DATA ENGINEERING

STUDIES OF FIRST DEGREE

COURSE DIRECTORY

Since 2013/2014

ALGORITHMS AND DATA STRUCTURES 1

Course code: 11.3-WK-ID-SP-ASD1
Type of course: obligatory
Language of instruction: English/Polish
Director of studies: dr inż. Janusz Jabłoński
Name of lecturer: dr inż. Janusz Jabłoński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					5
Lecture	30	2	II	Exam	
Laboratory	30	2		Grade	

COURSE AIM:

Objective of the course is to introduce in basic useful algorithms for solving the problems of data processing. Introduction with basic useful algorithms in solving the problems of data processing. The introduction to analysis of computational and complexity of algorithms. After completion the course the student should know to prepare the model of problem as well as can specify model of problem and realize this algorithms (to 200 line of code) in chosen programming language (the Pascal, C, C ++, the Java) as well as introduce their computational complexity.

ENTRY REQUIREMENTS:

The basis of logic and the quantitative analysis. Basics of computer programming.

COURSE CONTENTS:

Lecture/Laboratory

- The algorithms of sorting the introduction to computational complexity.
- Folded the structures of data and the dynamic variables.
- Recurrence and recurrence algorithms.
- Introduction to graph algorithms and dynamically programming.
- The textual structures of data and the algorithms of finding the pattern.
- The introduction to object-oriented methods and the object data structures.

TEACHING METHODS:

Accessible lecture in electronic form; the computer laboratories from utilization the tools (the Dev ++, the Turbo the Pascal, Java), the presenting models, complexity and the implementations of solutions of problems with range of processing of data.learning outcomes:

LEARNING OUTCOMES

(K_W07 +) Students knows the basis of programming and the computational technique helping the analyst's work as well as reason of their limitation

(K_W08.+++) It knows the chosen languages of programming as well as the basis of object-oriented programming; it knows the basic structures of data (boards, tree's, letters, objects, graph), their computer representations and executed on them operations

(K_W11 ++) It knows the basic techniques of construction and the analysis of algorithms as well as the reason the basic limitations in solving the algorithmic problems

(K_U05 +) It knows to analyse the designed algorithms under angle of correctness and computational complexity.

(K_K01 +) The Rrozumie need of continuous lifting of its qualifications across broadening its knowledge and the practical skills.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Checking degree of the students' preparation as well as their activity in track of laboratory.
The credit of laboratory on basis of tests (30%) reporting with realized tasks (70%).
Grade from object consists with grade of laboratory (50%) as well as grade from the written examination (50%). Positive grade is from laboratory the condition of credit of object and examination.

STUDENT WORKLOAD:

Contact hours: 75 hours.

- Participation in lectures: 30 hours.
- Participation in laboratory classes: 30 hours.
- Participation in consultations: 12 hours.
- Exam: 3 hours.

Working alone: 50 hours.

- Preparation for laboratory classes: 10 hours.
- Preparation for the exam: 20 hours.
- Preparation of the written reports: 15 hours.
- Searching for the sources in the literature: 5 hours.

Total for course: 125 hours. (5 ECTS)

RECOMMENDED READING:

1. Aho A., Hopcroft J.E., Ullman J.D., : Data structures and algorithms
2. T.H. Cormen, Ch.E. Leiserson, R.L. Rivest: Introduction to Algorithms, 2001, MIT Press.
3. L. Banachowski, K. Diks, W. Rytter A.Björck, G.Dahlquist, Algorytmy i struktury danych, WNT, Warszawa, 2006;
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein; Wprowadzenie do algorytmów WNT, Warszawa, 2004;
5. A. and K. Kingsley-Hughes, Programowanie od podstaw, Helion, Gliwice, 2005;
6. A. Majczak, Programowanie strukturalne i obiektowe. Podręcznik do nauki zawodu technik informatyk, Helion, Gliwice, 2010

OPTIONAL READING:

1. P. Wróblewski, Algorytmy, struktury danych i techniki programowania, Helion, Gliwice, 2003;
2. A. Aho, J. E. Hopcroft, J. D. Ullman, Algorytmy i struktury danych, Helion, Gliwice, 2003;
3. J. Grebosz, Symfonia C++, Wydawnictwo Edition 2000, Kraków, 2010;
4. J. Bloch. Java, Efektywne programowanie, Helion, Gliwice, 2009.

Attention:

Part in occupations is obligatory. Written examination.

ALGORITHMS AND DATA STRUCTURES 2

Course code: 11.3-WK-ID-SP-ASD2
Type of course: obligatory
Language of instruction: English/Polish
Director of studies: dr inż. Janusz Jabłoński
Name of lecturer: dr inż. Janusz Jabłoński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					2
Project	30	2	II	Grade	

COURSE AIM:

Objective of the course is to introduce in basic useful algorithms for solving the problems of data processing. Introduction with basic useful algorithms in solving the problems of data processing. The introduction to analysis of computational and complexity of algorithms. After completion the course the student should know to prepare the model of problem as well as can specify model of problem and realize this algorithms (to 200 line of code) in chosen programming language (the Pascal, C, C ++, the Java) as well as introduce their computational complexity.

ENTRY REQUIREMENTS:

The basis of logic and the quantitative analysis. Basics of computer programming.

COURSE CONTENTS:

Project

- The algorithms of sorting the introduction to computational complexity.
- Folded the structures of data and the dynamic variables.
- Recurrence and recurrence algorithms.
- Introduction to graph algorithms and dynamically programming.
- The textual structures of data and the algorithms of finding the pattern.
- The introduction to object-oriented methods and the object data structures.

TEACHING METHODS:

The project of solution of problem with range of the data processing (projects to choice) as well as his documentations and the implementations in chosen the language of programming (the DevC ++, the Turbo the Pascal, Java).

LEARNING OUTCOMES

(K_W07 +) Students knows the basis of programming and the computational technique helping the analyst's work as well as reason of their limitation

(K_W08.+++) It knows the chosen languages of programming as well as the basis of object-oriented programming; it knows the basic structures of data (boards, tree's, letters, objects, graph), their computer representations and executed on them operations

(K_W11 ++) It knows the basic techniques of construction and the analysis of algorithms as well as the reason the basic limitations in solving the algorithmic problems

(K_U05 +) It knows to analyse the designed algorithms under angle of correctness and computational complexity.

(K_K01 +) The Rrozumie need of continuous lifting of its qualifications across broadening its knowledge and the practical skills.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

The grade on basis of implementation project (50%) as well as the documentations (25%) with analysis of computational complexity (25%) the solution of set problem..

STUDENT WORKLOAD:

Contact hours: 38 hours.

Participation in project 30 hours.

Participation in consultations: 8 hours.

Working alone: 22 hours.

Preparation for project: 15 hours.

Preparation of the written reports: 5 hours.

Searching for the sources in the literature: 2 hours.

Total for course: 60 hours. (5 ECTS)

RECOMMENDED READING:

1. Aho A., Hopcroft J.E., Ullman J.D., : Data structures and algorithms
2. T.H. Cormen, Ch.E. Leiserson, R.L. Rivest: Introduction to Algorithms, 2001, MIT Press.
3. L. Banachowski, K. Diks, W. Rytter A.Björck, G.Dahlquist, Algorytmy i struktury danych, WNT, Warszawa, 2006.
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein; Wprowadzenie do algorytmów WNT, Warszawa, 2004.
5. A. and K. Kingsley-Hughes, Programowanie od podstaw, Helion, Gliwice, 2005.
6. A. Majczak, Programowanie strukturalne i obiektowe. Podręcznik do nauki zawodu technik informatyk, Helion, Gliwice, 2010.

OPTIONAL READING:

1. P. Wróblewski, Algorytmy, struktury danych i techniki programowania, Helion, Gliwice, 2003.
2. A. Aho, J. E. Hopcroft, J. D. Ullman, Algorytmy i struktury danych, Helion, Gliwice, 2003.
3. J. Grebosz, Symfonia C++, Wydawnictwo Edition 2000, Kraków, 2010.
4. J. Bloch. Java, Efektywne programowanie, Helion, Gliwice, 2009.

Attention:

Part in occupations is obligatory. Written examination.

COMBINATORIAL FOUNDATIONS OF COMPUTER SCIENCE

Course code: 11.0-WK-ID-SP-KPI

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr hab. Ewa Drgas-Burchardt

Name of lecturer: dr hab. Ewa Drgas-Burchardt
dr Anna Fiedorowicz
dr inż. Mariusz Hałuszczak

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	VI	Exam	
Class	30	2		Grade	
Laboratory	15	1		Grade	

COURSE AIM:

The course *Combinatorial Foundations of Computer Science* shows basic methods of counting labeled and unlabeled combinatorial objects. These skills can and should be used in order to estimate the size of the data needed to solve a given problem and study its computational complexity. Moreover, the course aims to show probabilistic and derandomization methods in combinatorics and computer science.

ENTRY REQUIREMENTS:

Basics of probability theory and mathematical analysis.

COURSE CONTENTS:

Lecture

1. Counting methods for labeled combinatorial objects (10 h).
2. Counting methods for unlabeled combinatorial objects. Polya's Enumeration Theorem (6 h).
3. The probabilistic method of Erdös. Local Lovász Lemma, derandomization of probabilistic method using conditional probabilities (8 h).
4. Randomized algorithms, their types and characteristics (6 h).

Class

1. Elements of combinatorics:
   a. combinatorial object recognition in the practical problems, the concept of functions operating on finite sets, which are free, injective, "on", decreasing, non-increasing, the usage of well-known formulas to count combinatorial objects (4 h),
   b. application of Inclusion-Exclusion Principle and Pigeonhole Principle, double counting of labeled combinatorial objects, recurrence (6 h).

2. Application of Polya's Enumeration Theorem in order to count unlabeled combinatorial objects (6 h).
3. The probabilistic method of Erdös: proving the facts on the combinatorial structures by usage of the naive method, the expected value method and Local Lovász Lemma (6 h).
4. Finding in a deterministic manner combinatorial objects whose the existence follows from the probabilistic method (the method of conditional probabilities) (2 h).
5. Analysis of randomized algorithms and their random parameters (4 h).
6. Test completion (2h).

Laboratory

Solving complex computing tasks in the field of training sessions using the selected mathematical package or an independently written computer program.

TEACHING METHODS:

Conversation lecture; traditional lecture; discussion exercises; auditorium laboratory

LEARNING OUTCOMES:

1. A student is able to list and define the basic concepts of combinatorics and its basic methods, including the method of double counting, Principle of Inclusion-Exclusion, Pigeonhole Principle, recurrence, the method of the generating function, Polya Enumeration Theorem, the naive method, the method of the expected value, Local Lovász Lemma method (K_W02 +, K_W03 +).
2. A student knows the basic types of randomized algorithms and examples of these types and the conditional probabilities method of derandomization (K_W02 + K_W11 +).
3. A student is able to use the methods of mathematical analysis, algebra and probability to test the convergence of sequences and series, to solve systems of linear equations, to axiomatic recognize of groups, to test the independence of events and random variables and study their characteristics in order to solve tasks in the field of combinatorics (K_U07 + +, K_U17, K_K02 +).
4. A student is able to decide with which objects in the field of combinatorics the solution of the practical problem can be identified (K_U07+, K_U17+).
5. A student can solve combinatorial problems and problems of number theory using algorithmic methods (K_U15 + +).
6. A student understands the significance of intellectual honesty, both in their own and in other people's activities; demonstrate ethical behavior (K_K04+).

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Checking of preparedness of students and their activity during exercises and laboratories.

The grade of the module consists of the assessment exercise (40%), the assessment laboratory (40%) exam grade (30%). The condition of the exam is to get a positive assessment of the exercises and laboratories. The prerequisite to obtain a positive evaluation of the module is the positive evaluation of the exercise, the laboratory and the exam.

STUDENT WORKLOAD:

Activity	Student load
Participation in lectures	30 h
Participation in exercises	30 h
Participation in laboratories	15 h
Self preparation for exercises	20 h
Self preparation for laboratories	20 h
Self preparation for lectures	25 h
Independent problem solving	15 h
Consultation	12 h
Exam	2 h
The combined student workload	169 h

Number of ECTS credits allocated 6

RECOMMENDED READING:

1. Z. Palka, A. Rucinski, Wykłady z kombinatoryki, cz. I, WNT, Warszawa, 1998.
2. K.A. Ross, Ch.R.B. Wright, Matematyka dyskretna, PWN, Warszawa, 1996.
3. Diesel, Grach Theory, Springer-Verlag, Heidelberg, Gradule Test In Mathematics, Vol. 173.
4. N. Alon, J. Spencer, The Probabilistic Method, Wiley, second edition, 2000.
5. R. Motwani, P. Raghavan, Randomized Algorithms.

OPTIONAL READING:

1. W. Lipski, Kombinatoryka dla programistów, WNT, 2005.
2. W. Lipski, W. Marek, Analiza kombinatoryczna, PWN, Warszawa, 1989.
3. C.H. Papadimitriou, Złożonosc obliczeniowa, WNT, Warszawa 2002 (seria Klasyka Informatyki).

DATABASE SYSTEMS 1

Course code: 11.3-WK-ID-SP-SBD1

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr inż. Mariusz Hałuszczak

Name of lecturer: prof. dr hab. Mieczysław Borowiecki,
dr Anna Fiedorowicz,
dr inż. Mariusz Hałuszczak

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	III	Exam	
Class	15	1		Grade	
Laboratory	20	2		Grade	

COURSE AIM:

The course introduces basic notions, definitions and problems related to the relational models of databases. At the end of the course each student should be able to design and create both database and database application.

ENTRY REQUIREMENTS:

Fundamentals of logic. Programming skills.

COURSE CONTENTS:

Lecture:

1. The basic notions and definitions related to the relational databases.
2. Operations on relation (union, difference, intersection, complement, projection, selection, join, division).
3. The functional dependencies and Armstrong's axioms.
4. Relational schemes.
5. Decompositions.
6. Normalization through decomposition (1NF, 2NF, 3NF,B-CNF, 4NF).
7. Multivalued dependencies.
8. Inference axiom for multivalued dependencies.

Class:

1. Operations on relation
2. Normalization through decomposition (1NF, 2NF, 3NF,B-CNF, 4NF).

3. Structured Query Language.
    a. Data Manipulation Language,
    b. Data Definition Language,
    c. Data Control Language.
4. Creating the project of a database.
    a. Data-Flow Diagram,
    b. Entity-Relationship Diagrams,
    c. Creating Database Scheme.

Laboratory:

1. The use of SQL.
2. Data types, expressions and operators, conditions, functions, procedures.
3. SELECT statement:
    a. inner join,
    b. outer join,
    c. simple subqueries,
    d. correlated subqueries,
    e. grouping and aggregate functions.
4. Defining the database structure:
    a. domain,
    b. tables,
    c. views,
    d. indexes,
    e. sequences/generators,
    f. triggers,
    g. referential integrity constraints.
5. Database user management and control of transactions.
6. Creating a project and generate the database schema using computer tools such as CASE.

TEACHING METHODS:

Lecture: Seminar lecture.

Class: Method problematic, brainstorming, presentations.

Laboratory: Computer laboratory exercises.

LEARNING OUTCOMES:

K_W05+	Students understand the basic concepts and knows the theoretical basis of relational databases.
K_W13++, K_W14++	Students know the basic syntax of SQL commands.
K_W05+, K_W14++	Students know the method of normalization of a scheme up to 2NF, 3NF and BCNF.
K_U24++, K_W09+	Students are able to extract the information stored in the database using SQL commands, using joins, subqueries and grouping.
K_U25+, K_W09+	Students are able to design a simple database schema and generate it using computer tools like CASE.
K_U18+	Students are able to present the basic concepts and theorems related to the relational data model.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Lecture: The exam consists of two parts, written and oral, access to the oral part is getting 30% of the points of the written part, 50% of the points from the written part guarantees a positive evaluation.

Class: condition pass is 50% of the points of the four planned tests or final test covering all the material processed.

Laboratory: condition pass is 50% of the points of the four planned tests or final test covering all the material processed.

Final evaluation of the course is the arithmetic mean of the lecture, class and laboratory. However, a prerequisite for a positive final assessment is to obtain positive evaluations of the lecture, class and laboratory.

STUDENT WORKLOAD:

Contact time with the teacher:

Participation in lectures - 30 hours.

Participation in classes - 15 hours.

Participation in the lab - 30 hours.

Participation in consultations - 15 hours.

Examination - 4 hours.

total: 94 hours.

Standalone student work:

Preparation for the lecture - 6 hours.

Preparation for the classes - 6 hours.

Preparation for the lab - 20 hours.

Preparation for the exam - 20 hours.

Reading the literature - 4 hours.

total: 56 hours.

Total for the course: 150 hours. (6 ECTS)

RECOMMENDED READING:

1. T. Pankowski, Podstawy baz danych, Wydawnictwo Naukowe PWN, W-wa, 1992.
2. D. Maier, The theory of relational databases, Computer Science Press, 1983.
3. M. Gruber, SQL, Helion, 1996.
4. M. Wybrańczyk, Delphi 7 i bazy danych, Helion, 2003.
5. G.Reese, Java. Aplikacje bazodanowe. Najlepsze rozwiązania, Helion, 2003.

OPTIONAL READING:

1. W. Kim, Wprowadzenie do obiektowych baz danych, WNT, Warszawa, 1996.
2. J.D. Ullman, Podstawowy wykład z systemów baz danych, WNT, Warszawa, 1999.
3. P. Neil Gawroński, InterBase dla ,,delfinów", Helion, 2001.
4. Jakubowski: SQL w InterBase dla Windows i Linuksa, Helion, Gliwice 2001.
5. R. Barker, CASE* Method. Modelowanie związków encji, WNT, Warszawa 2005
6. M. Marzec, JBuilder i bazy danych, Helion, 2005.
7. Mościcki, I. Kruk, Oracle 10g i Delphi. Programowanie baz danych, Helion, 2006.

DATABASE SYSTEMS 2

Course code: 11.3-WK-ID-SP-SBD2

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr inż. Mariusz Hałuszczak

Name of lecturer: dr Anna Fiedorowicz,
dr inż. Mariusz Hałuszczak

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					2
Project	30	2	IV	Grade	

COURSE AIM:

Students design a relational database modelling and create applications for its use.

ENTRY REQUIREMENTS:

Database Systems 1. Programming skills.

COURSE CONTENTS:

Students create a system on a selected topic. Students implement and document the process of creating an information system. The final effect will be a working system, working in a client-server architecture, and documentation.

During the course, students shall analyze the present area, do conceptual data model, SQL script, creating database structure, if it is necessary then create a description of the system using the selected UML diagrams (class, use case, state, activity, implementation), create an application to operate on this database.

Projects are done individually or in groups.

TEACHING METHODS:

Practical

LEARNING OUTCOMES:

K_W14++	Students have the theoretical knowledge to design average complex database.
K_W14++	Students know how to create an application that supports the database.
K_U25+++	According to a given specification, students are able to analyze, design and implement a simple database system using properly selected methods, techniques and tools.
K_U25++, K_U28+	Students can create an application that supports the database.
K_U18+	Students can create technical documentation of the project.
K_K03++	Students understands necessity of systematic work on the project.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Total score: 40% for the project database, 40% of the created program, 20% of the documentation.

STUDENT WORKLOAD:

Contact time with the teacher:

Participation in consultations - 2 hours.

Participation in project lessons - 30 hours.

Total: 32 hours.

Standalone student work:

Implementation of project tasks - 30 hours.

Preparation of audit work, reports, reports, etc. - 1 hour.

Total: 31 hours.

Total for all items: 63 hours. (2 ECTS)

RECOMMENDED READING:

1. M. Wybrańczyk, Delphi 7 i bazy danych, Helion, 2003.
2. M. Marzec, JBuilder i bazy danych, Helion, 2005.
3. G.Reese, Java. Aplikacje bazodanowe. Najlepsze rozwiązania, Helion, 2003.
4. Mościcki, I. Kruk, Oracle 10g i Delphi. Programowanie baz danych, Helion, 2006.
5. M. Cantù , Mastering Delphi 6, Sybex Inc.,2001.

OPTIONAL READING:

1. P. Neil Gawroński, InterBase dla ,,delfinów", Helion, 2001.
2. A. Jakubowski: SQL w InterBase dla Windows i Linuksa, Helion, Gliwice 2001.
3. R. Barker, CASE* Method. Modelowanie związków encji, WNT, Warszawa 2005

DATABASES IN WEB APPLICATIONS 1

Course code: 11.3-WK-ID-SP-BDAI1
Type of course: optional
Language of instruction: English/Polish
Director of studies: dr inż. Mariusz Hałuszczak
Name of lecturer: dr inż. Mariusz Hałuszczak

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	V	Exam	
Class	15	1		Grade	
Laboratory	30	2		Grade	

COURSE AIM:

Familiarize students with the ORACLE database and PL/SQL. At the end of the course students should be able to independently design and develop dynamic website using database.

ENTRY REQUIREMENTS:

Programming skills. Basic knowledge of relational databases and SQL, and HTML.

COURSE CONTENTS:

Lecture:

1. PL/SQL
   - Structure of programme, variables, data types, expressions, comparisons and control structures.
   - Using collections and records.
   - Performing SQL operations from PL/SQL.
   - Procedures, functions, packages in PL/SQL.
   - Handling PL/SQL errors.
   - Dynamic PL/SQL.
3. Deriving functional dependencies using:
   - Armstrong's axioms.
   - B-axioms
   - directed acyclic graphs.

Class:

1. PHP
   - Operations on text and numbers.
   - Creating interactive forms.
   - Communication with databases.

- Sessions and cookies.
- File operations.

2. Object-oriented databases and XML
    1. Structure of the XML document.
    2. DTD and XML-Schema.
    3. XSLT.
2. JavaScript
    - Syntax,
    - Classes, objects, JSON format,
    - AJAX and XML support,
    - Examples of frameworks.

Laboratory:

3. SQL in Oracle.
4. Tree structures in Oracle databases.
5. PL/SQL, create stored procedures, functions, triggers, and packages.
6. Views describes schema objects in the database.
7. Transforming XML data with XSLT and JavaScript.

TEACHING METHODS:

Lecture: Seminar lecture.

Class: Method problematic, brainstorming, presentations.

Laboratory: Computer laboratory exercises.

LEARNING OUTCOMES:

K_W13+, K_W14++	Students know the syntax of SQL commands and PL/SQL.
K_W13++	Students are able to extract and present data that are stored in XML format.
K_U25++	Students can collect and extract the information stored in databases with web applications.
K_K01++, K_U20++	Students can search for relevant information.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Lecture: The exam consists of two parts, written and oral, access to the oral part is getting 30% of the points of the written part, 50% of the points from the written part guarantees a positive evaluation.

Class: condition pass is 50% of test covering all the material processed.

Laboratory: condition pass is 50% of the points of the four planned tests or final test covering all the material processed, for the preparation of the talk, you can get up to an additional 20%..

Final evaluation of the course is the arithmetic mean of the lecture, class and laboratory. However, a prerequisite for a positive final assessment is to obtain positive evaluations of the lecture, class and laboratory.

STUDENT WORKLOAD:

Contact time with the teacher:

Participation in lectures - 30 hours.

Participation in classes - 15 hours.

Participation in the lab - 30 hours.

Participation in consultations - 15 hours.

Examination - 4 hours.

Total: 94 hours.

Standalone student work:

Preparation for the classes - 20 hours.

Preparation for the lab - 20 hours.

Preparation for the Exam - 20 hours.

Reading the literature - 10 hours.

Total: 70 hours.

Total for the course: 164 hours. (6 ECTS)

RECOMMENDED READING:

1. D. Maier, The theory of relational databases, Computer Science Press, 1983.
2. E. Balanescu, M. Bucica, Cristian Darie, PHP 5 i MySQL. Zastosowania e-commerce, Helion, 2005.
3. J. Clark, XSL Transformations (XSLT), http://www.w3.org/TR/xslt7.
4. L. Quin, Extensible Markup Language (XML), HTTP://WWW.W3.ORG/XML.
5. T. Converse, J. Park, C. Morgan, PHP5 i MySQL. Biblia, Helion, 2005.
6. S. Urman, R. Hardman, M. McLaughlin, Oracle Database 10g. Programowanie w języku PL/SQL, Helion, 2007.

OPTIONAL READING:

1. E. Naramore, J. Gerner, Y. Le Scouarnec, J. Stolz, M.K. Glass, PHP5, Apache i MySQL. Od podstaw, Helion, 2005.
2. B. Basham, K. Sierra, B. Bates, Head First Servlets & JSP, Helion, 2005.
3. W. Kim, Wprowadzenie do obiektowych baz danych, WNT, Warszawa, 1996.

DATABASES IN WEB APPLICATIONS 2

Course code: 11.3-WK-ID-SP-BDAI2
Type of course: optional
Language of instruction: English/Polish
Director of studies: dr inż. Mariusz Hałuszczak
Name of lecturer: dr inż. Mariusz Hałuszczak

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					3
Project	30	2	VI	Grade	

COURSE AIM:

Students design a relational database model and create WEB applications for its use.

ENTRY REQUIREMENTS:

Databases in Web Applications 1. Programming skills.

COURSE CONTENTS:

Students create a system on a selected topic. Students implement and document the process of creating an information system. The final effect will be a working WEB application, working in a client-server architecture, and documentation.

During the course, students shall analyze the present area, do conceptual data model, SQL script, creating database structure, if it is necessary then create a description of the system using the selected UML diagrams (class, use case, state, activity, implementation), create an application to operate on this database.

Projects are done individually or in groups.

TEACHING METHODS:

Practical

LEARNING OUTCOMES:

K_W14++	Students have the theoretical knowledge to design average-complex database.
K_W14++	Students know how to create a WEB application that supports the database.
K_U25+++	Students can, in accordance with specifications, analyze, design and implement a simple database system using properly selected methods, techniques and tools.
K_U25++	Students can create an application that supports the database.
K_U18++	Students can create technical documentation of the project.
K_K03+++	Students understand the need for systematic work on the project.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Total score: 40% for the project database, 40% of the created program, 20% of the documentation.

STUDENT WORKLOAD:

Contact time with the teacher:

Participation in project lessons - 30 hours.

Total: 30 hours.

Standalone student work:

Implementation of project tasks - 50 hours.

Preparation of audit work, reports, etc. - 1 hour.

Total: 51 hours.

Total for all items: 81 hours. (3 ECTS)

RECOMMENDED READING:

1. E. Balanescu, M. Bucica, Cristian Darie, PHP 5 i MySQL. Zastosowania e-commerce, Helion, 2005.
2. J. Clark, XSL Transformations (XSLT), http://www.w3.org/TR/xslt7.
3. L. Quin, Extensible Markup Language (XML), http://www.w3.org/XML.
4. T. Converse, J. Park, C. Morgan, PHP5 i MySQL. Biblia, Helion, 2005.
5. S. Urman, R. Hardman, M. McLaughlin, Oracle Database 10g. Programowanie w języku PL/SQL, Helion, 2007.
6. E. Naramore, J. Gerner, Y. Le Scouarnec, J. Stolz, M.K. Glass, PHP5, Apache i MySQL. Od podstaw, Helion, 2005.

OPTIONAL READING:

1. Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets & JSP. Helion, 2005
2. Wojciech Romowicz, Java Server Pages oraz inne komponenty JavaPlatform, Helion, 2001

DIFFERENTIAL EQUATIONS WITH APPLICATIONS

Course code: 11.1-WK-ID-SP-RRZ

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Tomasz Małolepszy

Name of lecturer: dr Tomasz Małolepszy

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	V	Exam	
Class	15	1		Grade	
Laboratory	30	2		Grade	

COURSE AIM:

The main aim of this course is to familiarize students with the basic theory of ordinary differential equations (such as finding solutions of first-order and second-order ODE, finding solutions of first-order systems of ODE, the existence and the uniqueness of solutions of ODE) and with the elements of theory of linear partial differential equations. Particular emphasis will be placed on the role of differential equations in modelling of real-world phenomena as well as on the use of computer software to find numerical solutions of given problems for differential equations.

ENTRY REQUIREMENTS:

Mathematical Analysis 1 and 2, Linear Algebra, Mathematical Software 1 and 2.

COURSE CONTENTS:

1. First-order and second-order ordinary differential equations: basic theory of the existence and the uniqueness of solutions of initial problems for such equations, methods (also numerical) of solving them, examples of phenomena leading to such ODEs.
2. Systems of linear first-order differential equations: basic theory of the existence and the uniqueness of solutions of initial problems for such systems, methods (also numerical) of solving them.
3. Introduction to the theory of linear partial differential equations with their practical application.

TEACHING METHODS:

Traditional lectures; classes with the lists of exercises to solve by students; computer labs with the lists of exercises to solve by students with the use of computer software.

LEARNING OUTCOMES:

Student is able:

1. to solve such I order ordinary differential equations as separable equations, linear equations, exact differential equations as well as II order linear equations with constant coefficients and simple linear systems of ODEs, (K_W01+, K_U01+)
2. to describe basic physical phenomena such as a radioactive decay or the cooling of object in terms of Cauchy problems for I order ODEs or initial-boundary value problems for linear II order PDEs, (K_W01+, K_W03+)
3. to use mathematical software to solve ordinary and partial differential equations. (K_U03+, K_U09++, K_U12+, K_K01+)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

1. Class (laboratory): learning outcomes will be verified through two tests consisted of exercises of different degree of difficulty. A grade determined by the sum of points from these two tests is a basis of assessment.
2. Lecture: final exam. A grade determined by the sum of points from that exam is a basis of assessment.

A grade from the course is consisted of the grade from classes (30%), laboratory (30%) and the grade from the final exam (40%). To take a final exam, students must receive a positive grade from classes. To attain a pass in the course students are required to pass the final exam.

STUDENT WORKLOAD:

Contact hours

Lectures - 30 hours.

Classes - 15 hours.

Laboratory - 30 hours.

Consultation hours - 13 hours.

Final exam - 2 hours.

Total - 90 hours (3 ECTS).

Individual work

Preparation to classes - 30 hours.

Preparation to laboratory - 40 hours.

Preparation to the final exam - 10 hours.

Total - 80 hours (3 ECTS).

Total time needed for this course: 170 hours (6 ECTS).

RECOMMENDED READING:

1. Andrzej Palczewski, *Równania różniczkowe zwyczajne*, WNT, Warszawa.
2. Walter A. Strauss, *Partial differential equations: an introduction*, Wiley, New York 1992.
3. William E. Boyce, Richard C. DiPrima, *Elementary differential equations and boundary value problems*, Wiley, New York 2001.

OPTIONAL READING:

1. Marian Gewert, Zbigniew Skoczylas, *Równania różniczkowe zwyczajne. Teoria, przykłady, zadania*, Oficyna Wydawnicza GiS, Wrocław 2008.

ENGINEERING OF INFORMATIVE SYSTEMS

Course code: 11.3-WK-ID-SP-ISI

Type of course: eligible

Language of instruction: English/Polish

Director of studies: dr inż. Janusz Jabłoński

Name of lecturer: dr inż. Janusz Jabłoński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	VI	Exam	
Laboratory	30	2		Grade	

COURSE AIM:

Objective of the course is to introduce in the engineering of *informative systems* with classification of informative systems as well as the live cycles of software how also the performance of methodologies and technician uses in projecting and realization of computer informative systems. The software systems life cycle choice dependent on functional requirements and the limitations of project The skilful utilization the knowledge and the tools of aid of projecting and the production of computer adjusting the efficiency of work systems and helping the undertaking the decision. The performance analytic the approach to projecting the computer systems as well as the preparation of documentation how also the performance of tools the (SVN in Eclipse) to work in realizing computer fulfilling the users' requirement system group.

ENTRY REQUIREMENTS:

Computer and object oriented programming.

COURSE CONTENTS:

Lecture/Laboratory

- Classification of informative systems.
- Life Cycles of software.
- Structural and object-oriented methodology in projecting computer sosftware systems.
- Defining and the specification of functional requirements and impractical.
- Utilization language UML in computer project.
- The technique of planning and the estimating the costs of software.
- Plan of works in sowtware project as well as monitoring computer projects.
- Computer software projects Management .
- The utilization the tools the CASE in realization of informative systems.
- SVN Tools and team work in production software.

TEACHING METHODS:

Accessible lecture in electronic form; the computer laboratories in frames which the students on basis of discussion and they choose in groups the work and they project the structure as well as the dynamics of computer system. In support about object-oriented methodology and the models the UML make the harmonogramowania of tasks as well as the division of tasks for participants of project which using from computer tools (the Excell, Access, Eclipse, SVN, MySQL) the programmings in VBA for MS realize chosen the functionality using from elements the Excel and the Java.

LEARNING OUTCOMES

The student knows in present science the meaning of computational mathematics and the technique as well as in development of informative society (K_W01 +)

it knows the method of management the information and the knows data bases systems (K_W13 +)

posses basic knowledge as well as it knows varied computer tools connected from projecting and the use the bases of data as well as the computer systems of aid of decision; my the basic knowledge about cycle of life of devices and the computer systems (K_W14 +++)

My the basic knowledge with economy, the organization of work and the management; my basic knowledge with range computer helping work small and average firms as well as enterprises workings (K_W18 +)

It be able to learn onself as well as in group; the economic aspect of realization of given task knows to consider; it be able to work out and to realize the schedule of works assuring keeping deadlines (K_U21 ++)

The usefulness of methods be able to estimate and mathematical tools and computer as well as to choose and to apply proper method and tool to folded inżynierskich tasks (K_U23 +)

It be able to, with set specification, to analyse, to design peaceably as well as to realize simple data base system, using practically well-chosen methods, technician and tools (K_U25 +++)

it solves the basic tasks connected from processing the information as well as it chooses the suitable mathematical methods and the computer tools to definite types of tasks (K_U28 +)

The dialogue be able to lead actively in aim the precising, the greater depth and/or extension of degree of understanding of discussed subject; it be able to work in team, accepting in him different parts (K_K02 ++)

It be able to suitably define the priorities the servants of realization definite by me or different tasks; the reason the necessity of systematic work over projects about long-wave character (K_K03 +);

It be able to think and to act in creative way and enterprising (K_K06 +)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Checking degree of the students' preparation as well as their activity in track of laboratory as well as the grade of project documentation.
The credit of laboratory on basis of tests (15%) reporting with realized tasks (70%) activity on laboratory and lecture.
Grade from object consists with grade of laboratory (50%) as well as grade from the written examination (50%). Positive grade is from laboratory the condition of credit of object and examination.

STUDENT WORKLOAD:

Contact hours: 75 hours.

- Participation in lectures: 30 hours.
- Participation in laboratory classes: 30 hours.
- Participation in consultations: 12 hours.
- Exam: 3 hours.

Working alone: 75 hours.

- Preparation for lecture: 10 hours.
- Preparation for laboratory classes: 20 hours.
- Preparation for the exam: 20 hours.
- Preparation of the written reports: 20 hours.
- Searching for the sources in the literature: 5 hours.

Total for course: 150 hours. (6 ECTS)

RECOMMENDED READING:

1. I. Sommerville, Software Engineering, Addison-Wesley, England 2009.
2. K. Górski, Inżynieria Oprogramowania, PWN, Warszawa, 2010;
3. R. Barker, C. Longman, CASE Method, modelowanie funkcji i procesów, WNT, 1996; ;.
4. J. Górski, Inżynieria oprogramowania w projekcie informatycznym, Warszawa 2000.

OPTIONAL READING:

1. P. Benon-Davies, Inżynieria Systemów Informacyjnych, WNT, 1999;
2. V. Sthern, C++ Inżynieria Programowania, Helion, Gliwice 2000
3. A. Björck, J. Cogswell, Tworzenie użytecznego oprogramowania, Warszawa 2005;
4. www.ibm.com/academicinitiative.

Attention:

Part in occupations is obligatory. Written examination.

FOUNDATIONS OF LOGIC AND QUANTITATIVE ANALYSIS

Course code: 11.1-WK-ID-SP-PLAI
Type of course: compulsory
Language of instruction: English/Polish
Director of studies: dr hab. Zbigniew Świtalski, prof. UZ
Name of lecturer: dr hab. Zbigniew Świtalski, prof. UZ

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	I	Exam	
Class	30	2		Grade	

COURSE AIM:

Knowledge of basic logic (general and formal), developing skills of logical thinking, analysis of scientific texts, constructing concise and logical oral and written presentations. Understanding foundations of mathematical modeling and quantitative analysis. Knowledge of theory and applications of methods of creative thinking.

COURSE CONTENTS:

1. Elements of general logic (foundations of logical theory of language, names, sentences, definitions, theorems, questions, reasonings, deduction and induction, Mill's canons, logical fallacies and errors in reasonings).
2. Formal logic (laws of logic, propositional calculus, quantifiers, elements of set theory and relation theory).
3. Quantitative methods and their applications. Quantitative language in science and every-day communication.
4. Mathematical modelling – methods, possibilities of application and limitations.
5. Problem solving and decision making, Methods of creative thinking.

TEACHING METHODS:

Lecture, classes (solving problems, texts analysis, preparing oral and written presentations, discussions, group project).

LEARNING OUTCOMES:

Student:

1. Knows basic laws of logic, rules of inference, is able to analyze fallacies and errors in reasonings. (K_W02)
2. Is able to analyze logical structure of written text and oral presentation. (K_U16, K_U17, K_U18)
3. Is able to formulate, in a concise manner, a problem, possible solutions of it, compare them and choose the best. (K_U02)

4. Is able to perform a quantitative analysis of a problem (collecting data and information, analysis of their usefulness and reliability, performing the computations, drawing the conclusions). (K_U19, K_U20, K_U21)
5. Is able to analyze relationships between outputs, final demands and flows in the Leontief model. (K_U02, K_U03)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

1. Verification of activity of students during the classes.
2. Writing tests during the classes.
3. Group project
4. Writing exam.

Final score = Activity + writing tests + group project (50 %), exam (50 %).

STUDENT WORKLOAD:

Contact hours:

Lecture – 30 h.
Classes – 30 h.
Consulting – 12 h.
Exam – 3 h.

Self work:

Preparation for the lecture – 15 h.
Preparation for the classes – 45 h.
Preparation for the exam – 15 h.

Total: **150 h**. (6 p. ECTS)

RECOMMENDED READING:

1. B.Stanosz, Wprowadzenie do logiki formalnej, PWN, Warszawa, 2010.
2. G.Malinowski, Logika ogólna, PWN, Warszawa, 2010.
3. J.Such, M.Szcześniak, Filozofia nauki, Wyd. Naukowe UAM, Poznań, 2002.
4. J.Antoszkiewicz, Metody heurystyczne. Twórcze rozwiązywanie problemów, PWE, Warszawa, 1990.
5. G.Polya, Jak to rozwiązać, PWN, Warszawa, 1993.
6. Z.Michalewicz, D.B.Fogel, Jak to rozwiązać czyli nowoczesna heurystyka, WN-T, Warszawa 2006.
7. P.J.Hurley, A Concise Introduction to Logic, Wodsworth Inc., 2011.

OPTIONAL READING:

1. T. Hołówka, Kultura logiczna w przykładach, PWN, Warszawa, 2005.
2. Białynicki-Birula, I. Białynicka-Birula, Modelowanie rzeczywistości, Prószyński i S-ka, Warszawa, 2002.
3. Góralski, Twórcze rozwiązywanie zadań, PWN, Warszawa, 1989.
4. J.A. Paulos, Analfabetyzm matematyczny i jego skutki, Gdańskie Wydawnictwo Oświatowe, Gdańsk, 1999.
5. Ch.Leary, A Friendly Introduction to Mathematical Logic, Prentice Hall, New Jersey, 2000.

FOUNDATIONS OF MANAGING AND SECURITY OF DATABASE SYSTEMS

Course code: 11.3-WK-ID-SP-PZBS

Type of course: optional

Language of instruction: English/Polish

Director of studies: dr Anna Fiedorowicz

Name of lecturer: dr Anna Fiedorowicz,
dr inż. Mariusz Hałuszczak

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					5
Lecture	15	1	V	Grade	
Laboratory	30	2		Grade	

COURSE AIM:

The objective of the course is to introduce the students to database system management, on the example of IBM DB2 or Oracle. The students should obtain the knowledge and skills concerning creating and maintaining database objects in DB2/Oracle. At the course the students are introduced to transactions, isolations levels, concurrent access. Date security. The students are introduced to the database backup and recovery mechanisms and the usage of XML in database systems.

ENTRY REQUIREMENTS:

Database systems. Basics of computer programming.

COURSE CONTENTS:

1. The database system management (IBM DB2 or Oracle). Tools and entertainment.
2. Creating and maintaining database systems DB2/Oracle (schemas, tables, views, indices, aliases, sequences).
3. SQL in DB2/Oracle.
4. Transactions. Concurrency, isolation levels of transactions.
5. Security problems. Authorizations methods, users and privileges.
6. Backup and recovery of databases (full backup, incremental, online, offline).
7. XML in databases.
8. Stored procedures and triggers.

TEACHING METHODS:

Seminar lecture. Computer laboratory exercises.

LEARNING OUTCOMES:

K_W13+ K_W14+ K_K01+	The student understands the fundamentals of database system management and knows the databases objects, can use the SQL to manage the data.
K_U24+ K_U26++	The student is familiar with the problems of concurrent access and understands the necessity of ensuring the security of the data.
K_K02+	The student uses the mechanisms of backup and recovery. The student is familiar with basic possibilities of using XML in databases and can write simple stored procedures and triggers.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

The verification is based on:

a. the activity of the students at the laboratory and their preparation for the classes;
b. two written tests, with practical exercises of different difficulty levels, to check the students' knowledge and skills;

The grade from the lecture is based on the written test, with several exercises, both closed-ended and open-ended. The final grade consists of the grade from the laboratory (in 50%) and from the test (in 50%).

STUDENT WORKLOAD:

Contact hours: 60 hours.

Participation in lectures: 15 hours.

Participation in laboratory: 30 hours.

Participation in consultations: 15 hours.

Working alone: 65 hours.

Preparation for the laboratory: 35 hours.

Preparation for the tests: 10 hours.

Preparation for the test from the lecture: 15 hours.

Searching for the sources in the literature: 5 hours.

Total for course: 125 hours. (5 ECTS)

RECOMMENDED READING:

1. Raul Chong, Ian Hakes, Rav Ahuja, Wprowadzenie do DB2 Express-C, IBM Corporation, 2008 (e-book).
2. Raul F. Chong, Clara Liu, Sylvia F. Qi, Dwaine R. Snow, Zrozumieć DB2. Nauka na przykładach, Wydawnictwo Naukowe PWN, 2006.
3. Whei-Jen Chen, John Chun, Naomi Ngan, Rakesh Ranjan, Manoj K. Sardana, DB2 Express-C: The Developer Handbook for XML, PHP, C/C++, Java, and .NET, IBM Redbooks, 2006 (e-book).
4. Rafe Coburn, SQL dla każdego, Helion, 2001

OPTIONAL READING:

1. T. Pankowski, Podstawy baz danych, Wydawnictwo Naukowe PWN, Warszawa, 1992.
2. J.D. Ullman, Podstawowy wykład z systemów baz danych, WNT, Warszawa, 1999.

GRAPH ALGORITHMS

Course code: 11.0-WK-ID-SP-AG

Type of course: optional

Language of instruction: English/Polish

Director of studies: dr Anna Fiedorowicz

Name of lecturer: dr hab. Ewa Drgas-Burchardt
dr Anna Fiedorowicz
mgr Katarzyna Jesse-Józefczyk
dr Elżbieta Sidorowicz

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	IV	Exam	
Laboratory	30	2		Grade	

COURSE AIM:

The objective of the course is to introduce basic graph and network algorithms, paying attention to the use of these algorithms for solving practical tasks. At the laboratory classes, the students should analyze and implement the selected algorithms as well as study their practical applications.

ENTRY REQUIREMENTS:

Basics of computer programming. Introduction to graph theory.

COURSE CONTENTS:

Lecture

1. Asymptotic notation. Computational complexity classes of decision problems.
2. Shortest paths in graphs. Shortest paths in networks (networks with non-negative weights, without circuits of negative weight). Algorithms (Dijkstra, Bellman–Ford). Applications (i.e., project scheduling by Critical Path Method). Shortest paths between all pairs of vertices. The algorithm of Floyd–Warshall.
3. Minimal spanning trees and their characterization. Algorithms of Prim, Kruskal.
4. Spanning trees satisfying additional properties, such as bounded diameter, bounded degree.
5. Maximal matching in bipartite graphs, the Hungarian algorithm.
6. Connected and strongly connected digraphs. An algorithm computing strongly connected components in digraphs.
7. The Traveling Salesman Problem (TSP), branch and bound algorithm, selected heuristics.
8. Graph colorings. Algorithms for graph coloring.

9. Variants and generalizations of graph colorings, with applications.
10. The minimum feedback vertex set (MFVS) problem.

Laboratory

1. The analysis of selected graph algorithms.
2. Solving problems, also practical, by either choosing or creating an appropriate algorithm and a date structure.
3. Implementation of selected algorithms. The students should write and test the programs and also prepare a documentation.

TEACHING METHODS:

Seminar lecture. Computer laboratory exercises.

LEARNING OUTCOMES:

K_W02+ K_W04+ K_W10+	The student knows basic graph and network algorithms and understands how to use these algorithms to solve practical problems.
K_W11+	The student is familiar with computational complexity classes of decision problems.
K_U04+	The student is able to design algorithms solving typical graph and network problems by designing and selecting appropriate algorithmic techniques and data structures.
K_U05+	The student can analyze designed algorithms in terms of their correctness and computational complexity.
K_U06+ K_K02+	The student can implement selected algorithms, using appropriate tools, and is able to present a solution in a clear, graphical form.
K_U15+	The student can solve selected graph problems using algorithmic methods.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

The learning outcomes verification is based on:

1. the students' preparation for and activity at the classes;
2. the results of a few written tests, with exercises of different difficulty levels, to check the students' knowledge and skills;
3. the implementation by the students of a chosen graph or network algorithm and created documentation;
4. the written exam.

The final grade consists of the grade from the laboratory (in 50%) and from the exam (in 50%), but a necessary condition for a positive final evaluation is to obtain a positive evaluation of the exam and the laboratory.

STUDENT WORKLOAD:

Contact hours: 77 hours.

Participation in lectures: 30 hours.

Participation in laboratory classes: 30 hours.

Participation in consultations: 15 hours.

Exam: 2 hours.

Working alone: 75 hours.

Preparation for laboratory classes: 25 hours.

Preparation for the exam: 20 hours.

Preparation of the written reports: 25 hours.

Searching for the sources in the literature: 5 hours.

Total for course: 152 hours. (6 ECTS)

RECOMMENDED READING:

1. W. Lipski, Kombinatoryka dla programistów, WNT, Warszawa, 2005.
2. K.A. Ross, Ch.R.B. Wright, Matematyka dyskretna, PWN, Warszawa, 1996.
3. D. Jungnickel, Graphs, Networks and Algorithms, Springer-Verlag, Berlin Heidelberg, 2008
4. E. M. Reingold, J. Deo, N. Nievergelt, Algorytmy kombinatoryczne, PWN, Warszawa, 1985.
5. M. Sysło, N. Deo, J. Kowalik, Algorytmy optymalizacji dyskretnej z programami w języku Pascal, PWN, Warszawa, 1993.
6. J. Błażewicz, Złożoność obliczeniowa problemów kombinatorycznych, WNT, Warszawa, 1988.

OPTIONAL READING:

1. M. Kubale (Editor): Optymalizacja dyskretna – modele i metody kolorowania grafów, WNT, 2002.
2. A.V. Aho, J.E. Hopcroft, J.D. Ullman, Projektowanie i analiza algorytmów komputerowych, Helion, 2003.
3. B. Jankowski, Grafy – Algorytmy w Pascalu, MIKOM, 2003.
4. P. Wróblewski, Algorytmy, struktury danych i techniki programowania, Helion, 2003.

INTRODUCTION TO GRAPH THEORY

Course code: 11.1-WK-ID-SP-WTG

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Anna Fiedorowicz

Name of lecturer: dr hab. Ewa Drgas-Burchardt
dr Anna Fiedorowicz
dr Elżbieta Sidorowicz

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					5
Lecture	30	2	II	Exam	
Class	30	2		Grade	

COURSE AIM:

The aim of the course is to introduce the basic notions from graph theory, both in theoretic and algorithmic point of view.

ENTRY REQUIREMENTS:

Basics of logic and linear algebra.

COURSE CONTENTS:

1. Basic notions of graph theory. Selected classes of graphs. Graph isomorphisms.
2. Representations of graphs.
3. Paths and circuits in graphs. The connectivity.
4. Eulerian graphs. Hamiltonian Graphs.
5. Trees and their properties, binary trees, spanning trees, BFS and DFS algorithms. Counting of labelled trees.
6. *k*-connectivity of graphs.
7. Digraphs – the definition and basic notions. Eulerian digraphs. Tournaments.
8. Planar graphs, Euler's Theorem, the characterization of planar graphs and Kuratowski's Theorem. Dual graphs.
9. Covers, independence and domination.
10. Graph colourings, the chromatic number and the chromatic index of a graph. Map's colouring.
11. System of distinct representatives, Hall's Theorem with applications.

TEACHING METHODS:

Lecture, exercises in classes.

LEARNING OUTCOMES:

K_W02+ K_W08+	The student knows basic notions and concepts from graph theory as well as the representations of graphs.
K_W02+ K_W10+ K_U17+ K_K01+	The student knows and is able to present selected theorems concerning the properties and characterization of trees, eulerian and hamiltonian graphs, planar graphs, covers and independence, and minimal dominating sets, colouring of graphs and maps, as well as systems of distinct representatives and matchings in bipartite graphs, using the Hall's Theorem. The student knows basic graph algorithms, such as BFS and DFS, and algorithms for constructing eulerian tours in graphs. The student knows how to apply known properties and theorems to calculate graph's parameters and is able to do this.
K_U15+	The student is able to use an appropriate algorithm, chosen from the ones introduced during the course, to solve a particular problem (of theoretical or practical character).

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

The verification is based on:

a. the activity of the students at the classes and their preparation for the classes;
b. the results of a few written tests, with exercises of different difficulty levels, to check the students' knowledge and skills;
c. the written exam, with several exercises, both theoretical and practical.

The final grade consists of the grade from the classes (in 50%) and from the lecture (in 50%). Before taking the exam, the student has to get a positive grade from the classes.

STUDENT WORKLOAD:

Contact hours: 72 hours.

Participation in lectures: 30 hours.

Participation in classes: 30 hours.

Participation in consultations: 10 hours.

Exam: 2 hours.

Working alone: 60 hours.

Preparation for classes: 20 hours.

Preparation for the exam: 30 hours.

Preparation for the tests: 10 hours.

Total for course: 132 hours. (5 ECTS)

RECOMMENDED READING:

1. R.J. Wilson, Wprowadzenie do teorii grafów, PWN, Warszawa, 1998.
2. V. Bryant, Aspekty kombinatoryki, WNT, Warszawa, 1997.
3. W. Lipski, Kombinatoryka dla programistów, WNT, Warszawa, 2005.
4. K.A. Ross, Ch.R.B. Wright, Matematyka dyskretna, PWN, Warszawa, 1996.

OPTIONAL READING:

1. D.B. West, Introduction to Graph Theory, Prentice Hall, 2001.
2. N. Deo, Teoria grafów i jej zastosowania w technice i informatyce, PWN, Warszawa, 1980.
3. J.M. Aldous, R.J. Wilson, Graphs and Applications, Springer, 2000.

INTRODUCTION TO PROBABILITY THEORY

Course code: 11.1-WK-ID-SP-WRP

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Marta Borowiecka-Olszewska

Name of lecturer: dr Marta Borowiecka-Olszewska

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	III	Exam	
Class	30	2		Grade	
Laboratory	15	1		Grade	

COURSE AIM:

The aim of the course is to familiarize the student with the basic concepts, theorems and methods of reasoning related to the probability theory. Considered issues and problems will be illustrated with plenty of examples. Upon completion of this course the student should be able to construct and analyse a probabilistic model of a simple random experience. The student should also be prepared to apply basic mathematical software packages to solve simple probabilistic problems.

ENTRY REQUIREMENTS:

Getting a pass in Mathematical Analysis 1 and 2.

COURSE CONTENTS:

1. Events and the probability (The revision of combinatorics. The general definition of the probability, the concept and examples of the probability space, the event, basic properties of the probability. Different interpretations of the probability – classical, frequentist and geometrical. The conditional probability, the law of total probability and Bayes' rule. The independence of events.)
2. Random variables and their distributions, the expectation and moments of random variables (The concept, examples and properties of the random variable. The cumulative distribution function of the random variable and its properties, the empirical cumulative distribution function. Absolutely continuous and discrete distributions. The probability density function and its property. Functions of random variables. The independence of random variables. The expectation, moments, the variance, the standard deviation and quantiles of a random variable - basic properties and interpretations. Overview of the most important absolutely continuous and discrete distributions. The concept of the covariance and the correlation coefficient of random variables, their connections with independent random variables.)
3. Random vectors and their parameters (The joint and marginal distributions, multidimensional and marginal cumulative distribution functions, marginal probability density functions. Parameters of random vectors. The multidimensional normal distribution.)
4. The characteristic function (the moment generating function - for information) (The concept, examples and basic properties.)
5. Chebyshev's inequality, the law of large numbers, the central limit theorem and their applications.

TEACHING METHODS:

A traditional lecture. Students solve previously given tasks during the classes and apply the selected mathematical software package to solve tasks and problems during the laboratories.

LEARNING OUTCOMES:

1. The student is able to explain basic concepts of probability theory and give examples associated with them. He knows basic theorems with applications. (K_W03+, K_W04+, K_U17++)
2. He is able to use the conditional probability, the law of total probability and Bayes' rule. He is able to check the independence of events and use the Bernoulli scheme. (K_W03+, K_U13+)
3. He is able to construct and analyse a probabilistic model of a simple random experiment. He is able to give various examples of discrete and absolutely continuous distributions, and discuss selected random experiments and mathematical models in which they occur. He knows practical applications of basic distributions. (K_W04++, K_W05++, K_U01+, K_U13++)
4. He is able to calculate the probability of events parameters of the distribution of various random variables. He knows and is able to use limit theorems and the law of large numbers to estimate probabilities. (K_W03+, K_U13+)
5. He is able to make simple analysis and draw conclusions. He has the ability to apply basic mathematical software packages to solve simple probabilistic problems. (K_W06+, K_U01+, K_U03+, K_U13++)
6. He understands the limitations of his own knowledge and the need for the further education. (K_K01++)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

1. Checking the level of preparation of students and their activity during the classes and the laboratories.
2. Two colloquia during the classes and one colloquium during the laboratories with tasks of varying difficulty which allow to assess whether students have reached a minimum level of learning outcomes.
3. The exam in the form of a multiple-choice test, consisting of several dozen statements that require the verification on the basis of the acquired knowledge. The verification of statements is connected with the use of the theory or making simple calculations. The possible answers are Yes or No. The student may receive +1,-1 or 0 points for each statement.

To pass the class and laboratory it is necessary to get passing scores in colloquia. To take the exam it is necessary to pass the class. In order to pass the course it is necessary to get passing score in the class, the laboratory and the exam. The final course grade is based on graded components: the class grade – 40%, the laboratory grade – 20% and the exam grade – 40%.

STUDENT WORKLOAD:

Contact hours

lecture – 30 hrs.

class (traditional) – 30 hrs.

laboratory – 15 hrs.

consultation – 7 hrs.

exam – 3 hrs.

Total: 85 hrs.

Individual work

preparation for the lecture – 5 hrs.

preparation for the class (traditional) – 30 hrs.

preparation for the laboratory – 15 hrs.

preparation for the exam – 15 hrs.

review of the literature – 5 hrs.

Total: 70 hrs.

Total for the whole course: 155 hrs. (6 ECTS)

RECOMMENDED READING:

1. J. K. Misiewicz, Wykłady z rachunku prawdopodobieństwa z zadaniami, SCRIPT, Warszawa 2005.
2. J. Jakubowski, R. Sztencel, Rachunek prawdopodobieństwa dla (prawie) każdego, SCRIPT, Warszawa 2002.
3. W. Krysicki, J. Bartos, W. Dyczka, K. Królikowska, M. Wasilewski, Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, część I, PWN, Warszawa 1999.
4. T. Inglot, T. Ledwina, Z. Ławniczak, Materiały do ćwiczeń z rachunku prawdopodobieństwa i statystyki matematycznej, PWR, Wrocław 1984.
5. T. Górecki, Podstawy statystyki z przykładami w R, BTC, Legionowo 2011.
6. G. Grimmett, D. Welsh, Probability: an introduction, Oxford University Press, 1986.
7. G. Roussas, Introduction to probability, Elsevier Science, 2006.

OPTIONAL READING:

1. E. Plucińscy, Elementy probabilistyki, PWN, Warszawa 1982.
2. A. Plucińska, E. Pluciński, Zadania z probabilistyki, PWN, Warszawa 1983.
3. Ch. M. Grinstead, J. L. Snell, Introduction to probability, American Mathematical Society, 1997.
4. J. M. Horgan, Probability with R: An Introduction with Computer Science Applications, John Wiley & Sons, 2008.
5. K. Baclawski, Introduction to Probability with R, Chapman & Hall/CRC, 2008.

REMARKS:

Participation in the classes and the laboratories is mandatory.

INTRODUCTION TO PROGRAMING

Course code: 11.3-WK-ID-SP-PP

Type of course: obligatory

Language of instruction: English/Polish

Director of studies: dr inż. Janusz Jabłoński

Name of lecturer: dr inż. Janusz Jabłoński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					5
Lecture	30	2	I	Exam	
Laboratory	30	2		Grade	

COURSE AIM:

Objective of the course is to introduce in the bases theory of information as well as the basic of data types how also the arithmetical and logical operations realized by CPU. Show the basic program structure and on straight examples show the syntax of: sequential instructions, iterative the as well as choice. The introduction in algorithms and paradigms of programming as well as the methods of specification of algorithms. The utilization the languages of programming (the Pascal, C, Java) as well as the straight lines folded and the structures of data from regard the dynamic variables (table, records, list object) in implementation of simple program (about 100 line of code).

ENTRY REQUIREMENTS:

Basis of the computers use

COURSE CONTENTS:

Lecture/Laboratory

- The basis of computer architectures as well as the computer data representation.
- The basic definitions, simple and complex the data types as well as algorithmic constructions.
- The parameters passing: by value and by functions
- The basic programming techniques and the streams of data
- The recurrence and the conditioning of recurrence in programming
- Programming with the dynamic data structures.
- basic programming paradigms.

TEACHING METHODS:

Accessible lecture in electronic form; computer laboratories from utilization programistic tools (Dev ++, Turbo Pascal, Eclipse). The laboratories the presenting computational algorithms and their implementations together with with set modifications in different languages the programming (the Pascal, C, JAVA) the straight lines of programmes.

LEARNING OUTCOMES

(K_W07 +) Students knows the basis of programming and the computational technique helping the analyst's work as well as reason of their limitation

(K_W08.+) It knows the chosen languages of programming as well as the basis of object-oriented programming; it knows the basic structures of data (boards, tree's, letters, objects, graph), their computer representations and executed on them operations

(K_W11 ++) It knows the basic techniques of construction and the analysis of algorithms as well as the reason the basic limitations in solving the algorithmic problems

(K_U05 +) It knows to analyse the designed algorithms under angle of correctness and computational complexity.

(K_K01 +) The Rrozumie need of continuous lifting of its qualifications across broadening its knowledge and the practical skills.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Checking degree of the students' preparation as well as their activity in track of laboratory.

The credit of laboratory on basis of tests (40%) reporting with realized tasks (60%).

Grade from object consists with grade of laboratory (50%) as well as grade from the written examination (50%). Positive grade is from laboratory the condition of credit of object and examination.

STUDENT WORKLOAD:

Contact hours: 75 hours.

- Participation in lectures: 30 hours.
- Participation in laboratory classes: 30 hours.
- Participation in consultations: 12 hours.
- Exam: 3 hours.

Working alone: 50 hours.

- Preparation for laboratory classes: 10 hours.
- Preparation for the exam: 20 hours.
- Preparation of the written reports: 15 hours.
- Searching for the sources in the literature: 5 hours.

Total for course: 125 hours. (5 ECTS)

RECOMMENDED READING:

1. A. Majczak, Programowanie strukturalne i obiektowe, Helion, Gliwice, 2010.
2. J. Grebosz, Symfonia C++, Wydawnictwo Edition 2000, Kraków, 2010;
3. C. Horstmann, G. Cornell, Java 2. Podstawy, Helion, Gliwice, 2003
4. WWW.BOOKB1 OON.COM, S. Kendal, Object Oriented Programming using Java

OPTIONAL READING:

1. A. and K. Kingsley-Hughes, Programowanie od podstaw, Helion, Gliwice, 2005;
2. J. Bloch. Java, Efektywne programowanie, Helion, Gliwice, 2009.
3. T. M. Sadowski, Turbo Pascal, Helion, Gliwice, 1996

Attention:

Part in occupations is obligatory. Written examination.

LINEAR ALGEBRA

Course code: 11.1-WK-IiD-SP-AL

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Elżbieta Sidorowicz, dr Alina Szelecka

Name of lecturer: dr Elżbieta Sidorowicz dr Alina Szelecka

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	I	Exam	
Class	30	2		Grade	

COURSE AIM:

Students should acquire a good knowledge of topics that will be discussed during the lectures and should achieve the ability to apply linear algebra for formulating and solving economics, engineering, financial and social problems.

ENTRY REQUIREMENTS:

Secondary school mathematics

COURSE CONTENTS:

1. Complex numbers: conjugation, modulus, trigonometric forms, de Moivre's formula, roots.
2. Polynomials: roots of polynomial, fundamental theorem of algebra, Horner's rule.
3. Matrices: matrices operations, properties of determinants, matrix inversion, the rank of the matrix.
4. The system of linear equations, Kronecker – Capelli theorem, Cramer's rule, Gaussian elimination.
5. Binary relations (properties, types and examples), equivalence relations, abstract classes, partially ordered sets. Lattices. Algebra and subalgebra. Boolean's algebra. Groups, fields (basic properties and examples).
6. Examples of application linear algebra for engineering.

TEACHING METHODS:

Lecture: the traditional oral essay, the participatory lecture.

Class: solving selected problems, applying the theory for solving problems.

LEARNING OUTCOMES:

1. Student can perform calculation on complex numbers. Student knows and can prove de Moivre's formula. (K_W02+)

2. Student knows matrices operations. Student determines the value of a determinant and the rank of a matrix. Student knows properties of a determinant. (K_U07+)
3. Student can verify the properties of a relation. (K_U07+)
4. Student is able to find a solution of systems of linear equations. (K_U09++)
5. Student knows Kronecker – Capelli theorem. Student is able to discuss the number of solutions of a system of linear equations. (K_W02+, K_W04+)
6. Student understands the need for further learning lifelong education. (K_K01+)
7. Student can find in relevant literature a method of linear algebra for solving an elementary engineering problem. (K_U20++)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

1. Verifying the level of preparation of students and their activities during the classes.
2. Two written tests.
3. The written and oral exam.

Assessment criteria:

the mean of the assessment and evaluation of lectures and exams (written and oral)

The necessary condition for taking the exam is positive assessment of two tests (with tasks of different difficulty which help to assess whether students have achieved effects of the course in a minimum degree) and active participation in the classes.

The necessary condition for passing the course is the positive assessment of exam.

STUDENT WORKLOAD:

Contact hours:

lecture – 30 hours

class – 30 hours

consultation – 12 hours

exam – 3 hours

Independent work:

preparing to class – 20 hours

preparing to tests – 15 hours

preparing to exam – 30 hours

studying literature – 5 hours

Sum for the course: 160 hours (6 ECTS)

RECOMMENDED READING:

1. J. Klukowski, I. Nabiałek, Algebra, WNT, 1999.
2. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 1, Oficyna Wydawnicza GiS, Wrocław.
3. A. I. Kostrikin, Introduction to algebra, Springer, 1982.
4. A.I. Kostrikin, Y. I. Manin, Linear algebra and geometry, Gordon and Breach Science Publishers, 1997.

OPTIONAL READING:

1. G. Banaszak, W. Gajda, Elementy algebry liniowej, cz. I, WNT, 2002.W.
2. W. Dubnicki, L. Fikus, H. Sosnowska, Algebra liniowa w zadaniach, PWN, 1985.
3. A. Ostoja-Ostaszewski, Matematyka w ekonomii, Modele i metody, cz.I, Algebra elementarna, PWN, W-wa.

LINEAR ALGEBRA AND ANALYTIC GEOMETRY

Course code: 11.1-WK-ID-SP-ALGA

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Elżbieta Sidorowicz
dr Alina Szelecka

Name of lecturer: dr Elżbieta Sidorowicz
dr Alina Szelecka

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	II	Exam	
Class	30	2		Grade	

COURSE AIM:

Students should acquire a good knowledge of topics that will be discussed during the lectures and should achieve the ability to apply linear algebra for formulating and solving economics, engineering, financial and social problems.

ENTRY REQUIREMENTS:

Linear Algebra

COURSE CONTENTS:

Lecture/class

1. The three-dimensional geometry: the scalar, the cross product, lines and planes in the tree-dimensional space.
2. Linear spaces and subspace: the linear combination, the span of vectors, the linear independence of vectors. Basis and the dimension of a linear space. Linear transformations, the kernel and image of a linear transformation, the matrix of a linear transformation.
3. Euclidean spaces. Orthogonal vectors, orthonormal basis.
4. Eigenvalues and eigenvectors of matrices and linear transformations.
5. Bilinear forms and quadratic forms, diagonalization of a quadratic forms, signature of quadratic forms.
6. Examples of application linear algebra for engineering.

TEACHING METHODS:

Lecture: the traditional oral essay, the participatory lecture.

Class: solving selected problems, applying the theory for solving problems.

LEARNING OUTCOMES:

1. Student knows the definition of the linear space, the vector and the linear transformation. Student is able to solve simple problems related with these topics. (K_W02+, K_U07+)
2. Student is able to find the matrix of a linear transformation. Student understands the relation between matrix operations and linear transformation operations. (K_U07+)
3. Student knows the definition and examples of a scalar product. (K_W02+, K_U07+)
4. Student understands the need for further learning lifelong education. (K_K01+)
5. Student can find in relevant literature a method of linear algebra for solving an elementary engineering problem. (K_U20++)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

1. Verifying the level of preparation of students and their activities during the classes.
2. Two written tests.
3. The written and oral exam.

Assessment criteria:

the mean of the assessment and evaluation of lectures and exams (written and oral)

The necessary condition for taking the exam is positive assessment of two tests (with tasks of different difficulty which help to assess whether students have achieved effects of the course in a minimum degree) and active participation in the classes.

The necessary condition for passing the course is the positive assessment of exam.

STUDENT WORKLOAD:

Contact hours:

lecture – 30 hours

class – 30 hours

consultation – 12 hours

exam – 3 hours

Independent work:

preparing to lectures – 20 hours

preparing to class – 30 hours

preparing to exam – 30 hours

studying literature – 5 hours

Sum for the course: 160 hours (6 ECTS)

RECOMMENDED READING:

1. J. Klukowski, I. Nabiałek, Algebra, WNT, 1999.
2. T. Jurlewicz, Z. Skoczylas, Algebra liniowa 2, Oficyna Wydawnicza GiS, Wrocław.
3. A.I. Kostrikin, Introduction to algebra, Springer, 1982.
4. A.I. Kostrikin, Y. I. Manin, Linear algebra and geometry, Gordon and Breach Science Publishers, 1997.

OPTIONAL READING:

1. G. Banaszak, W. Gajda, Elementy algebry liniowej, cz. I, WNT, 2002.W.
2. W. Dubnicki, L. Fikus, H. Sosnowska, Algebra liniowa w zadaniach, PWN, 1985.
3. A. Ostoja-Ostaszewski, Matematyka w ekonomii, Modele i metody, cz.I, Algebra elementarna, PWN, Warszawa.

MATHEMATICAL ANALYSIS 1

Course code: 11.1-WK-ID-SP-AM1

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Maciej Niedziela

Name of lecturer: The employees of the Faculty of Mathematics, Computer Science and Econometrics

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					7
Lecture	45	3	I	Exam	
Class	45	3		Grade	

COURSE AIM:

The aim of this course is to provide students with skills and competences for them to understand basic mathematical issues listed under a subject scope of the course, and to use the gained knowledge as a tool of mathematical analysis to formulate and solve engineering problems in economic, financial, technical and social issues.

ENTRY REQUIREMENTS:

Knowledge of mathematics on a secondary school level.

COURSE CONTENTS:

Lecture/class:

1. Elements of logic and set theory
   - Elements of sentential calculus. Elements of predicate calculus. Set calculus. Relationships and functions.
2. Real and complex numbers. Elementary functions
   - Properties of real number sets. Complex numbers. Elementary functions and their properties. Examples of functions applied in engineering.
3. Sequences
   - Sequences of real numbers. Convergences of numerical sequences (basic theorems on limits of numerical sequences, “e” number, improper limit, subsequence and its limit, extreme limits). Block diagrams and sequences. Recursively defined sequences. Application of induction. Metric space. Convergence of points in the metric space. Sets of points in the metric space.
4. Limit and continuity of a mapping
   - Limit of a function and its properties. Limits of some elementary functions. Continuity of a mapping. Properties of continuous functions on compact sets. Properties of continuous functions in an interval. Monotonic and convex functions.
5. Elementary differential calculus

- Definitions and interpretations of a derivative of a function in points. Differentiability of functions on a set. Continuity and differentiability. Basic rules of differential calculus. Mean values theorems and their applications. L`Hospital's rule. Derivatives of higher orders. Approximation by polynomial. Approximate solving of equations. Extreme values. Examination of a function. Characteristics of convex functions. Engineering applications.

TEACHING METHODS:

Conventional lecture; a seminar; problem solving lecture.

Classes: solving typical tasks illustrating a course's subject, applying theories in practice, solving problems.

LEARNING OUTCOMES:

1. Student knows basic elementary functions and is able to apply their properties in solving engineering problems. (K_W04+, K_U01+, K_U07+)
2. Student knows the most important limits of sequences and functions; Student is able to apply the concept of a limit to approximation of numbers and functions. (K_W03+, K_U10+)
3. Student can define a function derivative and can give basic examples illustrating the interpretations of a derivative, and can describe the application of a derivative. (K_W03+)
4. Student is able to apply theorems and methods of a differential calculus in solving optimization problems with a function of one variable, searching local and global extrema (on basic examples). (K_W03+, K_W04+, K_U01+, K_U07+, K_U11+)
5. Student is able to gain information from the literature, internet and other reliable sources in the field of selection of the appropriate methods and numerical procedures necessary to solve elementary engineering problems. (K_U20+)
6. Student knows the limitations of his knowledge and understands the need to constantly improve his qualifications. (K_K01+)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

1. Evaluating students' preparation and their activeness during classes.
2. Two tests.
3. Written and oral exam.

Form of receiving a credit for the course: arithmetic average of grades in classes and the grade in the written and oral exam.

In order to take the exam a student has to obtain a positive grade in classes (out of three written tests containing tasks at a variable difficulty level, which enable to check if a student has achieved a minimal learning outcome). Active participation in classes is also evaluated.

In order to obtain a credit for the course a student has have a positive grade in the exam.

STUDENT WORKLOAD:

Contact hours

lecture – 45 hours

laboratory – 45 hours

consultation – 10 hours

exam – 2 hours

Sum: 102 hours

Independent work

Preparing to lecture – 20 hours

preparing to class – 30 hours

preparing to exam – 30 hours

becoming familiar with literature sources – 3 hours

Sum: 83 hours

Sum for the course: 185 hours (7 ECTS)

RECOMMENDED READING:

1. J. Banaś, S. Wędrychowicz, Zbiór zadań z analizy matematycznej, WNT, W-wa, 2004.
2. W. Kołodziej, Analiza matematyczna, PWN, W-wa, 2009.
3. W. Rudin, Podstawy analizy matematycznej, PWN, W-wa, 2009.
4. K. A. Ross, Elementary Analysis: The Theory of Calculus, Springer, New York, 2013.
   G. Strang, Calculus, Cambridge Press, 1991. (book available online: http://ocw.mit.edu/resources/res-18-001-calculus-online-textbook-spring-2005/textbook/)

OPTIONAL READING:

1. J .Banas, Podstawy matematyki dla ekonomistów, WNT, W-wa, 2005.
2. L. Polkowski, M. Szczura, Elementy matematyki dla studentów kierunków informatycznych, Akademicka Oficyna Wydawnicza PLJ, Warszawa 1995.
3. M. Cichoń, I. Kubiaczyk, A. Sikorska, A. Waszak, Elementy matematyki dla informatyków, Wydawnictwo Uniwersytetu im. A. Mickiewicza, Poznań, 1999.
4. G.M. Fichtenholz, Rachunek różniczkowy i całkowy, t.1,2, PWN, W-wa, 2004/5.
5. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, PWN, W-wa, 2008.
6. H.J. Musielakowie, Analiza matematyczna, Wyd. Nauk. UAM, t.1/2, 2002.
7. R. Rudnicki, Wykłady z analizy matematycznej, PWN, W-wa, 2006.
8. W. Sosulski, J. Szajkowski, Zbiór zadań z analizy matematycznej, Red. Wyd. Nauk Ścisłych i Ekonomicznych, UZ, 2007.

MATHEMATICAL ANALYSIS 2

Course code: 11.1-WK-ID-SP-AM2

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Maciej Niedziela

Name of lecturer: The employees of the Faculty of Mathematics, Computer Science and Econometrics

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					
Lecture	45	3	II	Exam	7
Class	45	3		Grade	

COURSE AIM:

The aim of this course is to provide students with skills and competences for them to understand basic mathematical issues listed under a subject scope of the course, and to use the gained knowledge as a tool of mathematical analysis to formulate and solve engineering problems in economic, financial, technical and social issues.

ENTRY REQUIREMENTS:

Mathematical analysis 1.

COURSE CONTENTS:

Lecture/class:

1. Differential calculus of a function of several variables
   - Partial derivatives. The Frechet derivative. The directional derivative. Applications of a differential and a derivative. Engineering applications of differentiability. A derivative of a composite function. Partial derivatives and differentials of higher order. Local and global extrema. Inverse function theorem and implicit function theorem. Conditional extrema.
2. Indefinite integral
   - Primitive function. Definition of an indefinite integral. Basic methods of defining indefinite integrals.
3. Elementary integral calculus
   - Riemann`s integral and its basic properties. Geometrical and economic interpretation of a finite integral. Basic theorems of integral calculus. Estimating finite integrals. Improper integrals. Applications of Riemann`s integral. Cavalieri`s principle.
4. Multiple integrals
   - Definition and properties of a multiple integral. Iterated integral and Fubini formula. Multiple integral on any set. Change of variables in multiple integrals. Applications of multiple integrals.
5. Numerical series
   - Numerical series and its convergence. Criteria for convergence of a positive term series. Alternating series. Operations on series. Block diagrams and numerical series.

6. Sequences and series of functions
    - Power series. Examples of Taylor series expansions. Approximating the sum of a convergent series.

TEACHING METHODS:

Conventional lecture; a seminar; problem solving lecture.

Classes: solving typical tasks illustrating a course's subject, applying theories in practice, solving problems.

LEARNING OUTCOMES:

1. Student can characterize convergent and divergent series and is able to apply their basic properties in solving engineering problems. (K_W04+, K_U01+, K_U07+)
2. Student can definite integral for a function of one and multiple variables and is able to give basic examples of application of integral calculus. (K_W03+)
3. Student is able to apply theorems and methods of a integral calculus in solving optimization problems with a function of one variable, searching local and global extrema (on basic examples). (K_W03+, K_W04+, K_U01+, K_U07+, K_U11+)
4. Student is able to apply theorems and methods of a integral calculus in solving optimization problems with a function of two variables, searching local and global extrema (on basic examples). (K_W03+, K_W04+, K_U01+, K_U07+, K_U11+)
5. Student is able to gain information from the literature, internet and other reliable sources in the field of selection of the appropriate methods and numerical procedures necessary to solve elementary engineering problems. (K_U20+)
6. Student knows the limitations of his knowledge and understands the need to constantly improve his qualifications. (K_K01+)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

1. Evaluating students' preparation and their activeness during classes.

2. Two tests.

3. Written and oral exam.

Form of receiving a credit for the course: arithmetic average of grades in classes and the grade in the written and oral exam.

In order to take the exam a student has to obtain a positive grade in classes (out of three written tests containing tasks at a variable difficulty level, which enable to check if a student has achieved a minimal learning outcome). Active participation in classes is also evaluated.

In order to obtain a credit for the course a student has have a positive grade in the exam.

STUDENT WORKLOAD:

Contact hours

lecture – 45 hours

laboratory – 45 hours

consultation – 10 hours

exam – 2 hours

Sum: 102 hours

Independent work

Preparing to lecture – 20 hours

preparing to class – 30 hours

preparing to exam – 30 hours

becoming familiar with literature sources – 3 hours

Sum: 83 hours

Sum for the course: 185 hours (7 ECTS)

RECOMMENDED READING:

1. J. Banaś, S. Wędrychowicz, Zbiór zadań z analizy matematycznej, WNT, W-wa, 2004.
2. W. Kołodziej, Analiza matematyczna, PWN, W-wa, 2009.
3. W. Rudin, Podstawy analizy matematycznej, PWN, W-wa, 2009.
4. K. A. Ross, Elementary Analysis: The Theory of Calculus, Springer, New York, 2013.
5. G. Strang, Calculus, Cambridge Press, 1991.(book available online: http://ocw.mit.edu/resources/res-18-001-calculus-online-textbook-spring-2005/textbook/)

OPTIONAL READING:

1. J .Banas, Podstawy matematyki dla ekonomistów, WNT, W-wa, 2005.
2. L. Polkowski, M. Szczura, Elementy matematyki dla studentów kierunków informatycznych, Akademicka Oficyna Wydawnicza PLJ, Warszawa 1995.
3. M. Cichoń, I. Kubiaczyk, A. Sikorska, A. Waszak, Elementy matematyki dla informatyków, Wydawnictwo Uniwersytetu im. A. Mickiewicza, Poznań, 1999.
4. G.M. Fichtenholz, Rachunek różniczkowy i całkowy, t.1,2, PWN, W-wa, 2004/5.
5. W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, PWN, W-wa, 2008.
6. H.J. Musielakowie, Analiza matematyczna, Wyd. Nauk. UAM, t.1/2, 2002.
7. R. Rudnicki, Wykłady z analizy matematycznej, PWN, W-wa, 2006.
8. W. Sosulski, J. Szajkowski, Zbiór zadań z analizy matematycznej, Red. Wyd. Nauk Ścisłych i Ekonomicznych, UZ, 2007.

MATHEMATICAL SOFTWARE 1

Course code: 11.9-WK-ID-SP-PM1

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Tomasz Małolepszy

Name of lecturer: dr Tomasz Małolepszy

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					3
Laboratory	30	2	I	Grade	

COURSE AIM:

The familiarization of the students with the capabilities of the computational software program for symbolic computation (*Maxima, Mathematica*) and the acquisition of the ability to use such a program for the solving of calculus and linear algebra problems.

ENTRY REQUIREMENTS:

No requirements.

COURSE CONTENTS:

1. First steps with CAS (Computer Algebra System).
2. Using CAS to solve problems related to calculus (limits, sequences, series, differential and integral calculus,…).
3. Using CAS to solve problems related to linear algebra (basic matrix operations, determinants, inverse matrices,…).
4. Creating of two- and three-dimensional plots.

TEACHING METHODS:

Computer labs with the lists of exercises to solve by students with the use of CAS.

LEARNING OUTCOMES:

Student is able:

1. to use CAS to solve typical problems related to calculus and linear algebra, (K_W06+, K_U03+, K_U08+, K_U11+, K_K06+)
2. to create and describe some simple 2D as well as 3D graphs using CAS. (K_U12++)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Learning outcomes will be verified through two tests consisted of exercises of different degree of difficulty. A grade determined by the sum of points from these two tests is a basis of course assessment.

STUDENT WORKLOAD:

Contact hours

Laboratories - 30 hours.

Laboratories' consultation hours - 10 hours.

Total - 40 hours (2 ECTS).

Individual work

Preparation to laboratories - 35 hours.

Total - 35 hours (1 ECTS).

Total time needed for this course: 75 hours (3 ECTS).

RECOMMENDED READING:

1. Cyprian T. Lachowicz, *Matlab, Scilab, Maxima : opis i przykłady zastosowań*, Oficyna Wydawnicza Politechniki Opolskiej, Opole 2005.
2. Stephen Wolfram, *The Mathematica book*, Champaign: Wolfram Media 2003.

MATHEMATICAL SOFTWARE 2

Course code: 11.9-WK-ID-SP-PM2

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Tomasz Małolepszy

Name of lecturer: dr Tomasz Małolepszy

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					3
Laboratory	30	2	II	Grade	

COURSE AIM:

The familiarization of the students with the capabilities of the mathematical software *Matlab*.

ENTRY REQUIREMENTS:

Computer Programming, Mathematical Software 1.

COURSE CONTENTS:

1. First steps with Matlab.
   Overview of the basic capabilities of *Matlab*. Command window. Variables and types in Matlab. Basic constants. Auxiliary commands (*clc, clear, diary*). *Help* command. Standard mathematical functions in *Matlab*. (2 hours)
2. Vectors and matrices.
   Creating. Access to the elements. Removing elements. Basic functions operating on vectors and matrices. (3 hours)
3. String - char vectors.
   Creating. Basic functions operating on char vectors. Reading data - *input* function. Displaying text - *disp* function. *Sprintf* function - an advanced way to display the data. (4 hours)
4. Special types of arrays.
   Creating and operations on the following types of arrays: sparse matrices, cell and struct arrays. (4 hours)
5. Elements of the programming.
   Conditional statements - *if, switch*. Loops - *for, while*. Vectorization. M-files - scripts and functions. *Inline* functions. (4 hours)
6. Test. (2 hours)
7. Two- and three-dimensional graphics.
   Plot function (changing the type and the color of the graph). Labeling of axis and the graph, creating a legend. Creating graphs of the functions stored in files - *fplot* function. *Ezplot* function - parametric plots and graphs of implicit functions. *Matlab* functions plotting polygons and polylines. Basic operations on the graphic window (*figure*).

Plotting curves in space (*plot3, ezplot3*). Plotting surfaces (*mesh, surf, ezsurf*). Animations. Import and export files. (4 hours)

8. Symbolic calculation in *Matlab*.

   Defining symbolic data - *sym* function. Solving equations and systems of equations - *solve* function. Computing limits (*limit*) and summing the series (*symsum*). Symbolic differentiation and integration (*diff* and *int* functions). Solving differential equations - *dsolve* function. (5 hours)

9. Test. (2 hours)

TEACHING METHODS:

Computer labs with the lists of exercises to solve by students with the use of Matlab.

LEARNING OUTCOMES:

Student is able:

1. to use numerical software (Matlab) in two different ways: using built-in functions as well as writing own programs to solve some mathematical problems, (K_W06+, K_U02+, K_U03+, K_U06+, K_K06+)
2. to create and describe some simple 2D as well as 3D graphs. (K_U12++)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Learning outcomes will be verified through two tests consisted of exercises of different degree of difficulty. A grade determined by the sum of points from these two tests is a basis of course assessment.

STUDENT WORKLOAD:

Contact hours

Laboratories - 30 hours.

Laboratories' consultation hours - 10 hours.

Total - 40 hours (2 ECTS).

Individual work

Preparation to laboratories - 35 hours.

Total - 35 hours (1 ECTS).

Total time needed for this course: 75 hours (3 ECTS).

RECOMMENDED READING:

1. Jerzy Brzózka, Lech Dorobczyński, *Programowanie w Matlab*, Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, Mikom, Warszawa 1998.
2. Wiesława Regel, *Wykresy i obiekty graficzne w programie Matlab*, Mikom, Warszawa 2003.
3. Desmond J. Higham, Nicholas J. Higham, *MATLAB guide*, SIAM, Philadelphia 2005.

OPTIONAL READING:

1. Anna Kamińska, Beata Pańczyk, *Ćwiczenia z ... Matlab. Przykłady i zadania*, Mikom, Warszawa 2002

MODELING OF RANDOM PHENOMENA

Course code: 11.0-WK-ID-SP-MZL

Type of course: optional

Language of instruction: English/Polish

Director of studies: dr Marta Borowiecka-Olszewska

Name of lecturer: dr Marta Borowiecka-Olszewska, dr Jacek Bojarski

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	V	Grade	
Laboratory	30	2		Grade	

COURSE AIM:

The aim of the course is to familiarize the student with the basic methods to simulate different probabilistic phenomena and deterministic problems as well as random simulations of selected real problems, with a particular focus on Monte Carlo methods.

ENTRY REQUIREMENTS:

Getting a pass in Introduction to Probability Theory and basic knowledge of selected mathematical software packages.

COURSE CONTENTS:

1. Random variables in computer simulations (Pseudo random number generators. Various methods of generating random variables and random vectors. Generating a finite random sampling from distributions of these variables. The construction and the use of the empirical cumulative distribution function, the estimation of quantiles and the probability density function.)
2. The Monte Carlo method and its applications in solving of probabilistic and deterministic problems, the accuracy of this method.
3. Simulations of selected stochastic processes.
4. The use of the selected mathematical software package to simulate different probabilistic phenomena and deterministic problems.

TEACHING METHODS:

A traditional lecture. Students solve problems analytically and apply the selected mathematical software package during the auditorial laboratory.

LEARNING OUTCOMES:

1. The student knows the basic level of the selected mathematical software package to simulate probabilistic phenomena. (K_W06+, K_U01+, K_U03+)

2. He is able to choose the appropriate probabilistic model for a given problem, carry out the simulation, interpret and draw appropriate conclusions. (K_W04++, K_W05+, K_W06+, K_U01+, K_U03+)
3. He is able to apply the Monte Carlo method to solve selected probabilistic and deterministic problems. He is able to carry out random simulations of selected real problems. (K_W03+, K_W06+, K_U01+, K_U03+, K_U13+)
4. He is able to get information on other applications of known methods from literature, Internet and other reliable sources. (K_U20+)
5. He is able to study on their own and in a group. He understands the limitations of his own knowledge and the need for the further education. (K_U21+, K_K01++, K_K02+)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

1. Checking the level of preparation of students and their activity during the laboratories.
2. Colloquia (laboratory) with tasks of varying difficulty which allow to assess whether students have reached a minimum level of learning outcomes.

To pass the laboratory it is necessary to get passing scores in colloquia. To pass the lecture it is necessary to get passing scores in written test. In order to pass the course it is necessary to get passing score in the laboratory and the lecture. The final course grade is based on graded components: the laboratory grade – 50% and the lecture grade – 50%.

STUDENT WORKLOAD:

Contact hours

lecture – 30 hrs.

laboratory – 30 hrs.

consultation – 12 hrs.

exam – 3 hrs.

Total: 75 hrs.

Individual work

preparation for the lecture – 30 hrs.

preparation for the laboratory – 40 hrs.

review of the literature – 5 hrs.

Total: 75 hrs.

Total for the whole course: 150 hrs. (6 ECTS)

RECOMMENDED READING:

1. W. Niemiro, Symulacje stochastyczne i metody Monte Carlo, Uniwersytet Warszawski, Warszawa 2013, http://mst.mimuw.edu.pl/lecture.php?lecture=sst, materiały opracowane w ramach projektu Ministerstwa Nauki i Szkolnictwa Wyższego.
2. A. Janicki, A. Izydorczyk, Komputerowe metody w modelowaniu stochastycznym, WNT, Warszawa 2001.
3. S. M. Ross, Introduction to probability models, Academic Press, 2007.

OPTIONAL READING:

1. A. Jakubiak, J. K. Misiewicz, Wykład z procesów stochastycznych z zadaniami. Część pierwsza: Procesy Markowa, SCRIPT, Warszawa 2010.
2. B. D. Ripley, Stochastic simulation, Wiley & Sons, 1987.

REMARKS:

Participation in the laboratories is mandatory.

OBJECT ORIENTED PROGRAMING 1

Course code: 11.3-WK-ID-SP-PO1

Type of course: obligatory

Language of instruction: English/Polish

Director of studies: dr inż. Janusz Jabłoński

Name of lecturer: dr inż. Janusz Jabłoński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	III	Exam	
Laboratory	30	2		Grade	

COURSE AIM:

The introduction students in object-oriented conceptions in the programming. The skilful imitations of field of problem on structure of computer system as well as his implementation. The structure of computer software system modeling in UML (diagram of classes in UML) as well as the modelling the data. ERP questions be become represented with examples of problems in real systems of class in e together with - economy. After completion this the course the student should be prepared to using with object-oriented methods and the bases of data as well as the CASE tools (the Java and the Eclipse together with additions for data-bases) in aim of implementation of computer software system with the user's graphic interface - realizing the definite functionalities.

ENTRY REQUIREMENTS:

Basis computer programming. Algorithms and data structures.

Lecture/Laboratory

- Basis object-oriented conceptions.
- Process suit approach and introduction to object-oriented programming.
- The business process approach and object-oriented programming.
- Object-oriented modelling in UML the field of problem
- The problem domain modelling in UML
- Object-oriented programming in JAVA.
- JAVA interfaces utilization in software system project.
- Tthe data bases and the project patterns utilization in JAVA.
- Programming with GUI utilization.

TEACHING METHODS:

Accessible lecture in electronic form; the computer laboratories in frames which the students implement the set problems near utilization the programming object-oriented in environment the CASE the Eclipse from utilization the Java and the chosen of bases of data (the MySQL, Postgres, DB2, Oracle, Firebird).

LEARNING OUTCOMES

knows what it is in present science the meaning of computational mathematics and the technique as well as in development of informative society (K_W01 +)

knows the basis the technician computational and the programming, helping the analyst's work and reason of their limitation; my knowledge on subject of the law the suit approach as well as the object-oriented methods in engineering problems (K_W07++)

it knows the chosen programming languages as well as the basis of object-oriented programming; it knows the basic structures of data (table, tree, list, object, graph), their computer representations and executed on them operations (K_W08 ++)

knows the meaning of computational mathematics in present science and the technique as

it knows the information management method and the data-bases systems menagement (K_W13 +)

it possesses the basic knowledge as well as it knows the varied computer tools connected from projecting and the use the bases of data as well as the computer systems of aid of decision; my the basic knowledge about cycle of life of devices and the computer systems (K_W14 +)

understanding the need of continuous lifting of its qualifications across broadening its knowledge and practical skills (K_K01 +)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Checking degree of the students' preparation as well as their activity in track of laboratory.
The grade of laboratory on basis of tests (20%) reporting with realized tasks (60%) and activity on the tasks (20%).
Grade from object consists with grade of laboratory (50%) as well as grade from the written examination (50%). Positive grade is from laboratory the condition of credit of object and examination.

STUDENT WORKLOAD:

Contact hours: 75 hours.

- Participation in lecture: 30 hours.
- Participation in laboratory: 30 hours.
- Participation in consultations: 13 hours.
- Exam: 2 hours

Working alone: 75 hours.

- Preparation for laboratory: 30 hours.
- Preparation for exam: 20 hours
- Preparation of the written reports: 20 hours.
- Searching for the sources in the literature: 5 hours.

Total for course: 150 hours. (2 ECTS)

RECOMMENDED READING:

1. J. McKim, ‘‘Teaching Object-Oriented Programming and Design’’, Eiffel Outlook 1, vol. 2, no. 3, pp. 8-19, USA Santa Barbara, 1992.
2. G. Cornell, C. Horstmann, ,Java Podstawy, Helion, Gliwice, 2008,
3. E. Gamma, R. Helm, R. Johnson, J. Vlissides, Wzorce projektowe, Helion, Gliwice, 2010.
4. J. Schmuller, UML w Kropelce, Helion, 2003.
5. G. Horstmann, G. Cornell, Java 2. Techniki zaawansowane, Helion, Gliwice, 2005.

OPTIONAL READING:

1. G. Ian, Metody Obiektowe w Praktyce, WNT, Warszawa, 2004.
2. A. Bochenek, Eclipse, Biblioteka SWT, PWN Warszawa, 2008.
3. B. Meyer, Programowanie Zorientowane Obiektowo, Helion, Gliwice, 2005.

Attention:

Part in occupations is obligatory. Written examination.

OBJECT ORIENTED PROGRAMING 2

Course code: 11.3-WK-ID-SP-PO2

Type of course: obligatory

Language of instruction: English/Polish

Director of studies: dr inż. Janusz Jabłoński

Name of lecturer: dr inż. Janusz Jabłoński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					2
Project	30	2	IV	Exam	

COURSE AIM:

Elaboration is at students of skill the aim of object independent specification, projecting and connected implementing functionality from effective utilization and the processing the data (the different fields to choice the: aid of management, the controling, logistics, marketing, cryptography ...) After completion the course the student should know to propose the model of solution of problem and the base of data, supply the documentary evidence the undertaken project decisions as well as zaimplementować in language the solution the programming object-oriented the solution (the CASE the Eclipse)..

ENTRY REQUIREMENTS:

Object-oriented programing 1.

Lecture/Laboratory

- The UML utilization in the realization of computer systems projects.
- Process suit approach and introduction to object-oriented programming.
- The business process approach and object-oriented programming.
- JAVA interfaces utilization in software system project.
- the data bases and the project patterns utilization in JAVA.
- Programming with GUI utilization.
- The problem domain modelling in UML.

TEACHING METHODS:

The project occupations on principle of talk and the review of examples of accessible implementations in literature as well as the proposed by students solutions. The environment of realization the CASE the Eclipse with additional indispensable packets of software - the "Plugins".

LEARNING OUTCOMES

knows the meaning of computational mathematics in present science and the technique as

it knows the information management method and the data-bases systems menagement (K_W13 +)

it possesses the basic knowledge as well as it knows the varied computer tools connected from projecting and the use the bases of data as well as the computer systems of aid of decision; my the basic knowledge about cycle of life of devices and the computer systems (K_W14 +)

the skill of effective help possesses the existing software for operating systems, the data-bases, computer nets (K_U24 +)

it be able to, with set specification, to analyse, to design peaceably as well as to realize simple bazodanowy system, using practically well-chosen methods, technician and tools (K_U25 ++)

understanding the need of continuous lifting of its qualifications across broadening its knowledge and practical skills (K_K01 +)

it be able to think and to act in creative way and enterprising (K_K06 +)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

The grade of project on of project records the taking into account the specifications of requirements basis as well as the structure and the dynamics of system in UML for proposed solution (50%) as well as the implementation and the verification of correctness of solution set problem (50%).

STUDENT WORKLOAD:

Contact hours: 38 hours.

Participation in project: 30 hours.

Participation in consultations: 8 hours..

Working alone: 27 hours.

Preparation for project: 20 hours.

Preparation of the written reports: 5 hours.

Searching for the sources in the literature:25 hours.

Total for course: 65 hours. (2 ECTS)

RECOMMENDED READING:

1. J. McKim, "Teaching Object-Oriented Programming and Design'', Eiffel Outlook 1, vol. 2, no. 3, pp. 8-19, USA Santa Barbara, 1992.
2. G. Cornell, C. Horstmann, ,Java Podstawy, Helion, Gliwice, 2008.
3. E. Gamma, R. Helm, R. Johnson, J. Vlissides, Wzorce projektowe, Helion, Gliwice, 2010.
4. J. Schmuller, UML w Kropelce, Helion, 2003.
5. G. Horstmann, G. Cornell, Java 2. Techniki zaawansowane, Helion, Gliwice, 2005.

OPTIONAL READING:

1. G. Ian, Metody Obiektowe w Praktyce, WNT, Warszawa, 2004,
2. A. Bochenek, Eclipse, Biblioteka SWT, PWN Warszawa, 2008.
3. B. Meyer, Programowanie Zorientowane Obiektowo, Helion, Gliwice, 2005

Attention:

Part in occupations is obligatory. Written examination.

SAFETY OF COMPUTER SYSTEMS AND DATA SECURITY

Course code: 11.3-WK-ID-SP-BSIOD
Type of course: obligatory
Language of instruction: English/Polish
Director of studies: dr inż. Janusz Jabłoński
Name of lecturer: dr inż. Janusz Jabłoński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	V	Exam	
Laboratory	30	2		Grade	

COURSE AIM:

The course aim is the introduction students of basic definitions as well as the threats of securioty data and safety the computer systems. The introduction with methods the technicians and the tools of prevention the breaking the attributes of safety of data and the systems. Preparation to independent recognizing threats and proposing effective as well as safe solutions for computer informative systems.

ENTRY REQUIREMENTS:

Basis computer programming.

Lecture/Laboratory

- The threat of computer systems: confidentiality, integrality accessibility.
- The lawmaking and norms conditioning of data safety and security.
- Legal conditioning the protection of intellectual property.
- The practical aspects of utilization of cryptography and the cryptoanalize.
- The models and the class of computer systems safety.
- The most frequent threats of safety and security in informative and teleinformatic systems.
- The lawmaking and norms conditioning digital signature
- The policy of safety defining
- The digital signature and the infrastructure of public key.
- The practical methods of protecting the data and the computer systems.

TEACHING METHODS:

Accessible lecture in electronic form; the computer laboratories on which students analyze and realize the practical examples they demonstrate the question mechanisms and the method of the most often stepping out threats as well as the methods of eliminating the danger. The project being study and solution ones of the possible threats of data safety and system security, the application or the WEB services the from regard the Cloud the Computing.

LEARNING OUTCOMES

knows what it is in present science the meaning of computational mathematics and the technique as well as in development of informative society (K_W01 +)

he assimilated on subject of network technologies the basic knowledge, in this the architecture of computer nets, communication minutes, safety and the building of network applications (K_W15 +)

the basic knowledge about social aspects of computer science as well as conditioning ethical, legal and economic connected with the analyst's occupation, the mathematician and the programmer; it knows the general principles of creating and the development of forms of individual enterprise; my the basic knowledge in range of protection of intellectual property as well as right patent (K_W16 ++)

knows the basic principles of safety and the hygiene rule of work near computer and the computer net (K_W17 +)

be able to estimate of usefulness methods and mathematical tools as well as to choose and to apply proper - safe method and tools (K_U23 +)

It be able to take the care about elementary safety of data and computer nets (K_U26 +++)

understanding the need of continuous lifting of its qualifications across broadening its knowledge and practical skills (K_K01 +)

Understanding and the meaning of intellectual honesty values in workings own and different persons; it proceeds ethical (K_K04 +++)

Understanding ethical, legal and social aspects computerization and it knows to warn in one's professional activity treating to them principles (K_K05 ++)

The understanding and the consciousness of technical validities has as well as the non technicall aspects and results of the engineer's activity and connected from this the responsibility for undertaken decisions (K_K07 +)

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Checking degree of the students' preparation as well as their activity in track of laboratory.
The grade of laboratory on basis of tests (20%) reporting with realized tasks (80%). Project grade on basis at study of chosen question with range of safety of computer systems (40%) with presenting the possible solutions for this protection (60%).
Grade from object consists with grade of laboratory (35%) as well as grade from the written examination (35%) and project (30%). Positive grade is from laboratory and project the condition of credit of object and examination.

STUDENT WORKLOAD:

Contact hours: 85 hours.
- Participation in lecture: 30 hours.
- Participation in laboratory: 30 hours.
- Participation in project: 15 hours
- Participation in consultations:8 hours.
- Exam: 2 hours

Working alone: 75 hours.
- Preparation for laboratory: 25 hours.
- Preparation for project: 10 hours
- Preparation for exam: 15 hours
- Preparation of the written reports: 20 hours.
- Searching for the sources in the literature: 5 hours.

Total for course: 160 hours. (6 ECTS)

RECOMMENDED READING:

1. W. Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 2011 – 417.
2. N. Ferguson, B. Schneier, Kryptografia w praktyce., Helion, 2004.
3. J. Stokłosa, T. Bliski, T. Pankowski, Bezpieczeństwo danych w systemach informatycznych, PWN, Warszawa, 2001.
4. W. R. Cheswick. Firewalle i bezpieczeństwo w sieci. Helion, Gliwice, 2003.

OPTIONAL READING:

1. W. Stallings, Kryptografia i bezpieczeństwo sieci komputerowych. Matematyka szyfrów i techniki kryptologii, Helion, Gliwice, 2011;
2. B. Hoffman, B. Sullivan, Bezpieczeństwo aplikacji tworzonych w technologii Ajax, Helion, Gliwice, 2009;
3. W. Stallings, Kryptografia i bezpieczeństwo sieci komputerowych. Koncepcje i metody bezpiecznej komunikacji, Helion, Gliwice, 2012;
4. L. Kępa, P. Tomasik, S. Dobrzyński, Bezpieczeństwo systemu e-commerce, czyli jak bez ryzyka prowadzić biznes w internecie, Helion, Gliwice, 2012.

ATTENTION:

Part in occupations is obligatory. Written examination.

THE WEB APPLICATION PROGRAMMING

Course code: 11.3-WK-ID-SP-WEB

Type of course: eligible

Language of instruction: English/Polish

Director of studies: dr inż. Janusz Jabłoński

Name of lecturer: dr inż. Janusz Jabłoński

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					6
Lecture	30	2	VI	Exam	
Laboratory	30	2		Grade	

COURSE AIM:

The aim of course the programming the application the WEB is the introduction with basic questions of programming data base applications distracted and the technology of services of Web. The students' preparation to practical utilization of tools and the technology of production of application and the services of Web.

ENTRY REQUIREMENTS:

Computer and object oriented programming. Software system engineering:

Lecture/Laboratory

- The history of Web, evolution of application the WEB.
- Basis of internet minutes.
- Many-layered architectures of internet applications.
- Project patterns in JAVA.
- Pattern MVC; network services, Service Oriented Architectures.
- The komponentowe tools in realization of application the WEB.
- Utilization Javascript and technology AJAX.
- The basis of utilization the Spring the Framework.
- Introduction to Cloud Computing.

TEACHING METHODS:

Accessible lecture in electronic form; computer laboratories from utilization tools (Eclipse, Spring) technology (AJAX) methods and project patterns (MVC) in implementation and initiating databases WEB applications.

LEARNING OUTCOMES

knows the meaning of computational mathematics in present science and the technique as well as in development of informative society (K_W01 +)

knows the most important resolvable problems near use mathematical engine and internet computer techniques (K_W10 ++)

it knows about of network technologies, in this the architecture of computer nets, communication minutes, safety and it knows the building of network applications the method of management the information and the systems of bases of data (K_W15 +)

The usefulness of methods be able to estimate and mathematical tools and computer as well as to choose and to apply proper method and tool to folded inżynierskich tasks (K_U23 ++)

It be able to, with set specification, to analyse, to design peaceably as well as to realize simple data base system, using practically well-chosen methods, technician and tools (K_U25 +)

it solves the basic tasks connected from processing the information as well as it chooses the suitable mathematical methods and the computer tools to definite types of tasks (K_U28 ++)

It be able to suitably define the priorities the servants of realization definite by me or different tasks; the reason the necessity of systematic work over projects about long-wave character (K_K03 +);

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

Checking degree of the students' preparation as well as their activity in track of laboratory.
The credit of laboratory on basis of tests (20%) reporting with realized tasks and implemented aplications (80%).
Grade from object consists with grade of laboratory (50%) as well as grade from the written examination (50%). Positive grade is from laboratory the condition of credit of object and examination.

STUDENT WORKLOAD:

Contact hours: 75 hours.

- Participation in lectures: 30 hours.
- Participation in laboratory classes: 30 hours.
- Participation in consultations: 12 hours.
- Exam: 3 hours.

Working alone: 75 hours.

- Preparation for laboratory classes: 30 hours.
- Preparation for the exam: 20 hours.
- Preparation of the written reports: 20 hours.
- Searching for the sources in the literature: 5 hours.

Total for course: 150 hours. (6 ECTS)

RECOMMENDED READING:

1. E. Gamma, R. Helm, R. Johnson, and J. Vlissides, Design Patterns: Elements of Reusable Object-Oriented Software. Addison-Wesley. England 1995.
2. D. Alur, J. Crupi, D. Malks, J2EE Wzorce projektowe, Helion, Gliwice 2004,
3. G. Horstmann, G. Cornell, Java 2. Techniki zaawansowane, Helion, Gliwice, 2005,
4. N. Dai, L. Mandel, A. Ryman Eclipse Web Tools Platform. Tworzenie aplikacji WWW w języku Java, Helion, Gliwice 2008.
5. A. Hemrajani, Java. Tworzenie aplikacji sieciowych za pomocą Springa, Hibernate i Eclipse, Helion, Gliwice 2007

OPTIONAL READING:

1. M. Fowler, Patterns of Enterprise Application Architecture. Addison-Wesley, England 2002
2. E. Gamma, R. Helm, R. Johnson, J. Vlissides, Wzorce projektowe, Helion, Gliwice, 2010.
3. A. Bochenek, Eclipse, Biblioteka SWT, PWN Warszawa, 2008,
4. B. Burke, R. Monson-Haefel, Enterprice Java Beans 3.0, Helion 2007.
5. D. Minter, L. Linwood, Hibernate od nowicjusza do profesjonalisty, Apress, Warszawa 2007.
6. C. Walls, Spring w Akcji, Helion, Gliwice, 2013

Attention:

Part in occupations is obligatory. Written examination.

UTILITY PACKAGES

Course code: 11.9-WK-ID-SP-PU

Type of course: compulsory

Language of instruction: English/Polish

Director of studies: dr Anna Fiedorowicz

Name of lecturer: dr Anna Fiedorowicz
mgr Katarzyna Jesse-Józefczyk

Form of instruction	Number of teaching hours per semester	Number of teaching hours per week	Semester	Form of receiving a credit for a course	Number of ECTS credits allocated
Full-time studies					2
Laboratory	30	2	II	Grade	

COURSE AIM:

The aim of the course is to gain knowledge and skills in the use of basic office software, such as word processors, spreadsheets, presentation software. The students also learn how to integrate different applications.

ENTRY REQUIREMENTS:

The basics of computer.

COURSE CONTENTS:

1. Working with word processors. Formatting techniques. Generating tables of contents. Basic tools, equation editor and macros. Mail merge. Diagrams and images in the document.
2. Working with spreadsheets. The basic notions, such as row, column, cell, relative/absolute cell references. Formatting. Formulas and functions. Charts. Advanced features.
3. Elements of programming (either in Visual Basic for Applications or in some other Basic-type language) and their usage in spreadsheets.
4. Presentation software. The students create presentations (in groups), and give talks at the classes.

TEACHING METHODS:

Computer laboratory exercises.

LEARNING OUTCOMES:

K_W09+ The student knows the capabilities and features of word processors and spreadsheets, supporting the processing, analysis and presentation of data, is familiar with the techniques of text formatting.

K_U12+ The student has skills to use word processors and spreadsheets, including the usage of built-in functions and formulas in spreadsheets, the student can create charts. The student can design a presentation, using an appropriate software, and also can integrate different applications.

K_K02+ The student can work in groups on a given project.

LEARNING OUTCOMES VERIFICATION AND ASSESSMENT CRITERIA:

The learning outcomes verification is based on:

1. the students' preparation for and activity at the classes;
2. written reports;
3. the preparation of presentations (in groups) and talks given at the classes.

STUDENT WORKLOAD:

Contact hours: 40 hours.

Participation in laboratory classes: 30 hours.

Participation in consultations: 10 hours.

Working alone: 33 hours.

Preparation for laboratory classes: 10 hours.

Preparation of the reports: 15 hours.

Preparation of the project: 8 hours.

Total for course: 73 hours. (2 ECTS)

RECOMMENDED READING:

1. M. Dziewoński, OpenOffice 3.x PL. Oficjalny podręcznik, Helion.
2. J. Walkenbach, M. Alexander, Analiza i prezentacja danych w Excel, Helion, 2011.
3. R. Zimek, PowerPoint 2010 PL. Ćwiczenia, Helion, 2010.
4. G. Kowalczyk, Word 2010 PL. Ćwiczenia praktyczne, Helion, 2010.
5. K. Masłowski, Excel 2010 PL. Ćwiczenia praktyczne, Helion, 2010.

OPTIONAL READING:

1. P. Szwedowski, Opcje graficzne w Word XP, MIKOM, Warszawa, 2003.
2. D. Rasała, R. Motyka, W 80 zadań dookoła Excela. Zaawansowane funkcje arkusza kalkulacyjnego w ćwiczeniach, Helion, 2012.
3. M. Lewandowski, Tworzenie makr w VBA dla Excela 2003/2007. Ćwiczenia, Helion, 2007.
4. Agata i Jerzy Rzędowscy, Mistrzowskie prezentacje slajdowy poradnik mówcy doskonałego, Helion.