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	AEe	English	TUE:10:15-12:00
Practice	AGYe	English	

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	AEe	English	MON:10:15-12:00; THU:08:15-10:00
Practice	AGYe	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	AEe	English	TUE:10:15-12:00
Practice	AGYe	English	THU:10:15-12:00

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIAUMA02	Business Intelligence	Exam	4

Course type	Course code	Course language	Timetable information
Practice	AEe	English	TUE:14:15-16:00
Practice	AGYe	English	THU:14:15-16:00

https://portal.vik.bme.hu/kepzes/targyak/VIAUMA02/en/

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	AL2	English	TUE:16:15-18:00
Laboratory	AL	English	WED:08:15-10:00
Lecture	AE	English	TUE:14:15-16:00

https://portal.vik.bme.hu/kepzes/targyak/VIEEAC00/en/ 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
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
BMEVIETAA00	Basics of Electrical and Electronic Systems	Exam	3

Course type	Course code	Course language	Timetable information
Laboratory	1_LA	English	THU:16:15-20:00
Lecture	1_EA	English	MON:14:15-16:00

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	8_LA	English	THU:14:15-18:00
Lecture	8_EA	English	TUE:12:15-14:00; TUE:12:15-14:00; WED:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIETAB00/en/

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

Course type	Course code	Course language	Timetable information
Lecture	8_A	English	WED:08:15-10:00; THU:08:15-10:00

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIETMA07	Nanoscience	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	11_a	English	

https://portal.vik.bme.hu/kepzes/targyak/VIETMA07/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
BMEVIHIAV39	Administrating Computer Networks in Practice I.	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	LA2	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	EA	English	MON:12:15-14:00; MON:12:15-14:00; THU:08:15-10:00
Practice	GA	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	EA	English	WED:10:15-12:00
Practice	GA	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
BMEVIHVAC05	Space Technology	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	MON:14:15-16:00
Practice	GA	English	TUE:16:15-18:00

https://portal.vik.bme.hu/kepzes/targyak/VIHVAC05/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIMIAV10	Bioinformatics	Exam	4

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

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
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/

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEAB00	Electrotechnics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	2223_1_VIVEAB00_lab_angol	English	FRI:09:15-12:00
Lecture	2223_1_VIVEAB00_elm_angol	English	TUE:08:15-10:00; TUE:08:15-10:00; WED:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIVEAB00/en/Basic things about Electrotechnics: History. Electricity as energy carrier. AC, DC Current systems. Multiphase systems. Practical circuit calculation methods Definition of the active, reactive power in single phase and 3-phase systems. Calculations with instantaneous values and phasors. Positive directions. Definition of the power sign. Y-D conversion. Nominal values. Per-unit system. Practical calculation methods of energy converters Calculation methods of magnetic circuits. Symmetrical components method. Three-phase vectors. Transformers Magnetic materials. Hysteresis and eddy-current losses. Induced voltage. Excitation balance law. Equivalent circuit and its parameters. Phasor diagram. No-load and short-circuit. Definition of the DROP. 3-phase transformers, connections, phase-shift, parallel connection. Magnetic field of the electromechanical energy converters Magnetic fields of the electrical machines: stationary, pulsating and rotating field. Generation of the rotating field. Torque development. Frequency condition. Operation principles of the basic electromechanical energy converters 3-phase synchronous machine. Condition of the steady-state torque. Synchronous speed. Cylindrical synchronous machine. Equivalent circuit. Pole-voltage, armature voltage, synchronous reactance. 3-hase induction machine. Condition of the steady-state torque. Slip-ring and squirrel-cage rotor. The slip. Equivalent circuit. The DC machine. The commutation. Power electronics, electrical drives Basic converter connections. Electrical drives: starting, braking, speed modification. Electrotechnical environment protection Electromagnetic compatibility (EMC). Low and high frequency effects. Electrostatic discharge. Electromagnetic impulses. Electrical safety regulations Basics, methods, limits, measurements. Electrical energy storage Chemical, electrical, magnetic, mechanical energy storage. Fuel-cells. Electrotechnical applications, trends Requirements of sustainable development. Application of alternative energy sources. Alternative electrical vehicles. New materials and technologies. Superconductivity. Laboratory practices: · Investigation of high-voltage discharges. · Electric shock protection. · The transformer. · Electrical rotating machines. · Non-conventional energy converters.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEAC00	Electric Power Transmission	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	2223_1_VIVEAC00_elm_angol	English	TUE:10:15-12:00
Practice	2223_1_VIVEAC00_gyak_angol	English	WED:16:15-18:00

https://portal.vik.bme.hu/kepzes/targyak/VIVEAC00/en/ The course is intended to provide theoretical knowledge and practical skills in the following fields: structure of the power system, network transformations, process of power transmission and distribution, network elements used for transmission and distribution tasks - interpretation and determination of parameters of transmission network elements used for calculations, representation of the elements - power line and transformer operations - power and voltage conditions of steady state operation, power losses - application of symmetrical components - fundamental effects of short-circuits and switches, calculation - Principles of star point earthing, related phemomena - Substation and busbar topologies - Basics of short-circuit protection Synopsis: 2. Impedances and capacitances of overhead lines. 4-wire model. Self and mutual impedances and capacitances. Symmetrical impedances and capacitances. Line asymmetries, symmetrisation. Calculation of series impedances and capacitances of overhead lines. Tower constructions of overhead lines. Calculation of inductances

of overhead lines. Role of the protective wire. Double circuits, coupling in zero order. 3. Cables. Structure, electric parameters. Warming of cables. Operation of HV transmission lines. Distributed model, line parameters. Charging power, surge impedance power. Characteristic electric parameters. Concentrated T and Pi model, U-I phasor diagrams, approximate calculation of Q-flows. Evaluation of HV line operations: (1) open circuit, voltage profile, (2) active power flows, phase angle difference. Power losses of transmission networks: interpretation and components. 4. Limits of power transmission. Current loading, voltage stability, synchronous stability. Increasing transmission capabilities, FACTS devices. Cross-border capacities: interpretation and definitions. HVDC transmission. HVDC converter stations. Power transmission in HV AC and DC systems. Structure and application of HVDC. Advantages and disadvantages of HVDC. Operation and control of HVDC converter stations. 5. Control with HV transformers. Switching of shunt reactors. Effects of lengthwise and widthwise control of HV transformers in looped networks. Phase shift transformer. 6. MV and LV networks, voltage control, power losses. Roles in distribution network. Typical transformers, line cross sections, electric parameters. Structure of MV and LV networks, voltage profiles, regulations, voltage drops. Voltage control. MV and LV power losses. 7. Calculation of looped HV networks. Calculation models, basic relationships. Interpretation and application of I=Y*U and U=Z*I nodal equations. Determination and measurement of Y and Z. Equivalent models based on Z. Network reduction. 8. Load-flow calculations on looped HV networks. Nonlinear nature of the task, theorem of iteration solutions. Data, parameters, nodal models. Basic equations, solutions. Representation of the results. 9. Representation and calculation of short-circuits and switches with symmetrical components. Comparison of short-circuits. Principles of short-circuit current limitation. Calculation of simultaneous faults. Asymmetrical loading of 0.4 kV networks. Solutions using phase quantities and symmetrical components. Interpretation, analysis. Terminal short-circuit of transformers. Currents, effect of Yd and Dy windings. Earthing transformer, structure, role. Currents and voltages of short-circuits on power lines. Currents and voltages using 4-wire model. Phasor diagrams, symmetrical components. 10. Earthing methods. Effect of star point earthing in case of single-phase-to-ground faults, current-voltage phasor diagrams. 11. Voltage sag, loss of phases on 120/MV/0.4 kV radial networks. Phase-to-ground faults, voltage distortion effect of single-phase switch openings, spread of the effects, role of Yd and Dy transformers. Operation under faulty conditions. Three-phase short-circuit current, short-circuit power, voltage sag. 12. Busbar and substation topologies, principles. Busbars, feeders, devices, current and voltage transformers. Double busbar system, breaker-and-half system, other topologies. 13. Protection devices in the power system. Basic definitions. Role and requirements of protection. Structure and role of protection. Detection methods. Protection of MV busbar and feeders. Protection of radial networks. Coordination of current thresholds. Delayed overcurrent protection. Breaker failure protection. Busbar protection. Distance-time characteristic of protection schemes. 14. Network development. Design standards (ENTSO-E, Operating Rules, Distribution grid codes), methods, calculations. The European power system. Basic characteristics. Maps, differences between the European and the Hungarian network. Grid connection. Prerequisites, contracts, fees. Power supply of electric traction. Circuits, voltage levels feeding stations used in traction.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEAC01	Electrical Machines and Applications	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	2223_1_VIVEAC01_elm_angol	English	WED:08:15-10:00
Practice	2223_1_VIVEAC01_gyak_angol	English	THU:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIVEAC01/en/ Transformers Single-phase and 3-phase transformers. Steady-state and transient operation. Unbalanced load of the 3-phase transformers. Special transformers. Windings of the rotation machines, torque development Concentrated and distributed winding (slots). The induced voltage, the developed air-gap filed, the stray field. Force and torque development and calculation. Induction machines Equivalent circuit and torque development. Deep-slot and double-slot rotors. Effect of the spatial harmonics. Starting and speed modification methods. Asymmetric operation, stator and rotor asymmetry. Single-phase and auxiliary-phase machines. Synchronous machines Cylindrical rotor case: Equivalent circuit and torque development. Motor and generator operation. Stability. Effect of the salient-pole. Reluctance machines. Permanent-magnet machines. Synchronous and induction linear machines. DC machines Armature windings. The role of the auxiliary and compensating windings. Separate, parallel and mixed excitation, characteristics. Starting and speed modification. Modern calculation methods Finite element method (FEM). Poisson equation. Lagrange interpolation polynom. Dirichlet and Neumann conditions. Simple 2D promlem. Presentation of the QuickField, Flux2D and Motorpro, MotorCad software. Applications of electrical machines Household electrical machines. Electrical machines in consumer electronics. Electrical machines in vehicles. Magnetically levitated trains. Superconducting generators and motors. Servo motors. Kinetics of electrical drives Reduction of torques and masses to common shaft. Motion equation of the electrical drives. Stability criterion of drives. Definition of time constants. Design of electrical drive Protection levels. Operation condition of electrical motors. Thermal conditions. Selection of electrical motors. Applications of electrical drives Speed modification and braking methods of DC urban electrical vehicles. Voltage source inverter-fed induction machine driven trolley-bus. Semiconductor-based DC drive driven trains. Inverter-fed trains. Wind generators. The practices: · Calculation of electromagnetic forces · Single-phase transformers · Parallel operation of transformers · Connections of transformers · 3-phase transformers · AC windings · Calculation of the induced voltage · Steady-state operation of induction machines · Starting of induction machines · Steady-state

operation of synchronous machines

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEAC02	Electrical Equipment and Insulations	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	2223_1_VIVEAC02_elm_angol	English	MON:14:15-16:00
Practice	2223_1_VIVEAC02_gyak_angol	English	THU:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIVEAC02/en/ The aim is to provide knowledge about the low and high voltage switchgears, basics of their operation and selection, the interaction between the switchgears and the electric network, insulators applied in electric devices and equipment. Synopsis: Week 1: Categorization of electric switchgears and apparatus, their role in the low, medium and high voltage networks and their functions in the operation of substations. Duties of electrical insulation in apparatus and stresses affecting them. Operation phases of switchgears and calculation of their load. Week 2: Discharges in gaseous insulation. Basic properties of the electric arc, its quenching and behaviour as a circuit element. Goals and methods of electric arc protection. Properties of sulphur-hexafluoride gas as an arc quenching medium. Week 3: Construction and operation of sulphur-hexafluoride circuit breakers and metal-clad switchgear. Construction and operation of medium and low voltage circuit breakers and fuses. Apparatus of the medium voltage overhead distribution network. Week 4: Aspects of the selection of electrical apparatus. Types of low voltage switches and their role in the electrical supply of homes, offices and industrial facilities. Standards related to building electrification. Week 5: Basics of electrical design. Phases of design and the required documentation. Standard symbols. Week 6: Physical processes in insulation at low electric field: conduction and polarization. Week 7: Physical processes in liquid and solid insulation at high electric field: breakdown and flashover. Week 8: Duties and stresses of insulation. Coordination of insulation levels. Week 9: Construction and operation of overvoltage protecting devices. Week 10: Basics of design on electrical stress. Economic use of insulation. Potential control. Week 11: Insulation of transformers and the applied insulating materials. Insulation of rotating machines and the applied insulating materials. Construction of high voltage current and voltage transformers and their insulation system. Week 12: Construction and insulation of overhead lines and the applied insulating materials. Construction of cables and the applied insulating materials. Week 13: Generation and measurement of high voltage – DC, AC and aperiodic voltage impulse, high frequency and damping impulse. Week 14: Basics of standard commissioning tests of electrical apparatus, electrical commissioning tests. Calculations in the following topics: Loads of switchgear. Switch-on transients and let-through current calculation at DC and AC voltage. Transient recovery voltage calculation in case of short circuit at the busbar, on the network and in the dangerous zone. Calculation of electrical stress in the most common insulation arrangements.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEMA04	Protection Systems and Measurement Technology	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	2223_1_VIVEMA04_elm_angol	English	MON:14:15-16:00
Practice	2223_1_VIVEMA04_gyak_angol	English	FRI:08:15-10:00

https://portal.vik.bme.hu/kepzes/targyak/VIVEMA04/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEMA05	Electric Energy Market	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	2223_1_VIVEMA05_elm_angol	English	WED:14:15-16:00
Practice	2223_1_VIVEMA05_gyak_angol	English	WED:16:15-18:00

https://portal.vik.bme.hu/kepzes/targyak/VIVEMA05/en/