub nowsze |
| J. R. Silva and P. M. del Foyo, "Timed Petri Nets," 2012 lub nowsze |
| A. Gogolinska and W. Nowak, "Petri Nets Approach to Modeling of Immune System and Autism," in Artificial Immune Systems. vol. 7597, C. Coello Coello, et al., Eds., ed: Springer Berlin / Heidelberg, 2012 lub nowsze, pp. 86-99. |

# Monitoring and detecting security threats

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Monitoring and detecting security threats |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | Second-cycle – postgraduate |
| Education profile | Practical |
| Specialty | Cybersecurity |

2. PREREQUISITES (resulting from the sequence of courses)
Fundamentals of cybersecurity

3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course<br>On completing the course, the student has the following KNOWLEDGE, SKILLS AND SOCIAL COMPETENCES |
|---|---|
| P_W01 | Be able to characterize threats and system monitoring techniques |
| P_U01 | Applies system security monitoring tools |
| P_U02 | Interprets information from monitoring and detection systems |
| P_U03 | Be able to plan penetration tests |
| P_U04 | Be able to prepare project and implementation documentation |
| P_U05 | Test systems from a security perspective |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| - | - | - | 30 | 20 | - | 4 |

3.3. Learning content (separately for each form of classes)
LABORATORY

| No. | Learning content |
|---|---|
| Lab1 | Log data processing in Linux |
| Lab2 | Obtaining threat information |
| Lab3 | Process monitoring on Windows and Linux |
| Lab4 | Log Management Systems |
| Lab5 | Intercept network traffic and monitor for attacks |
| Lab6 | Performance testing of the Snort tool |
| Lab7 | Isolation of threat actors using monitoring and threat detection tools |

3.4. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|
| P_W01 | Test | Laboratory |
| P_U01 - 02 | Evaluation of completed laboratories | Laboratory |
| P_U03 - U05 | Evaluation of project | Project |

3.5. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2<br>the student cannot | For grade 3<br>the student can | For grade 4<br>the student can | For grade 5<br>the student can |
|---|---|---|---|---|
| P_W01 | characterize the threats and techniques of systems monitoring | Correctly answers at least 50% of the questions on techniques of systems monitoring | Correctly answers at least 70% of the questions on techniques of systems monitoring | Correctly answers at least 85% of the questions on techniques of systems monitoring |

| | | | | |
|---|---|---|---|---|
| P_U01 | Use system security monitoring tools | Perform a basic set of labs on the use of systems security monitoring tools | Perform an entire set of labs on the use of systems security monitoring tools with some deficiencies or errors | Complete the entire set of labs on the use of systems security monitoring tools without error |
| P_U02 | Interpret information from monitoring and detection systems | Interpret key information from monitoring and detection systems | Interpret key and more detailed information from monitoring and detection systems - less significant errors acceptable | Interpret key and more detailed information from monitoring and detection systems - without error |
| P_U03 | Plan penetration tests | Plan basic penetration testing | Plan the detailed steps for implementing penetration testing | Plan detailed steps for implementing more advanced penetration testing |
| P_U04 | Prepare project and implementation documentation | Prepare basic documentation of project and implementation | Prepare detailed documentation of project and implementation | Prepare detailed documentation of project and implementation with appendices |
| P_U05 | Test systems from a security perspective | Complete the test plan sufficiently | Complete the test plan to a good level | Complete the test plan completely |

3.6. Literature

| Obligatory literature |
|---|
| Materiały Akademii Cisco: CCNA CyberOps http://cisco.netacad.net |
| Glen D. Singh , Learn Kali Linux 2019: Perform powerful penetration testing using Kali Linux, Metasploit, Nessus, Nmap, and Wireshark, Packt Publishing , Nov 14, 2019 |
| Network security bible / Eric Cole, Ronald Krutz, James W. Conley. - 2nd ed. - Indianapolis, IN : Wiley Pub., Inc., cop. 2009. |

| Supplementary literature |
|---|
| Cryptography and Network Security: Principles and Practice by William Stallings (13 Jun 2013) |
| CompTIA Security + Review Guide: Exam SY0-401 by James M. Stewart (1 Jul 2014) |
| Allen Harper, Daniel Regalado, Gray Hat Hacking: The Ethical Hacker's Handbook, Fifth Edition , McGraw-Hill Education, Jun 8, 2018 |

## Cybersecurity essentials

| Cybersecurity Essentials (MA degree - 2 ECTS) | |
|---|---|
| Lecture | - Cyberspace - security actors, cybercriminals, security professionals , impact of threats on individuals, business, institutions;<br>- Security models and standards. Basic components: confidentiality, integrity, availability;<br>- Threats and vulnerabilities - overview;<br>- Ensuring confidentiality - cryptography. Techniques, tools, protocols;<br>- Ensuring integrity. Integrity control methods, digital signatures, certificates. Integrity in databases;<br>- High availability and reliability. Methods for increasing reliability, incident response, disaster recovery;<br>- Securing devices and systems. Securing servers, networks. Physical security. |
| Laboratory | - Identification of threats using professional bases. Preparing an environment based on virtualization;<br>- Applying methods of authentication, authorization and accounting in operating systems;<br>- Detecting basic threats in an operating system;<br>- Encryption and password cracking;<br>- Examining digital signatures. Configuring secure remote access;<br>-Securing the operating system. |

# Introduction to network technologies

1. BASIC INFORMATION ON THE COURSE

| | |
|---|---|
| Course name | Introduction to network technologies |
| Academic year | 2022/2023 |
| Faculty | Faculty of Information Technology |
| Field of study | Information Technology |
| Education level | Second-cycle – postgraduate |
| Education profile | Practical |
| Specialty | Cybersecurity |

2. PREREQUISITES (resulting from the sequence of courses)

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3. LEARNING OUTCOMES AND THE METHOD OF CARRYING OUT ACTIVITIES

3.1. Course learning outcomes - knowledge, skills and social competences,

| No. | Description of the learning outcomes for the course<br>On completing the course, the student has the following KNOWLEDGE, SKILLS AND SOCIAL COMPETENCES |
|---|---|
| P_W01 | Evaluate the suitability of models, topologies, protocols and technologies for specific applications |
| P_W02 | Analyze solutions in terms of computer network and services operating conditions. |
| P_W03 | Characterize a systematic approach to computer network design considering business requirements and technical constraints. |
| P_U01 | Develop documentation for the project task |
| P_U02 | Prepare and conduct an experiment using laboratory equipment and software |
| P_U03 | Prepare a study of the results of the experiment |

3.2. Forms of classes and number of hours and ECTS credits

| Lec | Tutorial | RC | Lab | P | eL | ECTS |
|---|---|---|---|---|---|---|
| - | - | - | 30 | - | - | 2 |

3.3. Learning content (separately for each form of classes)

LABORATORY

| No. | Learning content |
|---|---|
| Lab1 | Analysis of communication methods – connection oriented/connectionless and their applications |
| Lab2 | Services in networks and the application, presentation, and session layers of the OSI model. |
| Lab3 | Analysis of TCP and UDP protocol. Evaluation of the usefulness of both protocols. |
| Lab4 | Comparison of IPv4 and IPv6 protocols. Analysis of the pros and cons of the protocols. |
| Lab5 | Study of data link layer protocols and multi-access methods using Ethernet, wi-fi, ppp as examples |
| Lab6 | Investigation of transmission channels and analysis of their properties |
| Lab7 | Application of remote access in business |
| Lab8 | Analysis of security solutions at different layers of the OSI model. |
| Lab9 | Testing protocols for secure transmission |
| Lab10 | Methodology of computer network design |
| Lab11 | Business requirements analysis for a planned or upgraded computer network |
| Lab12 | Formulating technical requirements for a computer network |
| Lab13 | Planning of logical topology, addressing, selection of communication security solutions. |
| Lab14 | Selection of network technology (Ethernet, Wi-Fi), devices and media types. Design of physical network topology and deployment of cabling and devices. |
| Lab15 | Optimize computer network operations and services |

3.4. Methods of verification of learning outcomes

| Course outcome | Assessment method | Form of classes within which attaining the outcome is verified |
|---|---|---|

| | | |
|---|---|---|
| P_W01 – 03<br>P_U01 – 03 | Assessment, practical task | Laboratory |

3.5. CRITERIA FOR GRADING THE LEVEL OF ACHIEVEMENT OF COURSE OUTCOMES

| Course outcome | For grade 2<br>the student cannot | For grade 3<br>the student can | For grade 4<br>the student can | For grade 5<br>the student can |
|---|---|---|---|---|
| P_W01 | Evaluate the suitability of models, topologies, protocols and technologies for specific applications | Evaluate the suitability of key models, topologies, protocols and technologies for typical applications | Evaluate the suitability of various models, topologies, protocols and technologies in typical applications | Evaluate the suitability of various models, topologies, protocols, and technologies for a variety of applications |
| P_W02 | Analyze solutions in terms of computer network operating conditions and services. | Analyze simple solutions in terms of computer network operating conditions and services. | Analyze more complex solutions in terms of computer network operating conditions and services. | Analyze more complex solutions in terms of computer network operating conditions and services in a degree that demonstrates independent study of the topic. |
| P_W03 | Characterize a systematic approach to computer network design considering business requirements and technical constraints. | Characterize a main assumptions of systematic approach to computer network design considering business requirements and technical constraints. | Characterize a systematic approach to computer network design considering business requirements and technical constraints. | Characterize, giving various example, a systematic approach to computer network design considering business requirements and technical constraints. |
| P_U01 | Prepare documentation for the project task | Document a design task based on template solutions | Develop documentation for a project task using their own ingenuity | Develop documentation of a design task that closely represents the actual design steps |
| P_U02 | Prepare or conduct an experiment using laboratory equipment and software | Prepare and conduct a simple experiment using laboratory equipment and software | Prepare and conduct a more complex experiment using laboratory equipment and software | Prepare and conduct a more complex experiment using laboratory equipment and software demonstrating independence and creativity. |
| P_U03 | Prepare a study of the results of the experiment | Prepare the results of the experiment with simple tools and without making significant mistakes | Prepare a study of the results of an experiment using various tools and without making mistakes | Prepare a study of experimental results using a variety of tools and demonstrating independence and creativity |

3.6. Literature

| Obligatory literature |
|---|
| Wendell Odom, CCNA 200-301 Official Cert Guide Library |

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|---|
| Cisco press, 2020 or Introduction to Networks course materials at http://netacad.com |
| Oppenheimer P., Top-Down Network Design, Top-Down Network Design, Cisco Press; 3 edition (24 Aug 2010) |

| Supplementary literature |
|---|
| CompTIA Network+ Certification Premium Bundle: All-in-One Exam Guide, Seventh Edition with Online Access Code for Performance-Based Simulations, Video Training, and Practice Exams (Exam N10-007) 7th Edition, 2019 |
| Wendell Odom, CCNA 200-301 Official Cert Guide Library 1st Edition, Cisco press, 2020 |
| Wenliang Du , Computer & Internet Security: A Hands-on Approach 2nd Edition, Wenliang Du, 2019 |