# Faculty of Electrical Engineering and Informatics

IMPORTANT NOTES

If for one subject you can find several different types (lecture, practice, laboratory) of courses then please choose one and only one course from each type in order to be able to perform the subject's requirements successfully.Civil Engineering courses are on the website seperately. Courses chosen from the offer of Faculty of Civil Engineering will be checked and arranged individually by the departmental coordinator.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIEEAA00 | Basics of Programming 1 | Mid-semester mark | 7 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AL | English | FRI:08:15-10:00; |
| Lecture | AE | English | THU:08:15-10:00(QBF08); |
| Practice | AG | English | THU:10:15-12:00(QBF08); |

The main objective of this course is to provide students with appropriate skills in computer-based problem solving and basic use of program development tools. These skills are to be effectively applied during further studies. The C language is selected as working language to illustrate how portable programs can be developed and to allow students to gain practice in actual coding. The classroom practice follows the syllabus of lectures; helps better understand the topics of the lecture through detailed examination of the algorithms. The classes are completed with a long-term individual homework assignment to help improve the students' skills.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIEEAC00 | Technology of IT Devices | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | A2 | English | WED:10:15-12:00(QB331); |
| Lecture | A1 | English | MON:12:15-14:00(QB331); |

The goal of the subject is to present the students the operation of the most important hardware elements of IT devices, the fundamentals of electronics and its manufacturing technology. It is presented what opportunities modern microelectronics assures to computation, what are the physical limits and the trends of development. At the laboratory practices the students experience themselves that hardware and software development occurs with the help of similar methods and tools.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIEEAV99 | Solar Cells and Renewable Energy Sources | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | a1 | English | TUE:12:15-14:00(QB331); THU:12:15-14:00(QB331); |

This course gives a short description of the well-known and generally used renewable energy sources, During the classes the students can get acquainted with socio-economic impacts, basic environment protection principles related to renewable energy sources and are provided with basics of device physics, device construction and manufacturing processes, especially that of solar cells. Besides other renewable energy source the course is focusing on usage of solar energy especially through photo-voltaic devices and the semiconductor aspects of these devices.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIEEJV14 | Optoelectronics | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | a1 | English | WED:12:15-14:00(QB329); FRI:12:15-14:00(QB329); |

The subject discusses a relatively broad range of optoelectronic devices in depth; including operating characteristics, structure, typical application areas in optical communications and in measurements. The subject is presented only in English language, primarily for foreign students, but Hungarian students may also elect it. Synopsis: Week 1 Optoelectronic semiconductor materials and their technology. Energetic interactions of light and material. The wave equation and its solution. Plane wave, phase velocity, refractive index. Refraction. Generation and recombination in semiconductors and their relationship to the light sensing and light emission. Week 2 Macroscopic solids, heterostructures, optical properties of nanometer-thick layers. Passive devices: transmission properties of optical waveguides and direction couplers. Week 3 Optical fibers in practice. Dispersion. Multipath dispersion, abrupt and gradual change of refractive index type multimode optical fibers. Material dispersion, Waveguide dispersion, single-mode fibers. Week 4 Absorption, attenuation, atomic and electron resonance, the minimum absorption wavelength. Light spillage of the optical fiber, the scattering mechanisms. Week 5 Resonators and optical sensors. Controlled passive devices: optical deflectors, modulators, switches. Week 6 Optical amplifiers.

Light amplifier mechanisms in optical fibers. Rahman and Brillouin scattering. Stimulated scattering. Light-doped optical fiber amplifier. Semiconductor light amplifiers. Week 7 Photodetectors. Light Detection using pn junction. The PIN photodiode. Avalanche photodiode. Heterojunction photodiode. The detectors for optical and electrical characteristics. Week 8 Image converter, storage and dissector devices. MOS and CCD video recorders. CCD operation basics. Various CCD arrangements. Realization of the high speed shutter. Week 9 ERROR Week 10 Stimulated emission. Structure, types, and optical modulation properties of laser diodes. Cut-off frequency, transient operation modes. Week 11 ERROR Week 12 Display devices. LCD, plasma, photoluminescent displays. Week 13 Organic semiconductors, OLED light sources and displays. Week 14 Optical digital information recording. Holographic information recording, DVD-ROMs, flash EPROMs.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIETAB00 | Electronics Technology and Materials | Mid-semester mark | 6 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | L_CsduA | English | THU:14:15-18:00; |
| Lecture | 3_EA | English | TUE:12:15-14:00(V1102); TUE:12:15-14:00(V1102); WED:12:15-14:00(V1102); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIETMA06 | Photonic Devices | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 3_A | English | WED:10:15-12:00(V1102); THU:08:15-10:00(V1102); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHIAB00 | Coding Technology | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EA | English | THU:14:15-16:00(IL108); FRI:10:15-12:00(IL108); FRI:10:15-12:00(IL108); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHIAB01 | Communication Networks I. | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | LA | English | TUE:14:15-18:00; |
| Lecture | EA | English | MON:12:15-14:00(IL108); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHIAB02 | Electronics 1 | Exam | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EA | English | WED:14:15-16:00(V1502); |
| Practice | GA | English | THU:14:15-18:00; |

Virtually every electronic equipment used today is constructed on the basis of high complexity circuits. All electrical engineers must know the construction and functioning principles of such devices. In order to understand the behavior of complex systems, the elementary design principles and dimensioning procedures should be presented which is the objective of this course. Obtained skills and expertise: The students get acquainted with the definitions and management of the parameters of electrical components and will understand the calculations of the properties of electronic circuits built up of such components. The skills obtained in the framework of this course (together with the course entitled Electronics 2)empowers students with the necessary expertise to understand the courses of the related study specialization blocks. /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:10.0pt; font-family:"Times New Roman","serif";}

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHIAC04 | Mobile Communication Systems | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EA | English | TUE:08:15-10:00(IB144); |
| Practice | GA | English | WED:10:15-12:00(IB144); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHVAB00 | System Theory | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A2 | English | TUE:10:15-12:00(V1501); |
| Practice | C2 | English | WED:08:15-10:00(V1501); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHVAB01 | Signals and Systems 2 | Exam | 6 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A2 | English | MON:10:15-12:00(V1501); MON:10:15-12:00(V1501); WED:08:15-10:00(V1501); |
| Practice | C2 | English | WED:08:15-10:00(V1502); THU:12:15-14:00(V1502); THU:12:15-14:00(V1501); |

The course is a follow-up of Signals and Systems I. It provides the foundations of analysis methods for continuous time systems in the frequency and complex frequency domains. Furthermore, it presents various system description methods and establishes the connections between these representations. It also deals with analysis methods of discrete time signals and systems both in time, frequency and z domains. The link between continuous and discrete systems is presented by dealing with discrete approximation of continuous time systems, and the basics of signal sampling and reconstruction are shown. The last part introduces analysis techniques for continuous time nonlinear circuits and systems.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHVAC03 | Introduction to Electromagnetic Fields | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A2 | English | TUE:10:15-12:00; |
| Practice | C2 | English | THU:10:15-12:00; |

The course teaches the fundamentals of classical electrodynamics in an engineering approach. Besides the main principles, the most important fields of engineering applications as well as some analysis methods are discussed. The lectures are complemented with classroom practices. Synopsis: Part I. Fundamental laws Measurable global quantities of electromagnetism Scalar and vector fields of electromagnetism The system of Maxwell's equations Electromagnetic fields in materials Interface conditions Energy balance of the electromagnetic field Forces in the electromagnetic field Uniqueness of the solution of Maxwell's equations Classification of problems Part II. Static fields Scalar potential and Laplace-Poisson equation of electrostatics Electrodes, capacitances Field of the electric dipole Method of images The finite difference method Current flow problems and the electrostatics analogy Grounding, step voltage Static magnetic fields, Biot-Savart law Self and mutual inductance Induction phenomena Lumped circuits Part III. Transmission lines Telegraph equations Helmholtz-equation and its general solution Voltage and current distribution for specific loads (matched load, open end, etc.) Standing waves, transmission line as resonant circuit Circuit equivalents of the transmission line Part IV. Wave phenomena Wave equations (homogeneous and inhomogeneous) Helmholtz equation for plane waves, the transmission line analogy Reflection and refraction, polarised waves Plane waves in ideal dielectrics Plane waves in conductors, the skin effect Elementary electric dipole antenna Rectangular waveguides

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHVAC05 | Space Technology | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A2 | English | MON:12:15-14:00(V1502); MON:12:15-14:00(V1502); TUE:16:15-18:00(V1502); |
| Practice | B2 | English | TUE:16:15-18:00(V1502); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHVJV62 | Simulation of Electronics Circuits | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | B | English | FRI:12:15-14:00; |

Introduction of the state-of-the-art circuit simulation computer programs used in the modern engineering practice, as well as practicing their use and further deepening the skills obtained about the electronic circuits by solving practical simulation problems. Synopsis: Introduction: the evolution of simulation programs, the history of the SPICE simulator and its versions, non-SPICE based simulators Modeling issues, modeling of semiconductors, functional models Basic algorithms of circuit simulation: operating point calculation, transient analysis, calculation of transfer characteristics Fundamentals and syntax of the SPICE circuit definition language, simple circuits, node and component names, setting of values and subcircuits Using individual analysis types: operating point calculation,

transfer characteristics, sensitivity analysis, transient analysis, distortion calculation, small signal transfer function Presentation of the simulation results: conventional output data structure, graphical representation, post-processing opportunities, parametric analysis Using the schematic editor: editing diagrams, symbols and symbol library operations Block-based and multi-level diagrams, interfacing to PCB design programs Simulation of digital and mixed signal circuits: functional analysis, delay effects and their consequences, input and output modeling of digital circuits, mixed signal simulation Signal integrity simulation, usage of transmission lines, investigation of termination types (near-end and far-en terminations), investigation of the effect of capacitive loads Simulation of high frequency circuits: the concept of scatter parameters and the usage thereof, simulation of the input reflection and transfer properties of attenuators and low-pass filters, introduction of filter design Simulation of telecommunication systems, characterization of frequency mixers and amplifiers, investigation of a single-mixing heterodyne receiver Circuit measuring exercise: operating point measurement of a transistor amplifier, comparison of the measured data with the simulation results, measurement of the driving range and its comparison with the simulation results Circuit measuring exercise: introduction of the measurement of high frequency and microwave circuit components, investigation of the transfer and reflection of a filter and an amplifier, demonstration of large-signal properties, as well as the comparison of all these results with the simulated values

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHVMA08 | Electromagnetic Fields | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A2 | English | WED:08:15-10:00; WED:08:15-10:00; THU:10:15-12:00; |

The main goal of the course is the qualitative and quantitative discussion of the electromagnetic phenomena using deductive reasoning based on the Maxwell-equations. In-depth discussion of the theory of electromagnetism starting from the knowledge gathered during the BSc studies. Understanding the basics of the various methods used for the numerical analysis of electromagnetic field problems. Discussion of relevant questions related to the modelling of electromagnetic devices. Analysis, design and optimization of electromagnetic devices in the engineering practice. Discussion of the electromagnetic theory behind the working principles of some devices: ranging from the high power engineering apparatuses through the high frequency applications to the optical and nanoelectronic devices.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIIIAA01 | Digital Design 1 | Exam | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | ERASMUSL | English | |
| Lecture | ERASMUS | English | |
| Practice | ERASMUSG | English | |

The aim of the course (together with Digital Design 2) is to provide students with all the system level hardware knowledge required to the logical level design of digital equipment. This first semester focuses on the basic logic design principles, namely: Boole algebra and number systems; Basic models of combinational and sequential systems; Truth-table representation of combinational systems; Switching functions, disjunctive and conjunctive canonical forms; Building blocks of combinational systems (gates); Methods for minimization of switching functions; Classification of sequential systems as state machines; Design steps of synchronous state machines; Special problems, race conditions and hazards; Basic principles of hardware description languages. The theoretical background is widened through the solution of design problems during the classroom practices and problems assigned as homework. The course is also complemented by three simple laboratory exercises. Students completing the course should be able to formulate logical problems and solve simple logical or sequential design problems they may encounter in electrical engineering.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIIIAA04 | Digital Design 1 | Exam | 6 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | ERASMUS-L | English | THU:12:15-16:00; |
| Lecture | ERASMUS-E | English | TUE:08:15-10:00(IE218); TUE:08:15-10:00(IE218); TUE:10:15-12:00(IE218); |
| Practice | ERASMUS-G | English | TUE:10:15-12:00(IE218); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIIIAC03 | Industrial Control | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | aG | English | |

The course presents the technologies used to realize industrial control systems. Sensing principles and sensor devices for the measurement of temperature, pressure, force, torque, displacement and flow of fluids are studied together with generally used transducers. The course also presents signal interfacing techniques, issues related to

proper grounding and to reject external disturbances (conductive, electromagnetic) and the most widely used actuator devices. The special characteristics of the architecture of process control computers are analyzed together with the related software requirements, programming models and human machine interface solutions. The hardware architecture of programmable logic controllers (PLC) are introduced with the most widely used programming techniques (ladder, text based, function blocks, etc.) according to the IEC-61131 standard. The course also deals with distributed control system principles, control networks (ASI, CAN, MODBUS, POROFIBUS) and supervisory control and data acquisition (SCADA) systems.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIMIAC06 | Embedded and Ambient Systems | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EA | English | TUE:08:15-10:00(QBF10); TUE:08:15-10:00(QBF10); WED:10:15-12:00; |
| Practice | GA | English | WED:10:15-12:00(QBF10); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIMIAD00 | Embedded Information Systems | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EA | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVISZMA03 | Information Theroy | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A0 | English | MON:09:15-12:00(IB147); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVISZMA04 | Languages and Automata | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A0 | English | WED:10:15-12:00(IB147); WED:10:15-12:00(IB147); THU:10:15-12:00(IB147); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVITMAC00 | Building and Operation of Networks | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A01 | English | TUE:14:15-16:00; |
| Practice | AGY01 | English | TUE:16:15-18:00; |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVITMAC05 | Network Technologies and Applications | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A02 | English | TUE:14:15-16:00; TUE:14:15-16:00; |
| Practice | AGY03 | English | WED:10:15-12:00; |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVITMAK47 | Engineering Management Methods | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A14 | English | |

Engineer as a leader (situations and solution): role of informaticians and electrical engineers in the information based society. General trends, business models and the development of value chains. Leader roles, leader tasks and situations. Management of IT based, communication related and business functions in a company. Complex engineering methods in the information transmission and processing, technological and economical optimization of the related processes. Management problems of resource and time allocation, task distribution and scheduling, and workforce placement. Decision preparation techniques: statistical and heuristics based methodologies.Innovation management: tools of innovation management, institutions of innovation management, funding models and typical calls for applications. Organizations of scientific research and technology development, business models of spin-off

companies. Conception of technological visions about the future, ways to identify technological breakthroughs, management of generation changes. The process of standardization, its organization and its consequences on technological markets. Intellectual property rights during the innovation process: protection of technical creations, neighboring rights, protection of databases. New trends in IP rights: free software licensing models. Processes of product development and product introduction to the market, market study and marketing methodology. The role of IT technologies in the product and business development, their contribution to the value creation.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVITMMA03 | Modeling Seminar for Engineers | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A01 | English | TUE:10:15-12:00(IB138); |
| Practice | AGY01 | English | WED:08:15-10:00(IB138); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVITMMA04 | Internet Services and Applications | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A01 | English | MON:12:15-14:00(IB138); |
| Practice | AGY01 | English | WED:08:15-10:00(IB138); |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVITMMA11 | Human-Computer Interaction | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A3 | English | MON:12:15-14:00(IB138); |

Objectives, learning outcomes and obtained knowledge The aim of the subject is to introduce visual, gesture and speech interface technologies to students in Human Computer Interaction (HCI). The focus is on applications and services in intelligent environments (smart city, home, workplace) and their personalized and context-sensitive interfaces. The course will introduce in detail the elements of the user interface, the basic principles of software ergonomics, the evaluation methods of software from an ergonomic point of view. Parallel to introduction of theory, practical classes are also held. Students will demonstrate the comprehension of the material by solving practical problems. By the end of the course students will learn the basic principles necessary for the design,prototyping, testing and evaluation of user interfaces so that they could employ that knowledge during their future work career. 1.Introduction Basic concepts and definitions 2. Modalities between humans and the environment Speech interfaces Visual interfaces Tactile interfaces Multimedia HCI Joint handling and synchronization of interface modalities 3. Speech Interfaces Speech communication 4. Visual Interfaces Iterative design principles Iterative design methods 5. User interface techniques Principles Golden rules for design 6. User interface principles and examples Menu systems Text dialogues Graphical interfaces Web interfaces Dialogue systems 7. User interfaces on mobile devices General principles Operating system dependent issues Modality dependent issues 8. Design guidelines Focus-group method Conjoint analysis Design space analysis GOMS model 9. Usability of websites Special user interfaces (e.g. multimedia, groupware) Usability for all (W3C WAI) 10. Evaluation of user interfaces Criteria for evaluation Methods of evaluation 11. Intelligent enviroments location and context-sensitive interfaces personalized interfaces 12. Case studies Presentation of practical tasks

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVITMMB03 | Engineering Management | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A07 | English | FRI:08:15-12:00(IE220); |

Engineering management (EM) in the knowledge-based society. Definition, role and areas of the EM. The evolution of the EM discipline. Peculiarities, generic trends and EM of the information, communication and electronic media technologies (ICT). Managerial elements of the engineering activity. Components and principles of the managerial activity. Managerial situations, methods and tools. Strategic management. Strategy types and parts. Business strategic planning methods. Classes of competitive strategies. Implementation of strategy: success factors, progress tracing. Methods of the strategic direction and control. Complex engineering decision problems, customer-oriented and systemic approaches, solutions, procedures. Planning and allocation of resources, multi-project management. Management of organizations. Organization types in the ICT sector. Lifecycle, decision culture of organizations, change management. Managing cooperation of organizations, complex working groups. Knowledge management. Knowledge process: accumulation, internalization, adaptation, externalization. Competence. Knowledge sharing and transfer. Knowledge based systems. Types of the intellectual property, principles of intellectual property rights. Open access software. Exploitation of the intellectual properties. Intellectual public utilities. ICT specific EM. Technology management. Technological planning, forecast, transfer, launching, change. Making technology vision, analyzing driving forces, scenarios. Technology-driven business strategies. Corporate ICT functions. Application of the ICT in shaping new business strategies, global work-flows, efficient organization structures. Innovation management. Goals

of research, development and innovation. Innovation models and metrics. Management of the innovation process, quality and risks. Innovation chain: university-industry partnership, role of the government. Multi-tier organization and operation of the research-development-innovation management. Innovation financing. National and EU sources, grants, funds, tenders. Development projects. Technological incubators, innovation centers, start-up companies, technological consortia in the ICT sector. Product management. Goals and process of the product development. Markets of the ICT products and services. Market players, competitive environment. Market segmentation. Life-cycle of the product, and its management. Product pricing, price-sensitivity of the customers. Market-research, sale and sale-support methods. Business process management. Analyzing, planning, regulating, improving and transforming corporate business process. Criteria of the process-based management systems. Methods for developing processes. IT in the corporate value creation. Customer relationship management (CRM), operation support systems, supply chain management, business continuity management. Special business functions (e.g. billing), industry-specific systems, IT system architecture of telecommunication service providers. Regulatory environment. Sector regulation. Goals and principles of the regulation in general and in the networked and public service sectors. Competition regulation, consumer protection. Regulatory institutions and procedures, ex-ante and ex-post regulation, self-regulation, public hearing, standards. Regulation of the information and communication technologies and markets. Technology and marker regulatory models in the ICT sector. Regulatory tasks for deploying the convergence of the telecommunications, information and media technology sectors. Community and national regulation of the electronic communications network and services. Framework and specific directives. Rules for the cooperation of the network operators and service providers. Regulation for managing scarce resources, frequency, number and address management. Concept for regulating information security, data protection and content.