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
BMEVIAUAC01	Data-driven Systems	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	AE	English	TUE:10:15-12:00
Practice	AGY	English	WED:14:15-16:00

https://portal.vik.bme.hu/kepzes/targyak/VIAUAC01/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIAUAC05	Electronics 2	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	AE	English	MON:10:15-12:00; THU:08:15-10:00
Practice	AGY	English	TUE:14:15-16:00

https://portal.vik.bme.hu/kepzes/targyak/VIAUAC05/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIAUAC06	Microcontroller Based Systems	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	AE	English	TUE:10:15-12:00
Practice	AGY	English	THU:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIAUAC06/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIEEJV14	Optoelectronics	Exam	4

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

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
BMEVIETD081	Applied Nanoscience	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	7	English	

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

Course type	Course code	Course language	Timetable information
Lecture	7_A	English	MON:08:15-10:00; WED:14:15-16:00

https://portal.vik.bme.hu/kepzes/targyak/VIETMA06/en/

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; THU:14:15-16:00; FRI:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIHIAB00/en/ Error control coding: Basic notions of error control (code, codeword, error models, Hamming distance, error correction, error detection, code distance, code parameters). Binary linear code: generator matrix, parity check matrix, systematic codes. Hamming codes. Cyclic linear code, generator polynomial, parity check polynomial. CRC detection technique. Nonbinary linear codes. Reed-Solomon code. Data compression and source coding: Prefix code. Average codeword length and the entropy. Shannon-Fano code, Huffmann code, Lempel-Ziv code. Quantization. Uniform quantization. Lloyd-Max quantizer.. Predictive coding. Voice compression. Video compression. Cryptography and data security: Basic notions, encryption, authentication, integrity protection, access control, repudiation. Ideal encryption. Linear encryption. Public key encryption. RSA algorithm. Hash functions. Basic cryptographic protocols: party authentication, integrity protection, key distribution, digital signature, key certificate. Typical security holes in cryptographic primitives and protocols.

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	WED:14:15-16:00

https://portal.vik.bme.hu/kepzes/targyak/VIHIAB01/en/ The main goal of this course is to introduce the basic paradigms, architectures and protocols of communication networks to students. The course follows a top-down approach. The students will get familiar with the basic paradigms, architectures and protocols of communication networks through the transport, network, data link, and physical layers. Topics, among others, include the main application layer protocols like DNS and HTTP, congestion control solutions, UDP and TCP protocols, routing schemes, IPv4 and IPv6, medium access, and the essentials of physical layer techniques. Laboratory experiments help students to deepen their understanding of the essential characteristics of the most important building blocks of IP-based communication networks. Students who successfully accomplish the course will understand essentials of IP-based communication networks from the application to the physical layers, routing techniques and protocols, IPv4 and IPv6 network layer solutions, congestion control paradigms, UDP and TCP mechanisms and TCP session management, the operation of main network layer protocols like DNS, SMTP, FTP, and HTTP,

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAV06	Introduction to Quantum Computing and Communication	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EA	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHIAV06/en/ The quantum mechanics-based algorithms and protocols can play an important role in our nowadays used technical solutions. Quantum computing and quantum communications is no longer belongs to the world of scientific laboratories since more and more products are offered by different companies in the market. This course gives an overview on different areas of quantum computing and communication including qubits, quantum registers, quantum gates and different quantum algorithms (Grover, Deutsch-Jozsa, Shor, etc.) and protocols (including quantum teleportation and quantum key distribution).

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAV35	Privacy-Preserving Technologies	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	E	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHIAV35/en/ This course provides an introduction into the practical problems of data protection and privacy. Students can develop skills of understanding and assessing privacy threats

and designing countermeasures. The course focuses on the problem of unwanted personal and sensitive data leakage from different information sources (e.g., large datasets, web-tracking, encrypted traffic, source/binary code, machine learning models), and its detection as well as mitigations using Privacy Enhancing Technologies (PETS). The objective of the course is to provide skills needed by Data Protection Officers (DPO) and also required by the European General Data Protection Regulation (GDPR).

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAV39	Administrating Computer Networks in Practice I.	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	LA1	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHIAV39/en/ The basic objective of "Administrating Computer Networks I." is to introduce the practical administration of computer networks - including network design, installation, and configuration of network devices. This subject gives the basics of "Administration Computer Networks in Practice II." (VIHIAV42) subject, thus providing adequate theoretical and practical knowledge and the way of its direct application. The students who successfully complete also the subject "Administrating Computer Networks II" acquire the knowledge and skills required for the Cisco CCNA (Cisco Certified Network Associate) certification. The certification can be obtained in authorized examination centers, independently from the University education.

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAV43	Cybersecurity Operations Fundamentals	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	LA	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHIAV43/en/ The aim of the course is to provide students an insight into the security problems related to the operation of computer systems. The course also discusses the basics of attacks against computer systems and defense against them. By discussing the possibilities of implementing defense, the students get an insight into the basics of operating a security operations center. The course examines the security of both networks and endpoints, from the perspective of both the attacker and the defender. A secondary objective of this course is to help students prepare for the Cisco Certified CyberOps Associate exam which can be taken at independent certification centers.

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:12:15-14:00; MON:12:15-14:00; THU:08:15-10:00
Practice	C2	English	WED:12:15-14:00; WED:12:15-14:00; THU:08:15-10:00

https://portal.vik.bme.hu/kepzes/targyak/VIHVAB01/en/ 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	WED:10:15-12:00
Practice	C2	English	TUE:14:15-16:00

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
BMEVIIIAA04	Digital Design 1	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	AE	English	TUE:08:15-10:00; TUE:08:15-10:00; TUE:10:30-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIIIAA04/en/

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

Course type	Course code	Course language	Timetable information
Lecture	AE	English	TUE:08:15-10:00
Practice	AG	English	MON:14:15-16:00

https://portal.vik.bme.hu/kepzes/targyak/VIIIAC03/en/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
BMEVIMAD041	Numerical Methods of Linear Algebra	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	1	English	

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:16:15-18:00
Practice	GA	English	WED:16:15-18:00

https://portal.vik.bme.hu/kepzes/targyak/VIMIAC06/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIMIAC10	Artificial Intelligence	Mid-semester mark	3

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

https://portal.vik.bme.hu/kepzes/targyak/VIMIAC10/en/

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	TUE:14:15-16:00
Practice	GA	English	TUE:16:15-17:00

https://portal.vik.bme.hu/kepzes/targyak/VIMIAD00/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIMIMA01	Software and Systems Verification	Exam	4

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

https://portal.vik.bme.hu/kepzes/targyak/VIMIMA01/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIMIMA11	Design and Integration of Embedded Systems	Exam	4

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

https://portal.vik.bme.hu/kepzes/targyak/VIMIMA11/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVISZA026	Combinatorics and Graph Theory 2	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	TA0	English	
Practice	TA1	English	

Geometric and abstract duality, weak isomorphism (2-isomorphism) and the Whitney theorems.Vertex and edge coloring, Mycielsky's construction, Brooks' theorem. 5-colour theorem, Vizing's theorem, connection of edge-colouring to matchings, Petersen's theorem.List colouring of graphs, Galvin's theorem.Perfect graphs, interval graphs and the perfect graph theorem. Ramsey's theorem, Erdős-Szekeres theorem, Erdős' lower bound and the probabilistic method. Turán's theorem, Erdős-Stone theorem, Erdős-Simonovits theorem.Hypergraphs, Erdős-Ko-Rado theorem, Sperner's theorem and the LYM inequality.De Bruijn-Erdős theorem, finite planes, construction from finite field, and from difference sets.Generating functions, Fibonacci numbers, Catalan numbers. Posets, Dilworth's theorem.

Subject code	Subject name	Requirement	ECTS credit
BMEVISZAA03	Introduction to the Theory of Computing 1	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A0	English	MON:12:15-14:00
Practice	A1	English	WED:12:15-14:00
Practice	A2	English	WED:14:15-16:00
Practice	A3	English	FRI:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VISZAA03/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVISZAA05	Foundation of Computer Science	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A0	English	MON:10:15-12:00
Practice	A1	English	WED:12:15-14:00
Practice	A3	English	MON:16:15-18:00
Practice	A2	English	WED:14:15-16:00

https://portal.vik.bme.hu/kepzes/targyak/VISZAA05/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVISZAB02	Probability Theory	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A0	English	MON:10:15-12:00
Practice	A2	English	THU:08:15-10:00
Practice	A1	English	TUE:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VISZAB02/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVISZD309	Matroid theory and its engineering applications	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	1	English	

Subject code	Subject name	Requirement	ECTS credit
BMEVISZDV06	Stochastic models and adaptive algorithms	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	1	English	

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

Course type	Course code	Course language	Timetable information
Lecture	A0	English	TUE:09:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VISZMA03/en/

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	MON:14:15-16:00; MON:14:15-16:00; THU:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VISZMA04/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.
https://portal.vik.bme.hu/kepzes/targyak/VITMAK47/en/