

**COURSES**  
**OFFERED TO INTERNATIONAL STUDENTS**  
**in English**  
**ACADEMIC YEAR 2023/2024**

**FALL SEMESTER**

| <b>Course Name</b>  | <b>Code</b>   | <b>ECTS</b> |
|---|---------------|-------------|
| <b>MANAGEMENT UNDERGRADUATE STUDIES</b>                     |               |             |
| IT Tools*   | ICT_1_007.300 | 3           |
| Fundamentals of Economics*                                  | ECO_1_004.300 | 6           |
| Fundamentals of Management*                                 | BUS_1_012.300 | 6           |
| Introduction to Psychology*                                 | PSY_1_022.300 | 6           |
| College Mathematics*  | MAT_1_009.300 | 6           |
| Interpersonal Communication                                 | GEN_1_018.300 | 3           |
| Critical and Creative Thinking                              | GEN_1_019.300 | 3           |
| Fundamentals of Marketing                                   | MKT_1_004.300 | 6           |
| Fundamentals of Law   | GEN_1_020.300 | 6           |
| Financial Accounting  | ACC_1_001.300 | 6           |
| Spreadsheet Applications (Business analyst)                 | ICT_1_017.300 | 6           |
| Marketing Research  | MKT_1_001.300 | 6           |
| IT Systems  | ICT_1_013.300 | 6           |
| Organizational Behavior                                     | BUS_1_017.300 | 6           |
| <b>MANAGEMENT GRADUATE STUDIES</b>                          |               |             |
| Data Analysis and Inferential Statistics                    | MAT_2_008.301 | 6           |
| Concepts of Management                                      | BUS_2_005.300 | 6           |
| Macroeconomics  | ECO_2_003.300 | 6           |
| Entrepreneurship  | BUS_2_014.300 | 6           |
| Managerial Accounting                                       | ACC_2_003.300 | 6           |
| Commercial Law  | GEN_2_022.300 | 3           |
| Economic Analysis   | FIN_2_001.300 | 6           |
| Leadership  | BUS_2_027.301 | 6           |
| Financial Markets   | FIN_2_007.300 | 6           |
| <b>COMPUTER SCIENCE UNDERGRADUATE (ENGINEERING) STUDIES</b> |               |             |
| Critical and Creative Thinking                              | GEN_1_019.300 | 3           |
| IT Tools*   | ICT_1_007.300 | 3           |
| Introduction to Computing                                   | ICT_1_016.300 | 7           |
| College Mathematics*  | MAT_1_009.300 | 6           |
| Introduction to Programming                                 | PRG_1_020.301 | 7           |
| Computer Graphics   | GRS_1_003.300 | 6           |
| Software Engineering Fundamentals                           | PRG_1_003.300 | 6           |

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|--|---------------|---|---|
| JAVA Programming   | PRG_1_012.300 | 7 |   |
| Database Applications  | ICT_1_010.300 | 6 |   |
| Operating Systems  | ICT_1_015.300 | 6 |   |
| Computer Organization and Architecture                                     | ICT_1_008.300 | 3 |   |
| Physics  | MAT_1_001.300 | 3 | 3 |
| Fundamentals of Electronic and Digital Technology                          | ICT_1_009.300 | 3 |   |
| Computer Networks  | ICT_1_012.300 | 6 |   |
| IT Systems   | ICT_1_013.300 | 6 |   |
| Personal data administration (Cybersecurity analyst)                       | NET_1_003.300 | 6 |   |
| Cryptography (Cybersecurity analyst)                                       | NET_1_007.300 | 6 |   |
| Desktop App Programming for Business<br>(Business Application Programming) | PRG_1_005.301 | 6 |   |
| PHP Programming<br>(Business Application Programming)                      | PRG_1_013.301 | 6 |   |
| Advanced Games Programming (game developer)                                | PRG_1_021.301 | 6 |   |
| 3D Modeling and Visualization (game developer)                             | GRS_1_004.300 | 6 |   |

## COURSES DESCRIPTIONS

### Management

#### MANAGEMENT UNDERGRADUATE STUDIES

##### **ICT\_1\_007.300 IT Tools**

The course "IT Tools" introduces to the students wide range of topics connected to computer systems and Internet. The use of office applications (especially MS Office package) and web site building are covered. The goal of the course is introducing basic understanding of computers.

1. Introduction to issues related to the operation of modern computer systems.
2. The CloudA system.
3. Support for office packages (text editor, spreadsheet).
4. Creating multimedia presentations.
5. Application of spreadsheets.
6. Use of Google surveys and forms.
7. Useful aspects of the Windows operating system.

##### **ECO\_1\_004.300 Fundamentals of economics**

Modern economies are characterized by a large share of the state in various spheres of economic life. The multitude of mutual interactions between the public and private sectors in economic life makes it necessary to understand the principles governing the public sector in the practice of enterprise management. The aim of the course is to familiarize the student with the basic principles governing the production of goods and services and their distribution. Theoretical knowledge conveyed in the content of the subject, is based on the current situation in Poland and on the data on the economies of other countries (primarily the members of the European Union).

1. Introduction to economics.
2. The essence of the market.
3. The circular flow of goods and income in the economy and national accounts
4. The role of the state in the economy, introduction to public finances
5. Economic cycles, inflation and unemployment. The role of the central bank.

### **BUS\_1\_012.300 Fundamentals of Management**

The aim of this course is to provide students with knowledge of the basic concepts of management theory and practice. The course provides students with an opportunity to enhance understanding of management's role in today's organizations. Throughout the course students will analyze case studies of successful business organizations and their management practices. By the end of the course students will be able to comprehend, analyze and evaluate the basic principles of managing organizations.

1. The concept of organization
2. Management and management - definition, essence, process
3. The evolution of work organization and management
4. Management as a decision-making process
5. Basic principles, methods and functions of management
6. Fundamentals of strategic management
7. Leadership as a specific way of managing people
8. Model of a modern manager

### **PSY\_1\_022.300 Introduction to Psychology**

Psychology is an empirical science that investigates the mechanisms and laws that govern human behavior and its interactions with the environment. The course aims to present the most important concepts, theories, methods and problems of psychology as science.

The student must be able to:

- Describe and recognize the concepts of psychology.
  - Define the basic contents of psychology.
  - Use correctly psychological terminology.
  - Describe the main processes studied by psychology.
  - Define and recognize the main approaches applied in psychological research.
  - Describe the areas of research and application of psychology.
1. Introduction to Psychology.
  2. Learning.
  3. Development.
  4. Sensation and Perception.
  5. Memory.
  6. Thinking, Language, and Intelligence.
  7. Motivation and Emotion.
  8. Personality.
  9. Health Psychology: Stress, Coping, and Well-Being.
  10. Psychological Disorders.
  11. Social Psychology.

### **MAT\_1\_009.300 College Mathematics**

Mathematical proficiency in elementary functions, differential calculus, integration, and linear algebra is essential for successful application of many quantitative techniques in economics and management. The objective of this course is to help students acquire the mathematical skills they will need while taking courses in micro and macroeconomics, econometrics, finance, operations management, quantitative methods, etc. Because for many first-year students obtaining a sufficient mathematical competence is a challenge, a special effort will be made to make this course as practical as possible without the loss of the essentials of the mathematical theory.

1. Introductory Topics
2. Matrix and Vector Algebra
3. Systems of Linear Equations
4. Functions of One Variable; Properties of Functions
5. Differentiation of Single-Variable Functions
6. Single-Variable Optimization.

### **GEN\_1\_018.300 Interpersonal Communication**

Interpersonal communication is the basis of interpersonal relations. Each social situation implies a process of transmitting and receiving various information. It is a psychological process by which information is exchanged between individuals. The basic concept in this process is communication competence, which is necessary for full functioning in private, professional and social life. It allows you to fulfill traditional communication functions, i.e. informational (talking about the world), expressive (revealing yourself), impressive (influencing others), fatal (making contact), meta-linguistic (explanatory), and poetic (related to the aesthetics of the language). In the face of globalization changes, it also goes beyond these standard functions, meeting modern phenomena. Hence its role in the new space, in processes such as: empowerment, building participatory democracy, generating elusive capital, digital apartheid. It is also important today in various market conditions (negotiations, promotional policy, etc.). The course reviews communication theories, types, forms and methods of communication, and also presents examples of selected communication behaviors.

1. The concept of interpersonal communication: basic components of the communication process, features of this process, types and forms of communication.
2. Interpersonal communication and cultural and civilization changes in the contemporary world. Consequences for communication in the space of interpersonal relations.
3. Communication functions. Impressive function and its value in achieving the communication effect. The rules and techniques of influencing others, used in the space of communication. Characteristics of selected manipulative, persuasive, eristic, and rhetorical techniques. Techniques of assertive behavior.
4. Verbal communication. Linguistic means and the efficiency and effectiveness of communication. Selection of funds according to the communication partner. Emotionalization and axiologization of linguistic behavior in the communication process.
5. Non-verbal communication. Characteristics of communication gestures. Apart from words - the role of the body in achieving the communicative effect.
6. Barriers in the communication process and ways of overcoming them. Factors hindering the communication process. Body language in breaking communication barriers.
7. Ethics in communication. Savoir-vivre rules regulating correct communication.
8. Exemplification of communication behaviors: diagnosis of the situation, analysis, evaluation in terms of effective communication, eg analysis of communication behavior of public persons; negotiations; own participation in the space of private and public discourse; communication in commercial space.
9. Communication on the Internet. Professional text creation for the Internet.
10. Correct forms of interpersonal communication; which should facilitate the performance of professional roles and proper social functioning - summary.

### **GEN\_1\_019.300 Critical and Creative Thinking**

Various errors of thinking (irrationality) that are expressions of various prejudices. Overview of methods of critical thinking that are meant to protect us from errors of judgment. Overview of various heuristic methods that may be used individually or by teams, during properly managed group sessions.

Being a modern professional (e.g. a scientist, consultant, official or entrepreneur) means that you must both be aware of the philosophical foundation of the empirical approaches used, as well as be able to apply various quantitative methods to the analysis of phenomena. The approach to these issues will be typical of practitioners, not of philosophers or logicians: we avoid philosophical jargon and try to get around without the formalism of logic. The human mind functions according to different methods, because it must deal with unpredictability of events in life. In some situations it is possible to rely on algorithms, and in other situations heuristic methods are effective, based on approximate judgments, incomplete information about the problem to be solved, lack of time for analysis and complexity of the problem (the so-called bounded rationality). Creative thinking can be based on heuristic methods. This course discusses a number of heuristic methods used in both individual and group work.

1. Logic and logical fallacies.
2. Heuristic methods and creativity
3. Superstitions
4. Review of psychological experiments related to cognition
5. Constructive criticism: problem solving

### **MKT\_1\_004.300 Fundamentals of Marketing**

This course introduces students to the fundamental principles and operations of marketing. Marketing system and marketing functions are studied in the context of company management. Course includes an in-depth analysis of the strategic role played by marketing in contemporary business, from marketing research to targeting the consumers and the formation of marketing mix which would properly respond to the changes in marketing environment.

1. The essence and meaning of marketing
2. Organization environment
3. Orientations for the functioning of enterprises on the market
4. Marketing tools
5. Marketing mix concepts
6. Buyer and consumer on the market, purchasing process
7. Market segmentation
8. Positioning the offer
9. Marketing communication
10. Marketing analysis
11. Marketing information system
12. Internal marketing

### **GEN\_1\_020.300 Fundamentals of Law**

This course will provide students with a comprehensive overview of legal principles, legal history, and a variety of issues which relate to the application of law, for example, address the contrast between law and morality. A strong accent will be placed on the political, social, and cultural contexts in which law exists (Legal Studies).

This introductory course is catered to students with limited experience in law and provides a preliminary grounding in the basics. At the end of this course, the students will exhibit an understanding of legal terminology and concepts, including, but not limited to, the differences between legal systems and problems in the interpretation of the law.

1. Legal history and philosophy
2. The Legislative process
3. The Functions and Limits of Law
4. Rule of Law
5. Law and Politics

### **ACC\_1\_001.300 Financial Accounting**

The lectures and exercises present the aspects of theoretical and practical basis of accounting. Their knowledge is essential to understand the mechanisms of financial accounting, which is a fundamental issue of the course. Financial accounting is presented as a practical tool for recording economic events, accounts of various activities, in particular production, trade and services and the source of information outside the company.

1. Accounting functions and principles
2. Legal, Polish and international regulations
3. Financial reports: balance sheet, profit and loss account, cash flow
4. Principles of keeping the books of accounts
5. Records of individual components of the balance sheet
6. Principles of determining the financial result.

### **ICT\_1\_017.300 Spreadsheet Applications**

The aim of this course is to show the capabilities of spreadsheet software and teach the techniques needed to use it efficiently. Common applications of spreadsheets will be discussed. Laboratory classes will give the students hands-on experience with Microsoft Excel.

1. Ability to design spreadsheets for modeling business and financial problems.
  - Structure of a spreadsheet. Moving around. Data types. Formatting.
  - Formulas: Creating formulas. Operators.
  - Copying and moving data. Addressing modes.
  - Logical expressions. Conditional formatting.
2. Ability to use mathematical, statistical, and financial functions in a spreadsheet.
  - Functions: Definitions. Using the function wizard.
  - Survey of math, trig, and stat functions.
3. Ability to analyze data with the aid of built-in spreadsheet tools.
  - Lists: Sorting. Filtering. Grouping.
  - Data analysis. Scenarios. Solver.
4. Ability to present data in a visually appealing way.
  - Charts: Using the chart wizard.
  - Fine-tuning.

### **MKT\_1\_001.300 Marketing Research**

Market analysis and marketing research help make good and right decisions. The course prepares students to conduct market analyzes and marketing research. Students acquire skills in an effective and efficient planning and implementation of marketing research.

The cognitive aim of the course is to acquaint the market as the object of marketing research, methodological foundations and source base of research and transfer of knowledge of procedures for the design and implementation of marketing research. The aim of the application is to develop design skills, marketing research, collection, analysis and interpretation of the results of research and use of information in decision-making. Furthermore, the objective is the development of students' attitudes " marketing -oriented."

1. Introduction to marketing research.
2. Marketing research process.
3. Getting data.
4. Data analysis.
5. Communicating the results.

### **ICT\_1\_013.300 IT Systems**

The course will familiarize students with the problem of applying information technologies in business management. It presents computerization issues by showing its objectives, conditions and accompanying threats. Seminars are designed to give practical contact with specific IT systems supporting management and enable understanding of how they work.

1. Basic concepts (data, information, information processing, business object).
2. Information systems (structure, functions, typology).
3. Conditions and organization of computerization.
4. Acquiring an IT system.
5. Implementation of the IT system.
6. Operation of the IT system.
7. Information systems in enterprises and various types of institutions.
8. Information systems not directly related to business operations.
9. Dangers of computerization.
10. The legal context of computerization.
11. IT projects and their implementation. Project phases and models of software systems construction.

12. IT system design.
13. Implementation and testing of the IT system.
14. Further development of the IT system.

### **BUS\_1\_017.300 Organizational Behavior**

Emphasis is placed on pointing to cooperation, diversity management and innovativeness as the ultimate goals of any organization's activity. The study of theories of organizational behavior is aimed at developing these three issues.

1. Individual-level: assessment of personality - multiple approaches. Personality evaluation - a version of the MBTI approach; dominant's approach to problem solving; locus of control; Entrepreneurial spirit; Machiavellian intelligence. Organizational politics. Successful vs efficient managers.
2. Cooperation. The problem of cooperation among egoists: the Prisoner's Dilemma and Axelrod's solution. Putnam's social capital and networks. How to promote cooperation among workers and among organizations. Conditions for cooperation.
3. Diversity in the workplace. Managing cooperation vs managing diversity (of gender, race, nationality). Managing conflicts resulting from ethnic and gender diversity. Nature vs nurture and training of skills.
4. Team level: types of teams, team roles. Team dynamics and sociometrics. Tuckman's stages of team development. Team roles: various approaches and Belbin's approach. Traditional groups vs self-managed teams. Sociometrics.
5. Leadership. Job-centered and employee-centered leadership styles. Mintzberg's managerial roles. Increasing employee-centered behaviors. Goleman's 6 styles. Leadership styles: autocratic, consultative, participative, laissez faire. Vroom's prescriptive theory of leadership: analysis of cases. Managerial style and Hofstede's dimensions of culture: class activity.
6. Motivation. Creativity-stimulation approaches and group methods of generating creative solutions.

## **MANAGEMENT GRADUATE STUDIES**

### **MAT\_2\_008.301 Data Analysis and Inferential Statistics**

The course provides students with an overview of statistical inference and its many applications. The course will cover a variety of subject areas including discrete and continuous probability distributions, sampling distributions, confidence intervals and hypothesis testing for population means and proportions, tests of goodness of fit and independence, and linear regression and correlation. The discussion and development of each technique will be presented in an application setting, with the statistical results providing insights to decisions and solutions to problems. For each topic, the course provides step-by-step instructions on how to use Excel functions to conduct statistical analysis.

1. Descriptive statistics
2. Statistical tests.
3. Analysis of indexes and time series.
4. Data presentation

### **BUS\_2\_005.300 Concepts of Management**

This course is a response to the changing conditions of the enterprises in a market economy, which is becoming a knowledge-based and innovation economy. Such an understanding of the economy fundamentally differs from the "traditional" industrial economy, which has focused its attention on capital, labor, energy and raw materials. Currently, the so-called knowledge society emphasizes the importance of intellectual capital and intangible resources, describing them as quasi-factors of production, where knowledge and its utilization plays a key role. Useful and challenging to copy

knowledge is seen as a key element of the company's competitive advantage. Hence it becomes important to diagnose the process of its acquisition, localization, transfer, and use in the enterprise. Therefore, the theme of the course is focused on the intangible aspects of the operation of enterprises, e.g., the concept of knowledge management, intellectual capital management, methods of its assessment and valuation, innovation management, project management, and a concept of network management.

1. Benchmarking
2. Outsourcing
3. Lean Management
4. Business Process Reengineering
5. Human-oriented management concepts
6. Knowledge-oriented management concepts
7. Learning organization
8. Virtual organization

### **ECO\_2\_003.300 Macroeconomics**

Macroeconomics is the science of the economy as a whole. The subject of economics on a macro scale are issues related mainly to the wealth of countries, its division and dynamics, money, inflation, unemployment, and the role of foreign trade. These issues in the era of global economy, changes in the system of economic "powers", migration and debt crisis seem to be of particular interest to society.

The subject of Macroeconomics has been designed in such a way as to teach the recipient to understand macroeconomic categories, to describe and interpret selected macroeconomic phenomena and their impact on business management. The relevant College of Business - National-Louis University - a free-market, individualistic approach to economics (based on the "Austrian" and "Chicago" schools) is clearly visible.

The level of proficiency corresponds to master's level courses (MA, MSc or MBA). Normative issues are subject to discussion in the context of the economy illustrated by macroeconomic models.

The course is based on one of the most recommended textbooks in the world and current data on the economy of Poland, the EU and leading world economies.

1. Introduction. The measurement of economic activity (National Accounts, synthetic indicators).
2. Analysis of the economy in the long run. Money market.
3. Analysis of the economy in the short term. The adaptation process.
4. Development policy and stabilization policy (contemporary trends of economic policy, the analysis of monetary and fiscal policies).
5. Selected problems in the global economy: inflation, labor market, problems of the Euro zone.

### **BUS\_2\_014.300 Entrepreneurship**

Entrepreneurship as a competence applies to all spheres of life. It enables citizens to nurture their personal development, to actively contribute to social development, to enter the job market as employee or as self-employed, and to start-up or scale-up ventures which may have a cultural, social or commercial motive. Entrepreneurship can be understood as a transversal key competence applicable by individuals and groups, including existing organisations, across all spheres of life. It is defined as follows:

Entrepreneurship is when you act upon opportunities and ideas and transform them into value for others. The value that is created can be financial, cultural, or social. This definition focuses on value creation, no matter what type of value or context. It covers value creation in any domain and possible value chain. It refers to value creation in the private, public and third sectors and in any hybrid combination of the three. It thus embraces different types of entrepreneurship, including intrapreneurship, social entrepreneurship, green entrepreneurship and digital entrepreneurship.



The course covers both theoretical (based mainly on GEM conceptual model and The EntreComp conceptual model) and practical (business models, business plans, doing business in Europe) aspects of entrepreneurship.

1. The essence of entrepreneurship.
2. Selected legal and organizational forms of the enterprise.
3. Legal grounds for running a business.
4. Employment and remuneration of employees.
5. Procedure for establishing an enterprise.
6. Organization of the financial and accounting system.
7. Sources of financing.
8. Business plan - reasons for creating, functions and forms.
9. Discussing examples of entrepreneurship and entrepreneurs in Poland and in the world

### **ACC\_2\_003.300 Managerial Accounting**

This course will introduce the student to managerial accounting concepts and the use of those concepts in the evaluation of financial reports and other financial data. Issues addressed will include techniques to analyze and evaluate cost data for planning and control, inventory management and control, cost volume-profit analysis, revenue and profitability analysis, and quality control issues. A variety of managerial decision-making techniques will be used in the analysis and solving of managerial problems.

1. The essence of management accounting.
2. Cost classifications for different purposes.
3. Analysis of Break Even Point.
4. CVP analysis and sales mix.
5. Analysis of deviations and ways of their interpretation.
6. A static and flexible budget.
7. Short-term decisions.

### **GEN\_2\_022.300 Commercial Law**

The aim of the course is to provide students with the basic knowledge of relations, customs, norms and regulations in business environment. The impact of the course is laid on the law regulations with European Union and Poland. The students will get to know the principles how to set up business in EU or in Poland in terms of legal requirements of EU and Polish Commercial Law. The objective of the course is to provide an in-depth understanding of the nature of EU law and its inter-relationship with national legal systems.

1. General issues of commercial law.
2. Entrepreneur in commercial law.
3. Enterprise - the concept and definition, components of the enterprise.
4. Entrepreneurs in legal transactions.
5. Registration.
6. Partnerships.
7. Companies (corporations).
8. Societas europea.
9. Bankruptcy and restructuring

### **Economic Analysis (FIN\_2\_001.300)**

The aim of the course is to provide students with a wide range of instruments investigating a financial situation of a company, not only from an accounting point of view (financial statements) but also from an economic point of view. The presented methods and tools enable students to:

- evaluate the liquidity, profitability, solvency, capital structure, quality of asset management and risk of the enterprise,
- assess when a company operating under accounting conditions brings an economic loss by following the path of value destruction,
- estimate cost of capital,
- value a company and investigate symptoms of bankruptcy.

Topics:

1. The role and importance of financial analysis in an enterprise.
2. Methods (vertical, horizontal) and tools.
3. Financial statements.
4. Financial ratios (profitability, liquidity, efficiency, leverage).
5. Analysis of net working capital.
6. Analysis of the structure and cost of capital.
7. Measurement of the company's value.
8. Discriminant analysis.

### **BUS\_2\_027.301 Leadership**

This course provides students with a solid understanding of various concepts of leadership styles and organizational behavior. A special attention will be devoted to building competencies for creating trust and cooperation within organizations. Dynamics of teamwork and the role of team roles' diversity will be discussed and enriched with issues of gender and ethnic diversity in management. After completing this course, you will be able to: explain leadership concepts and its connection with organizational behavior; recognize strategies to successfully lead teams; integrate intercultural communication frameworks into cross-cultural connection and leadership issues; compare/contrast leadership capabilities; recognize the interplay of organizational culture and leadership styles.

Part 1

- Introduction to team management. Basic concepts.
- Differences between group and team.
- Basic principles of team functioning.
- Satisfying individual needs in teamwork.
- Team building - team roles.
- Team communication

Part 2

- The role of the team leader - leadership concepts.
- Team management - team life cycle, team results, overcoming problems in team work.
- Teams in the organization - the company's policy on teamwork, types of teams in the organization.
- Teams and the change process.

Part 3

- Developing creativity in teams.
- Decision making in teams.
- Pathologies in teamwork - group thinking, social idleness.
- Socialization of team members. Sociometric analysis.

### **FIN\_2\_007.300 Financial Markets**

Financial markets are a key element of a market economy and play an important role in allocating capital and managing investment portfolios. The aim of the course is to familiarize students with the basic categories of financial markets and their principles of functioning, as well as to provide

knowledge about the most important financial instruments and their risk in capital investment management. The aim of education is also to develop among students the ability to analyze and interpret phenomena occurring in financial markets, in particular bond and stock markets. The acquired skills may turn out to be useful especially in times of financial crisis. The principles of investing in the bond market along with risk measurement and construction of investment portfolios are discussed in the second part of the course. The management of stock and futures investments, on the other hand, are carried out in separate courses.

1. Characteristics of financial markets (essence and division, functions, segments, instruments).
2. The most important financial institutions and stock exchanges in Poland and in the world.
3. Money market (role in the economic and financial system, participants, instruments).
4. Capital market (legal regulations, participants, structure, importance of the capital market in the country's economy, valuation and cost of capital, risk, quantitative methods).
5. Investing in the bond market (valuation of bonds, rate of return to maturity, duration, yield curve, investment portfolio).

# Computer Science

## **GEN\_1\_019.300 Critical and Creative Thinking**

Various errors of thinking (irrationality) that are expressions of various prejudices. Overview of methods of critical thinking that are meant to protect us from errors of judgment. Overview of various heuristic methods that may be used individually or by teams, during properly managed group sessions.

Being a modern professional (e.g. a scientist, consultant, official or entrepreneur) means that you must both be aware of the philosophical foundation of the empirical approaches used, as well as be able to apply various quantitative methods to the analysis of phenomena. The approach to these issues will be typical of practitioners, not of philosophers or logicians: we avoid philosophical jargon and try to get around without the formalism of logic. The human mind functions according to different methods, because it must deal with unpredictability of events in life. In some situations it is possible to rely on algorithms, and in other situations heuristic methods are effective, based on approximate judgments, incomplete information about the problem to be solved, lack of time for analysis and complexity of the problem (the so-called bounded rationality). Creative thinking can be based on heuristic methods. This course discusses a number of heuristic methods used in both individual and group work.

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4. Review of psychological experiments related to cognition.
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2. The CloudA system.
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1. Introductory Topics
2. Matrix and Vector Algebra
3. Systems of Linear Equations
4. Functions of One Variable
5. Properties of Functions
6. Differentiation of Single-Variable Functions
7. Single-Variable Optimization.

### **ICT\_1\_016.300 Introduction to Computing**

This course is devoted to basic topics and fundamentals of computing. Main subjects: what the computing means, the concept of algorithm, notations, the concept of computational complexity, basic programming constructions, the logical structure of computers, hardware and software, basic data structures and algorithm design techniques. Students learn in practice how to design and implement basic data structures and algorithms.

1. Introduction: computer science, algorithms, development history. Algorithm and its notation: the concept of the algorithm and the language of its notation, programming languages, examples of simple algorithms. Basic concepts in programming: constant, variable, declaration, assignment instruction, conditional instruction.
2. Basic concepts in programming: unlimited and limited iteration.
3. Basic concepts in programming: iteration and array variables.
4. Basic concepts in programming: examples of algorithms on tables.
5. The concept of algorithm computational complexity. Notation O. The concept of decidability. Complexity classes.
6. The logical structure of the computer and the principle of its operation: binary and hexadecimal system, fractions, floating-point representation.
7. The logical structure of the computer and the principle of its operation: von Neumann machine, command cycle, assembler, example digital machine.
8. Computer hardware and software (hardware, software).
9. Program design process: specification, formal model, further refinements. Data structures: graphs.
10. Data structures: stack, queue, cyclic queue, set, dictionary.
11. Data structures: indicators, lists.
12. Data structures: operations on lists.
13. Data structures: trees, expression tree, binary trees, overview, search tree.
14. Advanced algorithmic techniques: recursion, exhaustive search (recurrence technique, sieve method), greedy technique.
15. Parallelism and concurrency.

### **PRG\_1\_020.301 Introduction to Programming**

The goal of the course is to master the basics of procedural and structural programming in C language. Introduction to Programming is the foundation course for learning more advanced object programming and object-oriented programming courses. When designing the course, it was assumed that students do not have basic knowledge about programming.

1. Basic structures of structured programming:
  - functions, recursion and its consequences for algorithm complexity
  - selected sorting algorithms.
2. Basics of procedural & structured programming:
  - conditional instructions
  - loops
  - functions, recursion
  - local and global variables,
  - heap - pointers and references
  - complex data structures: structs, arrays, lists.

### **GRS\_1\_003.300 Computer Graphics**

In the lecture part, the course gives theoretical foundations of selected fields of computer graphics, including the basis of perception, the theory of color and elements of aesthetics. At the same time, it introduces the history of computer graphics, its relationships with other fields. In addition, the course covers many aspects of usable computer graphics that use equipment, graphic file formats, and color application. The course also includes elementary theoretical aspects of creating graphics.

1. History of computer graphics.
2. Basics of perception.
3. Color spaces and models.
4. The practice of using colors.
5. Properties of raster and vector graphics.
6. Graphic file formats.
7. Equipment in computer graphics.
8. Graphics in brand creation and consolidation.
9. Graphic software: Photoshop, Gimp, Corel, Illustrator.

### **PRG\_1\_003.300 Software Engineering Fundamentals**

The course involves software development process, especially requirements analysis and system design phases. Functional requirements identification and specification methods are focused on use cases method. In a part of system design an UML (Unified Modeling Language) language is introduced. Its terminology, basic elements and most important diagrams modeling static and dynamic aspects of system are presented and practiced. The course prepares also to use of CASE (Computer Aided Software Engineering) tools.

- Genesis, objectives and tasks of Software Engineering
- Software quality characteristics
- Models of software development lifecycle
- Good practices in software development
- Requirements analysis and specification
- Use cases
- Relationships between use cases, use case diagram
- Software designing, goals
- Features and structure of UML - review
- Object analysis fundamentals
- A class designing in UML, modelling of class set
- A review of main UML classifiers
- Interfaces, their role and modelling, realization relationship
- Relationships between classes in UML, class diagram
- Activity diagram, elements and usage
- Instance modelling, objects diagram
- Interaction modelling, sequence diagram and cooperation diagram
- State machine diagram, basic elements and an usage
- Software testing and validation
- Evolution and maintainance of a software, basic issues
- Software designing using selected CASE tool

### **PRG\_1\_012.300 JAVA Programming**

The course covers the principles of object-oriented programming on the example of Java. Concepts of Java class, object, inheritance, abstract classes, interfaces, and data collections are presented during the course. The aim of the course is to master the practical skills of object oriented programming in Java.

- Basics of the Java language
- Java: operators and statements
- Java: packages
- Java: classes and objects

- Java: Inheritance & Polymorphism
- Interfaces
- NetBeans environment.

### **ICT\_1\_010.300 Database Application**

The course enables understanding of collecting, presenting and searching data in database systems, mainly based on the relational model. The use of nonrelational database systems ("NoSQL") is also discussed. The lecture includes relational database design (relationship entity model, database schema design, relationship normalization) and their implementation in server systems on the example of Microsoft SQL Server. An important part of the course is devoted to SQL and transaction processing. In addition, basic administrative tasks in database systems are discussed, including backup strategies and disaster recovery as well as the basics of query optimization and indexes.

1. Introduction, basic concepts, examples of databases, architecture of database systems.
2. Basics of relational database systems.
3. SQL language.
4. Designing relational database schemas.
5. Database programming.
6. Transactions.
7. Physical structure of databases. Input and output subsystems.
8. Basic administrative tasks. Backup and disaster recovery.
9. Indexes.
10. Query processing.
11. NoSQL databases.
12. Repetition, summary. Exam overview.

### **ICT\_1\_015.300 Operating Systems**

The course covers problems related to the construction and functioning of operating systems.

1. Basic concepts such as process, concurrency, multi-programming, virtual machine, virtual memory. The main functions of the operating system are considered, i.e. resource management (processors, memory, file system, input / output devices, program resources) as well as system functions seen from the user's perspective. Particular attention was paid to Unix / Linux: shell, filesystem, batch processing and system programming. The course also discusses the problems of cooperation between processes and the mechanisms of their synchronization and communication.
2. Automatization the use of the operating system using shell scripts:
  - Creating shell scripts.
  - Filters and pipelines.
3. Programming using the functions of the operating system kernel:
  - System functions for handling the file system.
  - System functions for handling processes.
  - System functions for handling communication and process synchronization.
4. Using popular operating systems as an user:
  - File system support.
  - Process and pipe support.
5. Using popular operating systems for configuration and basic administration:
  - Creating shell scripts.
  - Installation and basic configuration of typical operating systems.
  - Elementary administrative tasks.
6. Principles of construction and operation of operating systems:
  - Basic concepts, including the history of operating systems development, examples of systems and their characteristic features and functions of the operating system.
  - The structure of the operating system.
  - Process and thread concept.
  - Process management, time sharing.
  - Memory management, virtual memory.
  - Input-output, file system.

### **ICT\_1\_008.300 Computer Organization and Architecture**

The subject allows you to learn about the ideas underlying all computer systems and their impact on the correctness, efficiency, and usability of application software. The ultimate goal, then, is to create better programs. The subject includes: representing information, assembler, debugger, memory hierarchy, virtual memory, input-output subsystem.

#### Lectures

1. Basic types of architectures and related concepts.
2. Problems in the implementation of the flow and superscalar architecture; methods of solving them and the resulting microprocessor subsystems.
3. Characteristics of the architecture of selected contemporary processors used in stationary, mobile devices and supercomputers.
4. Communication between processor, memory and input / output devices.
5. Characteristics of the architecture of selected desktop computers and mobile devices.
6. Modern operating memories / basic static and dynamic parameters.
7. Bus types and their parameters.
8. Benchmarks.
9. Characteristics of single-chip microcomputers and their purpose.

#### Exercises

1. Analysis of the speed of fixed- and floating-point operations.
2. Analysis of the instruction cycle and the instruction pipeline in one core of a single and multi-core processor.
3. Communication with memory and with input / output devices and interrupt handling.
4. Analysis of the operation of selected instructions and sample programs in the assembly language of the selected processor.
5. Creating example programs in assembly language with the use of conditional statements and loops.
6. Control system software for an exemplary task (eg, controlling traffic lights at an intersection, handling elevator call requests, etc.)

### **MAT\_1\_002.300 Physics**

As part of the course, students will learn the basics of classical physics and elements of modern physics at the general academic level in the scope allowing to better understand the physical foundations of computer hardware. In particular, students learn about the elements of classical mechanics, electromagnetism, optics, and selected issues of modern physics and materials physics. The course is largely based on the materials available on the OCW MIT (MIT Open courseware). In the practical part of the course, students solve specific physical problems in the form of tasks and perform a simple computer simulation of a physical phenomenon.

1. Mechanics of a material point and a rigid body: kinematics, dynamics, conservation rules in mechanics.
2. Vibrations and waves.
3. Electromagnetism: electric field, current, magnetic field, induction.
4. Electromagnetic waves, geometric and wave optics.
5. Elements of quantum physics.
6. Fundamentals of semiconductor physics.
7. Structure of an atom, nucleus, elementary particles.
8. Elements of solid-state physics and materials physics.

### **ICT\_1\_009.300 Fundamentals of Electronic and Digital Technology**

The subject of "The basics of electronics and digital technology" is a description of issues related to electronics, including the presentation of the construction and operation basic elements used in electronic circuits, both analog and digital. The following are given: description of systems used in modern analog electronics including operational amplifier, the most important layout of today's analog electronics. In the digital part are presented basic logical functors and a further description of all combinational and sequential circuits with particular emphasis on those used to build a complex system which is a computer. Also teaching how to properly measure electrical quantities.



The aim of the classes is to provide rules for the functioning of analog integrated circuits seen as an introduction to the understanding of subsequent parts of electronics, such as digital circuits, in turn which description of construction and operation is necessary for further learning about the construction of computer hardware.

1. Selected issues from the theory of circuits: Kirchoff's laws, generalized Ohm's law, binary and quadruple. Examples of binary connectors, passive components: resistors, capacitors, coils. Voltage divider as an often used example of the crossover.
2. Basic concepts in the field of electrical measuring. Introduction to semiconductor physics: construction and operation of a semiconductor connector, Characteristics of a semiconductor diode, diode systems, rectifying diodes, one-wave rectification, two-wave diodes. Examples of other diodes: Zener diodes, SCR, photodiodes - electric cells, LEDs, other. Bipolar transistors: structure and operation, configurations transistor operation: OC, OB, OE, Properties of amplifiers with transistors in various configurations Unipolar transistors: connector and MOS, basic operating configurations
3. Feedback theory: positive and negative feedback. Impact of negative feedback on the properties of amplifiers Operational amplifiers: definitions, basic configurations: inverting and non-inverting phase amplifier. System transfer characteristics, Examples of operational amplifier applications: adder, subtraction system, integrator, differential system, active filters. e.t.c.
4. 4Basic concepts in the field of digital systems, digital system parameters. Combination and sequential systems - introduction. Implementation techniques of digital circuits - TTL and MOS systems. Basic properties of Boolean algebra. Logic gates, truth tables. Implementation of complex logic functions and project minimization. Karnaugh grids. Flip-flops: types, classifications and basic parameters, Counters: division, types, classifications and basic parameters, ways to create a meter for any n, examples of implementation, reversing counters. Definition of micro-operations. Code converters, Multiplexers and demultiplexers Registers: parallel and shifting, Half adders, adders, comparators, multipliers, arithmetic and logic units. FSM finite state machines

### **ICT\_1\_012.300 Computer Networks**

Students learn how computer networks work. The course covers: the stack of protocols TCP/IP (IPv4 and IPv6, addressing rules, ARP, TCP, UDP, ICMP, IGMP), routing protocols, basic rules how to design and configure Local Area Networks, including the configuration of routers and switches, WiFi networks, basics of network security (encryption methods, digital signatures, secure protocols).

1. ABC of computer networks.
2. Basic concepts: processes that run in a computer network when programs communicate between each other via a network (example: a web browser and a web server).
3. ARP protocol.
4. Encapsulation of PDU's.
5. IPv4.
6. ICMP.
7. IPv4 addressing rules: classful and classless addressing.
8. Static Routing.
9. Default and floating routes.
10. Dynamic Routing - basic concepts.
11. Routing protocols RIP, IGRP. Routing protocols EIGRP, OSPF.
12. TCP and UDP. Spanning Tree Protocol. VLANs.
13. Basics of asymmetric and symmetric encryption methods.
14. Digital signatures.
15. Secure protocols (basics): SSL/TLS, IPsec.
16. IPv6.
17. Wifi Networks.
18. WANs.

### **ICT\_1\_013.300 IT Systems**

The course will familiarize students with the problem of applying information technologies in business management. It presents computerization issues by showing its objectives, conditions and accompanying threats. Seminars are designed to give practical contact with specific IT systems supporting management and enable understanding of how they work.

1. Basic concepts (data, information, information processing, business object).
2. Information systems (structure, functions, typology).
3. Conditions and organization of computerization.
4. Acquiring an IT system.
5. Implementation of the IT system.
6. Operation of the IT system.
7. Information systems in enterprises and various types of institutions.
8. Information systems not directly related to business operations.
9. Dangers of computerization.
10. The legal context of computerization.
11. IT projects and their implementation. Project phases and models of software systems construction.
12. IT system design.
13. Implementation and testing of the IT system.
14. Further development of the IT system.

### **NET\_1\_003.300 Personal data administration**

The course covers all practical aspects of European data protection law and practice. The issues of personal data, including the principles of their processing, will be analyzed. During the course, the General Data Protection Regulation (GDPR) will be presented in detail, as well as the relevant decisions of the Court of Justice and the key guidelines of the European Data Protection Supervisor and other institutions.

1. Terminology and definitions.
2. Principles of data protection.
3. Accountability and transparency.
4. Justifications for data processing.
5. Personal data of the special category.
6. Rights of natural persons.
7. Data security.
8. Notification of security breaches.
9. Outsourcing.
10. The role of the data protection officer.
11. Data Protection Impact Assessment.
12. International Data Transfers.
13. Enforcement by supervisory authorities.

### **NET\_1\_007.300 Cryptography**

The course introduces you to contemporary cryptography and communication security. The presented content relates to the operation of cryptographic algorithms and protocols. The course covers the concepts of block ciphers and message authentication codes, public key encryption, digital signatures, and covers common examples and applications of schemes including AES, RSA-OAEP, and the digital signature algorithm. Using examples of practical solutions, the participant learns the design, implementation and evaluation of modern security solutions.

1. Basic concepts of cryptography and cryptanalysis. Cryptographic systems.
2. Theoretical foundations of cryptography. Security of the cryptographic system.
3. Selected algorithms of symmetric cryptography. DES / AES algorithm.
4. Selected algorithms of asymmetric cryptography. Electronic signature.
5. Hash functions and message authentication codes.
6. Public key infrastructure.
7. Selected applications of cryptography.

### **PRG\_1\_005.300 Desktop App Programming for Business**

Students learn the rules of creating business applications using Microsoft Visual Studio.

1. Designing business applications
2. Implementation of business applications
3. Advanced techniques of programming object-oriented business - database applications
4. Advanced Object-Oriented Programming Techniques in C #
5. Microsoft Visual Studio
6. Model View ViewModel (MVVM) pattern
7. Application example
8. Business scenarios
9. Error handling
10. Reports
11. Business application testing

### **PRG\_1\_013.300 PHP Programming**

The course is practical workshop of programming PHP application, with view tier in HTML and a little bit of Javascript. Students learn (by practical examples) elements of programming in mentioned technologies by making exercises and preparing a project – simple internet application using relational database.

The course has practical character, it practices programming skills and ability of software development. It teaches common techniques of usage HTML and PHP technologies in internet business applications development.

- preparing a local work environment for internet application development in Windows
- basics of PHP,
- PHP arrays
- working with HTML forms
- handling of files
- working with databases
- session and cookie
- basic DOM objects of Javascript, their properties and methods
- events handling by Javascript code
- tiered structure of internet applications

### **GRS\_1\_004.300 3D Modeling and Visualization**

The "3D modeling and visualization" course includes the practical use of tools for creating 3D graphics and visualization, and the basics of computer animation based on one of the most popular 3D graphics programs - 3DS Max. Strong emphasis will be placed on mastering the skills of creating / modeling objects and visualizations.

During the course, students learn about 3D graphics modeling and the basics of animation and rendering. In particular, the content of the classes includes:

1. 3ds Max - environment, interface.
2. Creating and editing basic objects, transformations.
3. Modeling basics, modifiers, modeling methods.
4. Materials, material editor.
5. Lighting models, stage lighting techniques.
6. Cameras, operation of cameras.
7. Types of textures, texturing.
8. Animations, basics of animation creation, types of animation.
9. Use of force fields.
10. Rendering methods and parameters.
11. Elements of post-production.

## **PRG\_1\_021.301 Advanced Games Programming**

The subject of the course is to familiarize students with the main graphic tools included in the Unreal Engine package and the basics of scripting with Blueprints. The main subsystems for operations with graphical resources, the processes of importing into the editor, and methods of configuring resources for optimal display will be presented and discussed in an overview. Scripting with

1. Introduction
  - a. What is Unreal Engine
  - b. Installation
  - c. Editor)
2. Models
  - a. Importing (i. Pivots ii. Vertex paint)
  - b. LOD - manual (\_LODX) vs automatic, generating (InstaLOD, Houdini)
  - c. Collisions - manual (\_UCX) vs automatic
  - d. Optimization issues: foliage, instancing, UV tricks, material tricks, culling, procedural merge
3. Materials
  - a. Shader types
  - b. Basic PBR textures( i. Albedo / Diffuse ii. Normal iii. Roughness / Metallic)
  - c. Transparency: Opacity vs Masked
  - d. Instances, parameters, parameter collections
  - e. Basic math: mixing, UV coordinates, correction
  - f. Use cases: displacement, vertex paint, landscape, translucent
  - g. Dumeny / Shading model
  - h. Optimization issues: instructions, platform limits, VAT, alembic
4. Light
  - a. Emitter types: Point, Spot, Directional, Skylight, Emmissive
  - b. Counting model: Static / Stationary / Movable
  - c. Baking vs dynamic
  - d. Lightmass: Importance Volume, Portals
  - e. Building lights - preview / production, basic configuration f. Realism - Volumetric, SSGI, RTX
5. VFX effects
  - a. The particle system (i. Types of emitters: Sprite, GPU, Mesh, Beam, Ribbon ii. Main Emitter Modules: Required, Spawn, Lifetime, Initial Size / Velocity, Initial Size, Color Over Life iii. Selected additional modules: Location, Rotation, Size, Orbit, Acceleration, Collision)
  - b. Fog
  - c. Reflections
  - d. Decals
  - e. Postprocess (i. Exposure ii. Chromatic Aberration / Vignette / Ambient Occlusion)
6. Blueprints
  - a. Variables and operators
  - b. Features
  - c. Basic engine objects
  - d. Interactions / collisions / object creation
7. Animations
  - a. Import - Skeletal Mesh / Skeleton / Physics Asset
  - b. Animation Blueprint - AnimGraph, EventGraph
  - c. Systems: Blend Space / Montage / Sequence / AimOffset
8. Sequencer
  - a. Basic tracking of cameras and objects
  - b. Rendering the sequence
9. Creating a build for Windows