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
BMEVIEEAV05	Intelligent Sensors	Exam	4

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

https://portal.vik.bme.hu/kepzes/targyak/VIEEAV05/en/

Types of the microelectronic integrated sensors, chemical sensors, cantilevers, micro-heaters, ISFETs, and ChemFET sensors, SAW sensors, integrated biological sensors, Lab-on-Chip electrochemical analyzers, intelligent pressure sensors. Features of the intelligence of the sensors, self-calibration, signal-digitalization, removing the artefacts, reconfigurability, data compression, adaptivity, communication capability. Methods for preprocessing the measured signals, digital and analogue integrated processing methods, circuit implementations of the self-calibrating A/D converters. The elements of the VHDL language used in the hardware design. Modeling the inherent parallelism of the hardware with VHDL language tools. VHDL descriptions of example circuits. Abstraction levels in the digital system modeling. VHDL description of the digital logic processing circuits of the sensors. The fundamentals of the VHLD based circuit synthesis. Comparison of the signal conditioning in case of the measured signals, frequency filtering, time-frequency transformations. Intelligent sensors in the medicine, pulse, blood pressure, ECG measurements, anemometers, blood-oxygen measure, touch-sensors. The fundamental features of the P2P computer networks. The most important procedures of the routing on the wireless sensors. Mobile sensors, wireless solutions, System-on-Chip Body sensor networks and communication interfaces. Architectures and communication electronics of the sensors of Body Area Network (BAN). Power supply of the implemented sensors, implanted sensors for pressure-measuring, multipath data communication solutions, protocols. Medical supervisor tools, supervision of nursing homes of elders, touch-free location-free sensor system. Telemetric systems in the telemedicine, systems based on mobile networks and Internet. Case studies of present-day solutions. Databases, expert systems. Multimedia processing in telemedical sensor networks. Processing-partitioning in case of wide, shared sensor networks. Data security of the telemedicine networks, security of the personal data with the possibilities of the conciliar, case study. Official web page: https://portal.vik.bme.hu/kepzes/targyak/VIEEAV05/en/

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	WED:12:15-14:00; FRI:12:15-14:00;

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
BMEVIHIAA02	Computer Architectures	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	MON:08:15-10:00;
Practice	G10	English	THU:14:15-16:00;

https://portal.vik.bme.hu/kepzes/targyak/VIHIAA02/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAC01	IT Security	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EA	English	WED:10:15-13:00;

https://portal.vik.bme.hu/kepzes/targyak/VIHIAC01/en/ This course gives an overview of the different areas of IT security with the aim of increasing the security awareness of computer science students and shaping their attitude

towards designing and using computing systems. The course prepares BSc students for security challenges that they may encounter during their professional carrier, and at the same time, it provides a basis for those student who want to comtinue their studies at MSc level. We put special emphasis on software security and the practical aspects of developing secure programs.

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAV34	Security and Privacy: an Economic Approach	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	E	English	WED:12:15-14:00;

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAV96	Administrating Computer Networks I.	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	L2	English	WED:14:15-16:00(IL107);

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIM009	Signal Processing Fundamentals	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	TUE:12:15-14:00;

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIMA07	Mobile and Wireless Networks	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	WED:14:15-16:00;
Practice	GA	English	FRI:08:15-10:00;

https://portal.vik.bme.hu/kepzes/targyak/VIHIMA07/en/ The objective of this course is to introduce today’s modern wireless and mobile systems to our students. This contains basic knowledge needed to operate and maintain such networks. Further goal of this course is to show the possibilities and operations of advanced radio and wireless solutions, through practical examples.amp;lt;!-- --amp;gt; amp;lt;!-- /* Font Definitions */ @font-face {font-family:"MS Mincho"; panose-1:2 2 6 9 4 2 5 8 3 4; mso-font-alt:"MS ??"; mso-font-charset:128; mso-generic-font-family:modern; mso-font-pitch:fixed; mso-font-signature:-536870145 1791491579 18 0 131231 0;} @font-face {font-family:"MS Mincho"; panose-1:2 2 6 9 4 2 5 8 3 4; mso-font-alt:"MS ??"; mso-font-charset:128; mso-generic-font-family:modern; mso-font-pitch:fixed; mso-font-signature:-536870145 1791491579 18 0 131231 0;} @font-face {font-family:Cambria; panose-1:2 4 5 3 5 4 6 3 2 4; mso-font-charset:0; mso-generic-font-family:roman; mso-font-pitch:variable; mso-font-signature:-536870145 1073743103 0 0 415 0;} @font-face {font-family:"\@MS Mincho"; panose-1:2 2 6 9 4 2 5 8 3 4; mso-font-charset:128; mso-generic-font-family:modern; mso-font-pitch:fixed; mso-font-signature:-536870145 1791491579 18 0 131231 0;} /* Style Definitions */ p.MsoNormal, li.MsoNormal, div.MsoNormal {mso-style-unhide:no; mso-style-qformat:yes; mso-style-parent:""; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:12.0pt; font-family:"Cambria","serif"; mso-ascii-font-family:Cambria; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:"MS Mincho"; mso-fareast-theme-font:minor-fareast; mso-hansi-font-family:Cambria; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-ansi-language:EN-US; mso-fareast-language:EN-US;} p.MsoCommentText, li.MsoCommentText, div.MsoCommentText {mso-style-noshow:yes; mso-style-priority:99; mso-style-link:"Jegyzetszöveg Char"; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:12.0pt; font-family:"Cambria","serif"; mso-ascii-font-family:Cambria; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:"MS Mincho"; mso-fareast-theme-font:minor-fareast; mso-hansi-font-family:Cambria; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-ansi-language:EN-US; mso-fareast-language:EN-US;} span.MsoCommentReference {mso-style-noshow:yes; mso-style-priority:99; mso-ansi-font-size:9.0pt; mso-bidi-font-size:9.0pt;} span.JegyzetszvegChar {mso-style-name:"Jegyzetszöveg Char"; mso-style-noshow:yes; mso-style-priority:99; mso-style-unhide:no; mso-style-locked:yes; mso-style-link:Jegyzetszöveg;} .MsoChpDefault {mso-style-type:export-only; mso-default-props:yes; font-size:12.0pt; mso-ansi-font-size:12.0pt; mso-bidi-font-size:12.0pt; font-family:"Cambria","serif"; mso-ascii-font-family:Cambria; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:"MS Mincho"; mso-fareast-theme-font:minor-fareast; mso-hansi-font-family:Cambria; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-ansi-language:EN-US; mso-fareast-language:EN-US;} @page WordSection1 {size:612.0pt 792.0pt; margin:72.0pt 72.0pt 72.0pt 72.0pt; mso-header-margin:35.4pt; mso-footer-

margin:35.4pt; mso-paper-source:0;} div.WordSection1 {page:WordSection1;} --amp;gt; /* 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:12.0pt; font-family:"Cambria","serif"; mso-ascii-font-family:Cambria; mso-ascii-theme-font:minor-latin; mso-hansi-font-family:Cambria; mso-hansi-theme-font:minor-latin; mso-ansi-language:EN-US; mso-fareast-language:EN-US;}

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIMA08	Foundations of Multimedia Technologies	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	THU:14:15-16:00;
Practice	GA	English	FRI:10:15-12:00;

https://portal.vik.bme.hu/kepzes/targyak/VIHIMA08/en/ Starting from the basics the lecture presents the psychophysical properties of the human audiory and visual system, the principles of production, processing and compression of audio and video signals and their practical implementation. The lecture also includes applied image processing tasks with possible solutions.

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVAA00	Signals and Systems 1	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	A2	English	MON:08:15-10:00; MON:08:15-10:00; THU:12:15-14:00;
Practice	C2	English	FRI:10:15-12:00;

https://portal.vik.bme.hu/kepzes/targyak/VIHVAA00/en/ The objective of the two semester Signals and Systems classes is to introduce the basic concepts of signal and system, and to provide computational methodologies to continuous and discrete time systems. The first semester (Signals and Systems I) presents the time domain and the sinusoidal steady state analysis. The examples refer to continuous systems represented by Kirchoff type electric circuits. The principles to formulate the models and the methods to solve the resulting equations are discussed. The students fulfilling the requirements of this class will be able to apply the methodologies of system and network analysis in the time domain and in the frequency domain in case of sinusoidal excitation. Synopsis: 1-2. classes (1. week) Basic concepts: signals, systems and circuits. System properties: linearity, causality and time – invariance. Input – output relationship. Systems represented with electric circuits. Two poles. Kirchhoff type systems. 3-4. classes (2. week) The full set of circuit equations. Series resistors and voltage division. Parallel resistors and current division. The principle of superposition. Node voltage analysis. Mesh current analysis. Source transformations. Maximum power transfer. 5-6. classes (3. week) Coupled two poles: ideal transformer, controlled sources, ideal operational amplifier and gyrator. 7-8. classes (4. week) Two-Port Resistive Networks. Equations of the Two-Port Networks. Reciprocity, symmetry and passivity of the Two-Ports. Equivalent circuits of reciprocal and nonreciprocal Two-Ports. Two-Ports terminated with Two- Poles. Calculation of the input and transfer characteristics. 9-10. classes (5. week) Dynamic circuits. Capacitors, inductors, coupled capacitors and coupled inductors. Circuit equations. Regularity. Initial conditions. State variables. The normal form of the continuous time state equations. Generation of the continuous time state equations from the full set of circuit equations. 11-13. classes (6-7. week) Solution of the continuous time state equations. The natural response and the forced response. First-order circuits. The time constant of first-order circuits. Sequential switching. Second and higher order dynamic systems and circuits. Higher order dynamic circuits with complex or equal eigenvalues. The concept of stability. 14-16. classes (7-8. week) Step function and Dirac delta function. Generalized derivatives. The Step response and Impulse response of dynamic systems. Calculation of linear time invariant dynamic systems response to arbitrary input with convolution. The concept of bounded-input, bounded-output (BIBO) stability. 17-20. classes (9-10. week) Sinusoidal steady state analysis. Phasor notation. The concept of impedances. The methods of circuit analysis with phasors (node voltage and mesh current analysis, source transformations). Resonant circuits, quality factor, Wheatstone-bridge. Coupled inductors (the model of a transformer). Phasor diagrams. AC Steady state power analysis: averaged power, reactive power, complex power, apparent power, power factor. Maximum power transfer. 21-22. classes (11. week) The concept of the Network Function. Logarithmic units and quantities. The Bode- and the Nyquist- diagram. Two-Port Network equations in frequency domain. The scattering parameters of Two-Ports. Interconnection of Two-Ports and equivalent equations. 23-26. classes (12-13. week) Periodic steady state analysis. Fourier series of periodic signals. The trigonometric, the engineering and the complex Fourier series. Calculation of systems response to periodic excitation. Properties of periodic waveforms: definitions and relations to Fourier series. Periodic steady state power analysis. Averaged power calculations based on Fourier series. 27-28. classes (14. week) Summary, auxiliary.

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVAV05	Electromagnetic Metamaterials and Its Applications	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	C	English	MON:12:15-14:00; WED:12:15-14:00;

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVMA05	Optical Networks Elements	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A2	English	MON:10:15-12:00;
Practice	B2	English	THU:10:15-12:00;

https://portal.vik.bme.hu/kepzes/targyak/VIHVMA05/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVISZMA06	Advanced Mathematics for Electrical Engineers - Combinatorial Optimization	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A0	English	MON:08:15-10:00;
Practice	A1	English	THU:08:15-10:00;

https://portal.vik.bme.hu/kepzes/targyak/VISZMA06/en/ The subject introduces some areas of operations research and combinatorial optimization. Besides covering the most relevant algorithms and methods and their limits, it also aims at giving a glimpse into some of their engineering applications. Thus the subject also covers some general algorithmic approaches like linear and integer programming and matroid theory. Furthermore, the course aims at extending and deepening the knowledge formerly provided be the Foundations of Computer Science subject of the BSc degree program in Electrical Engineering.

Subject code	Subject name	Requirement	ECTS credit
BMEVITMAB01	Communication Networks II.	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	AL1	English	TUE:14:15-18:00;
Lecture	AE1	English	MON:12:15-14:00;

https://portal.vik.bme.hu/kepzes/targyak/VITMAB01/en/To provide both theoretical and practical knowledge about communication networks, especially about telecommunication networks. Starting from the classical telephony networks, through mobile (cell) phone systems and IP access networks, to high speed backbones, the students of this course will get acquainted with the architecture of these networks, along with their main building blocks as well as the communication protocols they apply. This course, in accordance with Communication Networks 1, aims to provide strong foundation for the relevant specialization courses. Synopsis: Introduction to the course Basics Overview of telephony networks Analog and digital speech transfer Architecture of telephony switches Wired IP access networks Digital subscriber loops (xDSL) Cable television Internet access Optical access networks Voice over IP (VoIP) speech codecs, SIP and H.323 protocols 3play services: Video on Demand, IPTV, etc. Mobile telephony networks overview, GSM, UMTS, HSPA, LTE, satellite telephony systems Signaling Backbone network technologies MPLS and its extensions, optical wavelength- and waveband switching Outlook: Peer-to-peer, AdHoc networks, Machine to machine communication – Internet of Things The lectures are accompanied by laboratory measurements: 3 measurements, each 4x45 minutes, allowing the students to exercise with some of the technologies discussed above (e.g. VoIP, DSL, telephony switches).

Subject code	Subject name	Requirement	ECTS credit
BMEVITMAC02	Information Systems Management	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	AL1	English	WED:14:15-18:00;
Lecture	AE1	English	MON:14:15-16:00;

https://portal.vik.bme.hu/kepzes/targyak/VITMAC02/en/

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

Course type	Course code	Course language	Timetable information
Lecture	AE1	English	THU:14:15-16:00;

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
BMEVITMAV24	Performance Evulation of Infocommunication Systems	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	AE1	English	TUE:12:15-14:00;
Practice	AG1	English	THU:12:15-14:00;

Subject code	Subject name	Requirement	ECTS credit
BMEVITMMA01	Agile Network Service Development	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	AE1	English	MON:08:15-10:00;
Practice	AG1	English	WED:10:15-12:00;

https://portal.vik.bme.hu/kepzes/targyak/VITMMA01/en/

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

Course type	Course code	Course language	Timetable information
Lecture	AE1	English	FRI:08:15-12:00;

https://portal.vik.bme.hu/kepzes/targyak/VITMMB03/en/ 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.