SIEDLCE UNIVERSITY
OF NATURAL SCIENCES AND HUMANITIES

Siedlce University of Natural Sciences and Humanities

Faculty of Science

Erasmus+ course catalogue

for academic year 2019/2020

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Preface

Dear Students,

Thank you for your interest in our University and Faculty. We cordially invite you to study in Siedlce under the Erasmus programme. We offer a wide range of Bachelor's and Master's degree programmes. However, at the moment, only some of the courses – these presented in this very catalogue – are taught in English.

Most of the courses consist of two parts: lectures and laboratory classes. Please be aware that if the number of students from abroad is relatively low compared to the number of Polish students, the lectures are given in Polish. In this case, you will receive the literature and requirements from our professors to self-study but, obviously, you are encouraged to regularly consult with our lecturers during their contact hours. The laboratory classes are conducted in smaller groups which allow to a more individual approach to students. Thus, our staff is obliged to provide the materials and all explanations in English.

You can also choose other courses, outside of the catalogue, but it requires individual arrangements with our teachers. Please follow the links below to look at study plans (in Polish) to find out what subjects we teach.

Chemistry: https://ich.uph.edu.pl/studenci/plany-i-programy-studiow

Computer Science: https://ii.uph.edu.pl/studenci/plany-studiow

Mathematics: https://imif.uph.edu.pl/studia/plany-studiow

If you are interested, please contact the Erasmus+ coordinator and you will get more details and the information you need.

CHEMISTRY

Winter semester

Course title:	**Inorganic Chemistry II**
Lecturer(s):	dr Danuta Kroczewska, dr hab. Anna Kamecka
ECTS credits:	6
Course contents:	Periodic table of elements. Properties of transition elements compounds – an introduction (colour, magnetic and catalytic properties). The f-block elements. An introduction to the coordination chemistry. Valence bond theory. Crystal field theory. Stereochemistry. Prerequisites: completing and crediting the courses selected according to the programmes with standards and established syllabuses: Inorganic Chemistry I.
Language:	Lectures: English and Polish; Classes and Laboratory classes: English
Semester (winter or spring)	winter
Duration:	1 semester
Textbooks:	1. J. D. Lee, "Concise Inorganic Chemistry", 4th ed, Chapman & Hall, 1991. 2. C. E. Housecroft, A. G. Sharpe, Inorganic Chemistry, Pearson Education Ltd., Harlow, 2005 3. F.A. Cotton, G. Wilkinson, P.L. Gauss, "Basic Inorganic Chemistry", John Wiley & Sons, Inc., 1987. 4. M. J. Sienco, R. A. Plane, „Chemistry - Principles and Applications", McGraw-Hill, Inc., 1996. 5. S. F. A. Kettle, "Physical Inorganic Chemistry. A Coordination Chemistry Approach", Oxford University Press, 1996. 6. M. S. Silberberg, Chemistry: the molecular nature of master and change, McGraw-Hill Higher Education, USA, 2000.

Course title:	**Organic chemistry II**
Lecturer(s):	Dr hab. Danuta Branowska
ECTS credits:	8
Course contents:	Introduction to amino acids. Dipolar structure of amino acids. Isoelectric point. Synthesis of α-amino acids: the Strecker synthesis, reductive amination of α-ketoacids: biosynthesis, the amidomalonate synthesis. Resolution of R, S amino acids. Covalent bonding in peptides. Peptide structure determination: amino acid, peptide sequencing; analysis the Edman degradation. Peptide sequencing; C-terminal residue determination. Peptide synthesis. Automated peptide synthesis: the Merrifield solid-phase technique. Structure and stereochemistry of carbohydrates: Fischer projections for depicting carbohydrates. D, L-sugars, configurations of aldoses. Cyclic structures of Monosaccharides. Hemiacetal formation. Monosaccharide anomers: mutarotation. Conformation of monosaccharides. Reactions of monosaccharides: ester and ether formation, glycoside formation, reduction of monosaccharides, oxidation of monosaccharides. Chain lengthening: the Kiliani-Fischer synthesis. Chain shortening: the Wohl degradation. Sterochemistry of glucose: the Fischer proof. Determination of monosaccharide ring size. Disaccharides (cellobiose and maltose). Polycarbohydrates: lactose, sucrose, cellulose, starch. Carbohydrates on cell surfaces. The nucleic acids: deoxynucleic acid (DNA), ribonucleic acid and phosphorylated nucleosides. Hydrogen-bonded base pair. Structure of DNA, replication of DNA; sequencing and laboratory synthesis. Structure and synthesis of RNA: translation. Chemistry of natural products. Steroids: the estrogens and progesterone as regulators of human biology. Biosynthesis of cholesterol. Lipids. Fats and oils. Soaps. Phospholipids (phoshoglycerides, lipid bilayer). Biosynthesis of fatty acids. Prostaglandins. Terpens; Stereochemistry of steroids. Isoprene rules.
Language:	Lectures English and Polish, Laboratory English, Seminar English
Semester (winter or spring)	Winter
Duration:	1 semester
Textbooks:	1. J. McMurry, „Organic chemistry”, Brooks/Cole, 2011. 2. R. T. Morrison, R. N. Boyd, „Organic chemistry”, Prentice Hall, 1992. 3. J. Clayden, N. Greeves, S. Warren, P. Wotheres, „Organic chemistry”, Oxford University Press, second edition, 2012. 4. J. M. Berg, J. L. Tymoczko, L. Stryer, „Biochemistry”, W. H. Freeman, 2008.

Course title:	**Organometallic chemistry**
Lecturer(s):	dr hab. Danuta Branowska
ECTS credits:	4
Course contents:	Bonding in Transition Metal Compounds,18 Electron Rule, Metal-Ligand Bonding, Ligand Exchange – Dissociative Substitution, Associative Substitution, Oxidative Addition, Reductive Elimination, β-Hydride Elimination, Simple Organometallic Processes in Pd-Chemistry – Common Sources of Pd, Common modes of Reduction of Pd (II) Precatalysts. The modern reactions cross-coupling: Heck, Suzuki, Stille, Hiyama, Sonogashira, Kumada etc. and mechanism.The application of the cross coupling reaction in organic chemistry. Olefin metathesis: ROMP, RCM, CM etc. Synthesis and reactions of organolithium compounds and organosodium; synthesis and reactions of organomagnesium compounds; organometallics of zinc, silicon and tin: preparation, structure, bonding and reactions.
Language:	Lectures: English and Polish; Seminar: English
Semester (winter or spring)	Winter
Duration:	1 semester
Textbooks:	1.Organometallic Hyper TextBook" http://www.ilpi.com/organometallic/index.html 2.„Virtual Textbook of Organic Chemistry" http://www.cem.msu.edu/˜reusch/VirtulText/introl.htm 3."Handbook of Grignard Reagents" G. S. Silverman, P. E. Rakita (Eds), Dekker, NY 1996 4.„Metal –catalysed Cross-coupling Reactions" F. Diederich, P. J. Stang (Eds), Wiley-VCH, Weinheim, 1998 5.„Handbook of Metathesis" Volume I-III R. H. Grubbs (Editor), Wiley-VCH, Weinheim, 2003 6.„Synthesis of Organometallic Compounds", S. Komiya (Editor) John Wiley & Sons, 1997 7.„Applications of Organometallic Compounds" I. Omae John Wiley & Sons, 1998 8.„Cross-Coupling Reactions N. Miyaura (Editor) Springer-Verlag Berlin Heidelberg 2002 9.Ch. Elschenbroich, A. Salzer, "Organometallics: a concise introduction" 2nd ISBN: 3- 527-28164-9 10. J. P. Collman, L. S. Hegedus, J. R. Norton, R. G. Finke, "Principles and applications of organotransition metal chemistry" 2 nd edition 1987 11. S. E. Kegley, A. R. Pinhas, "Problems and solution in organometallic chemistry" University Science Books, Oxford University Press.

Course title:	**Crystal Chemistry**
Lecturer(s):	dr hab. inż. Zbigniew Karczmarzyk, prof. UPH
ECTS credits:	3
Course contents:	Crystalline state, phenomenological and microscopic definition of crystal. Crystal structure theory and crystal morphology (fundamental laws of geometrical and structural crystallography). Symmetry of the crystals (principles of symmetry, point groups, space groups). Crystal chemistry; examples of crystal structures of chemical elements and chemical compounds. Some physical properties of the crystals.
Language:	Lectures: English and Polish; Laboratory: English and Polish
Semester (winter or spring)	winter
Duration:	1 semester
Textbooks:	1. W. Kleber, An Introduction to Crystallography, VEB Verlag Technik Berlin. 2. International Tables for Crystallography, Kluwer Academic Publishers, Dordrecht, Boston, London, 1995.

Spring semester

Course title:	**Spectroscopic Identification of Organic Compounds**
Lecturer(s):	dr hab. Robert Kawęcki
ECTS credits:	3
Course contents:	Analysis of organic compounds using spectroscopic methods; UV, IR, Raman, NMR and MS spectroscopy. In particular: UV-VIS chromophores, preparation of samples for IR measurement, IR absorption bands of main functional groups, preparation of samples (reference, solvents) for NMR measurement, ^{1}H and ^{13}C chemical shifts ranges of organic compounds, factors which determine chemical shift, spin-spin coupling, ionization methods in MS spectrometry, influence of ionization method on MS spectrum, fragmentation of organic compounds, isotope peaks. Structure elucidation using data from UV, IR, NMR and MS spectra. Spectroscopic databases in literature and internet.
Language:	English and/or Polish
Semester (winter or spring)	spring
Duration:	1 semester, 15 h
Textbooks:	1. R. M. Silverstein, F. X. Webster, D. Kiemle Spectrometric Identification of Organic Compounds, 7th ed., John Wiley & Sons Inc, 2005. 2. J. McMurry, Organic Chemistry, Thomson Brooks/Cole, 2007.

Course title:	**Fundamentals of Physical Chemistry**
Lecturer(s):	dr hab. Wiesława Barszczewska
ECTS credits:	9
Course contents:	**Thermodynamics:** first law of thermodynamics, thermochemistry, ideal gas carnot engines and efficiency, the Clausius inequality and the mathematical statement of the second law of thermodynamics, entropy and the third law, the chemical potential, Maxwell relations, the free energy, entropy of mixing. **Kinetics:** rate of reaction, rate laws, integrated rate laws, order of a reaction, half lives, determining the rate law from experimental data, experimental techniques, complex reactions, consecutive reactions, reversible reactions, the steady state approximation, temperature dependence of reaction rates, the Arrhenius equation and activation energies, catalysis, simple collision theory, **Electrochemistry:** electric current conductors, electrolytes and ions, condition of electroneutrality, degree of dissociation, reactions occurring during electrolysis, Faraday's law, coulometers, transport numbers, concentration changes during electrolysis, electric conductivity of electrolytes, Kohlrausch's law of independent migration of ions, chemical potential, activity and activity coefficient in electrolyte solutions, Debye-H¨uckel limiting law, thermodynamics of galvanic cells, classification of half-cells, classification of galvanic cells, Nernst equation, electrode polarization.
Language:	Lectures: English and Polish; Classes: English
Semester (winter or spring)	Spring
Duration:	1 semester
Textbooks:	1. P.W. Atkins and J.C. de Paula, *Physical chemistry.* W.H. Freeman, New York (2009). 2. P.W. Atkins and J.C. de Paula, *Physical chemistry for the life sciences.* W.H. Freeman, New York (2005). 3. S.I. Sandler, *Chemical and engineering thermodynamics*. Wiley, New York (1998). 4. D.R. Crow, *Principles and applications of electrochemistry*. Blackie, London (1994). 5. S.R. Logan, *Fundamentals of chemical kinetics*. Longman, Harlow (1996) 6. J.I. Steinfeld, J.S. Francisco, and W.L. Hase, *Chemical kinetics and dynamics*. Prentice Hall, Englewood Cliffs (1998)

Course title:	**Inorganic Chemistry I**
Lecturer(s):	dr hab. Anna Kamecka
ECTS credits:	4
Course contents:	The periodic table and properties of the elements. Periodic trends in the main atomic properties. Atomic and ionic size. Ionization energy. Electronegativity and electron affinity. Periodic patterns in the main-group elements: bonding, structure, and reactivity. Acid-base behaviour of the element oxides. Solubility of oxides, hydroxides and salts. Heat of hydration, heat of solvation. Classification, nomenclature, structure, properties, reactivity and application of inorganic compounds. Models of chemical bonding. Theories of covalent bonding. Prerequisites: completing and crediting the courses selected according to the programmes with standards and established syllabuses: General Chemistry.
Language:	Lectures: English and Polish; Classes: English
Semester (winter or spring)	spring
Duration:	2 semesters
Textbooks:	1. J. D. Lee, "Concise Inorganic Chemistry", 4th ed, Chapman & Hall, 1991. 2. F.A. Cotton, G. Wilkinson, P.L. Gauss, "Basic Inorganic Chemistry", John Wiley & Sons, Inc., 1987. 3. M. J. Sienco, R. A. Plane, „Chemistry - Principles and Applications", McGraw-Hill, Inc., 1996. 4. S. F. A. Kettle, "Physical Inorganic Chemistry. A Coordination Chemistry Approach", Oxford University Press, 1996. 5. M. S. Silberberg, Chemistry: the molecular nature of master and change, McGraw-Hill Higher Education, USA, 2000. 6. C. E. Housecroft, A. G. Sharpe, Inorganic Chemistry, Pearson Education Ltd., Harlow, 2005.

COMPUTER SCIENCE

Winter semester

Course title:	**Low-level programming**
Lecturer(s):	Dr Andrzej Salamończyk
ECTS credits:	4
Course contents:	Architecture and low-level programming on x86 processors. Application of assemblers in information systems. Using MASM language for programming console and window applications. Prerequisites: basic programming skills, basic knowledge of computer systems architecture
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	Winter
Duration:	1 semester; lectures 21 h, laboratory classes 24 h
Textbooks:	1. Kip R. Irvine. Assembly Language for x86 Processors, 7th edition, Prentice-Hall, 2014 2. D. Kusswurm. Modern X86 Assembly Language Programming: 32-bit, 64-bit, SSE, and AVX. Apress 2014. 3. Vlad Pirogow. The Assembly Programming Master Book. A-List Publishing 2004.

Course title:	**Advanced Programming Technologies**
Lecturer(s):	dr Artur Niewiadomski
ECTS credits:	3
Course contents:	The main goals of the course are: 1. Deepening knowledge and improving skills related to Java programming, especially in the field of: multithreaded programming, Java Collection Framework, Java8 streams. 2. Broadening knowledge in the area of object-oriented programming and in particular the design patterns (creational, structural, and behavioural patterns). 3. Introduction to techniques characteristic of functional languages which infiltrate popular object-oriented programming languages (lambda functions, higher-order functions, side-effects free functions). 4. Introduction to functional programming using one of the languages: Scala, F#, Haskell, Elm (to be chosen by students) Part of Master's programme **Prerequisites**: object-oriented programming, Java
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	winter
Duration:	1 semester; lectures 21h, laboratory classes 22h
Textbooks:	1. J. Bloch, Effective Java (2nd Edition), Addison-Wesley, 2008 2. B. Goetz, Java Concurrency in Practice, Pearson 2014 3. E. Freeman et. al., Head First Design Patterns, O'Reilly. 2014 4. R.G. Urma et. al, Java 8 in Action: Lambdas, Streams, and functional-style programming, Manning 2015

Course title:	**Programming Platforms**
Lecturer(s):	Dr Dariusz Mikułowski, dr Grzegorz Terlikowski, dr Waldemar Bartyna
ECTS credits:	4
Course contents:	The aim of the course is to familiarize students with the techniques of implementing web applications on the 2 major software platforms J2EE and .Net. After completing of this course the student should be familiar with the MVC paradigm for creating web applications and be able to implement it in two environments: a J2EE environment with use the Spring Framework and the .NET (visual studio) environment using .NET MVC library. During familiarization with the elements of .Net platform student will be also familiarized with the basic constructs and structures of C# language. Except this, during implementing a web applications in J2EE platform the student will be able to extend his practical skills and knowledge of Java language.
Language:	English
Semester **(winter or spring)**	winter
Duration:	1 semester; lectures 30h, laboratory classes 30h
Textbooks:	1. Marty Hall, Larry Brown, Yaakov Chaikin. *Java Servlet and Java Server Pages*. II Edition. 2. Alur Deepak, Crupi John, Malks Dan. *J2EE. Core J2EE Patterns: Best Practices and Design Strategies ...* 3. Andrew Troelsen, *Pro C# 2010 and the .NET 4 Platform*, Apress 2009; 4. Jon Galloway, Scott Hanselman, Phil Haack, Scott Guthrie, Rob Conery, *Professional ASP.NET MVC 2*, Wiley Publishing, Inc. 2010;

Course title:	**Algorithms and Complexity**
Lecturer(s):	prof. dr hab. inż. Wojciech Penczek dr Artur Niewiadomski
ECTS credits:	4
Course contents:	Computer algorithms: algorithm concept and properties, algorithm construction methods, block diagrams, data types, complexity of computational algorithms, types of time complexity, magnitudes, comparison and evaluation of complexity of algorithms. Basic data structures and types of algorithms, lists, stacks, queues. Graph representations, graph algorithms, graph searching, path finding, strongly connected components, spanning tree. Trees, binary trees, BST, AVL, RST, TRIE, PATRICIA, 2-3 trees, tournament trees, tree operations. NP-Hard and more complex problems, list of NP-complete problems, transformations between NP-complete problems, undecidable problems, heuristics for NP-complete problems. Sorting algorithms, sorting by inserting, selecting, bubble sorting, sorting by the Shell method, heap-sort, quick-sort, merge-sort, file sorting algorithms. Text-search algorithms, pattern matching. Recursive backtracking algorithms (8 queens puzzle, knight's tour problem, tower of Hanoi). Prerequisites: basic mathematical knowledge, basic programming skills
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	winter
Duration:	1 semester; lectures 30h, laboratory classes 30h
Textbooks:	1. A. V. Aho, J. E. Hopcroft , J. D. Ullman: The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974 2. A. V. Aho, J. E. Hopcroft , J. D. Ullman: Data Structures and Algorithms, Addison-Wesley, 1987 3. Ch. H. Papdimitriou: Computation Complexity, Addison-Wesley, 1994

Course title:	**Fundamentals of Computer Security**
Lecturer(s):	dr Piotr Świtalski
ECTS credits:	5
Course contents:	The main goals of this course are: 1. Introduction to area of the computer security. 2. Showing existing methods of the computer attacks. 3. Explaining the basics of the cryptography, authentication and digital signatures. 4. Introduction to the network security: firewalls, intrusion detection systems, web application security.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	winter
Duration:	1 semester; lectures 30h, laboratory classes 30h
Textbooks:	1. William Stallings, Cryptography and Network Security: Principles and Practice (7th Edition), Pearson, 2016. 2. Christof Paar, Jan Pelzl, Bart Preneel, Understanding Cryptography: A Textbook for Students and Practitioners, Springer, 2010.

Course title:	**Software Engineering**
Lecturer(s):	dr Jarosław Skaruz
ECTS credits:	5
Course contents:	Introduction to software engineering. Business processes analysis and use of BPM to model processes. Gathering functional and nonfunctional requirements. Analysis and design of information systems. Design patterns and some insights into effective Java programming. Developing an information system based on a project containing results of analysis phase and common diagrams of UML language.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	Winter
Duration:	1 semester; lectures 30h, laboratory classes 30h
Textbooks:	1. Software Engineering (10th Edition), Ian Sommerville, 2015 2. Software Engineering: A Practitioner's Approach 8th Edition, Roger Pressman and Bruce Maxim, 2015

Course title:	**Multimedia User Interfaces**
Lecturer(s):	Dr Anna Kołkowicz
ECTS credits:	2
Course contents:	The aim of the course is to present the methodology of creating a graphic and multimedia UI design, methods and tools for creating multimedia interfaces, as well as methods for assessing the usability. 1. **The role and evolution of user and human-computer communication**. Basic Concepts: User Interface, Multimedia User Interface, Mental User Model. History and evolution of UIs; 2. **Visual perception of images**. *Philosophy of vision.* Perception of color**.** Optical illusions and visual phenomena 3. **Perception of sounds.**. How do we hear? Speech Recognition. 4. **UI design principles**. Character psychology. Rules of perception. Ergonomic principles. Application of perception principles in interface design. **Design standards.** Norms: ISO 9126, ISO/IEC 25010, ISO 9241, 5. **User Interface Design** User Experience Design (UX design), User Oriented Design - User Centered Design (UCD), UI Design, Agile UX Methods 6. **Object oriented analysis and design of the Multimedia User Interface.** Techniques for detailed modeling of user activities. Task levels. Semantic level. Syntactic level; Interaction ***level*** 7. **Quality and Usability of UI.** Usability of UI. Nielsen Heuristics. Evaluation of graphical and multimedia interface quality. Tests. Questionnaires. Eye-tracking. Web-usability. 8. **Kansei-based user modeling methodology for user interfaces.** KANSEI ENGINEERING. KANSEI design methodology; 9. **Design and usability of voice interfaces.** Interactive creation of the system. Quality assessment of VUI; 10. **Tools and technologies for UI design.** The condition for participation in classes is to obtain a pass from the following subjects or knowledge of the appropriate literature: 1. Computer graphics and human-computer communication. 2. Software engineering.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester	Winter (Master's programme)
Duration:	1 semester; lectures 20h, laboratory classes 22h
Textbooks:	1. M. Kasperski, Anna Boguska-Torbicz Projektowanie stron WWW. Użyteczność w praktyce, Helion 2008, 2. J.Nielsen, Projektowanie funkcjonalnych serwisów internetowych, Helion 2003; 3. J. Tidwell Projektowanie interfejsów. Sprawdzone wzorce projektowe, Helion 2012;

Course title:	**Data Mining**
Lecturer(s):	Dr Anna Kołkowicz
ECTS credits:	3
Course contents:	1. Statistics and Data Mining in the analysis of data sets : Concept of data mining. Preparation data for analysis. 2. Statistical analysis: Measuring scales. Measures of central tendency, dispersion and association. Statistical hypothesis testing. 3. An introduction to multivariate analysis: Characterizing and displaying multivariate data. Graphical techniques for displaying multivariate data. Multivariate analysis of variance. Principal component analysis. Multivariate regression. 4. Knowledge discovery in databases: Data mining models. SEMMA methodology. Data preparation (sampling, transformation, outliers treatment, treatment of missing values). Exploratory data analysis. Techniques. Creating data mining models. Testing of the predictive validity of the model. 5. Discovering sequential patterns and rules: Measures of a rule's (support, confidence). Algorithm Apriori and FP-growth. Market basket analysis. Sequential pattern discovery 6. Classification methods: Assessment of classifier's quality. Naive Bayesian classifier. 7. Inductive Learning Algorithms: . Prediction modeling - Decision trees. Building and pruning of decision trees. Criteria for attribute/test selection. Application of decision trees. Advantages and disadvantages.. 8. Descriptive modeling - cluster analysis: Distance and similarity of multidimensional observations. Grouping algorithms. The k-medium method. Agglomeration methods 9. Use of artificial neural networks in the data mining process: Data preparation, construction and training of networks. Use of neural networks in time series analysis. Regression analysis using artificial neural networks. Self-organizing networks. 10. Analysis of Unstructured Data: Information retrival, Text Mining, Web Mining, Image analysis. The condition for participation in classes is to obtain a pass from the following subjects beforehand: • 1. Knowledge of probabilistic methods and statistics. • 2. Knowledge and skills in the field of databases • 3. Knowledge in the field of artificial intelligence. or knowledge of the literature in these subjects.

Language:	Lectures: English and Polish; Laboratory classes: English
Semester	Winter (Master's programme)
Duration:	1 semester; lectures 20h, laboratory classes 24h
Textbooks:	1. D.Hand, H.Mannila, P.Smyth, "Eksploracja danych", WNT, 2005. 2. Daniel T.Larose, "Metody i modele eksploracji danych", PWN, Warszawa 2008 3. T.Morzy, Eksploracja danych. Metody i algorytmy., PWN, 2013 4. Daniel T.Larose, "Odkrywanie wiedzy z danych. Wprowadzenie do eksploracji danych", PWN, Warszawa 2006

Course title:	**Integrated Information Systems Design**
Lecturer(s):	Dr Marek Pilski
ECTS credits:	3
Course contents:	1. **Information and decision aspects of IT management systems.** The essence of information. The role of information resources in the enterprise. Information and decision processes (OODA loop). Information and decision making. Information system and IT system. 2. **The essence of information management systems**. Model of enterprise IT architecture. Models of system operation (Zachman grid, Index Boara, Garthner Group grid) IT systems - classification criteria. Evolution and application of management information systems (TPS, MIS, ESS, EIS, DIS, DSS, BI, CIM, MSS, IMIS). Impact of management information systems on organizations. 3. **The use of information technology in organizational transformation management**. Five-phased model of IT application to business needs: single applications, internal integration, reorganization of business processes, reorganization of the business network, change of business activity. 4. **Scope and structure of the Integrated Information System**. Structure of an integrated IT system (functional, technical, organizational and spatial). Types of IT systems integration. Integrated management information systems: MRP (Material Requirments Planing), MRP II (Manufacturing Resource Planning), ERP (Enterprise Resource Planning), CRM (Customer Relationship Management). 5. **Basics of the methodology of designing integrated IT systems**. Scope and elements of information system design methodology. Classification of methodologies. Implementation of document management, Prototyping, Exploratory programming, Incremental implementation, Assembly of finished elements, Spiral model, Formal transformations, Modification of the traditional life cycle of the information system, IT system as a technical object. 6. **Planning of integrated IT systems**. Objectives and stages of strategic planning. Create a strategic plan for computerization. Methods and tools for planning information systems. Restructuring. Essential effects of strategic planning. 7. **Analysis and design of integrated IT systems**. Analysis of IT systems, objectives, principles and results. Design of information systems, design phases. Approach to analysis and design of information systems: structural, object, social - disadvantages, advantages, examples of application. 8. **Structural approach in the analysis and design of information systems**. Creating a structural model: modeling functions, data modeling,

	process modeling. Structural techniques in design and implementation. 9. Object-oriented approach in the analysis and design of information systems. The concept of "object" in the design of information systems. Creating an object model (identifying classes and objects, identifying relationships between classes and objects, identifying and defining fields, identifying and defining methods and messages). Object-oriented techniques in design. Analysis strategies and object-oriented design. 10. **Designing information systems in Oracle Designer.** Transformation of Entity Relationship Model to Database Project. Create a Database Project in Design Editor. Data Presentation Standards - Setting the column display properties for tables. Sequence design. Generate database from prepared project. Transform entity hierarchy to database design. Transformation of the function hierarchy model into the application module design. Acceptance of Candidate Modules. Management of module projects. Generating applications based on module design. 11. **IT system design in IBM Rational Software Modeler (RSM) and project documentation management in IBM Rational Requisite Pro (RRP).** Managing the project structure in RSM, using the use case model, creating component diagrams, packages, deployments. Design of real time systems. Managing design documentation in RRP, binding documentation requirements with IT system design elements. 12. OCL. Precise modeling of IT systems in UML. Defining constraints, imposing invariants on attributes, defining start and end conditions. Prerequisites: 1. Knowledge of issues related to the functioning of economic institutions and the problems of their management, in addition to principles and rules of software engineering and analysis and modeling of information systems 2. General knowledge of Oracle Designer and IBM Rational Software Modeler tools
Language:	Lectures: English and Polish; Laboratory classes: English
Semester	Winter (Master's programme)
Duration:	1 semester; lectures 20h, laboratory classes 24h
Textbooks:	1. Barczak. A., Florek J., Sydoruk T.: *Projektowanie zintegrowanych systemów informatycznych zarządzania*, Wyd. AP, Siedlce 2006 2. Płodzień J, Stemposz E.: *Analiza i projektowanie systemów informatycznych*, Wyd. PJWSTK, Warszawa 2003

Course title:	**Technologies and systems of computer security**
Lecturer(s):	dr Piotr Świtalski
ECTS credits:	3
Course contents:	**1.** Key management and their distribution. Distribution of keys using symmetric cryptography. Transparent key management. Decentralized key organization. Distribution of keys using asymmetric cryptography. Public key announcement. Public key certificates. X.509 standard. Public key infrastructure. **2.** User authentication. Mutual authentication. One-way authentication. Authenticate remote users using symmetric cryptography. Kerberos system. Authenticate remote users using asymmetric cryptography. **3.** Security of data transport. Threats to network security. Securing transmission over the World Wide Web. SSL architecture, cipher change subscription, alarm sub-protocol, welcome subprotocol. Transport Layer Security. HTTPS, Secure Shell (SSH). **4.** Security of electronic mail. PGP, cryptographic keys and key rings. S / MIME - functional elements, messages, processing of key certificates. DKIM architecture. **5.** Security of the IP protocol. Characteristics of the IPsec protocol. IPsec services. Transport mode and tunnel mode. Security policy according to IPsec. ESP protocol. A combination of security associations. Internet key exchange (IKE). **6.** Security of wireless networks. Wireless networks IEEE 802.11 - architecture and components. Security of IEEE 802.11 wireless networks. WAP protocol. RADIUS service. **7.** Telecommunications security part 1. GSM networks. GSM network architecture. Cell and area of invocation. Security model - SIM module. Authorization. Encryption of information in GSM. Attacks against A3 / A8 algorithms. Abuses in the GSM system. Fraud related to pre-paid services. **8.** Telecommunications security part 2. LTE standard - security concept. LTE architecture. LTE components. E-UTRAN and EPC protocols. Security mechanisms in LTE. LTE security concept. Security contexts. **9.** SELinux. The SELinux structure. Security models in SELinux. SELinux security policy - targered policy. The role of policy in the SO commissioning process. Security context. Rules. Domain transitions. An example of SELinux action. **10.** Security of mobile devices. Mobile devices. Threats and attacks on equipment. Application security. Malware on mobile devices. Security of mobile devices. Mobile devices management technologies. Security of the Android system. The structure of the

	Android system. Activity component and message exchange. Services - remote calling. ContentProvider component. BroadcastReceiver component. Android Package (APK). Sandpit. Security of the Dalvik virtual machine. Application access rights. The condition for participation in classes is to obtain a pass from the following subjects beforehand: • Basics of computer systems security, • Network technologies, • Operating Systems. or knowledge of the literature in these subjects.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	Winter (Master's programme)
Duration:	1 semester; lectures 20h, laboratory classes 24h
Textbooks:	1. Stallings W.: Cryptography and Network Security: Principles and Practice (7th Edition), Pearson, 2017. 2. Sesia S., Toufik I., Baker M.: LTE – The UMTS. Long Term Evolution. From Theory to Practice. Second Edition, Wiley, 2009. 3. Ferguson N., Schneier B., Kohno t.: Cryptography Engineering: Design Principles and Practical Applications, Wiley, 2010.

Course title:	**Data warehouses**
Lecturer(s):	prof. dr hab. inż. Andrzej Barczak
ECTS credits:	3
Course contents:	• **Concepts and Technologies part 1.** Operational and Analytical Data Systems – difference. Decision support system. Data Warehouse. Data Marts. Data access environment. Architecture. *Microsoft SQL Server work environment, ETL I I*;* • **Concepts and Technologies part 2.** Technical infrastructure. Source and target data. User Levels. Tool classes - MOLAP, ROLAP, HOLAP systems. Data integration. Synonyms, homonyms, analogies. Data Transformation. Data conversion tools. Software and hardware tools. Metadata. S***tar*** schema. Hierarchies, grains. *Database connection.. ETL II;* • **Architecture and infrastructure.** Data warehouse architecture. Extending the overall architecture of the data warehouse. Infrastructure vs architecture. Data Warehouse Entities. Typical applications. *Data Analysis Services: Data Creation and Modification;* • ***Life cycle* for a *DSS*.** Planning. Data requirements and modeling. Physical design and development of the database. Acquisition, integration and data mapping. loading data into the data warehouse. A***utomation of data loading*** Create an initial set of reports. Validation and testing of data. Running a warehouse. *Data Analysis Services - Unified Multidimensional Model;* • **Data warehouse design considerations. I**mportance of the preliminary design. Selection of the business area for the data warehouse. Key success factors for data warehouse implementation. Requirements and conditions for a successful data warehouse.*Data Analysis Services - Advanced Features, Scalability and Optimization;* • **Specification of data requirements.** Conversations with users. Tuning requirements. Creating a data model. Logical data model. *Analytical query language MDX I* • **Data Integration.** Data integration steps. Data Architecture. Metadata. Process of data integration. Data consolidation. The process of data consolidation. Additional analysis for data consolidation. Data conversion. Data Transfer Data Acquisition. *Analytical query language MDX II;* • ***Database Design for Data Warehouses*.** Decision support databases. Star schema. Types of star schema Aggregation. Denormalisation. Limitations of the star schema. *Analytical query language MDX III;* • **Data access.** Importance of data access..T***ypes*** of ***data access.*** User

	Levels. Data access characteristics. Tool classes.Management systems for multidimensional MDBMS databases. Advanced DSS tools. Layered architecture. Selection of tools for the company. **Metadata.** Metadata and change management. Metadata and data administration. Metadata Directory. Change management. Reality of metadata management in enterprises. Metadata for data integration. Metadata for data transformation. *Data Mining I;* • **Comparative analysis of data design tools.** Tool evaluation criteria. Product architecture and functionality . Performance and scalability. Interface availability and functionality. Presentation of the results System environment and administration.. *Data Mining II;* The condition for participation in classes is to obtain a pass from the following subjects beforehand: 1. Database 2. Database systems 3. Information management systems 4. Programming technologies - internet systems or knowledge of the literature in these subjects.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	Winter (Master's programme)
Duration:	1 semester; lectures 20h, laboratory classes 24h
Textbooks:	1. Poe V.: Tworzenie hurtowni danych. Wyd. WNT, Warszawa 2000 2. Todman Ch, Projektowanie Hurtowni Danych. Zarządzanie kontaktami z klientami (CRM), WNT, 2003 3. Andrzej Barczak, Michał Wolski, dat warehouse design based on UML language, w Studia Informatica, 1 (10) , Wyd. AP, Siedlce, 2008 4. Simon A.R., Shaffer S.L.: Hurtownie danych i systemy informacji gospodarczej. Zastosowanie w handlu elektronicznym. Wyd. Dom Wydawniczy ABC, Warszawa 2003 5. Jarke M., Lenzerini M., Vassiliou Y.: Hurtownie danych – podstawy organizacji i funkcjonowania. Wyd. Szkolne i Pedagogiczne, Warszawa 2003

Course title:	**Operational Research**
Lecturer(s):	DSc, PhD Krzysztof Szkatuła, prof. UPH
ECTS credits:	3
Course contents:	The goal is to acquaint students with the subject of Operational Research and its practical applications. **1. A mathematical model of the decision-making process.** Techniques of its construction. The concept of a decision problem. Model analysis methods. The concept of the objective function. **2. Optimization problems.** Linear programming, non-linear programming, dynamic programming, integer programming, multicriteria programming, scheduling tasks, problem. graph theory. Creating optimization models. Optimal solutions. **3. Computational complexity.** Calculation expenditure. Assessment in the sense of the asymptotic dominance of the calculation effort function. Computational complexity classes P and NP. **4. The simplex method for linear programming problems.** Mathematical justification of the simplex method. Modifications of the simplex method. **5. Selected methods of solving optimization problems.** Greedy algorithms. Branch and bound method. Evolutionary algorithms including genetic and other algorithms based on a similar philosophy. Artificial neural networks. Methods based on analogy to nature, e.g. ant colony algorithm, bee's algorithm, etc. **6. Basic concepts of the game theory.** Two and multi-player games. The prisoner's dilemma and other types of games. The relationship between game theory and decision problems. Nash equilibrium and other concepts. Prerequisites: Knowledge of mathematics on the level of the B.Sc. studies is required.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester	Winter (Master's programme)
Duration:	1 semester; lectures 15h, laboratory classes 18h
Textbooks:	1. Trzaskalik T., Wprowadzenie do badań operacyjnych z komputerem, Polskie Wydawnictwo Ekonomiczne, Warszawa, 2008. 2. Jędzejczyk Z., Kukuła K. (red.), Skrzypek J., Walkosz A., Badania operacyjne w przykładach i zadaniach, Wydawnictwo naukowe PWN, Wydanie 6, Warszawa, 2011. 3. Cormen T.H., Leiserson Ch.E., Rivest R.L., Stein C. Wprowadzenie do algorytmów, WNT, 2007. 4. Stanisław Walukiewicz, Programowanie dyskretne, PWN, 1986.

Spring semester

Course title:	**Database Systems Administration**
Lecturer(s):	prof. dr hab. inż. Andrzej Barczak
ECTS credits:	3
Course contents:	**1. Database Administrator.** Ways to communicate with a database. Types of database administrators. Database administrator tasks. Database management. Archiving and retrieval of databases. Database tuning. *Applications for administering the ORACLE database.. Users and roles*; **2.Database management. Management process. Technologies. Package management. Environmental management.** Management of database creation **3.Database monitoring.** Identifying problem. Purpose of monitoring. Design and implementation of a monitoring database. Monitoring of memory structures. *Monitoring of database state;* **4. Managing rollback segments.** ***Types*** of rollback segments. Usage of the rollback segment space. Monitoring of the rollback segment space usage. Using Oracle Enterprise Manager(OEM) to manage the rollback segments. Specifying list of rollback segments. OLTP (online transaction processing) applications. *Practical management of the rollback segments* **5.Database tuning.** Application design tuning. SQL tuning. Memory tuning and data memory tuning. Manipulation of tuning date. Tuning of physical and logical memory.Reducing network traffic. Performance Tuning Packages. *Managing tables spaces* **6. Database security management.** Types of security**.** Deploying security. Limiting available commands. ***Password Security and Encryption***. Observation of logs, actions and objects. Write protection. Securing in a distributed environment. *Job queu and inspection mechanisms* **7. Optimization of backup and recovery procedures.** Logical and physical backups. Export and Import. Backups of closed and open data files. *Standby database*. Integration of backup procedures. Recovery scenarios. *Database archiving* **8. Managing large databases.** Zarządzanie transakcjami. Transaction management. Backups. Tuning. Portable tablespace. Locally managed

	tablespaces. *Managing tables and indexes* **9. Administering a database on a network**. Connection descriptors. Listening processes, launching the listening server process. Controling listening server process. Host identification, database identification. Identification of services. Monitoring and identifying connection problems. *Event management* **10. Management of distributed databases**. Remote queries. Dynamic data replication. Distributed data management, distributed transactions management. Database domains, Communities database Tuning of distributed databases. Monitoring of distributed databases. Task management for distributed databases. *Database network layer management.* ***11. Configuration of the Client-Server architecture and the WWW environment.*** *Client-server architecture. Server configuration. Client configuration. Intermediate layer - application server. Overview of database system perspectives* The condition for participation in classes is to obtain a pass from the following subjects beforehand: • Database, Distributed databases, • Database systems, Operating Systems, or knowledge of the literature in these subjects.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	Spring (Master's programme)
Duration:	1 semester; lectures 20h, laboratory classes 24h
Textbooks:	1. Administrator's Guide, Administrator's Guide for Windows, Advanced Security Administrator's Guide, Advanced Replication, Application Developer's Guide - Fundamentals 2. 2. Andrzej Barczak, Dariusz Zacharczuk, Configure Oracle 10g server to work with the Multimedia with through the web interface. Studia Informatica (Siedlce).. - 2009, nr 2 (13), s. 41-48. 3. Andrzej Barczak, Dariusz Zacharczuk., Typowe problemy optymalizacji zapytań SQL przy tworzeniu średnich i dużych serwisów/aplikacji WWW. Studia Informatica.(Gliwice) - 2012, Vol. 33, no. 2B (106), s. 359-367. 4. Theriault M., Carmichael R., Viscusi J.: ORACLE DBA - administrowanie bazą danych. Wyd. RM, Warszawa 2001. 5. Loney K.: Oracle Database 10g; Kompendium administratora, Helion 2005

Course title:	**Advanced Programming**
Lecturer(s):	prof. dr hab. inż. Stanisław Ambroszkiewicz
ECTS credits:	5
Course contents:	The main goals of the course are: 1. Deepening knowledge about object-oriented programming and subjects like interfaces, generics, serialization and reflection. 2. Learn how to program in C# language on .NET Platform in Visual Studio IDE. 3. Exercise using C#-specific solutions, like delegates and LINQ. 4. Improving skills in developing different types of projects and applications, i.e. libraries, Web Forms and Web Applications based on MVC paradigm and Entity Framework.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	spring
Duration:	1 semester; lectures 30h, laboratory classes 45h
Textbooks:	1. Andrew Troelsen, Pro C# 2010 and the .NET 4 Platform, Apress 2009 2. Adam Freeman, Joseph C. Rattz, Jr., Pro LINQ: Language Integrated Query in C# 2010, Apress 2010

Course title:	**Fundamentals of Digital Techniques**
Lecturer(s):	dr Marek Siłuszyk
ECTS credits:	5
Course contents:	Introduction to Digital Techniques, based on the mathematical Boole algebra. Understanding of basic Digital Techniques, like, e.g., combination and sequence. Optimization problem of Boolean function. Karnaught's method and McQuine'a table. Multiplexers, demultiplexer and transcoder systems. Flip-flop and registers simulations Prerequisites: basic mathematical knowledge, basic programming skills
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	spring
Duration:	1 semester; lectures 15h, laboratory classes 30h
Textbooks:	**1.** S. Hassoun, T. Sasao, R. Brayton (ed.), *Logic Synthesis and Verification*, Kluwer Academic Publishers, 2002. **2.** T. Sasao, *Switching Theory for Logic Synthesis*, Kluwer Academic Publishers, 1999. **3.** Anand Kumar Fundamentals of Digital Circuits , PHI Dheli, 2014

Course title:	**Operating Systems**
Lecturer(s):	dr Piotr Świtalski
ECTS credits:	3
Course contents:	The main goals of this course are: 1. Introduction to operating systems. 2. Structures of the computer systems and operating systems. 3. Processes, processor allocation, synchronization. 4. Memory allocation, paging, segmentation, virtual memory. 5. Filesystems.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	spring
Duration:	1 semester; lectures 30h, laboratory classes 30h
Textbooks:	1. Silberschatz A., Galvin P. B., Gagne G.: Operating System Concepts 8th Edition, Wiley, 2009 2. Stallings W.: Operating Systems: Internals and Design Principles, Prentice Hall, 2011.

Course title:	**Computational and Numerical Methods in Science**
Lecturer(s):	dr Anna Wawrzyńczak-Szaban
ECTS credits:	**2**
Course contents:	**Concepts of mathematical scientific calculations**. Mathematical model of the process. The concept of an approximate solution to the problem. Stages of modelling **Errors in numerical calculations**. Relative and absolute error. Basic error sources. General form of error. Floating point numbering and operation errors on these numbers. Error Propagation. Types of MatLab language variables.. **Methods of approximate solution of algebraic equations.** Bisection method. Linear interpolation method. Convergence of numerical methods. Iteration method. Newton-Rapson method. Comparison of method convergence **Methods of numerical solution of systems of linear equations.** Gaussian elimination method. Lu decomposition. Crout's (Thomas) method. MatLab built-in functions for finding the roots of algebraic equations. Jakobi's iteration method. Gauss-Seidel's iteration method. **Interpolation and approximation of the set of experimental data.** Interpolation using polynomials. Lagrange interpolation pattern. Newton interpolation for equilateral nodes. Interpolation with polynomial polylines. Principles of selection of appropriate approximation function. Determine the accuracy of approximation. Linear Regression. Polynomial approximation. Matlab built-in functions. **Numerical methods of approximation of derivatives.** Taylor's pattern. Stirling's pattern. Central differences. Built-in MatLab functions for calculating functions derivatives. **Numerical methods of approximation of the values of integral equations.** Rectangle Pattern. Newton-Cotes's quadrature. Simpson's method. Built-in MatLab functions of integral calcius**.** **One-step methods of numerical solution of first-order ordinary differential equations.** Euler's method. Heun's method. Runge – Kutty's method. Runge-Kutta-Fehlberg's method. Prerequisites: An ability to solve algebraic equations, systems of linear equations and ordinary differential equations and knowledge of programming fundamentals.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester	Spring (Master's programme)
Duration:	1 semester; lectures 15h, laboratory classes 18h
Textbooks:	1. Krzyżanowski Piotr, Obliczenia inżynierskie i naukowe , PWN ,2016 2. Zenon Fortuna, Bohdan Macukow, Janusz Wąsowski , Metody numeryczne, PWN, Warszawa, 2017 3. B. Pańczyk,E. Łukasik,J. Sikora,T.Guziak Metody numeryczne w przykładach, Politechnika Lubelska, 2012

Course title:	**Modeling and Analysis of Information Systems**
Lecturer(s):	Dr Marek Pilski
ECTS credits:	3
Course contents:	**Modeling of enterprise information system and methods and techniques of information system modeling.** Definition of basic concepts such as model, modeling, information, system, information system, computer system. Model role, system analysis. Types of models, recipients and model users. Model description languages. Quality requirements document. Processes of model building. Approaches to analysis and modeling (structural, object, social). **Use of CASE tools in analysis and modeling**. Classification of CASE tools. CASE tools (architecture, tools, workflows) on Oracle Designer w and IBM Rational Software Modeler. Repository Role in System Modeling on Oracle Repository Examples - Workspaces, Containers, Application Systems, Repository Access, Private and Shared Workspaces, Versioning of Model Objects, Import / Export Projects. **Structural approach. Process modeling**. Objectives and methods of describing processes, process models, process modeling approaches, process components (organizational units, process steps, stores, flows and events), process decomposition, process modeling stages. Working with Process Model Editor: Oracle Designer Process Modeler - creating models, examples. **Structural approach. Modeling data requirements**. Entity relationships diagrams, diagram components: entities, attributes, relationships, domains, unique entity identifier. Special constructs of entity relationships, entity hierarchies. Strategies for constructing entity relationship models. Model of entity relationships in the software manufacturing process. Working with the entity relationship diagram editor: Oracle Designer Entity Relationship Diagrammer – modeling and examples. **Structural approach. Data flow modeling.** Purpose of data flow modeling. Model hierarchy, Data flow model components: Process, Data Flow, Store, Externals. Data flow modeling, context, diagram, zero level diagram. Working with the data flow model editor: Oracle Designer Dataflow Diagrammer – modeling and examples **Structural approach. Modeling hierarchy and function dependencies**. Purpose and methods of modeling enterprise functions and systems. Business and system features. Function hierarchies and rules for creating them. Manipulating the hierarchy of functions. Selection rules for automation. Define the usage: Function-Entity and Function-Attributes. Modeling of function dependencies. Components of function dependency diagram: dependencies, results, events, and exclusions. Function dependency verification, Requirements Descriptions Forms. Relationships, sequences of functions, information and legal relationships. Working with the entity relationship diagrams editor: Oracle Designer Function Hierarchy Diagrammer - creating models, getting automatic function hierarchies

	based on other models from the Repository, examples. **Analysis of IT systems models.** Purpose of model analysis. CRUD matrix, examples of other popular arrays. Working with the matrix diagram editor: Oracle Designer Matrix Diagrammer - creating a matrix. Overview of model analysis tasks. Analysis tools and techniques, use of models, quality assurance analysis. Using reporting tools. Working with reporting tool: Oracle Designer Repository Reports - create selected quality reports for model analysis. **Object-oriented approach. Modeling requirements in UML**. The essence of object-oriented approach in modeling IT systems. Taxonomy of UML diagrams. Modeling tools in an object-oriented approach: IBM Rational Software Modeler, learning the structure of a RUP project. **Object-oriented approach. Use case modeling and functional analysis**. Basic concepts: actor, use case, association, relationship. Working with IBM Rational Software Modeler - creating case models, model examples, and model analysis. Object-oriented approach. Construction of a static model of classes and dynamic behavior model. Identification of classes and objects. Identification of class and object relationships. Identification and definition of fields. Identification and definition of methods and messages. Analysis of scenarios. Modeling of state transitions. State, activity, and interaction diagrams - Creating and analyzing sample models in IBM Rational Software Modeler.
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	Spring (Master's programme)
Duration:	1 semester; lectures 20h, laboratory classes 22h
Textbooks:	1. Barker R. Longman, C.: *CASE* Method: modelowanie funkcji i procesów*, Wydawnictwa Naukowo-Techniczne, Warszawa 2001 2. Dąbrowski W., Stasiak A., Wolski M.: *Modelowanie systemów informatycznych w języku UML 2.1 w praktyce*, PWN, Warszawa 2007

Course title:	**Computer Science Applications I**
Lecturer(s):	Prof. Asc. Dr Hab.Eng. Jerzy Tchórzewski Prof. dr hab. Mikołaj Trusz
ECTS credits:	3
Course contents:	**1.** Introduction to robotics, robot generations, mobile robots, humanoid robots, etc. development of industrial manipulators and robots, flexible production systems and uninhabited factories, rolling machines, **2.** Flexible manufacturing systems, robot modeling and control, robotics rights, degrees of freedom, assembly of systems, flexible stations and processing systems, flexible production systems, computer integration of manufacturing, computer aided machine manufacturing. **3.** Supporting control and management in the power industry, evolution of the power system in Poland, problems of the future of the power industry, development of IT systems in the fields of transmission, access and processing, smart matering, smart grid, etc. **4.** Supporting the management of large systems, Real-time system modeling, Simulation of threats and breakdowns, Expert systems, artificial neural networks and evolutionary algorithms in control and management systems, cluster analysis algorithms, etc. **5.** Intelligent car, machine, system, transhipment port (sea, air, road, etc.), Brake assistance, Other systems supporting system operation, etc. **6.** IT banking systems, stages of development of banking IT, features of banking systems, classification of banking systems, Operational systems oriented on: accounting, products, customer, Architecture of banking IT systems. **7.** IT systems in taxation (tax and customs), stages of development of tax information technology, characteristics of tax systems, eDeklaracje, POLTAX, POLTAX 2B, CELINA, etc. **8.** Computer-aided processes, Ways of computer-aided, Environment types: CAD, CAM, CAE, CAQ, etc., Intelligent systems in supporting human departments. **9.** Computer methods of identification, modeling, simulation, etc., Identification, modeling and simulation in the MATLABA and Simulink environment, Identification, modeling and simulation in the Simulink environment, Identification, modeling and simulation in other IT environments (SPHINX, SAS, SAP, etc.). **10.** Uninhabited factories, from manipulators and robots to uninhabited factories, Examples of modern uninhabited factories, Model of the power system as a deserted factory, nano- and quantum IT systems, an outline of nanoscience and information molecular nanotechnologies. **11.** Other applications of computer science, eg in the army, in astronomy, space, medicine, etc.
Language:	Lectures: English and Polish; Laboratory classes: English

Semester (winter or spring)	Spring (Master's programme)
Duration:	1 semester; lectures 22h, laboratory classes 20h
Textbooks:	1. Pratap R., MATLAB for scientists and engineers (in Polish), PWN, Warsaw 2015. 2. Serafin E., Krawczyk G., Information systems in power engineering (in Polish), publ. UTH, ed. III, Radom 2015. 3. Sewerwajn M., Wiśniewska J., Quantum information technology. Selected circuits and algorithms (in Polish), PWN, Warsaw 2015. 4. Wierzchoń S.T., Kłopotek M.A., Algorithms of cluster analysis, Monograph Series No. 3, Institute of Computer Science, Polish Academy of Sciences, Warsaw 2015.

Course title:	**Multimedia and Object Data Base**
Lecturer(s):	dr Artur Niewiadomski, dr Piotr Świtalski
ECTS credits:	3
Course contents:	The main goals of the course are: 1. Deepening knowledge about different data models and their evolution over last decades. 2. Expanding knowledge and skills related to Oracle DBs. 3. To gain knowledge and skills in the area of object-, object-relational, and multimedia databases. 4. Introduction to NoSQL databases. Topics: **1. Introduction to the problem of data models, multimedia systems and object-oriented databases.** Basic definitions. Data models. Data models for multimedia databases. **2. Object-oriented standards of ODMG databases.** Objectives and scope of standardization. OMG object model. ODMG standard vs CORBA. **3. Objectivity in object-relational architecture.** Object types (specification, implementation). Declaring an object and initializing it. Object type components. Types of inheritance. **4. Operations on objects.** Access to attributes and methods. Invoking constructors. Creating column and row objects. Shared and nested objects. **5. Collections. Indexed tables.** Nested tables. Variable-sized arrays. Collection methods. **6. Triggers.** Functionalities, types, and firing order of triggers. Trigger manipulation. **7. Packages and LOBs.** Features and benefits of using packages in a database. Package declaration (specification, implementation). Specification of LOB types in the table schema. BFILE objects, directories, BFILE files in DML instructions. BFILE type manipulation policy - LOB DBMS package. **8. Storage and characterization of multimedia data.** Methods and structures of storage. Data presentation issues. Data characteristics: images, audio, video. **9. SQL / MM Standards, MPEG-7.** Origin and development of the SQL / MM standard. SQL / MM Data Types: FullText, Spatial, Still Image. Introduction to MPEG-7. Content-based image retrieval. **10. Introduction to NoSQL Databases.** Overview of the NoSQL base family. Key-value DBs. Database of documents. Column bases. Graph databases. **Selected NoSQL databases in practice.** MongoDB. Neo4J. Part of Master's programme. Prerequisites and additional course requirements: 1. Object-oriented programming 2. SQL and relational databases 3. Basics of Oracle DBs

Language:	Lectures: English and Polish; Laboratory classes: English
Semester	spring
Duration:	1 semester; lectures 20h, laboratory classes 24h
Textbooks:	1. C.S.R. Prabhu, Object – Oriented Database Systems : Approaches and Architectures, PHI pub., 2011 2. W. Rahayu, D.Taniar, and E. Pardede, Object-Oriented Oracle, IRM Press, 2005 3. B. Thuraisingham, Managing and Mining Multimedia Databases, CRC Press 2001 4. D. Sullivan, NoSQL for Mere Mortals, Addison-Wesley, 2015

MATHEMATICS

Winter semester

Course title:	**Mathematics in Life Insurance**
Lecturer(s):	dr Agnieszka Siluszyk
ECTS credits:	6
Course contents:	Introduction to modeling of the lifetime, the life table as a probabilistic model, a mortality "law", the basic model and more general models for the life insurances, life insurance products, single premium of insurance products, general aspects of the policy reserve, reserves and profits in a life insurance portfolio Prerequisites: Differential and Integral Calculus, Financial Mathematics, Probability Theory.
Language:	Lectures: English and Polish; Laboratory classes: English and Polish
Semester (winter or spring)	winter
Duration:	1 semester
Textbooks:	1. N.L.Bowers, H.U.Gerber, J.C.Hickman, D.A.Jones, C.J.Nesbitt, Actuarial Mathematics. The Society of Actuaries, Schaumburg, 1997. 2. A.Olivieri, E.Pitacco, Introduction to Insurance Mathematics. Technical and Financial Features of Risk Transfers, Second Edition, Springer, 2015. 3. E.J.Vaughan, T.Vaughan, Fundamentals of Risk and Insurance, Wiley, New York, 2008

Course title:	**Topology in ZF**
Lecturer(s):	Dr hab. Eliza Wajch
ECTS credits:	3
Course contents:	Introduction to modern foundations of mathematics based on Zermelo-Fraenkel system of axioms ZF. Introduction to general topology in ZF. Differences between topologies in ZF and in ZFC. Topological equivalents of the axiom of choice. Independence problems in topology based on ZF. Prerequisites: basic knowledge of mathematical logic and mathematical analysis.
Language:	English and Polish
Semester (winter or spring)	winter
Duration:	1 semester
Textbooks:	1. K. Kunen, The Foundations of Mathematics, College Publications, London 2009. 2. H. Herrlich, Axiom of Choice, Springer-Verlag, Berlin-Heidelberg 2006. 3. R. Engelking, General Topology, Heldermann, Berlin 1989.

Course title:	**Discrete Optimization**
Lecturer(s):	dr hab. Krzysztof Szkatuła, prof. UPH
ECTS credits:	3
Course contents:	The aim of the course is to present basic knowledge on discrete optimization problems and its solution methods. The topics covered will include different formulations of the discrete optimization problems among others: integer programming, binary problems, graph theory problems, scheduling problems and others. Different solution techniques and methods will be presented covering branch and bound approach, dynamical programming, greedy algorithms as well as various methods of local solution improvement including random searching methods (like Monte Carlo or simulated annealing), tabu search, evolutionary algorithms, e.g. genetic algorithms, neural networks based approaches and others. Solution methods will be classified as exact (always providing optimal solutions), approximate (providing solutions of the guaranteed quality), heuristic (providing solutions without any guarantee of the solution quality and in some cases even solution feasibility). Computational complexity of the algorithms and problems will be considered, including polynomial and exponential algorithms; complexity classes of the combinatorial optimization problems, notably *P* and *NP* classes and other important related classes, e.g. classes of the problems being *NP* hard or *NP* hard in the strong sense.
Lectures:	English and Polish; Laboratory: English and Polish
Semester (winter or spring)	winter
Duration:	1 semester
Textbooks:	1. M.R. Garey and D.S. Johnson. Computers and Intractability: A Guide to the Theory of NP-Completeness. Freeman, San Francisco, 1979. 2. G.L. Nemhauser and L.A. Wolsey. Integer and Combinatorial Optimization. John Wiley & Sons Inc., New York, 1988. 3. C.H. Papadimitriou and K. Steiglitz. Combinatorial Optimization: Algorithms and Complexity. Prentice-Hall, Englewood Cliffs, 1982, second edition, Dover, 1998. 4. C.H. Papadimitriou, Computational Complexity. Addison Wesley, 1994. 5. M.M. Sysło, N. Deo, and J.S. Kowalik. Discrete Optimization Algorithms . Prentice-Hall Inc., Englewood Cliffs, 1983.

Course title:	**Collective set theory**
Lecturer(s):	dr hab. Lidia Obojska, prof. UPH
ECTS credits:	3
Course contents:	The aim of the course is to present another model of set theory--in comparison to the classical ZFC set theory--called *mereology* or *collective set theory*. The topics covered will include formal systems, the methods of axiomatization, foundations of mathematics, set theory and formal logic. A formal model of standard mereology and three methods of its axiomatization will be presented. Next, different non-standard models of mereology obtained by negation of one of the axioms, will be introduced. The equivalence of such models with standard algebraic structures will be proved. Finally, the application of such models in different real phenomena of modern physics will be shown. During this course, the students will gain the knowledge how to build formal systems in an axiomatic way, and how to make proofs in the language of formal logic.
Lectures:	English and Polish;
Semester (winter or spring)	winter
Duration:	1 semester
Textbooks:	1. Stanisław Leśniewski: *Collected Works* - Volumes I and II, (Eds.) Surma, S.J., Srzednicki, J.J.T., Barnett, D.I., Rickey, Nijhoff International Philosophy Series, Springer, Netherlands 1992. 2. Stanisław Leśniewski, *O podstawach matematyki*, Przegląd Filozoficzny XXX (1927), 164-206, XXXI (1928), 261-291, XXXI (1929), 60-102, XXXII (1930), 77-105. 3. Andrzej Pietruszczak, *Metamereologia*, UMK, Toruń 2000. 4. Cezary Gorzka, *Mereologia a topologia i geometria bezpunktowa*, UMK, Toruń 2003. 3. Lidia Obojska, *U źródeł zbiorów kolektywnych. O mereologii nieantysymetrycznej*, UPH w Siedlcach, Siedlce 2014.

Spring semester

Course title:	**Non-Life Insurance**
Lecturer(s):	dr Agnieszka Siluszyk
ECTS credits:	6
Course contents:	Collective risk models: the basic model, models for the claim number process, i.e. the Poisson process, the mixed Poisson process. The total claim amount: classical premium calculation principles, an exact numerical procedure for calculating and approximation by using the central limit theorem, reinsurance treaties. Ruin theory: risk process, ruin probability and net profit condition. Prerequisites: Probability Theory, Mathematical Statistics
Language:	Lectures: English and Polish; Laboratory classes: English and Polish
Semester (winter or spring)	spring
Duration:	1 semester
Textbooks:	**1.** **T. Mikosch**, Non-Life Insurance Mathematics, An Introduction with the Poisson Process, Springer, 2009. **2.** R. Kaas, M. Goovaerts, J. Dhaene, M. Denuit, Modern Actuarial Risk Theory, Kluwer Academic Publishers, Dordrecht, 2001. **3.** N.L. Bowers, H.U. Gerber, J.C. Hickman, D.A. Jones and C.J. Nesbitt, **Actuarial Mathematics,** The Society of Actuaries, Schaumburg, 1997.

Course title:	**Bascic Statistics**
Lecturer(s):	dr Agnieszka Prusińska
ECTS credits:	3
Course contents:	Data and visualisation (measures of central tendency and dispersion, z-scores), Correlation and Regression, Probability, Probability distributions, Sample and Sampling, Confidence Intervals, Significance tests,
Language:	English
Semester (winter or spring)	Spring
Duration:	1 semester (30 h)
Textbooks:	Alan Agresti, Christine A. Franklin. „Statistics: The Art and Science of Learning From Data”

Course title:	**Partial Differential Equations**
Lecturer(s):	dr Agnieszka Gil-Świderska
ECTS credits:	6
Course contents:	Solution of First-order ODE's by Analytical and Numerical Methods; Characteristics and the Cauchy problem for linear PDEs of first order; Fourier Series; Diffusion and Heat Equations; Laplace and Poisson Equations; Wave Equations; Introduction to Green's Functions; Black-Scholes Equation Prerequisites: Calculus, Analysis and Ordinary differential equations
Language:	Lectures: English and Polish; Classes: English
Semester (winter or spring)	spring
Duration:	1 semester
Textbooks:	1. T. Mint – U, Partial Differential Equations of Mathematical Physics, North – Holland 1980 2. Peter V. O'Neil, Beginning Partial Differential Equations, John Wiley & Sons, 2008 3. H. Weinberger, A First Course in Partial Differential Equations with complex variables and transform methods, Dover Pub., 1995

Course title:	**Financial Mathematics**
Lecturer(s):	**dr Renata Modzelewska-Łagodzin**
ECTS credits:	7
Course contents:	Interest rates. Simple interest rates. Present value of a single future payment. Future value. Discount factors. Effective and nominal interest rates. Real and money interest rates. Compound interest rates. Compound interest functions. Loans. Generalized cashflow model. Net present value of a sequence of cash flow. Equation of value. Internal rate of return. Examples of cashflow patterns and their present values. Basic financial functions in Excel. Applications. Prerequisites: basic mathematical knowledge
Language:	Lectures: English and Polish; Laboratory classes: English
Semester (winter or spring)	**spring**
Duration:	1 semester
Textbooks:	1. Kevin J. Hastings, Introduction to Financial Mathematics, Taylor and Francis Group, 2016 2. Ahmad Nazri Wahidudin, Financial Mathematics and its Applications, 2011 Ahmad Nazri Wahidudin, Ph. D & Ventus Publishing ApS, ISBN 978-87-7681-928-6

Course title:	**Deterministic Chaos**
Lecturer(s):	dr hab. Lidia Obojska, prof. UPH
ECTS credits:	3
Course contents:	The aim of the course is to present chaotic dynamic systems and their relation to fractals. The topics of the presented course will include: nonlinear dynamic systems, stable points, bifurcations, attractors, the global analysis of chaotic systems (Lyapunov exponents, power spectrum, invariant measure, autocorrelation function, reconstruction of phase space). We will examine some physical phenomena and see how to extract dynamics from experimental data. Later on during the course, some basic knowledge on fractals, in particular on Julia and Mandelbrot sets, will be given. During the course, the students will gain the knowledge how to discern chaotic systems from stochastic systems, how to calculate fractal dimension, and what is the relationship between chaotic dynamics and fractal geometry.
Lectures:	English and Polish;
Semester (winter or spring)	spring
Duration:	1 semester
Textbooks:	1. H. G. Schuster, *Chaos Deterministyczny*, PWN 1990. 2. S. Wiggins, *Introduction to Applied Nonlinear Dynamical Systems and Chaos.* (Eds.) F. John J.E. Marsden L., Sirovich L., Golubitsky M., Jager W., Springer Science+Business Media, New York 1990. 3. M. Schroeder, *Fractals, Chaos, Power Laws. Minutes from an Infinite Paradise*, Dover Publications Inc., New York 1991. 4. J. Kudrewicz, *Fraktale i chaos,* WNT 2007.