



Unicorn College © 2012

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Unicorn College  
Course Syllabus  
English Version

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## 1. SUMMARY

1. Summary.....	3
2. BEN – Business Economics.....	6
2.1 Description of the Course.....	6
2.2 Lectures.....	6
3. BFM - Banking and Financial Markets.....	9
3.1 Description of the Course.....	9
3.2 Lectures.....	9
4. BIT - Business and ICT .....	11
4.1 Description of the Course.....	11
4.2 Lectures.....	11
5. MIE – MicroEconomics.....	13
5.1 Description of the Course.....	13
5.2 Lectures.....	13
6. EHT – Economic History and Theory.....	15
6.1 Description of the Course.....	15
7. MAE - Macroeconomics.....	16
8. FIA - Financial Accounting .....	18
8.1 Description of the Course.....	18
8.2 Lectures .....	18
9. HRM – Human Resources management.....	20
9.1 Description of the Course.....	20
9.2 Lectures.....	20
10. ITA - Introduction to Accounting .....	21
10.1 Description of the Course.....	21
10.2 Lectures.....	21
11. LA1 - Law I .....	22
11.1 Description of the Course .....	22
11.2 Lectures.....	22
12. LA2 - Law 2 .....	23
12.1 Description of the Course.....	23
12.2 Lectures.....	23
13. MAN – Management.....	25
13.1 Description of the Course.....	25
13.2 Lectures.....	25
14. MAC Managerial Accounting.....	27
14.1 Description of the Course.....	27
14.2 Lectures.....	27
15. MKT Marketing .....	28
15.1 Description of the Course .....	28
15.2 Lectures.....	28
16. OPM - Operations management.....	29
16.1 Description of the Course.....	29
16.2 Lectures.....	29
17. PSE - Psychology and Sociology Essentials .....	31
17.1 Description of the Course.....	31
17.2 Lectures.....	31
18. SME - Small and Medium Enterprises.....	32
18.1 Description of the Course.....	32
18.2 Lectures.....	32
19. TAX – Taxes.....	33
19.1 Description of the Course.....	33

19.2 Lectures.....	33
20. ALG - Essentials of Algorithm Design and Optimization .....	35
20.1 Description of the Course.....	35
20.2 Lectures.....	35
21. ASP – Development in ASP.NET.....	36
21.1 Description of the Course.....	36
21.2 Lectures.....	36
22. CAR - Computer Architecture.....	38
22.1 Description of the Course.....	38
22.2 Lectures.....	38
23. CIT - Company ICT .....	41
23.1 Description of the Course.....	41
23.2 Lectures.....	41
24. COL - Computer Literacy .....	43
24.1 Description of the Course.....	43
24.2 Lectures.....	43
25. CSP - Development in C# .....	44
25.1 Description of the Course.....	44
25.2 Lectures.....	44
26. IFS – ICT Infrastructure of IS.....	46
26.1 Description of the Course.....	46
26.2 Lectures.....	46
27. ISA - Introducing information system architectures .....	48
27.1 Description of the Course.....	48
27.2 Lectures .....	48
28. JEE - Development in Java EE .....	50
28.1 Description of the Course.....	50
28.2 Lectures.....	50
29. JSE - Development in Java SE .....	52
29.1 Description of the Course.....	52
29.2 Lectures.....	52
30. MA1 - Mathematical Methods 1 .....	54
30.1 Description of the Course.....	54
30.2 Lectures .....	54
31. MA2 - Mathematical Methods 2 .....	56
31.1 Description of the Course.....	56
31.2 Lectures.....	56
32. NOS - Computer Networks and Operating Systems .....	58
32.1 Description of the Course.....	58
32.2 Lectures.....	58
33. OAD - Object Oriented Analysis and Design of IS .....	60
33.1 Description of the Course.....	60
33.2 Lectures.....	60
34. ORA - Development and Administration of Oracle Database .....	62
34.1 Description of the Course.....	62
34.2 Lectures.....	62
35. RDB - Relational Databases Design .....	64
35.1 Description of the Course.....	64
35.2 Lectures.....	64
36. SDP - Software Development Processes .....	67
36.1 Description of the Course.....	67
36.2 Lectures.....	67
37. STA - Statistics .....	69
37.1 Description of the Course.....	69

37.2 Lectures.....	69
38. TST – SW Testing.....	71
38.1 Description of the Course.....	71
38.2 Lectures.....	71
39. WEB - Web Technologies .....	73
39.1 Description of the Course.....	73
39.2 Lectures.....	73
40. GAL - Graph Algorithms .....	75
40.1 Description of the Course.....	75
40.2 Lectures.....	75
41. WSO - Web Site Optimization .....	76
41.1 Description of the Course.....	76
41.2 Lectures.....	76

## 2. BEN – BUSINESS ECONOMICS

### 2.1 Description of the Course

To provide essential skills and create habits required to manage a business. To acquaint students with basic business economics categories and to teach them a synthetic view of the business, laying foundations for later specialized lessons.

### 2.2 Lectures

- **Business Essentials**

Business is an activity, which is done at ones own risk with the objective to maximize the profit. The elementary construction unit of the economy is a company, so the study of corporate functions, objectives and processes is important not only for the businessmen themselves, but it is the heart of the theoretical economics as well. This is the job of business economics, which creates and uses tools for assessment of corporate effectiveness, tolerable indebtedness, investment decisions etc.

- **Business Environment**

No company exists in a vacuum. It is surrounded with the external world, with its environment. By environment of a company we mean everything, which is beyond the border of the company's own socio-economic system and which the company comes into contact with, be it actively or passively. The company environment importantly affects the behaviour of the company and its parts. The environment usually affects the company more than the company affects the environment.

- **Company Efficiency, Basic Analysis**

A company produces goods or services that it subsequently offers at the market. The goal of any rational businessman is to produce the maximum volume of production with minimum costs. But how to achieve this optimum? How runs the production and what factors participate? How many workers should we hire if we want to produce certain volume of production under minimum costs? How will develop the costs and profit if we expand production and how we can assess if we produce efficiently? These issues are addressed in the next chapter.

- **Company goals and functions**

Profit is usually considered the key goal of a company and business. But this need not be always and under any circumstances. Some companies can have, for example, the goal to maximize their market share or to achieve high sales, particularly in short term. Concerning joint stock companies, the shareholders can care particularly for maximization of the shares market value and dividends. The goals of the managements and of the owners can differ sometimes, usually

shareholders in a profit making company push to get high dividends, but the management may be wants to reinvest undistributed profit. The key issue is always what goal the company should follow, what instruments and what approaches it will apply and how it will assess satisfaction of its goal.

A company has some goal, but besides it, it has also series of functions (activities) that participate in its satisfaction. A characteristic function of a company is production.

- **Typology of companies**

Typology companies deals with classification of companies according to certain attributes, which differ one company from another. The companies can be basically classified according to their legal form, line of business and their size. The type of company determines its capital structure and method of management, as seen in chapter 12.

- **Company Development**

When a company is established, it goes through the basic life phases, which are graphically illustrated in the figure below. Often a company does not go through all of the phases; the rational entrepreneur usually does his best to postpone the liquidation of the company as long as possible (while in some cases the liquidation is the only rational solution of the existing problems). Each phase in the life of a company has its specifics and different problems.

- **Company assets**

Every company has not only human resources, but also some property or assets. It has some buildings, machinery and equipment used for its activities, as well as money in the cash desk, purchased securities etc. This property is bought from some sources. Declaration of this property (balance sheet) is required by law as these documents serve for analysis of the situation of the company as needed by the managers, potential investors, creditors etc. The basic question to be answered when analyzing the property and resources of a company is, what property the company has and whether its structure and the structure of the sources is optimal. So we need to know, whether we should borrow more capital or how big is the value of the site, which we have been using for then years intensively.

- **Management and Organization structure**

Each company has certain organizational structure reflecting its size, line of business and the need for effectiveness. Although organization structures differ company from company, they share some attributes. All structures should comply with certain generally valid principles. Organization structure of a company is closely related to the system of management. The companies must decide, how to control the individual units within the company to achieve the desired objectives with the highest effectiveness. In other words, what organizational units the company should have, which should be subordinate or superior to which, or where the relation of equality or advisory function would serve better, which unit should have which responsibility and who is in charge of what.

- **Business activities**

The business includes a number of activities which must be planned and organized and we have already encountered some of them in Chapter 8. In this Chapter and Chapters 10 and 11, we will

deal with them in closer detail. This Chapter will focus on manufacturing and marketing within business. We will strive to provide some basic answers to questions such as how to plan manufacturing and marketing, how product sales usually progress in the market, or how to handle human resources as efficiently as possible.

- **Enterprise financing**

Enterprise financing is a sectional activity, which is reflected in all the other business activities; therefore we must take a closer look. Lack of available financial means may hinder the company's development, while their excess may indicate inefficient usage of money. Therefore it is necessary to plan, evaluate, and manage enterprise financing to ensure efficient working of the business and prevent e.g. excessive indebtedness, insolvency, etc.

- **Investment activities**

You may encounter the term investment(s) in media quite frequently and you must have encountered it in your study materials several times. You may say that virtually any business invests and those that do not will soon lose their competitiveness and die. What is an investment and what is its purpose? How do investments affect company's situation and when is an investment expedient? How to evaluate an investment and what to do when there are multiple investment variants? These are the questions which should be answered by this Chapter.

- **Specific businesses economy types**

The economy consists of a number of business entities, which are identical in some features while they differ in others. To understand the situation and future development of a business, it is good to know to which group/industry it belongs and what are the specifics of this group. E.g., if the demand for steel grows in China, it will probably affect the entire metallurgical industry, not just one or two companies. Similarly, if the central bank increases the required rate of reserves, this measure will affect all bank institutions in the economy. Another example is subsidies to small and medium-sized enterprises, which can be granted only to businesses with no more than 250 employees. The company's specific business type also greatly affects its business processes and particularly its asset structure and management.

## 3. BFM - BANKING AND FINANCIAL MARKETS

### 3.1 Description of the Course

Goal of the course is to provide students with complex knowledge about international financial markets interrelations. Course is designed to allow students understand key relationships from macroeconomic and microeconomic points of view. Attention is paid especially to explanation of balance of payments, exchange rate, inflation and interest, operation of FX market, exchange rate risk and methods of its management, international monetary system. Students are going to calculate many examples focusing on foreign exchange (hedging, arbitrage,...), central and commercial bank operations and financial market which are part of the course .

### 3.2 Lectures

- **Financial environment**

What is finance about – an overview. Financial system, definition of money and money functions. Policy implications.

- **Financial intermediaries**

Non-banking financial intermediaries. Commercial bank as a financial intermediary. Types of banks. Banking systems. Central and commercial bank balances and profit and loss statements. Bank risks.

- **Savings-investment process and financial assets**

What is saved can be invested. Saving rate, creation of saving. Saving and GDP. Types of financial assets, long term and short term assets.

- **Interest rates**

Interest and interest rate, future value of present money, present value of future money, nominal and real interest rate, yield curve

- **Time value of money**

Money discounting. Present value, net present value, future value. Investment evaluation.

- **Return and risk**

The higher risk the higher return. Return calculation.

- **Securities market**

Issuing securities. Function of investment banks. Investment banking regulations. Primary and secondary market. Securities transactions.

- **Short-term business financing**

Working capital strategies. Basic financing strategies. Financing strategy problems. Short term financing specifics, trade credit, commercial paper. True effective cost of trade credit.

- **International finance and trade**

International finance system development. Currency exchange markets, PPP (purchasing power parity), interest rate parity. International trade and instruments.

## 4. BIT - BUSINESS AND ICT

### 4.1 Description of the Course

The goal of the course is to provide students with information related to selected sectors of business. The course is composed so that within individual sectors students get general knowledge of basic / typical business activities of a sector and the use of ICT in a given sector. After completion of the course, students should know what business areas are solved e. g. in insurance, banking, energetics, and in what way ICT is used in a typical bank, insurance company, etc. We do not guarantee all the topics to be covered in particular semester.

### 4.2 Lectures

- **Banking**

To provide general knowledge of banking and products /services offered by a typical bank

- **Use of ICT in a typical bank**

To provide general knowledge of the use of ICT in a bank, to give examples of the use of ICT and examples of systems used by a bank and their purpose

- **Energetics**

To provide general knowledge of energetics and the ways of doing a business in energetics

- **Use of ICT in energetics**

To provide general knowledge of a typical use of ICT in energetics

- **Capital markets**

to provide general knowledge of the area of capital markets, what it means to be in business on capital markets / deal on the exchange

- **Use of ICT on a stock exchange**

To provide general knowledge of the role of ICT on a stock exchange

- **Insurance**

To provide general knowledge of insurance and products / services offered by a typical insurance company

- **Use of ICT in a typical insurance company**

To provide general knowledge of a typical use of ICT in an insurance company, to give examples of the use of ICT technology and examples of systems used by an insurance company and their purpose

- **Enterprise and use of ICT**

To provide general knowledge of the use of ICT in an enterprise

- **State administration and use of ICT**

To give general knowledge about the use of ICT and its specificity in the state administration

- **Telecommunications**

To give general knowledge of telecommunication business and products /services offered by a typical telecommunication provider

- **Use of ICT in a typical telco company / by a typical telco provider**

To provide general knowledge of a typical use of ICT in a telco company, to give examples of the use of ICT and and examples of systems used by a telecommunication operator

## 5. MIE – MICROECONOMICS

### 5.1 Description of the Course

The aim of the course is to provide students with basic overview in the area of economics, respectively microeconomics. Economics studies redistribution of scarce resources. Microeconomics focuses on individual economic subjects as households and firms and their interactions. When passing the course the students should understand elementary relationships and connections like equilibrium and disequilibrium on the goods and services market.

### 5.2 Lectures

- **Introduction to economics**

Subject of economics. Economic scarcity. Production factors. Returns on production factors. Production possibilities frontier. Searching for optimum or balance.

- **Consumer behavior and demand function on market for goods and services**

Utility and its measurement. Optimum of a consumer and demand given direct measurability of utility or given its non-measurability. Derivation of individual demand. Changes of demand. Elasticities.

- **Production**

Production factors in short and long runs. Returns variable input (short run production function). Return to scale (long run production function). Isoquant. Costs as a production inputs function - Isocost. Production optimization (focus on long run).

- **Costs and revenues**

Costs as a function of good production volume. Costs in short and long run. Behavior of a cost function dependent on production function characteristics. Profit function, characteristics of a profit function under perfect competition.

- **Profit under perfect competition**

Economic profit. Profit function. Profit maximization under perfect competition in short and long runs. Break-even point, shutdown point. Supply function derivation under perfect competition.

- **Balance on perfectly competitive market**

Market balance and its prerequisites, factors that form it. Market demand and supply. Consumer surplus, producer surplus. Market imbalance, its causes and impacts. Spiderweb model (converging and diverging markets).

- **Imperfect competition I.**

Imperfect competition (IC) characteristics. Causes of its existence. Common and different features of perfect and imperfect competition. Revenue function under IC (incl. demand and its elasticity). Profit maximization and supply function under IC. Inefficiency of IC.

- **Imperfect competition II – types**

Monopoly – causes of emergence, characteristics, price discrimination. Cartel and Oligopoly with dominant company. Monopolistic competition. Volume of production & price in comparison with other market structures. Comparison of perfect and imperfect competition types.

- **Profit as an incentive and alternative goals of company**

Types of companies. Big company behavior. Alternative goals of company. Comparison of company that maximizes profit with a company maximizing revenue.

- **Price formation on production factors markets**

Demand and supply of production factors. Revenue from total product and revenue from marginal product under PC and IC. Marginal costs of production factor. Determination of optimal volume of inputs.

- **Labor and Capital markets**

Labor market. Wage. Perfectly competitive labor market. Individual demand and supply of labor. Market demand for labor. Imperfectly competitive labor market. Capital market. Capital and capital goods. Supply and demand for capital. Capital market balance. Returns on capital. Return on capital

- **Income redistribution market failures, microeconomic policy of state**

Income and wealth, Income redistribution (Ginni coefficient). Market failures causes. Monopoly power. Externalities. Public goods. Asymmetric information. Forms and causes of microeconomic policy of a government. Government influence on market balance. Government failures.

## 6. EHT – ECONOMIC HISTORY AND THEORY

### 6.1 Description of the Course

The course is focused on the historic-economic issues. Students will learn basic knowledge about the development of the world economy and the development of economic thinking.

- **Ancient times and feudalism**

Specifics of economy development during the ancient times and medieval changes. Trade, Money, private property. Feudal system. Economic thinking in feudalism.

- **Transition period and industrialization**

Periods of social development and the birth of modern times. The establishment of capitalist economic system in Europe and the emergence of modern colonial system. Merkantilism, first financial pyramid, first industrial revolution. Classical economists – Adam Smith, David Ricardo, Thomas Malthus, Karl Marx.

- **Second industrial revolution**

Principle of organized capitalism. Structural changes and technical-scientific revolution. Changes in the rate of economic strength of powers and their economic development. The First World War.

- **Post industrial society**

New economic and political configuration of the world. Differences in economic and social development of Western democracies and authoritarian states. The Second World War and its impact on the economies of countries that fought.

## 7. MAE - MACROECONOMICS

In macroeconomic students will learn basic principles on which national and international economy works. Among the principles is economic power analysis calculated through GDP, multiplication effect, money market explanation, macroeconomic balance, trade balance, fiscal and monetary policy.

Goal of the course is to provide students with basic orientation in macroeconomic issues that a student can put in big picture with past and present economic problems.

- **Introduction to macroeconomics**

Basic information about the course and topics discussed. Macroeconomics importance explanation. Presentation of Czech Republic macroeconomic indicators values. Interrelationships between individual macroeconomic subjects. Clarification of channels through which a government may influence the economy..

- **Macroeconomic indicators, national accounts**

Gross domestic product indicator explanation. Methods of GDP value calculation. Price changes affects on GDP value. Importance of place of production for economic performance indicators. Comparison of individual countries in respect to economic performance. Factors influencing welfare of society.

- **Economic growth**

The basic factors of economic growth. Solow model, growth accounting. Growth barriers, convergence and conditional convergence.

- **Aggregate expenditures**

Presentation of basic economic model which depicts equilibrium product in a short run. Two sector economy where households and companies operate. Three sector economy with government and four sector economy with international trade.

- **International trade**

Balance of transactions between domestic and foreign economic subjects. Trade balance and its development. Foreign direct investment (FDI). External indebtedness issues. Basic theory of international trade. Free trade and protectionism.

- **Money – historical evolution of money**

Its importance. Options of money supply determination in an economy. Factors influencing demand for money. Balance of supply and demand for money. Influence of price level on money market.

- **Labour market and unemployment**

Economically active and inactive population. Rate of unemployment. Causes of unemployment. Potential product and unemployment. Negative impacts of unemployment. Government policy of employment.

- **Business cycles**

Business cycle and its phases. Main causes for business cycles. Political implications.

- **Fiscal policy**

Government and public budget. Different forms of fiscal policy. Tax duty and economic performance. Fiscal policy in an open economy. Actual data on budget and fiscal policy of the Czech Republic.

- **Monetary policy**

Monetary policy of a central bank. Relationship between money supply and inflation. Different monetary policies in the world. Monetary policy in an open economy.

## 8. FIA - FINANCIAL ACCOUNTING

### 8.1 Description of the Course

During Financial Accounting course students learn how to record more complex economic transactions and their implications, how to work with estimates and foreign currencies, how to measure individual items and how to present all of it. Students learn the fundamental differences between the Czech accounting legislation and international accounting rules.

### 8.2 Lectures

- **Manufacturing Margin**

This lecture deals with the issue of determining the gross profit of the manufacturing company. In order to get the right result, we need to determine the cost of finished goods and the relation between finished and sold goods.

- **Change in Inventory, Capitalization**

This lecture is a close follow up to the previous one. It expands on the issue of manufacturing by adding the question of adjustment to revenues or expenses.

- **Provisions**

In accounting, provisions are not associated – although it may seem so at first sight –with any money in reserve for “worse times”. In this lecture, you will learn that provisions are associated with a probable future adverse event whose cause exists in the present.

- **Investments I**

Nobody lends money for free. The amount paid for his or her service is called an interest. The question is when the interest is accounted for as revenue.

- **Investments II**

Investments are assets for which it is typical that they make money “on their own”. To make money with machinery or goods, one must work a lot before he gets something; however, investments work on their own: gold as well as property, plant and artworks increase in value.

- **Exchange Rate Differences**

In practice, it happens quite often that a company buys from foreign suppliers or sells to foreign customers. Therefore, a foreign currency is involved in these deals, which causes certain accounting differences.

- **Accounting and Taxes II**

What is the deferred tax? The answer is provided by the deferred tax calculation method, so called balance sheet liability method. There are more deferred tax calculation methods; however, these days only the one previously mentioned is used in the Czech Republic as well as all around the world.

- **Cash Flow II**

Even if you understand the statement of cash flows rather well, it is better not to fill the whole table in one go (in the examples used in this lecture, it is possible to prepare the statement of cash flows mentally, however, in practice, it is not recommended).

- **International Financial Reporting Standards**

Every country has its own (national) accounting rules. However, there is also a globally applicable accounting regulation that was created especially as a result of the development of global capital markets.

- **Construction Contract**

It is not always easy to determine when the revenue is earned and what amount to recognize. This concerns especially long-term contracts, i.e. activities performed longer than one accounting period.

- **Leasing**

A lease is a form of financing an entity's assets. If an entity does not have enough money, it can – on the basis of a contractual agreement with a leasing company – lease the asset for a specified period of time.

- **Audit, Accounting theory**

Who checks if companies comply with the regulations?

## 9. HRM – HUMAN RESOURCES MANAGEMENT

### 9.1 Description of the Course

The objective of this course is to provide students with elementary theoretical knowledge of human resources management and to exercise some practical skills during the lessons.

### 9.2 Lectures

- **Human resources management**

Human resources management and its role in a company. Connection between personal management and human resources management. Strategic human resources management.

- **Recruitment and financial rewards**

What is the purpose of recruitment and how to do recruitment efficiently. HR management and planning. Career anchors. Types of contracts.

- **Motivation and Communication**

Motivating individuals, motivating groups. Maslow pyramid of needs. McClelland's basic needs. Herzberg's motivation factors. Goal theory, Expectancy theory.

- **Learning and development corporate cultures**

Learning organization development, employee development. Learning, training, education.

## 10. ITA - INTRODUCTION TO ACCOUNTING

### 10.1 Description of the Course

In this course you will learn about the process and use of accounting. You will also learn how the accounts work and how to prepare financial statements (balance sheet, income statement) and how to work with them.

### 10.2 Lectures

- **Introduction to accounting**

Explain what accounting is. Identify the users and uses of accounting. Explain generally accepted accounting principles and the cost principle. Explain the monetary unit assumption and the economic entity assumption. State the accounting equation, and define assets, liabilities, and stockholders' equity. Analyze the effects of business transactions on the accounting equation. Understand the four financial statements and how they are prepared.

- **Preparing Adjusting Entries and Completing the Accounting Cycle**

Analyze the effects of business transactions on the accounting equation. Understand the balance sheet and how it is prepared => check the illustrative examples of CFS.

- **Financial statements in greater depth**

Recording process, adjusting the accounts, income statement, balance sheet, cash flow statement. Case studies and examples.

- **Accounting for Inventories, Cash and Receivables, and Liabilities**

Inventories remain in the business for a time shorter than one year. The business purchases it rather frequently and sells it in a final form. It is important to properly value inventories upon acquisition and upon decrease (sale), but also to properly report the inventory value in the time between. Receivables are a part of company assets. But what happens when you find out their economic potential will not be fulfilled? The accounting must be able to cope with a situation when a receivable is not transformed into money. Company liabilities include a number of various debts which mostly differ in the creditor. However, there is a special debt (liability): provisions. Receivables and provisions have something in common: in certain situations, estimates are necessary.

## 11. LA1 - LAW I

### 11.1 Description of the Course

During this course students should gain basic understanding of the role of law in the market economy and knowledge of legal institutions of both domestic and European law. It introduces students the problem of human rights and includes introduction into various legal sectors. The aim is to acquaint students with the basic knowledge of the theory of state and law, legal principles and formation of legal relationships. The course should also define domestic and European sources of law. Basic principles of Community law.

### 11.2 Lectures

- **Law - the concept, importance, classification**

Explanation of basic concepts and principles of law, introduction into the normative systems, explanation of basic subjective rights and obligations and their enforceability.

- **Private and public law, types of legal cultures**

Explanation of differences between private and public law, substantive and process. Features and differences of continental, Anglo-American and Islamic legal system.

- **Sources of law**

What are the differences between the normative legal acts and other sources of law. How the process of adopting laws works in the Czech Republic.

- **Law application, interpretation of legal norms**

What is the application of law, the types and stages. The merits and its detection. Decision on the merits as a result of the application. Constitutive and declaratory law act. Interpretation of law and its methods.

## 12. LA2 - LAW 2

### 12.1 Description of the Course

During this course students should gain a basic understanding on the role of law in a market economy, basic principles of specific industries. It introduces students the relationship between commercial and civil law, basic principles of individual and collective labor law with the basics of criminal law. The aim of the course is the mastery of knowledge about basic commercial law institutes, its establishment and development, relationship between civil and commercial law and its basic sources. The course should also define the basics of employment law and regulation of commercial and its criminal law aspects.

### 12.2 Lectures

- **Civil law - System and principles, civil facts , representation, property rights, liability for damage and unjustified enrichment**

Explanation of the basic principles and concepts of civil law, basics of the responsibility and the consequences of its breaking.

- **Civil law - Family law, inheritance**

Explanation of family law and its internal relations and claims that arise from family relationships. The second part of the lecture is devoted to the issue of inheritance.

- **Civil law, commercial law – Obligation law (contracts) – comparison**

This lecture deals with the adjustment of contracts in general and also with the specific contract types.

- **Commercial Law - Basic concepts, corporations and cooperative**

Characteristic of the concept of commercial law, focusing on different types of corporations and their specifics.

- **Commercial Law - Specific obligations of foreign persons in the business, trade obligations, bankruptcy law (insolvency)**

In this lecture students will be introduced the differences between foreign business persons and the relations in the international trade. The final part of the lecture is devoted to the issue of insolvency and bankruptcy.

- **Trade law, basics of copyright law**

Characteristics of legislation through which the State provides natural and legal persons the equal right to run specifically defined activities while keeping the pre-defined conditions.

- **Process civil law, arbitration procedure**

The court process in which the rights and obligations of citizens and legal persons from the civil, commercial, family and labor law are decided. The end of the lecture will be devoted to the possibilities of law enforcement and arbitration procedure.

- **Labor law and social security law**

Adjustment of labor relations that arise during the performance of dependent work (personal work) between the employee and the employer, acquitting with demands and obligations that arise from the social security law.

- **Protection of competition, protection of consumers, protection of industrial property rights**

Competition as a part of the ongoing efforts of a large number of actors on both the supply and demand of certain goods, services or other activities, which aim is to obtain certain advantages in the field of economic performance before the others. The lecture also focuses on consumer protection and the basic principles that apply in the protection of the rights.

- **Financial law**

In this lecture students will be introduced the financial law and various kinds of taxes that are required to be paid by natural and legal persons.

- **Administrative Law**

The set of law norms governing the state executive power, public administration, territorial self-government and administrative punishment for committing delinquency.

- **Criminal law substantive and process**

Substantive criminal law defines criminal act, what are its statutory requirements, defines the range of sentences, or protective measures which may be imposed. This law provides a list of all types of criminal acts. Process criminal law deals with law enforcement authorities in the detection, prosecution and punishment of crimes.

## 13. MAN – MANAGEMENT

### 13.1 Description of the Course

Goal of this course is to present students fundamental information about management. Several lectures will be taught by company professionals from Unicorn and other partner companies since management is viewed as a practical discipline. Seminars were transformed to workshops where teams of students work on projects.

### 13.2 Lectures

- **Introduction to management**

Organization, external and internal environment, management, manager and their functions, history of management. Purpose - why to study management and why it is good, definition of key terms.

- **Planning**

What is planning, what is the purpose of planning. Strategic planning, making plans, goals, tools.

- **Planning - external lecturer's presentation**

Vision of setting goals (parts of a plan, how to form a vision and what is the result of the strategy process).

- **Planning - external lecturer's presentation**

Resource planning (short, long-term budget, how to create a plan, update, ...)

- **Organizing**

Organization, management range, centralization and decentralization, organizational structure.

- **Organizing and organizational structure - external lecturer's presentation**

Organizational structure, its formulation and efficiency (how to create organizational structure, an example of different models of organizational structures in practice).

- **Decision-making**

The structure of decision-making process, decision-making process.

- **Implementation, management and control**

Motivation, influence, leadership, coordination, evaluation and assessment criteria, internal control system of the organization.

- **Management and project control**

External lecturer's presentation - Management and control mechanisms, communication methods, the risks in decision-making in the management of a project (preference of solutions, unwillingness to risk or preferences of risk, waiting for the initiative of subordinates, inability to delegate ...)

- **IT management support - external lecturer's presentation**

To show how it is possible to support and facilitate management by using IT, example of UES Powered Company.

- **Management typology - human relations, financial management, quality management**

Overview of different types of management, what they deal with and what is interesting ... introduction to other subjects.

- **Manager profile**

External lecturer's presentation - How to motivate, management of a team, ... see UMC training.

## 14. MAC MANAGERIAL ACCOUNTING

### 14.1 Description of the Course

The aim of this course is to provide students with the knowledge of preparation, presentation and application of accounting information in value management at all levels of organizational management – especially when deciding about future business variants. To facilitate the process of understanding, students will solve a number of practical numerical examples and exercises. As far as more complex case studies are concerned, students will improve their skills to collect information that is relevant for decision making, to argue in favor of proposed solutions and to modify company's information system in such a way that it will properly fulfill its role in decision-making.

### 14.2 Lectures

- **Managerial Accounting: Definition, Development and Interpretation**

Introduction to managerial accounting. Relationship between managerial and financial accounting and taxes. Cost accounting, accounting decision process, controlling.

- **Basic terms and concepts**

Costs as a information basis for decision process. Relevant and irrelevant information about costs, standard costs, opportunity costs.

- **Patterns of cost behavior**

Introduction to purpose and phases of costs allocation. Decision making tasks based on costs allocation.

- **Costs Calculation and Allocation - CVP and Break-Even Analysis, ABC method, Variable costing**

Examples of various cost calculation/allocation methods and its implications.

- **Relevant costs for decision making and capital budgeting decisions**

Relevancy of various Costs for Decision Making. Long term and short term decision making.

- **Financial Statement Analysis and Pricing Products and Services**

Analysis of financial statement. Examples. Alternative ways of setting the price.

## 15. MKT MARKETING

### 15.1 Description of the Course

The aim of the course is to acquaint students with the basic categories of modern marketing, particularly with the essential marketing tools, and purchase behavior of customers. Based on the particular case studies the course will explain the selected marketing problems and help to understand the meaning and the logic of the marketing. Taking into account, that marketing is primarily a practical discipline, the theoretical lectures will be combined with lectures of experts from practice (especially Unicorn and its partners). The seminars will take place as workshops during which students will solve given problems and present their solutions of the problems/projects.

### 15.2 Lectures

- **Introduction to marketing, marketing basics.**

Basic information about the course and the content of the course. Explanation of the essence, concept and functions of marketing. Characteristics of basic business concepts, basic diversities in the concept of marketing. Marketing mix. Marketing plan. Customer. Targeting markets.

- **Product management and development**

Characteristics of the marketing concept of a product. Explanation of various stages of a product life cycle. Principles of product policy. Product innovation. Introduction of new products to the market. Explanation of the nature and expression of a brand. Characteristics of the basic strategies of marketing goods. Legal and institutional frameworks for security of a brand. Characteristics of design and packaging including explanation of their marketing value.

- **Price policy, distribution policy and branding**

Describing the price as a marketing category. Definition of basic factors that influence the formation of prices. Principles of price elasticity and its marketing use. Basic methods of making prices. Description of fundamental role of distribution and its specific position in the marketing mix. Definition of basic types of distribution channels. Deciding about distribution channels, management of distribution channels. Retailing. Marketing channel management.

- **Marketing communication**

The concept of marketing communication. Diversification of marketing communication and communication mix. Specifics in the marketing communication mix instruments. Marketing communication process. Tools of communication mix. Legal and ethical framework of communication tools. Advertising, publicity and public relations. Internet marketing.

## 16. OPM - OPERATIONS MANAGEMENT

### 16.1 Description of the Course

The purpose of this course is to introduce basic managerial activities focused on company processes leading to production or services supply including support activities. Students also get elementary knowledge concerning basic documentation providing essential information needed for production systems management.

### 16.2 Lectures

- **Operations management – introduction**

First lesson is focused on introduction of Operation Management and its importance for the company and the course layout. Student becomes aware of basic features and terminology that is used through the whole course. Definition of production units and production systems a typology is included here for instance.

- **Operations strategy**

Strategy definition, strategy level. Performance, quality and quantity. Speed and flexibility. Cost. Market based approach, Resources based approach. Internal performance objectives, external competitiveness factors.

- **Process types**

Manufacturing process types. Service process types. Matching processes with volume and variety.

- **Process technology**

Process technology for materials. Process technology for information. Management information systems. Operational information systems. E-business.

- **Planning and control**

Operations planning and control. Loading, sequencing, scheduling. Input-output control. Optimised production technology.

- **Capacity management**

Measuring Demand. Measuring Capacity. Reconciling Capacity and Demand. Evaluating alternatives and make a choice.

- **Inventory management**

Inventory classification. Inventory planning and management. ABC classification, ROP, EOQ, FOI models.

- **Lean operations and JIT**

Waste elimination idea. Lean techniques. Total preventative maintenance (TPM), setup reduction (SUR), visual control, push and pull production systems.

- **Enterprise resource planning**

Resource planning, materials requirement planning, master production schedule. MRP calculations and reports. Distribution requirements planning

- **Supply chain management**

Fluctuations in the supply chain. Supply chain integration. Market relationships. Strategic alliances and partnership. Vertical integration.

- **Quality**

Measuring quality, improving quality. Quality management. Six sigma quality. Quality standards.

- **Performance measurement and improvement**

Measuring performance – Balanced scorecard, Activity based costing. Benchmarking.

## 17. PSE - PSYCHOLOGY AND SOCIOLOGY ESSENTIALS

### 17.1 Description of the Course

The goal of the subject is to learn basic terms and their interconnections in psychology, focusing particularly on the issues of industrial psychology and management psychology. The subject provides the essential knowledge necessary to study specialized topics of industrial psychology and management psychology.

### 17.2 Lectures

- **Psychology and sociology**

Key words and historical significance. What is the purpose of psychology and basic sociological topics. Interaction between psychology and sociology.

- **Personality**

Human psyche, personality, personality characteristics – individuality, internal unity, relative consistency, development. Factors of personality development – biological, social, self-improvement. Experience, behaviour, mental processes, disposition and characteristics, mental function – cognition, feeling, trauma. Dimension of personalities, characteristic functions – ability, knowledge, skills, motivational dimension – motives, stimuli, profiling of personality characteristics - temperament, bearing, character

- **Methods of cognition and evaluation of a human**

Errors in cognition and evaluation of people: projection, halo effect, first impression, stereotypes, prejudices; methods: observation, questioning, interviewing, questionnaires, survey, experiment, tests ...

## 18. SME - SMALL AND MEDIUM ENTERPRISES

### 18.1 Description of the Course

The purpose of this course is to introduce the problems of small and medium businesses. Lessons are focused on selected issues from this area. Students will become aware of terminology like franchising or dealing. Businessman's image and causes of business failure will be analyzed in this course as well. The main part of course is devoted to case studies and students own work – they will learn how to develop their own business plan, how to manage the business funding.

### 18.2 Lectures

- **Meaning of Entrepreneurship**

Who is entrepreneur. Types of entrepreneurs. Personal qualities. Managers and leaders.

- **Different Types of Ventures**

Modest ventures, promising ventures, high-grow ventures...examples and studies.

- **Developing a Business Plan**

Why do we need it. What is the business plan. Designing the business plan. Plan structure. Time scale and specifics.

- **Business plan in greater detail**

The purpose and reliability. Controls. Own plan development.

- **Sources of funding**

You need money to run your business. How to get them and manage the budget? Financial planning, budget. Financial market options for business funding.

## 19. TAX – TAXES

### 19.1 Description of the Course

The aim of this course is to introduce students to the key terms used in taxation: payer, taxpayer, tax domicile, taxes, direct and indirect taxes, income and property taxes, tax liability, tax burden and so on.

### 19.2 Lectures

- **Introduction to Taxation**

What is taxation, why and how are agents being taxed.

- **The tax practice environment**

Taxes and Cash flow. Tax strategies. Tax legislation. Audit.

- **Determining gross income, personal income tax**

Income. Gross Income, net income. Tax year. Cash method, accrual method. Dividend income, transfer payments, social security benefits, damage awards, scholarship. Interantional taxation.

- **Employee compensation**

Payroll taxes. Life insurance, children, health insurance. Inctive stock, restricted stock. Retirement Accounts.

- **Business expenses**

Deductions. Cash method. Prepaid expenses. Start-up expenses. Organization costs, operating expenses.

- **Property acquisitions and cost recovery deductions**

Capital expenditure, basis of property. Acquisition. After-tax cost. Dispositions. Depreciation. Leasing.

- **Corporate income tax**

Tax base, legal conditions. TTax payers of CIT. Tax base. Tax reserves. Rectifying items. Contract penalty. Claims and Liabilities. Examples.

- **VAT and indirect taxes**

- **Wealth transfer taxes**

Gift tax. Joint property transfers. Life insurance transfers. Transfers to a trust. Fiduciary income tax rate. Real estate tax.



## 20. ALG - ESSENTIALS OF ALGORITHM DESIGN AND OPTIMIZATION

### 20.1 Description of the Course

The aim of the subject is to teach students to use the most well-known algorithms in solving elementary tasks. Not only **data structures** but also **searching** and **sorting** will be introduced. Apart from the theoretical background, students will practice all techniques with examples designed in Ruby programming language.

### 20.2 Lectures

- **Kick Start, Basic concepts**

Time, spatial complexity, asymptotic complexity, Turing machine.

- **Data structures**

Working with lists, arrays, stacks, queues.

- **Sorting I**

Basic principles of sorting (stability, complexity, etc.), simple sorting methods (bubble-sort, insertion sort, heapsort etc.).

- **Sorting II**

Advanced methods like mergesort and quicksort, lower bound for complexity based on comparing elements, counting sort.

- **Searching I**

A simple types of search – binary search, binary search tree, AVL tree.

- **Searching II**

Advanced Searching in trees – B-tree, searching in text.

## 21. ASP – DEVELOPMENT IN ASP.NET

### 21.1 Description of the Course

The aim of this course is to build on acquired knowledge of C # language and .NET under the subject Development in C #. Students will gain knowledge about the general functioning of web applications, web application development platform .NET using Visual Studio IDE, including the connection of the application to MS SQL. Creation and use of Web services.

### 21.2 Lectures

- **Basic principles of ASP.NET**

Web Application Architecture. Basic principles of processing HTTP requests in ASP.NET. Creating web applications using Visual Studio .NET. Explanations of principles of code-behinds.

- **Making Web Forms**

Making Web Forms with use of standard ASP.NET controls.

- **Validation of input data**

Use of embedded validation components ASP.NET to implement client-side and server-side validation.

- **Management of applications**

Explanation of problems arising from stateless application. Maintaining states using Session objects, Application, ViewState, cookies.

- **Navigation Controls**

The use of hierarchical navigation controls. Creating appearance of a single ASP.NET application.

- **Configuration and deployment of ASP.NET**

Basic configuration parameters in the Web.config (appSettings, ConnectionStrings, Trace, etc. ..). Inheritance level configuration. Deployment to IIS.

- **DataBinding**

Simple declarative databinding. View data retrieved from the database MS SQL. Creating linked master-detail views.

- **Presentation and modification of data**

Display data using ASP.NET components: DataList, FormView, DetailView. Template Definition view. Editing database records using data components.

- **Creating own controls**

Creating own user controls (UserControls) and using them in the web form. Implementation of own controls (Custom Controls).

- **Optimizing ASP.NET applications**

Introduction to using the Cache object and principles of cache output (output caching).

- **ASP.NET Security**

Overview of security principles in .NET. Overview of security mechanisms for Web applications.

- **Web Services**

Basic principles of Web services. Web services and their realization and their role from the client's point of view.

## 22. CAR - COMPUTER ARCHITECTURE

### 22.1 Description of the Course

The aim of this course is to acquaint students with basic knowledge of computer architecture. This is essential theoretical basis for understanding structure of computers, technical equipment and operation of personal computers.

### 22.2 Lectures

- **Introduction to Computer Systems Architecture**

Interpretation of the concept of computer architecture, origin and evolution of computers, Von Neumann computer architecture (memory, controller, arithmetic unit, input and output units), Harvard architecture, generation of computers (proposal, the technology, the main memory ....), current distribution computer market (design, desktop computers, servers, powerful computers and parallel supercomputers, and embedded computers in managing single equipment). Evaluation of the performance of computers, methods of measuring performance - MIPS, MFLOPS, computer performance monitoring, performance and time complexity, time complexity and throughput, Amdahl's law, CPU performance equation, the test role - benchmarks (division to: real application, modified the application, the kernel, "Toy" Test role, the role of artificial tests).

- **Motherboard**

What is the motherboard (MB) and what it is for; placing the motherboard inside the case and a description of various parts of the plate, basic parameters of MB (type of processors designed for MB, MB chipset), motherboard BIOS (CMOS RAM), backup battery; management ACPI power, power and cooling various parts of the plate.

- **Microprocessor**

What is it and what it is for, aspects related to processor technology and their impact on the workstation or server (system performance, software support, reliability and stability, energy consumption and cooling), the processor (single microprocessors, current processors), the core processor, the technology used in the manufacture, model designations selected current processor, the main manufacturers of processors, distribution according to Socket (AM2, F, 479, 771, 775, 940), the CPU operating frequency, the frequency of a system bus, cache L1, L2, CPU power, cooling processor, processor modes (real, protected, virtual real-mode), the functions for the expansion of power (superscalar architecture, intuitive implementation of instructions and branch prediction, out of order processing) architecture, signs, data bus speed, data bus bridges, aid instruction sets (MMX, 3DNow!, SSE, SSE2 ....); processors with RISC reduced instruction set (SPARC, Alpha, PowerPC) architecture CISCO; multiprocessor systems.

- **Communication of microprocessor with the surroundings**

What is a data bus and what it is for (system data buses, chipset, peripheral data buses, over-clocking) the PC / interface (parallel, serial, PS / 2, USB, IEEE 1394); cooperation with the micro-processor data bus (interrupts, DMA).

- **Memory**

What is a system memory RAM and what it contains, the relationship between memory and processor, the basic allocation of memory according to the functionality and the technologies used and their limitations (RAM, ROM, EPROM, EEPROM, DRAM, SDRAM, RDRAM ....); speed and memory access time; capacity RAM; working memory processes (paged memory, interleaved memory, caching); basic types of memory modules (SIMM, DIMM, RIMM, SDR, DDR ....); parity and ECC, CAS Latency - description ; power and cooling memory modules.

- **Hard disk**

Role of a hard disk in a computer, technology used in manufacture of a disk, the structure and schedule of a hard disk; connectors on the hard disk, LBA addressing limit and 137 gigabytes, compared technology IDE, USB, IEEE1394, SATA, SATA II, SCSI, disk arrays, a brief description SAN disk arrays and NAS, RAID basics, and additional integrated RAID controller - description; level system RAID (RAID 0, RAID 1, RAID 10, RAID 3, RAID 5, RAID 50) - comparison of different levels, advantages and disadvantages, resistance errors, the use of applications and systems, the RAID controller configuration and the creation of disk arrays, advanced operations (Optimized Disk Utilization, Online Capacity Expansion, etc.).

- **Portable Media**

List of portable media; disk (floppy disk), CD (standard CD, CD, CD-drive, the configuration properties of a CD), CD rewritable drives, CD-R and CD-RW (medium, drive, self-burning), DVD ( media, standards, drive); principles of burning to the media, the difference between technologies DVD and Blue Ray, the method of data storage on the medium. BD (media, standards, drive), USB Flash drives.

- **Graphic adapters and display devices**

The role of graphics cards, graphics cards according to the distribution of a data bus; comparison of PCI, AGP | PCI-E, the core of a video adapter, the basic block diagram of core graphics card, the boot parameters (Pixel Shader, Vertex Shader, ROPS, TMUs ...), timing frequency of cores; graphics memory (type, size, speed, memory bus width), I / O interface video adapter (cinch, S-Video, DVI, Display port); graphic description of DirectX and OpenGL, a new generation of technology (Intellisample, CineFX, UltraShadow ....); involvement in SLI and Crossfire mode, CRT monitors, LCD displays, I / O connectors; projectors - the fundamental difference between LCD, DLP and CRT projectors.

- **I/O devices**

- **Printers**

- Basic principles of ink-jet, laser and thermosublimation printers.

- **Scanners**

basic principle of image acquisition, scanner resolution, color depth, principle of scanning.;  
copying machines,

- **other topics**

sound card (external, internal), modems - a basic description of ADSL, GPRS, EDGE, CDMA,  
UMTS, comparison, differences in individual technologies, keyboard (wireless - transmission),  
mouse - shooting method movement, tablets.

## 23. CIT - COMPANY ICT

### 23.1 Description of the Course

The aim of this course is to provide an introductory overview of all essential characteristics of information and communication technologies used in business practice. Basic concepts and principles of business science will be explained. An overview of information systems and their applications at the enterprise level will be given and finally an overview of modern information and communication technologies with an explanation of the possibility of their integration will be discussed. The Business ICT subject will provide students with information concerning the environment, where information systems are deployed, and their basic architectural principles.

At first the basic problems addressed in the ICT business will be discussed. In the second part an introduction to architecture of 3-layer architectures and database technologies will be provided.

### 23.2 Lectures

- **Basic areas of company ICT**

Information and Communication Technologies (ICT) in an enterprise or an organization. Some remarks to information system as an investment. It also presents knowledge needed for information systems and necessary services for its functionality: System integration, Operation, First Line Support, Second Line Support and Development.

- **What is an Information System I**

The aim of this lesson is to understand what the ICT market is for and what are the basic types of IS.

Basic types of IS: Customer Relationship Management (CRM), Enterprise Resource Planning (ERP), Business Intelligence (BI), e-Business, Document Management System (DMS), Content Management System (CMS), Enterprise Content Management (ECM) and others.

- **What is an Information System II**

The aim of this lesson is to describe two of the five basic processes, which must be provided for a long-term and effective functioning of an information system: system integration and development of information systems.

- **What is an Information System III**

The area of operation and service of IS. It describes outputs of individual stages: Initial study, technical design, Construction and Deployment. Documentation of a project, operation, service and maintenance of an information systems – First Line and Second Line Support with Services Level Agreement. Outsourcing.

- **Introduction to information system architecture I**

The aim of this lesson is to understand the structure of information systems in terms of information system architecture. It contains a definition of architecture with various decomposition horizontal and vertical from which the second one define various tiers. Some notes to history is mentioned and current trends are roughly described.

- **Introduction to information system architecture II**

3-layer architecture of IS, including a detailed description of the role of different types of components for 3-layer architecture. There are other topics described like transaction processing, messaging, Event-driven architecture, clustering or Service-Oriented architecture.

- **Data layer as a base of IS**

The aim of this lesson is to describe what is a database, how databases work with data various model defined. It also describes what is the technical solution of a data layers in the IS.

- **Design of Data Layer**

The issue of database design in terms of entity-relation modeling and database models.

- **Principles of SQL**

The aim of this lessons is to teach the basics of querying in relational databases (RDBMS) and SQL basics.

- **Supplier - consumer relationship in ICT**

IS strategy for the sale. The difference between "small" and "big" business. The life-cycle phases of business opportunities. SPIN Method along with specific examples of SPIN used in trade negotiations.

- **Information system as an investment**

What is the investment in ICT (the repetition of the lesson 1) and in particular what constitutes a successful investment

## **24. COL - COMPUTER LITERACY**

### **24.1 Description of the Course**

The aim of this course is to develop intermediate skills with computers and basic office applications. In particular, it is about working with a text editor, spreadsheet calculator and creating presentations.

### **24.2 Lectures**

- **Working with a text editor**

Introduction to MS Office

- **Working with a spreadsheet calculator**

Introduction to MS Excel

- **Creating presentations**

Introduction to MS Powerpoint

## 25. CSP - DEVELOPMENT IN C#

### 25.1 Description of the Course

The aim of this subject is to introduce students the development of object-oriented applications in C# language. Students should be able to understand the differences between "scripting" in languages like Ruby with dynamic types and compiled languages like C# or Java, and also apply the principles of object-oriented programming in C# environment. Practical knowledge should enable the creation of GUI applications with access to a relational database and the support of running multiple threads.

### 25.2 Lectures

- **Basic principles of the .NET Platform**

Reasons for the arrival of the .NET Platform and language independence. The best-known programming languages for .NET. Types of generated applications. History of versions of .NET Framework. Actual structure of .NET.

- **Structure of C# program and objects in C#**

Basic means of classes definition and object creation with several important notions like instance variable, methods and constructors. This also include notions like inheritance, encapsulation and polymorphism. Static variables and namespaces.

- **Extension of object-oriented structure**

Interfaces, abstract classes, extended inheritance, internal classes and structures.

- **Basic language construction**

Other important construction of C#: basic programming, data types other than classes, typing, programming constructions. Data storage in arrays and collections.

- **Exceptions and I/O**

Why are exceptions used? Processing of exceptions. Throwing exceptions. Definition of own types of exceptions. Working with files and general approach to input output. Serialization.

- **Working with XML data**

Basic principles of XML. Stream processing of XML. Processing using DOM. XML serialization. Validation of XML using XSD.

- **Delegates and events**

The definition of delegates. Instance delegates. Sampling events. The definition of events. Creating events. Anonymous methods.

- **Genericity and other topics**

Genericity, lambda expressions, attributes, reflections.

- **Working with relational databases**

Basic principles of relational databases. ADO.NET philosophy. Working in connected environment. Working in the disconnected environment.

- **LINQ**

General description of LINQ. Description of LINQ to Objects and LINQ to SQL.

- **Multithreading applications**

Principles of threads. Implementation of asynchronous methods. Thread pool. Synchronizing threads.

## 26. IFS – ICT INFRASTRUCTURE OF IS

### 26.1 Description of the Course

The aim of this course is to acquaint students with basic concepts and operation of ICT infrastructure within the enterprise. After completion of this course students should be able to orientate in the basic terms of infrastructure and have sufficient information for the completion of follow-up subjects. Seminars are made as semester projects – the aim is to design a software infrastructure solutions (eg. an ordering system).

### 26.2 Lectures

- **Introduction**

Basic acquainting with the content and structure of the course lectures, forms of exam, what we mean by ICT infrastructure - servers, end-stations, system software, etc.

- **Terminal equipments**

Segmentation of terminal equipments to the basic groups and their key features, advantages, disadvantages, classical use - workstations, desktop computers, notebooks, netbooks, smart phones + PDA.

- **Servers**

Division of servers into basic categories - "Intel" based, AS/400, mainframe advantages disadvantages of space use, the classic division in terms of utilization of servers, used operation systems.

- **System software**

Basic types of operation systems used on computers - Windows, Linux, Mac OS X, basic types of operation systems used on servers - Windows, Linux, HP Unix, AS/400, AIX, Solaris.

- **Databases and application server software**

RDBMS Servers - Oracle, SQLServer, MySQL and PostgreSQL, application servers - division of the basic categories (web server + net application servers) - Apache, IIS, WebSphere and WebLogic.

- **Middleware and Communication Software**

Integration platforms, system of queues for messaging systems, mail servers - used transport protocols, often used products (sendmail, MS Exchange Server, ...), jabber.

- **Network infrastructure**

Basic elements of network infrastructure - wired (coax, twisted pair, optics) and wireless technologies, including technologies for mobile networks (Bluetooth, WiFi, WiMAX, GSM, UMTS, LTE)

- **Infrastructure Security**

Security of infrastructure - separation the Internet from the network infrastructure (firewalls, VPN, DMZ), security of communication (antivirus, antispam, antiphishing), ensuring the availability of infrastructure (clusters, geographic clusters, mirror disk arrays, etc.).

- **Infrastructure for voice**

Classical transmission of voice (used codecs) vs. VOIP infrastructure (used codecs), the advantages and disadvantages of integration into the global ICT infrastructure.

- **Infrastructure monitoring**

How it is possible to monitor the infrastructure, tools for monitoring infrastructure, SNMP Protocol.

## 27. ISA - INTRODUCING INFORMATION SYSTEM ARCHITECTURES

### 27.1 Description of the Course

The aim of this course is to provide comprehensive information on current and prospective enterprise application architectures and design principles in practice. Definition of enterprise applications, Java EE and MS. NET design patterns, application frameworks and definitions of its use in the development of information systems, types of IS architecture (MVC, internet / intranet, MDA), application, implementation, integration patterns.

### 27.2 Lectures

- **Kick start**

What is an architecture, the role of a software architect, types of architectures, history of architecture, design and documentation of architecture. Design and documentation of architecture: requirements driven by FURPS+, scopes of project in KKTR measures, 4+1 view. Architectural styles: 3-layer, space based like cloud or grid computing. Topics like modularization, continual integration and application framework.

- **3-layer architecture**

- **Presentation layer I**

The resources used for interaction between the user and IS, the basic principles of operation of these features and typical use cases in the IS architecture. Model-View-Controller.

- **Business layer**

Architectural elements in the implementation of IS business logic. Process flow, logn paradigma and performance, transactions.

- **Persistent layer**

Key approaches to address typical problems in data persistence, considering either performance, independence on data storage, etc.

- **Other topics**

Data back up, anything as a service (XaaS), high availability, load balancing, Clustering, Fault tolerance, scalability, NoSQL database, seaching, system integration.

- **Unicorn Universe case study**

- **DAMAS energy case study**

- **Tatrabanka case study**

## 28. JEE - DEVELOPMENT IN JAVA EE

### 28.1 Description of the Course

The aim of the course is to acquaint students with the basic principles of development of large-scale enterprise applications on the Java Platform, Enterprise Edition.

### 28.2 Lectures

- **Introduction to Java EE**

Basic information about the course and discussed content. Introducing Java EE architecture. Multilayer applications – a description of the presentation, application and business layers and an overview of used technologies. What are containers and components. Overview of Java EE servers.

- **Web Applications I**

Principles of servlets (interfaces `HttpServletRequest` and `HttpServletResponse`) and JSP. Phases of processing HTTP requests in JSF. Using Facelets to describe the component tree. Basic JSF components. Basics of JSF EL.

- **Web Applications II**

Data conversion and data validation in JSF. Bean Validation. JSF standard components. Third party libraries.

- **Web Applications III**

Creating custom components and composite components with Facelets. Events in JSF 2.0. Calling business logic. Internationalization.

- **Web Applications IV**

RichFaces library, data components – tables and trees, practical use of AJAX. Conversation scope and annotations for dependency injection, stateful navigation. Discussion of problems of web applications.

- **Enterprise JavaBeans I**

Distributed business logic and related issues. Stateless Session Bean and Stateful Session Bean, differences between them, remote interface declaration, implementation, JNDI look-up, life cycle. Dependency injection in Session Beans implementation. Deployment to a server.

- **Enterprise JavaBeans II**

Transaction support. Security in Java EE, authentication, declarative authorization and its limits. Task scheduling. Java Connector Architecture.

- **Java Message Service**

Sending and receiving messages in Java EE. Synchronous and asynchronous sending and receiving of messages. Message Driven Beans. Conditional receiving of messages. Possibilities of sender feedback. Communication models point-to-point and publish-subscribe.

- **Contexts and Dependency Injection I**

Dependency Injection in Java EE 6. Creating custom Java annotations. Conversation scope in CDI. Using events in CDI.

- **Contexts and Dependency Injection II**

Looking up CDI beans, alternative implementations. Producers, decorators and interceptors in CDI. JBoss Seam 3 overview.

- **Web Services**

Web services: what it is and what it is used for. Comparison of SOAP and REST. WSDL (Web Service Definition Language), using WSDL for code generation. Deployment descriptor of a module containing a web service. Registration of a service using UDDI. Implementation of a web service, error handling, implementation using SLSB.

- **Spring framework**

Spring modules overview. Definition of Spring beans and dependency injection in XML configuration. Practical examples of Spring: working with a database, remote calls.

## 29. JSE - DEVELOPMENT IN JAVA SE

### 29.1 Description of the Course

The aim of the course is to introduce students to the development of object-oriented applications in Java. Students should be able to understand the differences between “scripting” languages with dynamic typing system, such as Ruby, and compiled languages, such as Java or C#, and apply principles of object-oriented programming environment in Java. Practical knowledge should enable students to create GUI applications with access to a relational database and support for running in multiple threads.

### 29.2 Lectures

- **Introduction to Java**

History of the Java language – version overview, differences between them. Overview of the Java platform: description of Java SE, Java EE, Java ME. Architecture description – bytecode, virtual machine, operating system independence. Basic principles of the Java language – object orientation. Introduction of development environments for Java – Eclipse, NetBeans, etc., debugging the code.

- **Java Syntax I**

Declaring classes and creating their instances. Defining class properties and methods. Inheritance, interfaces and their implementation. Static content of classes. Structuring of classes into packages.

- **Java Syntax II**

Basic data types: numbers, strings, dates. Important methods of the Object class. Container types array and list. Primitive types and their operators. Conditional execution and cycles (if, switch, while, for). Checked and runtime exceptions.

- **Input and Output, Reflection**

Abstraction of inputs and outputs using classes InputStream, OutputStream, Reader, Writer and their descendants. Output formatting using classes Locale, NumberFormat, DateFormat and SimpleDateFormat. Working with the filesystem. Working with configuration files (class Properties), looking up resources using the getResourceAsStream method. Inspecting the running program, its classes and objects using reflection.

- **Container Types**

Limitations of regular arrays, a specific variant of for-cycle for container iterations. Generic types and their use in containers. Lists, queues, stacks, sets, associative arrays. Object equality

(equals and hashCode methods). Sorting of container types, interfaces Comparable and Comparator.

- **Documentation, Testing and Other Tools**

What is javadoc – tag overview, generating documentation from the source code. Annotations. Unit testing with the JUnit library.

- **XML Processing**

XML processing in Java. JAXP technology. Validating XML documents with XML Schema. Using SAX and DOM, comparison of both approaches. Transforming documents with XSLT. Java XML Binding – automatic serialization and deserialization, generating classes from XML Schema, generating XML Schema from classes.

- **Objects Persistence I**

Mapping object model into a relational database. Synchronizing object states. Controlling transactions. JPA 2.0 configuration. Basics of EJB-QL.

- **Objects Persistence II**

Mapping relations 1:N, M:N, 1:1, owner of a relationship. Handling inheritance, polymorphous queries. Advanced queries in EJB-QL.

- **GUI I**

Overview of windowing systems AWT, Swing, SWT and their principles with focus on Swing. Objects representing windows and control components. Basic component layouts and event handling.

- **GUI II**

Advanced component layouts (GridBagLayout, GroupLayout). CardLayout and JTabbedPane. Data components – lists, tables and trees.

- **Interconnection of Java Technologies**

Parallel task execution – basics of working with threads. Internationalization using locales and properties files. Logging. Using JPA in Swing applications. Java WebStart. Java applets.

## 30. MA1 - MATHEMATICAL METHODS 1

### 30.1 Description of the Course

The goal of this subject is to acquaint students with some basic mathematical terms and ideas. These include particularly essentials of mathematical logic, the set theory, algebra, and combinatorics. The subject prepares its students for use in their further study.

### 30.2 Lectures

- **Numeric arrays, views, functions**

Individual numeric arrays, properties of numbers, sets, what is a set of basic operations; the propositional logic that is operative, basic operations with statements; display - what it is and what properties it has, Cartesian product, functions as a type of display, properties of functions.

- **Elementary functions**

Functions and their properties, graphs, diagrams, use in practice, processes that can be described as those functions.

- **Limit of a function, continuity of a function**

Definition of limits using the inequality, proper and improper limits, right-hand limit, left-hand limit, rules for counting with the limits, relationships of monotony, narrowness and limits, limit composite functions, continuity of functions.

- **Derivation of a function**

Derivation as a change (speed) and direction (tangent), mathematical definition of a derivation, rules for counting with a derivation, derivation of compound functions, derivations of elementary functions, l'Hospital's rule.

- **Properties of continuous functions**

Inverse functions, what it is, properties, inverse function derivative; theorem of the existence of a zero point, theorem of the mean value etc.; interval bisection method, local and global extrema, convex and concave functions, use in practice (why it is useful to be able to identify the extreme).

- **Functions of several variables**

Introduction of a function of two real variables, work with such functions, limits and derivations of functions of several variables.

- **Primitive functions**

Looking for primitive features of derivation, properties of primitive functions, the basic formula for calculating primitive features (table of integrals).

- **Definite integral**

Derivation of Riemann's integral, numerical integration, definite integral as an area under the curve; indefinite integral.

- **Sequences, series**

Sequence as a type of a function, properties of sequences; series, properties of series.

- **Limit of a sequence, sum of a series**

Sequences that have (no) limit, series that have (no) sum, known limits and sums, relationship between a limit of a function and a limit of a sequence.

- **Complex numbers**

Complex number and a description of the various options (different coordinate system), introduction of a complex number as a point in a plane – analogy to a real number as a point of the numerical axis, what is the imaginary unit; properties of complex numbers (eg. can not be sorted), the algebraic form a complex number and the rules for counting; goniometric shape of a complex number and the rules for counting.

- **Application**

Examples of the use of the taught things in practice.

## 31. MA2 - MATHEMATICAL METHODS 2

### 31.1 Description of the Course

The aim of this subject is to teach students to use mathematical tools for their further study. This subject is focused on various ways of working with ordered n-tuples.

### 31.2 Lectures

- **Mathematical logic**

Proposition and propositional calculus, tautology, deriving rules (modus ponens, generalization rule), a mathematical proof.

- **Relations**

Binary relations, (partial) order, equivalence, equivalence classes, n-ary relations (only introduction and differences between pairs and n-tuples).

- **Graph and its representation**

Basic terms (peak, edge, subgraph, sequence, path, circle, ...), (not) directed graph, isomorphism of graphs, (dis) continuous graphs.

- **Euler's graphs and trees**

Euler's closed graph, a tree (forest), spanning tree of a graph.

- **Vector and linear space**

Vector, operations with vector, linear space and independence, base, rank of a space.

- **Matrix**

Matrix introduced as rectangular pattern, the rank of a matrix, transposed matrix, operations with a matrix.

- **System of linear equations**

General theorems about solvability, use of matrices to solve systems of linear equations.

- **Matrix algebra and determinants**

Square matrix, inverse matrix, determinant matrix.

- **Linear programming problems**

Types of problems, formulation of a mathematical model, basic terms, graphical solution, possibilities of an ending, interpretation

- **Simplex method**

Diversification of one and two phased simplex methods, interpretation of one method (use of simplex table), optimization test.

- **Analytical Geometry**

Geometric interpretations of algebraic concepts and their use in practice.

- **Application**

Examples of the use of the taught things in practice.

## 32. NOS - COMPUTER NETWORKS AND OPERATING SYSTEMS

### 32.1 Description of the Course

The aim of this subject is to teach students the basics of communication technology, networks and operating systems. The aim of the course is to provide a basic overview of computer networks and network operating systems. The basic concepts of computer networks will be explained. Also the structure of current core of computer networks ISO / OSI model and the basic protocols employed in each model layer will be discussed. Subsequently, students will be acquainted with various active elements of network infrastructure, their functionality and use in the design of the network will be described too. In the last part of the course the basics of operating systems, especially Windows and UNIX, will be discussed.

### 32.2 Lectures

- **Principles of operation systems**

Function, structure and types of operating systems, focusing on network OS, Multithreading, Multitasking and memory management.

- **Windows**

History, Versions, Desktops vs. Servers, Filesystem, Administration of privileges, Administration of users, Structure of directories, Command line, Device manager, network configuration.

- **UNIX**

History, Versions/Types (BSD), Desktops vs. Servers, Filesystem, Administration of rights, Administration of users, Structure of directories, Command interpreters, network configurations, basic commands (ls, cd, mkdir, rm, ps, man, etc.)

- **Introduction to computer networks**

Basic paradigms from the world of computer networks - circuit and packet switching, reliable and unreliable transmission, connected and not connected transmissions, convergence of computing and the world, electronic communications, the liberalization and regulation.

- **Taxonomy of computer networks**

Dividing computer networks to local and large, server type and peer-to-peer type, public and private, metropolitan networks, mobile networks.

- **Network models and architectures, RM ISO/OSI and TCP/IP**

Network models and architecture, history and the concept of RM ISO / OSI, an overview of layers and their basic role. In more detail about the family TCP / IP protocols - how the concept of TCP / IP was created, what are its basic ideas and approaches, standardization process.

- **Network infrastructure**

Network topology, active elements - repeater, hub, bridge, switch, router.

- **Fundamentals of data communications I**

Basic principles of data transmission, real properties of the peripheral routes of transmission, modulation and modulation rate, baud rate, Nyquist's and Shannon's theorem, transmission power, analog and digital transmission, broadband and narrowband.

- **Fundamentals of data communications II**

Wired and wireless transmission media, twisted pair, coaxial cable, optical fibers and cables, wireless transmission of spread spectrum, types of multiplex, multiplex hierarchy.

- **Techniques of data transfer**

Asynchronous and synchronous transmissions, maintaining synchronization, isochronous transmission bitstream, the synchronization frames, sign oriented and bit-oriented transfer protocols, ensuring transparency of data, ensuring reliability, possibility of detection, parity, checksums and CRC methods validation: stop & wait vs. continuous validation of the return and the selective repeat, independent and dependent validation, flow management, the method box, piggybacking.

- **Access methods**

Principles of access control, deterministic and nondeterministic access methods, distributed and centralized methods, challenges and applications, Demand Priority method (100 VG-AnyLAN), the reservation method, the priority access of the logical ring, uncontrolled distributed methods, persistence methods, CSMA / CD access methods of wireless networks (Wi-Fi, Bluetooth), in cable networks.

- **Computational model**

Development of a calculation model: batch processing, a model host / terminal, isolated PC, model file server / workstation, client / server, PC and NC, thin client, network-centric computing, server-based computing model, agent / manager, web services, ASP, utility computing, on-demand computing, distributed computing, grid computing, cloud computing.

## 33. OAD - OBJECT ORIENTED ANALYSIS AND DESIGN OF IS

### 33.1 Description of the Course

The aim of this course is to introduce students to the principles of object-oriented analysis and design with emphasis on the use of language UML (Unified Modeling Language).

### 33.2 Lectures

- **Introduction to modeling IS**

Explanations of differences between analysis and design (design). Explanations of the concept of system architecture. Explanations of the best proven approaches to the draft IS (best practices) - iterative development, requirements management (FURPS +), component architecture, visual modeling, continuous verification of quality, change management. Modeling languages, history of UML. General explanation of design patterns - different levels of design patterns. Explanations of the principles of Model Driven Architecture (MDA).

- **Basic principles of object-oriented approach and modeling classes in UML**

Explanations of basic terms related to object-oriented approach to the proposal software. Introduction to the basic type of diagrams in UML. Basic process during object-oriented analysis and design.

- **Activity UML diagrams**

Description of activity diagrams, their purpose and notations together with description of metamodel and elements of diagram.

- **Use case UML diagram**

Description of use case diagrams, their purpose and notations together with description of metamodel and elements of diagram. Moreover there is description of design process connected with this type of diagram.

- **Class UML diagram**

Description of class diagrams, their purpose and notations together with description of metamodel and elements of diagram.

- **Analytical patterns**

History of analytical patterns. Some of the used analytical patterns like accountability, observation and measurement, planning and trading.

- **State machine UML diagrams**

Description of state machine diagrams, their purpose and notations together with description of metamodel and elements of diagram.

- **Sequence UML diagrams**

Description of sequence diagrams, their purpose and notations together with description of metamodel and elements of diagram.

- **Package and component UML diagrams**

Description of package and component diagrams, their purpose and notations together with description of metamodels and elements of particular diagrams.

- **Design patterns for OOAD**

Introduction to the following design patterns (creational patterns): Abstract Factory, Prototype, Singleton, Builder. Introduction to the following design patterns (behavioral patterns): Chain of responsibility, Command, Observer, Iterator, State. Introduction to the following design patterns (structural patterns): Adapter, Bridge, Proxy, Decorator.

- **Deployment UML diagrams and UML extensions**

Description of sequence diagrams, their purpose and notations together with description of metamodel and elements of diagram. Explanations of the possibility of expanding the basic semantics of UML using stereotypes, tagged values and UML profiles. Description of integrity constraints in UML diagrams using Object Constraint Language (OCL).

- **Other artifacts in the process of software design**

Specifications of nonfunctional requirements (URPS +), a document describing the architecture (Software Architecture Document), the principle of mechanisms, Framework.

## 34. ORA - DEVELOPMENT AND ADMINISTRATION OF ORACLE DATABASE

### 34.1 Description of the Course

The aim of this course is to provide students with an overview of the procedures of database server Oracle10g (11 g) administration together with the basics of application development to the database in the language of aging PL / SQL.

### 34.2 Lectures

- **Introduction to RDBMS Oracle**

Basic information about the course and discussed content. Tasks of Oracle RDBMS administrator. Architecture of Oracle RDBMS. The terms database and database instance. Parts of a database and database instance. The procedure of processing the databases. Providing read consistency.

- **Planning and installation of Oracle RDBMS**

Requirements for the database infrastructure. Planning to ensure the availability and performance required. The concept of grid computing. Preparation and installation of custom RDBMS Oracle 11g. The specifics of the installation according to OS. Creation of the database in single-instance environment. Data Dictionary.

- **Administration of instances and structures for storing data**

Proces of starting and stopping databases. Consistent database state. Physical structure of a database. Sizing Database. Planning and creating tablespaces. Effects of physical configuration database structure for the exercise. Configuring Oracle Enterprise Manager. Monitoring the activities of DB Instances.

- **Creation and administration of users**

Creating users, granting privileges to users, creating roles and profiles. Creating database objects users. System and object privileges. User's access to the database - Oracle .NET configuration. Configuring the Oracle listener process. Configuration dedicated vs. Shared server (connection pooling on the database). Security and systém of privileges.

- **Creation of database objects**

Database Character Encoding. Types and suitability of the use of database objects (tables, indices, clusters) for different situations. Choosing appropriate data types. Heap table vs. Index-organized table. Types, usage and creation of indices. Ways of proposal indices. NULL value in a relation to an index and a later update. Sequence.

- **Creation of database backups and restoration**

Possible accidents of database environment and way of recovery. Methods for recovery from user errors, hardware failures and collapse of an operation system. Types of payments and procedure for their creation, the database recovery process.

- **Introduction into the language PL/SQL**

Specifics of development of database applications. Types of programming blocks of the language PL/SQL and the appropriateness of their use. The method of carrying out the PL/SQL programs, the Oracle server. Native vs. Interpreted PL/SQL.

- **Characteristics and management structures**

Types of variables and method declaration, commenting code. The importance of name conventions in PL/SQL. Using SQL in PL/SQL. Writing conditions and cycles in the PL/SQL. Nesting blocks of PL/SQL.

- **Composite data types and cursors**

Declaration and importance of composite data types. Use of collections. Collection as an associative cache. Explicit cursors, their importance and pitfalls.

- **Exceptions, creating procedures and functions**

Types, declaration and calling exceptions. Procedures for treatment of exceptions. Creating procedures and functions, the types of their parameters.

- **Packages**

The importance of packages, their use to improve memory and congestion management procedures. Procedure creation packages. Use of headers of packages without their implementation. Oracle predefined packages.

- **Design of PL/SQL programmes**

Autonomous transactions and their use. Deterministic and nondeterministic functions. Procedures performed with the privileges of the owner / caller. Bulk operations and their importance for the performance of PL/SQL programmes.

## 35. RDB - RELATIONAL DATABASES DESIGN

### 35.1 Description of the Course

The aim of this course is the mastery of foundations of the relational database systems theory and the acquisition of practical skills in using database technology to the level required for database design, creating database applications and database management systems.

### 35.2 Lectures

- **Introduction to databases**

Basic information about the course and discussed content. The importance of databases and database systems in current information systems - explanation why this area is important. The role of the data layer in stratified architecture (in particular with regard to the two-layer and three-layer architecture). Introduction to basic concepts in the field of database systems. What is a database of historical development. Data models - hierarchical data model, network data model, object model data, relational data model, XML data model. Architecture database - a central architecture, file-server architecture, client-server architecture. Typical users of data base management systems.

- **Relational model**

Basic terms - relation (table), entry (record), line (field), primary key, foreign key. Declaration and implementation of integrity constraints. Normal forms, Atomicity, functional dependency, partial functional dependency, transitive dependency, normalization process. The aim of this lesson is detailed understanding of the concept of the relational model and basic concepts related. It is also important that students understand sufficiently what is 1, 2 and 3 normalization form, including the standardization process of relational model. Normalization procedure will be practiced on practical examples.

- **Creation of models**

Conceptual model of data, relational data model, physical data model. Transfer conceptual model to relational model of data. Transfer of relational model, physical data model. ER modeling and diagrams (entity, attribute, key, relationship, relationship cardinality), extension of the ER model (EER), UML language (class diagrams). Specific examples, practical exercises focusing on this issue. Students should manage the basics of making data models - the issue will be a part of semester work, in which it will be necessary to cope with a more complex and extensive role. In addition, students become familiar with some CASE tools, which are used for creating data models.

- **Relational algebra**

Lesson's aim is to introduce students to the theoretical (mathematical) foundations of relational databases - relational algebra, which are the theoretical foundations of query languages, and many relational database systems. Students should understand the use of relational algebra operators and especially the context of the SQL language. Emphasis will be placed on practical exercises of this issue.

- **SQL Language – introduction**

Introduction to SQL, basic categories - DDL, DML, DCL. What is the SQL language. SQL Options. Data types. Inserting data into the database. Modification of data in a database. Deleting data in a database. Control access to data.

- **SQL Language– fundamentals of querying**

This lesson is an introduction to querying in SQL and use of SQL SELECT command. At first the basic principles and use of this command will be explained, students will receive additional information in subsequent lessons. Thoroughly practice of practical examples is a key part of this lesson. The lesson also focuses on simple queries, screening, selection, sorting, grouping and use of aggregation functions.

- **SQL Language – queries over multiple tables**

Completion of the previous section - the foundations of querying in SQL and SQL SELECT command. The aim of this lesson is to get acquainted with creating queries over multiple tables, explanations of the concepts of internal links, external links, half-connection (left / right), etc. The key is to thoroughly practice the discussed content on practical examples.

- **SQL Language – subqueries**

The aim of this lesson is to introduce students to issues of creation and use of subquery in the SQL language. Not correlated subqueries, correlated subqueries - explanation of the principles, the use of subqueries, concrete examples.

- **Optimization in databases**

In this lesson students will become familiar with problems of optimization of databases. Emphasis will be placed on understanding the objectives and purpose of optimization. Part of the interpretation of the specific examples. The key thing here is to understand the reasons why it is necessary to deal with optimization problems and what may cause inappropriately designed or implemented the database. Students will practice the discussed content on practical examples.

- **Transactional processing**

In this lesson students will get acquainted with the problems of parallel processing in database systems. It is important to explain the problems that the parallel processing may arise, and show ways to address them. In the introduction basic concepts such as transactions, basic operations (read, write), the beginning and end of the transaction, the transaction conditions, etc. will be explained. Also characteristics of transactions (ACID-Atomicity, Consistency, Isolation, Durability), with an emphasis on their detailed understanding, will be discussed. Then the lesson will focus on the issue of parallel (simultaneous) processing of transactions in database systems.

The aim is to ensure correct handling of data - students should understand the possible ways of solving this problem: the gradual implementation of transactions, serialization of requirements and methods of management of overlapping. In addition, the lesson will focus on issues of management of overlapping transactions, where students can get a basic idea of solving this problem using two methods - the use of locking and time tags (here is expected only contextual knowledge of a basic principle).

- **Introduction of mostly used RDBMS, directions in DBMS development**

The aim of this lesson is to acquaint students with the most current relational database systems - Oracle and Microsoft SQL Server. Development and administration of these databases is a further follow-up articles. In addition, students will learn about the current directions in the development of database systems, such as native XML databases, etc.

- **Introduction to the PostgreSQL environment**

The aim of this lesson is the presentation of fundamentals of the PostgreSQL environment, installation and use of this database platform for the necessary tests to be carried out just over the environment. Basic data types and functions will be presented. A simplified installation and control of the database will be shown.

## 36. SDP - SOFTWARE DEVELOPMENT PROCESSES

### 36.1 Description of the Course

The aim of this course is to provide students with contextual knowledge in the field of processes and organization of software development. The course is focused primarily on problems that a development team must deal with while implementing projects. Emphasis is also placed on understanding the basic principles. Detailed knowledge will be acquired during other courses.

### 36.2 Lectures

- **Kick start**

What is a "software", what is the process of software development and why it is necessary to deal with it. What are the current development projects (statistics of success), what does a company which deals with the software development need to "know", market overview.

- **Basic requirements for software products**

Quality, quantity, date, budget (QQDB) - a detailed explanation of good and bad examples from specific projects. What are the risks in software development. Understanding that success can outweigh factors that go against each other (QQDB). Monitoring of project using QQDB.

- **Knowledge in software development**

Technology, process, business, environment, customer softskills and teamwork - a detailed explanation, a need to balance knowledge. Understanding that an unsuccessful person is the one who do not have knowledge in a given context in required proportions. Examples of projects that failed because of missing type of knowledge.

- **The methodology of software development - how to manage a project**

What is a methodics and a methodology, what it usually consists of, how it is used in a company. Historical context of a methodology (waterfall model, Fountain model, etc.). Understanding that the methodology is only a basis which has to be adjusted (expanded, reduced, edited) for the specific situation. An example of a specific implemented methodology.

- **Overview of current "methodics" I**

RUP, XP, ITIL, CMMI, PRINCE2 etc. Explanations of existing methodologies (procedural frameworks, etc.), what is the relationship between them (traditional vs. agile, etc.), what they can be used for. The aim is only the contextual knowledge and basic concepts.

- **Rational Unified Process I**

Basic model of (R)UP (activities, artifacts, roles, etc.), RUP organization (disciplines, phases, etc.), the main benefits of RUP as a traditional software development methodology.

- **Rational Unified Process II**

6 best practices. UES as an implementation of RUP ideas. Specific examples of the RUP implementation. Extensions AUP, EUP, etc.

- **Phases and disciplines of software development**

Explanation of the temporal and material dimensions of a development project and how it iteratively passes through them (initial studies, technical project, implementation, deployment).

- **Requirements management**

What communication with a customer involves, what are the types of requirements and how they can be recorded. Principles of use. Explanations of properties that an analyst / manager of requirements must have.

- **Design and implementation**

How to proceed while looking for a solution (implementation of the requirements) in a particular environment. Forms of expressions for modeling. Transformation between analysis, design and implementation. Description of primary areas of interests for analysis and design.

- **Testing**

Principles of verification and validation to software projects. What can be tested, who tests, what are the tools, what can be automated. Students should understand that testing is an integral part of each development.

- **Configuration management and deployment**

What is the process of deployment and integration of systems, what is administration of versions and what problems it brings.

## 37. STA - STATISTICS

### 37.1 Description of the Course

The aim of this course is to acquaint students with elementary statistical concepts, the analysis and presentation of statistical data, fundamentals of probability, the basic elements of deductive and inductive way of thinking, mostly used statistical procedures and analytical methods, the conditions of application, advantages and shortcomings of various methods and learn how to correctly interpret obtained results.

### 37.2 Lectures

- **Descriptive Statistics**

Meaning and concept of modern statistics, basic statistical terms, processing of numeric variables, frequency distribution, tables, graphs (histogram, polygon).

- **Characteristics of unidimensional statistical files**

Description of unidimensional statistical files, degree position (level): average, mode, median, quantile, rate variability (variation margin, variance, standard deviation, coefficient of variation), degree of obliqueness and sharpness.

- **Probability theory**

Random events and operations with random events, definition of probability, rules for counting probability, random variables and their distribution, characteristics of random variables.

- **Probability theory (distribution of random variables)**

The most important types of probabilistic distributions (discrete distributions - binomial, Poisson, hypergeometric), the most important types of probabilistic distribution (continuous distributions: uniform, exponential, normal, t, F, chi-sq).

- **Limit theorems. Methods of statistical induction.**

Limit theorems, types of statistic surveys, random sampling, basic theory of statistical estimation (point and interval estimates)

- **Testing of statistical hypotheses**

Testing of statistical hypotheses, basic concepts and process of testing hypotheses, parametric tests with parameters of the basic file.

- **Methods of examining dependencies**

Distribution of basic file test, examining addictions of categorial features, construction of contingency tables, test of independence in contingency tables, leak rate of dependency (Cramér's and Pearson's contingency coefficient).

- **Types of dependencies between numeric characters**

Basic methods of monitoring and assessing the dependence between quantitative variables, simple regression analysis, basic concepts, choice of the type of regression function, linear regression model, estimation of parameters of regression model (method of the smallest squares).

- **Assessment of the quality of a regression model. Correlation Analysis**

Assessment of the quality of a regression model, measurement of leak rate of linear dependence - the correlation analysis.

- **Time series**

Chronological average, elemental characteristics of time series, classical decomposition of time series (additive, multiplicative model).

- **Time series - trend component**

Analytical compensation of time series - trend modeling, adaptive approaches to modeling time series (moving averages), the seasonal component of time series.

- **Time series**

Seasonal adjustment, quality of a model. Seasonal adjustment, assessment of quality of a model, possibilities of construction of forecasts.

## 38. TST – SW TESTING

### 38.1 Description of the Course

The aim of this course is to provide students with knowledge of the testing process of SW together with an explanation of various activities and practising the test cycles. The course is focused primarily on problems that a test team must deal with during implementation of projects. Emphasis is placed on understanding the process and obtaining at least basic experience with various activities of the testing process.

### 38.2 Lectures

- **What is testing SW and its goals**

Information about the course, introduction / summary – what students should know - what is software testing, what is quality assurance, what is a software error, difference between work of a tester and a QA, precision and accuracy / verification and validation, testing axioms, pesticides paradox, the two most important objectives of testers, dimensions of quality, testing of a black and white box, static and dynamic testing, types of tests according to the quality dimension, types of tests according to the time dimension.

- **Who, what and when in the process of testing**

Testing roles (Test Manager, Test Designer, Test Analyst, Tester), and their individual responsibilities within the testing process and the team (according to RUP) - life-cycle of testing (graduality of activities to be carried out) - inputs and outputs of various phases (ie. artifacts) of the test cycle, ie. Test Strategy, Test Plan (global, for the iteration), Test Interface Specification. Test Automation Architecture, Idea Test, Test Case, Test Data, Test Script, Test Suite, Test Log, Test Results, Change Request, Test Evaluation Summary, tools for test management, the importance of agreement on vocabulary before a project begins, some terms for documents may vary in different projects.

- **How to design tests**

Various testing techniques in particular for black box testing - functional testing, testing by compliance and failure, tests of equivalent cases, testing of conditions, testing focused on risk, tests focused on specification, weight regression tests, research testing, user testing, test scenarios, stochastic and random testing.

- **How to run tests**

Reporting problems, how to write error CAN PIG RIDE, tools for recording errors, test log, defect report, evaluation tests, life cycle of errors - the commercial tools, open source tools for recording and tracking errors, principles of tracing errors.

- **How to design and run automatic tests**

Automatic tests - where appropriate, general issues, general characteristics of instruments for automatic testing, commercial instruments - open source tools, automated unit tests.

- **How to design and run performance tests**

Summary of concepts - performance and weight tests, SLA - general characteristics of tools for performance tests, commercial tools - open source tools.

## 39. WEB - WEB TECHNOLOGIES

### 39.1 Description of the Course

The aim of this course is to introduce to students the development of three-layer MVC web applications. The first part includes HTML fundamentals, the second one consists of work on an referential example and technology of JavaScript with MVC framework Ruby-on-Rails. After the course, on the basis of knowledge gained in other subjects, students will be able to develop a simple web application on their own.

### 39.2 Lectures

- **Kick Start**

History of development of the World Wide Web. What is a web application? How is it different from console development applications? Various protocols used in Internet.

- **HTML**

Fundamentals of HTML syntax. The structure of HTML documents. Trends in creation of documents.

- **Cascading Style Sheets**

Selection of the HTML formatting. Formats for text, tables, images. Layout of components in a page.

- **Web Application Basics**

Dynamically generated content. Responding to user requirements. Maintaining state in Web applications. Web frameworks and application servers.

- **Accessing Database with Active Record**

Automatic migrations. Mapping objects to relational databases. Refreshing SQL. Basic operations in Active Record.

- **Advanced O-R Mapping and Database Queries**

Definition of a relationship between classes and tables. Validation of objects. Querying the database.

- **Generating Applications**

Generating simple applications of the data model. What are the actions and templates. Collaboration with a data model.

- **Page Formatting and Functionality**

Functionality of a controller. ERB templates and helpers. Layout of pages.

- **Web Services**

Web services - SOAP and REST. Creation and usage of REST services. Example of using a web service.

- **JavaScript Basics**

Language runtime environment. Basis of syntax. Built objects.

- **Using JavaScript - Validation and AJAX**

W3C standards - DOM. Changing structure of documents. Events. Validation of data in a browser.

- **JavaScript in Ruby on Rails**

Libraries Prototype and script.aculo.us. Automatic replenishment of texts, sorting. General use of AJAX in ROR.

## 40. GAL - GRAPH ALGORITHMS

### 40.1 Description of the Course

The aim of this course is to establish basic facts about graphs from the subject Mathematics II and extend them to some advanced knowledge. This time the emphasis will be placed more on the programming point of view, but at the same time the lectures will build on a solid mathematical basis, because the implementation of certain algorithms goes directly from the proofs of many claims. As a part of the exercises, students will be able to practice the discussed procedures.

### 40.2 Lectures

- **Graphs**

The concept of graphs and the basic arguments related to them (the summary of the MA2 course), representation of graphs in the computer memory.

- **Trees**

The concept of a tree and the basic argument of the trees (the summary of the MA2 course), isomorphism of trees.

- **Passing through graphs**

Passing through graphs to the depth, passing through graphs to the width, looking for the shortest path in the graph (Dijkstra's algorithm).

- **Looking for the minimum spanning tree of a graph**

Kruskal's greedy algorithm, Jarník's algorithm, Borůvka's algorithm

- **Coloring a graph**

Introducing the problem, algorithms for (not optimal) coloring of a graph: a naive algorithm, Welsh-Powell's algorithm, DSATUR, RLF.

- **Directed graphs**

Basic definition and claims, topological sort of vertices

## 41. WSO - WEB SITE OPTIMIZATION

### 41.1 Description of the Course

In this course students should learn the principles of a good web design and web applications and web search engine optimization - Search Engine Optimization (SEO). The aim is to show the most frequently used and validated methods of designing GUI of a website with an emphasis on the appropriate structure and navigation.

Search Engine Optimization is a process which can, with minimum (or zero) costs, help significantly to improve website traffic from search engines. This is a part of so called Search Engine Marketing (SEM).

### 41.2 Lectures

- **Principles of a good web design**

The basic philosophy of the creation of sites, development rules and a summary of general rules.

- **Basics of SEO**

What is SEO and SEM, how do search engines work, evaluation of sites by search engines, placement of sites in results pages of searching, labels of sites in results of searching.

- **Optimization of the source code of web pages**

Keywords, meta tags, URLs, copywriting, navigation, site map.

- **Backlinks**

The importance of backlinks, building backward links, buying and exchange of links, RSS, problems associated with backlinks.

- **Analytical tools**

An overview of basic analytical tools and the most important indicators, resources and evaluation of results.

- **Prohibited and potentially harmful methods, a brief introduction to PPC**