Centre of Modern Languages

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
BMEGT60W60A	Communication Skills - English - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	K10_acs	English	TUE:10:15-12:00
Practice	H10_acs	English	MON:10:15-12:00

Detailed description:https://edu.gtk.bme.hu/local/tad/tad.php?id=968
Recommended entrance level: B2
- The course is aimed to prepare the students for communication in their professional field and work, but it also includes study-related topics. All the skills are developed including writing, but the main focus is on oral communication.
- By the end of the course the students will be able to talk about their studies, professional interests, future plans, different types of work (for example small and large companies), their advantages and disadvantages, corporate culture, potential problems arising at work. The students will be able to resolve situations related to professional discussions, conflicts, corporate planning at work (planning discussions, presenting results). They become familiar with reasoning and negotiation techniques, and can successfully use them. They have the necessary skills to write short, formal letters, make suggestions, accept and refuse proposals politely.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W60N	Communication Skills - German - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	H12_nkk	German	MON:12:15-14:00

Detailed description:inyk.bme.hu/wp-content/uploads/2022/03/Communication-Skills-German-B2-.pdf
Recommended entrance level: B2
- The course is aimed to prepare the students for communication in their professional field and work, but it also includes study-related topics. All the skills are developed including writing, but the main focus is on oral communication.
- By the end of the course the students will be able to talk about their studies, professional interests, future plans, different types of work (for example small and large companies), their advantages and disadvantages, corporate culture, potential problems arising at work. The students will be able to resolve situations related to professional discussions, conflicts, corporate planning at work (planning discussions, presenting results). They become familiar with reasoning and negotiation techniques, and can successfully use them. They have the necessary skills to write short, formal letters, make suggestions, accept and refuse proposals politely.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W60S	Communication Skills - Spanish - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	Sz16_skk	Spanish	WED:16:15-18:00

Detailed description:http://inyk.bme.hu/wp-content/uploads/2022/03/Communication-Skills-Spanish-B2-.pdf
Recommended entrance level: B2
- The course is aimed to prepare the students for communication in their professional field and work, but it also includes study-related topics. All the skills are developed including writing, but the main focus is on oral communication.
- By the end of the course the students will be able to talk about their studies, professional interests, future plans, different types of work (for example small and large companies), their advantages and disadvantages, corporate

culture, potential problems arising at work. The students will be able to resolve situations related to professional discussions, conflicts, corporate planning at work (planning discussions, presenting results). They become familiar with reasoning and negotiation techniques, and can successfully use them. They have the necessary skills to write short, formal letters, make suggestions, accept and refuse proposals politely.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W62A	Cross-cultural Communication - English - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	Sz14_axc	English	WED:14:15-16:00

Detailed description: https://edu.gtk.bme.hu/local/tad/tad.php?id=977
Recommended entrance level: B2
- The course is aimed to develop communication skills through the topic of cultural differences and prepare participants for managing intercultural situations they might face in their academic and/or professional career in a globalised world. The focus is on oral skills development, though reading and listening comprehension, as well as writing skills are included.
- Upon completing the course participants will be able to talk about the background of cultural differences, manage intercultural differences with raised awareness and open up to groups from other cultures. Students can identify and analyse the values underlying cultural differences, as well as manage multicultural workplace or scientific and business situations which involve conflict management, discussing, planning and implementing ideas. The course not only develops analytical skills required to gauge and solve intercultural situations, but also emotional intelligence.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W62N	Cross-cultural Communication - German - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	K10_nxc	German	TUE:10:15-12:00

Detailed description: https://edu.gtk.bme.hu/local/tad/tad.php?id=979
Recommended entrance level: B2
- The course is aimed to develop communication skills through the topic of cultural differences and prepare participants for managing intercultural situations they might face in their academic and/or professional career in a globalised world. The focus is on oral skills development, though reading and listening comprehension, as well as writing skills are included.
- Upon completing the course participants will be able to talk about the background of cultural differences, manage intercultural differences with raised awareness and open up to groups from other cultures. Students can identify and analyse the values underlying cultural differences, as well as manage multicultural workplace or scientific and business situations which involve conflict management, discussing, planning and implementing ideas. The course not only develops analytical skills required to gauge and solve intercultural situations, but also emotional intelligence.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W63A	Hungarian Culture	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	K8_aHC	English	TUE:08:15-10:00

Detailed description:https://edu.gtk.bme.hu/local/tad/tad.php?id=1259
Recommended entrance level:: B2
- The series of lectures is designed to engage students in learning about Hungarian people, the land, history, cultural traditions and geography. The lecture focuses on Hungary’s history and culture in considerable depth from the arrival of the Magyars to the Carpathian basin in 896 to the present day, which creates a better understanding of today's Hungarian conditions.
- After completing the course, participants will be able to identify important historic events and their impact on today’s social, political and economic situation. Also, students will become familiar with the main geographical areas and their architectural heritage from Roman ruins and medieval townhouses to Baroque churches, Neoclassical public buildings and Art Nouveau bathhouses and schools. Getting acquainted with Hungary’s rich folk traditions, such as the wonderful embroidery, porcelain, wooden artefacts and music, students will have a better understanding of the Hungarian soul and symbols.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of

assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W64A	English for Engineers - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	Cs8_amű	English	THU:08:15-10:00
Practice	Cs10_amű	English	THU:10:15-12:00

Detailed description: https://edu.gtk.bme.hu/local/tad/tad.php?id=984
Recommended entrance level: B2
- The course is aimed to develop competencies required for effective general and technical/specialist communication in English. There is an equal emphasis on both written and spoken English. In the course students are introduced to distinctive uses of technical texts, with particular emphasis on their lexical and syntactic characteristics. Students acquire the basic technical terminology in all fields of engineering.
- By the end of the course students are able to understand more complex technical texts. Moreover, they are able to create simple technical scripts bearing the basics of the technical register in mind. They are able to formulate their opinions concerning specialist topics. They recognise and use terminology related to their own fields of interest and outside their profession's scope. They are able to elaborate on: technical inventions, innovations, appliances, devices, mechanisms, materials technology, properties of materials, basic geometrical shapes, primary mathematical concepts, proper names of tools, the principles of energy technology and the basic questions of sustainability.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W64N	German for Engineers - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	Cs14_nmű	German	THU:14:15-16:00

Detailed description: https://edu.gtk.bme.hu/local/tad/tad.php?id=985
Recommended entrance level: B2
- The course is aimed to develop competencies required for effective general and technical/specialist communication in English. There is an equal emphasis on both written and spoken English. In the course students are introduced to distinctive uses of technical texts, with particular emphasis on their lexical and syntactic characteristics. Students acquire the basic technical terminology in all fields of engineering.
- By the end of the course students are able to understand more complex technical texts. Moreover, they are able to create simple technical scripts bearing the basics of the technical register in mind. They are able to formulate their opinions concerning specialist topics. They recognise and use terminology related to their own fields of interest and outside their profession's scope. They are able to elaborate on: technical inventions, innovations, appliances, devices, mechanisms, materials technology, properties of materials, basic geometrical shapes, primary mathematical concepts, proper names of tools, the principles of energy technology and the basic questions of sustainability.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W65N	Business German - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	H14_nbl	German	MON:14:15-16:00

Detailed description:https://edu.gtk.bme.hu/local/tad/tad.php?id=988
Recommended entrance level: B2
- The course is aimed to engage students in business communication in the target language, to master business English vocabulary and to understand business processes. The course is aimed at students pursuing economics and engineering studies, providing them with the opportunities to understand and accept the similarities and differences in economic and engineering approaches.
- After completing the course, students will understand not only professional texts but also texts and videos intended for a wider audience, and they will be able to write texts related to managerial work (e.g., summary, reminder, official letter). As a result of the structured development of economic vocabulary, students are able to participate in workplace communication, can comment on economic events, and gather, organise, and share information about companies.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W67N	German in Company Contexts - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	Cs12_nDAF	German	THU:12:15-14:00

Detailed description:https://edu.gtk.bme.hu/local/tad/tad.php?id=991
Recommended entrance level: B2
- The course is aimed to improve B2-level communication required for employment. It focuses on improving verbal and written communication, with all language skills being developed in a balanced way to teach students about using the language in a professional setting.
- After completing the course, students will be able to talk about the various types of work and their own professional development, as well as understand the key information of texts they inevitably come across at work (e.g. job advertisement, employment contract, etc.). In addition, they will be able to produce texts for a job application by using the typical syntactic and lexical elements.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W68A	English for University Studies - B2+	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	K16_aUN	English	TUE:16:15-18:00

Detailed description:https://edu.gtk.bme.hu/local/tad/tad.php?id=992
Recommended entrance level: B2+
The course aims at developing the language skills of students who intend to proceed with their studies in English at a Hungarian or a foreign university. The main objective is to focus on language skills required for studies English in a higher education environment.
- By the end of the course students will be able to follow academic lectures, and they will also be able to take notes and write summaries about these lectures. They will be aware of the main reading strategies necessary for understanding academic literature, and they will be able to take notes and prepare summaries of written texts. They will be familiar with the main characteristic features of producing written texts for specific purposes. They will be able to write CVs, motivational letters and formal letters related to their studies and administrative tasks. They will be aware of the specific features of polite professional communication (e.g. correspondence with instructors), and they will also be able to provide feedback and make recommendations related to professional discussions.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W68N	German for Studies - B2+	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	Cs10_nUN	German	THU:10:15-12:00

Detailed description:https://edu.gtk.bme.hu/local/tad/tad.php?id=993
Recommended entrance level: B2+
The course aims at developing the language skills of students who intend to proceed with their studies in German at a Hungarian or a foreign university. The main objective is to focus on language skills required for studies English in a higher education environment.
- By the end of the course students will be able to follow academic lectures, and they will also be able to take notes and write summaries about these lectures. They will be aware of the main reading strategies necessary for understanding academic literature, and they will be able to take notes and prepare summaries of written texts. They will be familiar with the main characteristic features of producing written texts for specific purposes. They will be able to write CVs, motivational letters and formal letters related to their studies and administrative tasks. They will be aware of the specific features of polite professional communication (e.g. correspondence with instructors), and they will also be able to provide feedback and make recommendations related to professional discussions.
- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Faculty of Architecture

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
BMEEPAG0236	Applied Building Information Modelling B (Archicad advanced)	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN2-ER	English	WED:18:15-20:00(K217)
Laboratory	EN1-ER	English	WED:18:15-20:00(K216)

This course aims to expand the existing CAD knowledge of students to be able to create and modify complex CAD models easily. During the course, we use Archicad, so a basic knowledge of the program is expected.

Subject code	Subject name	Requirement	ECTS credit
BMEEPAG0246	Applied Building Information Modelling A (Revit Architecture)	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN2-ER	English	THU:18:15-20:00(K216)

Design and documentation with Revit Architecure - Introductory course.Design and basic CAD knowledge is recommended. (Architectural informatics 2)

Subject code	Subject name	Requirement	ECTS credit
BMEEPAG0249	Constructive CAAD CE	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1-ER	English	TUE:12:15-14:00(K218)

Advanced CAD modelling course for students who are familiar with AutoCAD. The course deals with modeling concepts and techniques, texture, lighting and rendering. In the second part of the semester students work more or less autonomously (with occasional one-on-one consultations) on a model of their choice. See: http://www.epab.bme.hu/en/?ccce/

Subject code	Subject name	Requirement	ECTS credit
BMEEPEG0995	Architectural Research for Exchange Students - EG	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	

Architectural Research for Exchange Students on the topics of the Department's competency. The aim of the subject is to carry out a research on a special topic. The research contains specifying and processing the related international literature, summing up the findings in a study and finally a presentation. The language of the research depends on the consultant - the available topics are listed on the department's homepage.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEGA301	Building physics	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:10:15-12:00(K230)

One dimensional steady state heat transfer of composit slabsThermal condition for a room, balance temperature of a nonheated space, energy conservation approaches. Conduction: Fourier’s equation, Concept of thermal conductivity, Range of thermal conductance of building materials, One-dimensional steady state conduction through a plane slab. Convection. Steady state heat transfer of composite slabs, overall heat transfer coefficient, temperature gradient. Modified conduction of insulations. Air gaps. Reverse tasks: Maximizing inner temperature different. fulfilling new U-value requirement for existing wall. Examples.Linear heat transmissionIntroduction to Thermal Bridges, Definition of Self-Scale Temperature, two applications of SST, Definition of Apparent Thickness, Generalized model of wall corner, generalized model of wall corner temperature, Example: estimation of wall corner temperature. Moisture transfer Definition of Moist air, Dalton‘s Law, Moisture content, Saturation vapour pressure, Relative humidity, dew point, dry and wet bulb temperatures, Specific Enthalpy, Moisture balance, Mechanism of vapour transfer, Scope of calculation,

Vapour conductivity and resistance, Overall vapour resistance of multilayer wall, Overall vapour transfer, Design consideration, example. Introduction to Solar Architecture Indirect Solar collecting walls. Mass walls: principles, surface, shading, energetic operation, delaying, losses, operation in summer, irradiated solar energy, examples, simplified thermal model. Example: calculation of thermal balance of a mass wallSolar Design Strategies Sustainable future (global impact of buildings, energy crises, the 2030 challenge, sustainable future). Energy Conscious Design (historical overview - traditional and modern architecture, international style, energy conscious architecture and refurbishment). Energy Conscious Refurbishment. Building Energy Standards (building energy regulation, certifications, standards). Energy Consumption of Buildings (Low and Passive and "zero" energy buildings). Autonom buildings. Energy Conscious Architecture, Passive Solar Systems (smart conceptual design, building volumes, thermal mass, mass wall, Trombe wall, transparent insulation, sun space, green roofs). Active Solar Systems (pv-panesl, solar collectors, heat pump, wind turbine)

Subject code	Subject name	Requirement	ECTS credit
BMEEPEGA501	Building Service Engineering 1	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:14:15-16:00(K350)

Water supply
The physical and chemical properties of water. Obtaining of water from the nature. Mechanical, chemical and biological treatment of water. Water treatment process of swimming pools. Transport of water. Characteristics of water pumps. Fresh water demand and production, hydrofors and hydroglobes. Cold water distribution network in a building. Metering of water consumption. Pipe materials and appliancies: valves and taps, safety equipments. Fire protection networks. Domestic hot water demand and production. Domestic hot water networks in a building. Boiler types. Circulation. Appliancies: toilets, baths, showers, washing machines, etc. Legionella.
Waste water systems
Requirements of waste water networks. Traps and syphons. Sanitary rooms for disabled people. Waste water networks. Rain water networks. Pipe materials and fittings.
Gas supply
Physical properties of natural and PB gas. Dangers of gas supply. Safety requirements. Gas supply networks outside and inside the building. Gas meters. Materials and fittings of gas networks. Gas appliancies: boilers, stoves, ovens. Categorisation and safety requirements of appliancies. Chimneys: types and requirements. Parameters of drought. Drought diverter.
Artificial lighting
Visual environment and its components. Characteristics of the human vision. Essential ideas of lighting technique: luminous flux, luminous intensity, illuminance, luminance. Characterisation of surfaces: reflection and transmission, spreading of light, colour. Requirements concerning the lighting. Average illuminance and its uniformity. Colour rendering. Modelling – shadows effect. Limitation of glare. Colour appearance. Balanced ratio of luminance. Cost efficiency. Artificial light-sources. Incandescent lamps. Fluorescent tubes. Compact tubes. HID lamps: mercury lamps, metal halide lamps and sodium lamps. Meeting of requirements. Efficiency-method. Proposed setting of luminaries. Electric network of buildings Parts of the network. Characteristics of the network: form, nominal voltage. Typical installations: lighting, building services and technology. Connection of building to public network. Transformers and its placing. Required areas of switchboards and transformers. Indirect contact.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEK0995	Architectural Research for Exchange Students - EK	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	00	English	

Architectural Research for Exchange Students on the topics of construction technology and management. The aim of the subject is to carry out a research on a special topic. The research contains specifying and processing the related international literature, summing up the findings in a study and finally a presentation. The language of the research depends on the consultant - the available topics are listed on the department's homepage.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEKA501	CM1 - Basics of Construction	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:10:15-12:00(K221)

The goal of the subject is to present basic information on the technologies and organization of construction work, with special respect on construction activities of sub and superstructures. Considering the character of the subject both theoretical and practical knowledge is essential, therefore besides the lectures the site visits play emphasized role as well.Main topics:The construction process. Phases and participants of the construction process (roles, responsibilities, connections, etc.). Technical preparation and controlling of the construction. Handover – take-over of the building (reviewing the constructions – quality and quantity – and the plans)Introduction to construction technologies, conditions, requirements. Aspects of selecting the technology. Sequence of construction works (the follow-up of processes).Main equipment of construction (earthwork, foundation work, construction of loadbearing structures, etc.) Material supply on site – to the site.Informations about the construction site. Construction site

planning.Time scheduling. Types, realations. List of operations, survey for quantities, labour schedule, plant schedule, material schedule.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEKAT41	Construction Management	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:12:15-14:00(K144); TUE:12:15-14:00(K144)
Practice	EN1	English	WED:08:15-10:00(K375)

Curricula, themes, individual projects, tests, subjects of lectures and seminars of the Course are embracing managerial and organizational learnings useful and necessary for all civil engineers, such as: - jobs and organizational structure of Contracting Construction Trade; - jobs and relations of parties collaborating in executing construction projects;- time and resource needs of executing construction projects (basic methods and terms of time -, resource- and cost estimates);- basics of mechanizing Construction, construction equipments and auxiliary plants, typical applications;- organizing construction site (site layout designs).Individual project: Organizational plans (time estimates, resources calculations and site layout designs) of building a simple linear structure (reinforced concrete retaining wall) well known in practice of all civil engineers.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEKK601	CM2 - Building Project Management	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:10:15-12:00(K350)
Practice	EN1-ER	English	WED:12:15-14:00(K350)

The subject introduces the investment process from emerging the idea through tendering until the hand-over and use. It shows the role and tasks of an architect in different phases of a construction process. It gives an introduction of real estate investment, basics of project management. The relationship between costs, time and quality: scheduling, planning and estimating and the procurement methods are revealed. There are case studies in the field of construction projects, their preparation and performance, planning, organising leading and commanding of works. Main topics:Building project managementParticipants of the constructionStart-up of the construction project - architectural competitionTendering and contractingScheduling, networksCost estimationPost occupancy evaluation

Subject code	Subject name	Requirement	ECTS credit
BMEEPEKMB51	Decision Support Methods	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:12:15-14:00(K375); MON:12:15-14:00(K375)

Subject code	Subject name	Requirement	ECTS credit
BMEEPEKMST4	Decision Support Methods	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(K374); TUE:08:15-10:00(K374)

Via some special modelling problems also to be elaborated by students the aim of subject is to introduce some basic skills and knowledge on applied mathematics for to support decisions when planning, controlling and monitoring construction projects.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEKQ903	Special Construction Technology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:13:15-15:00(K221)
Practice	EN1-ER	English	TUE:15:15-16:00(K221)

Subject code	Subject name	Requirement	ECTS credit
BMEEPESA101	Introduction to Building Constructions	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:08:15-10:00(K363)
Practice	EN1-ER	English	WED:08:15-10:00(K363)

This subject introduces all major building construction components (walls, foundations, floors, roofs, skeleton frames, stairs, ramps, doors and windows) and primary building engineering service systems. During lectures, the building is considered as a composition of spaces with different functions, separated by special surfaces. The course aims to introduce and explain the grammar of architectural design through practical tasks, such as the survey of one’s own flat. Concurrently, the basic dependant factors of the creative design process are described. Students are acquanted with technical terminology as well as the role and use of various construction solutions

including their classifications. The above shall assist students with both starting independent design exercise work and the continuing of building construction studies in greater detail.

Subject code	Subject name	Requirement	ECTS credit
BMEEPESA301	Building Constructions 2	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	THU:08:15-10:00(K344)
Practice	EN1-ER	English	FRI:08:15-10:00(K351)

The subject deals mainly with pitched roof constructions, roof coverings and different types of foundations – the latter with consideration to waterproofing solutions. During seminar lectures the principles and details of shallow and deep foundations are introduced, according to functional and load bearing requirements of various building constructions as well as subsurface water and soil type effects. Also introduced are the functions and primary principles of different pitched roof constructions such as: traditional roof, rafter type (modern) roof, purlin and truss type roof as well as contemporary methods of carpentry. Further explanation is provided on occupied (built-in) attic constructions with focus on principles, layers, ventilation, windows and lighting. The main types of roof coverings are shown, such as concrete and clay tiles, flashings and metal roof coverings with special attention to principles and details.

Subject code	Subject name	Requirement	ECTS credit
BMEEPESA501	Building Construction 4	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	MON:08:15-10:00(K344)
Practice	EN1-ER	English	WED:12:15-14:00(K353)

Flat roofs. Classification, general design aspects, basic construction principles (inclination and geometry of the water collecting areas) according to the impacts on the roofs. Arrangement of roofing layers. Requirements concerning to the different constructions, layers, materials, building physics. Waterproofing (membranes, coatings), applied materials and their features. Technologies and details. Tracking type and terrace roofs, green roofs. Flooring. Effects and requirements. Layers, subsystems, acoustical evaluation. Substructures of floor coverings and their technical features. Classification according to the materials, specifications. Waterproofing against domestic and industrial wet effects. Drywalls, suspended ceilings, internal wall coverings. Labelling systems, design aspects, effects, requirements, basic structural principles. Internal separating structures of residential buildings satisfying acoustical requirements, connecting details of slabs, floorings and stairs. Principles of primary building engineering service systems and building constructions of sanitary block.

Subject code	Subject name	Requirement	ECTS credit
BMEEPET0407	History of Theory of Architecture 1	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN1-ER	English	THU:13:15-15:00(K221)

The subject History of Theory of Architecture I. follows the structure of preliminary architectural history courses focusing on the determinant theories of architecture of different periods. The exploration of the most important tendencies and notions of theory of architecture is based on the preliminary history of architecture studies in an essentially chronological structure, evaluating them in critical analysis and searching their role in the history of ideas. Lecture topics include: Categories and concepts of theory in the history of architecture from antiquity to the raise of modernism in the beginning of the 20th century. Vitruvius and his interpretations. Architectural theory in the Middle Ages from early Christianity to late Gothic period. Humanism and the revival of antique architecture in the 15th. The column orders and commentaries on Vitruvius; the theory of the ideal city. Baroque in the reform of the catholic church. Academic movement in France and Classicism in Italy in the 17th . Theory of architecture in France in the 18th century. Enlightenment and revolutionary architecture. 19th century theories in England, France and Germany; the interpretation of medieval and classical heritage. The dilemma of eclecticism. Pioneers of modernism and their manifests. The pluralism in the interpretation of architectural space; architecture and philosophy.

Subject code	Subject name	Requirement	ECTS credit
BMEEPET0995	Architectural Research for Exchange Students - ET	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	

Similarly to the international practice, the course aims research activity in architecture and its documentation primarily. The research topics' possible horizon is determined by the course lists of the departments and the students' interest. Besides the architectural topics, the course will appreciate interdisciplinary and special fields in the international environment. The project work will demonstrate generic and specific skills and understanding of the research's open and synthetic character. The objective of this course is to hone the skills of analysis and abstraction in order to develop a framework for research. The student should be able to draw from precedent in the art, architecture, and engineering in the development of this framework, which will act as scaffolding for the theoretical,

experimental, and creative decisions. This course will consist of a series of consultations with the teachers, but the essay should write by the student. The available topics are given by the Departments of the Faculty. The student can also propose a special topic for research during the course, but the teacher must be agreeing with the proposal. The available topics are listed on the department's homepage: http://www.eptort.bme.hu/

Subject code	Subject name	Requirement	ECTS credit
BMEEPETA101	The Beginning of Architecture, Vernacular Architecture	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:10:15-12:00(K397)
Practice	EN1-ER	English	TUE:12:15-13:00(K397)

The course gives an overview of the architecture in the first period of the evolution of human culture. The classes follow chronology – mainly in the first part of the course – with focusing on the development of building constructions and the development of settlements. Prehistory: Palaeolithic human claim to space, from the cave to the hut. Building activity of Neolithic peasants, one-celled houses and fortified settlements. Introduction to building construction in the Near East and Europe. In the second part the course gives an overview of the vernacular architecture of the world. Native architecture: comparative outline of the architecture of hunting, pastoral and farming peoples. Construction, building materials and decorations. Native American, African and European architecture. The practical lessons show details were delivered in the lecture before. The drawings drawn by students help them to understand the colourful world of common and rural architecture.

Subject code	Subject name	Requirement	ECTS credit
BMEEPETA301	History of Architecture 3 (Medieval)	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:10:15-12:00(K392)
Practice	EN1-ER	English	TUE:12:15-13:00(K392)

The architecture of the Late Roman Empire. The born of Christianity and its „Necessity architecture”. The born of the monumental Christian architecture – Early Christian architecture in Rome. – Early Christian architecture in the eastern Provinces: Palestine, North Africa, Syria – Late Roman and Oriental traditions. Early Byzantine architecture in Thessalonica and in Constantinople. Load bearing structures of the Early Christian period. Different types of barrel vaults, Roman-type cross vault. – Syrian influences in Armenia. The „Iconoclasm” and the aftermath in Greece. Architecture in the radius of influence of Byzantium. The comparison of the basilicas in Rome and in Syria. – Ravenna. The penetration of Christian architecture into barbarian Europe – „Scattered monuments”. Byzantine vaulting systems. The main stream of the Romanesque architecture: the Carolingian architecture with the „evangelizer” Benedictine movements, the three periods of the German-Roman Empire. The Langobard architecture in North-Italy. The Romanesque vaulting systems: Romanesque cross vault, Sexpartite vaulting, „groin-rib” vaulting. Squire-bayed and free vaulting systems – the pointed arch. Basilica and „false basilica” type space organization. – The retrospective interregional influences in Romanesque architecture. – Antique influences. Byzantine influences. The progressive interregional influences in Romanesque architecture – monastic movements: Benedictine and Cistercian, Norman „Imperial” Romanesque architecture. Morphology of medieval detailing. The Early French Gothic cathedrals. – The flourishing period of the French cathedrals, and its influences in South-France, in England, in Germany and in Italy. Interregional influences in gothic architecture: Cistercian gothic formations, the Franciscan and Dominican movements. – The special characteristics of English and German gothic architecture. Late gothic vaulting systems: Cylindrical (or net vaults) and Spherical (or stellar) vaults. Halls and false-halls – Civic movements in Late Gothic in Germany and the proto-renaissance in Italy. Medieval secular architecture.

Subject code	Subject name	Requirement	ECTS credit
BMEEPETA501	History of Architecture 5 (19th century)	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	FRI:10:15-12:00(K211)
Practice	EN1-ER	English	FRI:12:15-13:00(K211)

The period of this History of Architecture subject is the “long nineteenth century” from the 1750s to the 1910s. In this era the architecture and the art turned to the past, to the previous styles using them in a new approach. The architects had discovered the history of art and artistic liberty at the same time. At the turn of the 20th century the art and also the architecture searched for new ways instead of using historical architectural elements or motifs. The changes led to the Modern Movement when buildings were being erected without decoration or ornaments in the first quarter of the 20th century.This period was divided into different eras, but these types of periodization were different in different countries and changed in the course of the 20th century. Beside the question of styles 19th century is important not only because of the appearing of new structures and materials in the architecture but because of the great development in the field of the functional planning. While following the timeline, the classes concentrate on the development of the styles in several areas of Europe (Great Britain, France, Germany, Russia) looking out to the United States of America too, because there the styles reflected the European ones.

Subject code	Subject name	Requirement	ECTS credit
BMEEPETO921	Theory of Achitectural Design	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:10:15-12:00(K285)

The course aims at awakening and strengthening the students' abilities, interest, to reflect on architectural design, in accordance with their own cultural background, in the original spirit of theorizing: thinking of, looking at, with freedom and criticism. Considering the special and unique position of this continuous reflective activity as an operative and constitutive part of the architectural design practice, the course not only picks up special themes of history and contemporary discourses,but also concentrates on mobilizing the students practical and theoretical skills, already acquired during their previous studies.

Subject code	Subject name	Requirement	ECTS credit
BMEEPETQ703	History of Hungarian Architecture	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	MON:17:15-19:00(K285)

Subject code	Subject name	Requirement	ECTS credit
BMEEPETT611	Preservation of Historic Monuments	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:16:15-18:00(K275)

The course gives an overview on history and theory of the architectural preservation in Europe and Hungary.
Presents the evaluation of the way of thinking from purism to the modern practice of restoration. It is an important part, when national and international documents and theoretic papers are discussed, form Morris and Ruskin's work, over Boito's "Prima carta del restauro" (1883) to Krakow Charter 2000.
Following the historic part some technical aspects of preservation are discussed, i.e. surveying methods and techniques, non-destructive and destructive building archaeological methods etc. The brief introduction to building archaeology helps to understand the importance of theoretic reconstruction of independent building phases of the historic monument. The detailed discussion of the topic is part of the Preservation of historic buildings 2 – Building archaeology elective subject.
The third part is dealing with architectural and design-methodological questions of preservation. Especially the architectural problems of presentation of archaeological heritage, the reuse and functional problems of industrial and vernacular buildings for modern purposes.

Subject code	Subject name	Requirement	ECTS credit
BMEEPIP0995	Architectural Research for Exchange Students - IP	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	

Similar to the international practice aims the course primary research activity on architecture and its documentation. The possible horizon of the research topics is determined by the course lists of the departments and the personal interest of the students. Beside the architectural topics will give the course an appreciation of interdisciplinary and special fields in international environment too. The project work demonstrating generic and specific skills and understanding of the open and synthetic character of the research. The objective of this course is to hone the skills of analysis and abstraction in order to develop a framework for research. The student should be able to draw from precedent in both art, architecture and engineering in the development of this framework, which will act as scaffolding for the theoretical, experimental and creative decisions. This course will consist of a series of consultations to the teachers, but the essay should written by the student. The available topics are given by the Departments of the Faculty. The student can propose also a special topic for research during the course, but the teacher has to be agree with the proposal.

Subject code	Subject name	Requirement	ECTS credit
BMEEPKO0995	Architectural Research for Exchange Students - KO	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	

Similar to the international practice aims the course primary research activity on architecture and its documentation. The possible horizon of the research topics is determined by the course lists of the departments and the personal interest of the students. Beside the architectural topics will give the course an appreciation of interdisciplinary and special fields in international environment too. The project work demonstrating generic and specific skills and understanding of the open and synthetic character of the research. The objective of this course is to hone the skills

of analysis and abstraction in order to develop a framework for research. The student should be able to draw from precedent in both art, architecture and engineering in the development of this framework, which will act as scaffolding for the theoretical, experimental and creative decisions. This course will consist of a series of consultations to the teachers, but the essay should written by the student. The available topics are given by the Departments of the Faculty. The student can propose also a special topic for research during the course, but the teacher has to be agree with the proposal.

Subject code	Subject name	Requirement	ECTS credit
BMEEPKOA301	Public Building Design 1	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN-KO-0	English	FRI:10:15-12:00(K221)

Our basis for design principles are the functions of public buildings and technical requirements, exploring by analysis of architectural history and references. During the course will be analysed important examples of Hungarian and International public buildings concerning architectural space, architectural form, use of materials and structures, in relationship to various environmental factors. Lectures indroduce all major types of public buildings from points of view of the consumers and contributors. The course lays on the practice of design in the second semester, the Public Building Design 2.

Subject code	Subject name	Requirement	ECTS credit
BMEEPRA0995	Architectural Research for Exchange Students - RA	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	

University of UniversitiesStudents joining the Department of Graphics, Form & Design will have the opportunity to participate at the University of Universities. UoU (https://uou.ua.es) is an international / interacademic course with the contribution and close collaboration of 40 faculties of architecture and arts around Europe, of which our department has been an active member since its first edition three years ago. Instead of a single specific research program, our students will have the opportunity to join six (2-week long) compact project or research-based creative & scientific workshops, over the course of the semester. Each of the 6 sessions offer a selection of 3 to 5 online workshops, covering various fields of Architecture & Arts, among which students have complete freedom to choose, according to their interest and preference. We will also offer students developing the results of one or more of their workshops into a scientific paper the opportunity to publish at the open access UoU Scientific Journal (indexed at DOAJ / SHERPA / RoMEO / Dialnet / Norwegian Register for Scientific Journals).For more information, please visit the following link: http://www.rajzi.bme.hu/en/research/research-themes/630-university-of-universities

Subject code	Subject name	Requirement	ECTS credit
BMEEPRAA305	Form and Composition 1.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	WED:15:15-18:00(K3R5)

Form and Composition 1 is the first course in the academic unit extending over four semesters, titled 'Studio of Architectonic Thinking' The course aims to provide students with guidance:
- from the aspect of forms: to the exploration of the interconnections among perpendicular and nonperpendicular, planar and spatial compositions based on the line (either straight or curved) as fundamental structural and geometrical component, and to the creation of such compositions in plane and space.
- from the aspect of composition: to grasp the possibilities, fundamental concepts and operations of linear compositions in plane and space;
- from the aspect of colour theory: to understand grayscale and coloured monochromaticity, the different monochromatic colour scales of the colour plane, and the context and aesthetic content of colours and the various colour systems;
- from a technical aspect: to the basic steps of preparing hand-drawn linear, structured drawings, colour paintings as well as manual collages, scale models, digital images and 3D models;
- and from the aspect of visual communication: the various potentials and essential functions of pi graphics, image manipulation, and the basic techniques of digital collage, photo montage, typography and infographics.
Projects of the semester include instructor-assisted and supervised individual and group works.

Subject code	Subject name	Requirement	ECTS credit
BMEEPRAA505	Form and Composition 3.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	TUE:15:15-18:00(K3R4)

Form and Composition 3 is the third course in the academic unit extending over four semesters, titled

'Studio of Architectonic Thinking'. The course aims to provide students with guidance:
- from the aspect of forms: to the potential principles of architectonic shaping, form-finding and form research based on the mass (spatial form, shape) as fundamental structural and geometrical component in perpendicular, non-perpendicular and curved configurations;
- from the aspect of composition: to grasp the possibilities, fundamental concepts and operations of volumetric compositions; the compositional principles of surface partitioning of volumetric forms and the visual compositional guidelines of orthogonal imagery;
- from the aspect of colour theory: to the application of colours in their most commonly used saturation, triad and quadriad colour harmonies, the aesthetics of realistic visualization (surface textures & factures) and its application possibilities in digital collage
- from a technical aspect: to digital or hybrid graphical techniques, and a more advanced level of creating quality manual or digital scale models.
- and from the aspect of visual communication: to an advanced use of raster graphics and realistic visualization or (matching to scale) abstraction of the characteristics of light and materials.
Projects of the semester include instructor-assisted and supervised individual and small-group works.

Subject code	Subject name	Requirement	ECTS credit
BMEEPRAOs80001-00	Colour Dynamics	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
EA	EN1-ER	English	TUE:10:15-12:00(K3R5)

Subject code	Subject name	Requirement	ECTS credit
BMEEPST0151	Basics of Structural Design	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	EN1	English	WED:14:15-16:00(K353)

The subject is suggested for student on MSc course to refresh the structural studies of the different BSc courses. The typical structural problems are presented: beams, slabs, columns, walls, trusses and bracings. All the typical structural materials are presented too: reinforced concrete, steel, timber and brick. The structural analysis is on the focus: loads, the hierarchy of structural elements, equilibrium, internal forces, stresses. The resistance of the structural elements is the other topic: elastic and plastic resistance, buckling resistance. The Eurocode is the base of the resistance calculations, but the subject tries to be “code freeCloseCurlyDoubleQuote, the knowledge can be used all over the world. After all the students pass this subject can be ready for the advanced courses of our MSc: Special Loadbearing Structures, Comprehensive Design and Diploma Design.

Subject code	Subject name	Requirement	ECTS credit
BMEEPST0655	Design of Reinforced Concrete Structures	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:14:15-16:00(K221)

The subject introduces students into the way of design of approximate dimensions, joints and structural solutions of reinforced concrete structures. Invited lecturers expose some of the most significant recent investments in reinforced concrete in Hungary. The aim of the course is to develop the ability of students - on the basis of EUROCODE 2 - to adopt architectural dimensions and to evaluate the effect of the chosen architectural lay-out onto the structural solution.

Subject code	Subject name	Requirement	ECTS credit
BMEEPST0995	Architectural Research for Exchange Students - ST	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	

Architectural Research for Exchange Students on the topics of the Department's competency. The aim of the subject is to carry out a research on a special topic. The research contains specifying and processing the related international literature, summing up the findings in a study and finally a presentation. The language of the research depends on the consultant - the available topics are listed on the department's homepage.

Subject code	Subject name	Requirement	ECTS credit
BMEEPSTA105	Statics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(K221)
Practice	EN1	English	FRI:10:15-12:00(K364)

Statics is a compulsory first-year BSc level course of the architectural engineering curriculum, which aims to promote

basic engineering skills.We focus on the theory of statics, as well as the basic steps of structural analysis and modeling. Basic concepts of mechanics are introduced (force, distributed force, moment, resultant, equilibrium). The basic elements of structural models are presented. Statically determinate structuresin two dimensions, including beams, columns, frames, trusses, and complex structures are analyzed.Reactions, internal force diagrams and their extremal valuesare calculated. Applications to building structures are demonstrated.

Subject code	Subject name	Requirement	ECTS credit
BMEEPSTA305	Strength of Materials 2	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:13:15-16:00(K364)
Practice	EN1-ER	English	THU:14:15-16:00(K364)

Strength of Materials 2 is a compulsory engineering core subject. The goal of the course is to determine the displacements of statically determinate load-bearing structures and the internal forces of statically indeterminate frame structures and bracing systems based on elastic and plastic design principles. The purpose of the course is to explain the theoretical relationships related to the mechanics of frame structures and to give the basis for the design decisions to be made in the conceptual design phase. The theoretical basis is presented through examples of architectural practice. Another goal is to develop appropriate skills in solving tasks of load-bearing structures.

Subject code	Subject name	Requirement	ECTS credit
BMEEPSTA501	Design of Load-Bearing Structures	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:10:15-12:00(K351)
Practice	EN1-ER	English	FRI:08:15-10:00(K352)

Basic conceptual and computational design methods of load-bearing structures are discussed for reinforced concrete-, steel-, timber and masonry buildings.
The main goal is to gain knowledge about structural design problems and principles of structural design in order to understand how and why the load-bearing structure influences the work of an architect.

Subject code	Subject name	Requirement	ECTS credit
BMEEPSTA505	Design of Loadbearing Structures 2	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:10:15-12:00(K351)
Practice	EN1-ER	English	FRI:08:15-10:00(K352)

The aim of the course is to become familiar with the important construction and calculation methods of structural design. The main themes of the course include design of the bracing system, effect of earthquake, 2D surface structures (plate, wall structures), usage of the finite element method for 2D elements; construction and design of reinforced concrete structures and load-bearing masonry structures, like slabs, reinforced concrete frames and masonry walls both in ultimate limit state and serviceability limit state. The course prepares students for the construction of reinforced concrete and masonry buildings, that is related to architectural needs. Besides getting to know the structural systems, the subject also deals with the dimensioning of structural elements and provides an opportunity to learn modern computer calculation methods.

Subject code	Subject name	Requirement	ECTS credit
BMEEPTCEP01	Interdisciplinary, Project based Design F	Mid-semester mark	16

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	MON:08:15-16:00(K222); WED:08:15-16:00(K222)
Practice	EN2-ER	English	TUE:08:15-16:00(K222); THU:08:15-16:00(K222)

The course is based on a cooperation of a design and a technical department. In each semester we try to attain and correspond to architectural quality while designing considering one selected technical aspect. The course will be held in a workshop style. Students' work will be accompanied by consultants of both departments. Students will have to complete their tasks in groups. The development/progress of their projects will be presented by the students in form of open presentations during the seminars. These presentations will be immediately evaluated by the consultants who will discuss the work in public. The seminars not only provide space to collective consultations and presentations but also contain the consultant's phase-specific presentations which shall improve the development of the work.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUI0893	Cities of the World	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN1-ER	English	FRI:12:15-15:00(K393)

Course on current challenges of global urbanization with special focus on small scale & network interventions in cities and suburban areas. Topics discussed: (1) how theoretical thinking on urban development is transformed in the context of global urbanization; (2) how deindustrialization is reflected in the changing urban development dynamics; (3) what are the impact of political and market forces on city development; (4) the impact of sustainability and resilience on urban planning; (5) possible ways to enhance the overall quality of urban life.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUI0995	Architectural Research for Exchange Students - UI	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	

Architectural research for exchange and international students: with the professional leadership of the tutors of the Department of Urban Planning and Design students work on individual research topics (eg.. Urban History, Urban Tipologies, Urban Morphologies, Housing estates etc.). The course is based on individual work, with a final output of an essay.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUIA501	Urban Design 1	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:08:15-10:00(K221)

The subject is the theoretical course of the fifth semester. The goal is to introduce students to the theoretical background of Urban Planning and Design with specially focusing on the knowledge and skills necessary for the successful participation in the Design courses later on in the curriculum. The course deals with the historical background, fundamental theories, basic typologies, most wide spread urban forms and basic sustainability aspects of the urban environments worldwide.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUIQ701	Contemporary City: Urban Form and Space Usage	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	FRI:12:15-16:00(K350)
Practice	EN1-ER	English	

Understanding the contemporary development of the inherited urban landscape is not about what to do, but how to think about what to do. The seminar focuses on the closed/open duality of the urban fabric because this qualitative dimension characterizes not only the physical context but is also strongly related to the social. On one hand, the degree of closeness/openness is one of the most important characteristics of every historic, modern, and contemporary urban form, and on the other hand, these physical forms influence or define the space usage within the city.As international students have various cultural and educational backgrounds, the course uses the opportunity to learn from each other, to discover, and compare several urban case studies. The practical part facilitates this method by analyzing so-called “déjá vu” urban situations worldwide. The course introduces local and global components that shape the contemporary city and gives tools for further complex discovery related to urban design or research.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUIQ802	Hungarian cities: urban culture and planning	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:15:15-17:00(K397)
Practice	EN1	English	

The aim of the course is to introduce students to the specific formation and development of the Hungarian settlement system through the different historical periods of urban growth. Each era will be presented through the historical and social background, as well as the settlement establishment and development factors, such as the town-forming role of the environment, nationalities, religions and social stratification; and the Soviet influence on town planning. Among other things specific environment-forming activities and morphological, townscape and floor plan characteristics typical of Hungary will be discussed. During the semester, several (invited) lecturers will give presentations on the different topics, enriching the course.Main topics: Geographical features of Hungary, Geography and Urban Space; Urban morphology;Modern recreational architecture on the Balaton Lakeside, Blocks of flats in Budapest, Urban architectural tendency during the State-socialism, Spatial patterns of urban tourism in Budapest; Local knowledge of settlementsOn Sept 22 2022: Urban walk

Subject code	Subject name	Requirement	ECTS credit
BMEEPUIQ902	City and City	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:16:15-17:00(K211)
Practice	EN1	English	WED:17:15-18:00(K211)

The course looks at cities from the perspective of the users, the inhabitants, from a kind of internal point of view, trying to understand the nature of change and the role of local societies, how the same tool can have different effects and spatial imprints in different cities on different socio-economic grounds.
The subject examines the interaction between the physical environment and social and economic change in specific types of cities. It also attempts to capture the spirit and nature of cities by including the cultural context. In the seminar-like but interactive theoretical lessons, thematic summary analyses based on international literature are complemented by literary and film material that is representative of the cultural imprint of the cities under study.
The main theme of the semester is PLACEMAKING, which will focus on a specific area of Budapest (Népszínház utca) together with several invited tutors.

Faculty of Chemical Technology and Biotechnology

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
BMEVEBEA301	Biochemistry	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A12	English	MON:15:15-18:00(CHA11)

The subject (biochemistry) does not aim at giving comprehensive biochemistry knowledge. Instead it would like to give a short overview of the biochemical pathways and their connections. The first part gives basic knowledge from the field of basic cell biology. The second part focuses to the basic principles of enzymology and bioenergetics. This part gives background to the metabolic processes discussed in the third block. The energy producing processes such as the oxidative phosphorylation and the photosynthesis is embedded into this metabolic part. This metabolic part is followed by the forth, last part which discuss the basics of molecular biology.
Basic chemical and biological principles
Cells are the structural and functional units of all living organisms Prokaryotes, Eukaryotes,Basic cell chemistry,. Cells Are Made From a Few Types of Atoms, Chemical bonds, Water, the most abundant part of cells, Four types of non-covalent interactions, A cell is formed from carbon compounds.
Enzymes The catalysed reactions, Most enzymes are proteins, Enzymes are classified by the reactions they catalyse, How enzymes work, Enzymes Affect Reaction Rates, Not Equilibria, Specificity of Enzymes,Enzyme Kinetics, Enzymes are subject to reversible or irreversible inhibition,Reversible inhibition,Irreversible Inhibition, The regulation of enzyme activity.
Bioenergetics Cells obtain energy by the oxidation of organic molecules, Oxidation and Reduction Involve Electron Transfers,The free-energy change for a reaction determines whether it can occur, Activated carrier molecules: energy currencies, ATP is the most widely used activated carrier molecule, FADH2, NADH and NADPH are important electron carriers, Other activated carriers
Carbohydrate metabolism – glycolysis gluconeogenesis Glycolysis, The reactions of glycolysis, Fates of pyruvate and NADH, Energy yield of aerobic versus anaerobic glycolysis, Other functions of glycolysis, Regulation of glycolysis,Gluconeogenesis.
Carbohydrate metabolism – pentose-phosphate pathway Oxidative phase of the pentose phosphate pathway, The non-oxidative phase of the pentose phosphate pathway
Pyruvate dehydrogenase enzyme complex – TCA cycle Pyruvate Dehydrogenase Complex, Structure of PDC, Regulation of PDC, The TCA cycle, Reactions of the TCA cycle, Energetics of the TCA cycle, Regulation of the TCA cycle, TCA cycle in biosynthetic pathways and anaplerotic reactions, The glyoxylate cycle
Terminal oxidation – oxidative phosphorylation, ATP synthesis in the mitochondria Overview of terminal oxidation and oxidative phosphorylation, Electron transfer fromNADH to O2,The electrochemical potential gradient, ATP Synthase, Energy yield from the electron transport chain, Respiratory chain inhibition and sequential transfer, Coupling of electron transport and ATP synthesis,Regulation through Coupling, Uncoupling ATP synthesis from electron transport
Photosynthesis – Calvin cycle, General features of photophosphorylation Light absorption, Chlorophylls Absorb Light Energy for Photosynthesis,Light-Driven Electron Flow, The cytochrome b6f complex links photosystems II and I, Cyclic electron flow between PSI and the cytochrome b6f complex increases the production of ATP relative to NADPH,. Water is split by the oxygen-evolving complex, ATP synthesis by photophosphorylation, The ATP synthase of chloroplasts is like that of mitochondria, Carbohydrate biosynthesis in plants, Carbon Dioxide assimilation occurs in three stages, Photorespiration and the C4 and CAM pathways
Lipid metabolism – Fatty acid oxidation Lipid transport, Mitochondrial oxidation of fatty acids, Oxidation of a fatty acid with an odd number of carbon atoms, Oxidation of unsaturated fatty acids,Generation of ketone bodies,Biosynthesis of fatty acids,Cholesterol
Protein, amino acid metabolism Nutritionally nonessential amino acids have short biosynthetic pathways, Catabolism of proteins and of amino acid nitrogen, Transamination, Oxidative deamination of glutamate, Ammonia transport, Reactions of the urea cycle, Catabolism of the carbon skeletons of amino acids
Nucleotides Metabolism of purine and pyrimidine nucleotides,Purines and pyrimidines are dietarily nonessential, Biosynthesis of purine nucleotides, Biosynthesisof pyrimidinenucleotides
DNA replication Replication is semiconservative
13. Transcription
Translation The Genetic Code, Cracking of the Genetic Code, Wobble Hypothesis, Translational Frameshifting and RNA Editing, The process of protein synthesis,The ribosome, Transfer RNAs,Stages of the translation process

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAA306	Plastics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	lab-ENG	English	FRI:13:15-17:00(HF4)
Lecture	theory-ENG	English	MON:08:15-10:00(CH301)

Introduction. Position and development of the plastics industry, the role of plastics in the economy. Definition: macromolecule, polymer, plastic, additives, other ingredients. Types of plastics: linear and cross-linked polymers, elastomer, engineering plastics. Properties of polymers and their modification. Outline of the subject, key questions (chemistry, physics, processing, application, environmental issues).
2.   Polymerization. Radical polymerization. Basic reactions: initiation, chain propagation, chain transfer, termination. Polymerization technologies: gas phase, emulsion, suspension, bulk. Copolymerization, relative reactivity. Ionic polymerization. Stereospecific polymerization.
3. Polycondensation, cross-linked polymers. Functionality, average functionality. Molecular mass and functionality, criterion of cross-linking and the production of cross-linked polymers. Materials, short introduction to the most frequently used polymers. Thermoplastics: PE, PP, PVC, PS and its copolymers. Engineering plastics: PC, PET, PA. Thermoset resins: pheno- and aminoplasts, epoxy resins, polyesters, polyurethanes. Elastomers and rubbers.
4   Polymer physics. Conformation, the freely-jointed chain model, factors hindering conformational changes. Radius of gyration, chain-end distance, entanglements. Polymer solutions, phase diagram, solubility. Several methods to determine molecular weight. The behavior of solid polymers, rubber elasticity.
5.   Deformation and fracture. Gas, liquid and solid state. Physical states. Crystalline and amorphous materials. Themomechanical traces, transitions. Melt rheology, flow, viscosity, shear dependence. Phenomenological models, viscoelastic deformation. Unidirectional deformation, stress vs. strain traces, necking. Fracture, brittle and plastic fracture, stiffness-impact resistance correlations.
6.   Correlation of structure and properties. Relationship of the molecular and macroscopic structure of plastics, characteristic temperatures, properties. Plasticization. Semi-crystalline polymers. Crystallization, melting, polymorphism. Nucleation. Correlation between crystalline structure and properties. Structure of amorphous polymers.
7.   Modified polymers. Polymer blends, miscibility, compatibility. Particulate filled polymers, correlation between component characteristics and composite properties. Reinforcing with short and long fibers. Micromechanical deformation processes. Structure and properties. Influence of interfacial interactions.
8.   Processing of thermoplastics. Physical states and processing technologies. Melt processing, the role of viscoelasticity. Extrusion, injection molding, blow-molding, calendaring. Processing in the rubber elastic state: thermoforming. Machining.
9.   Other processing methods and products. Fiber spinning, foams, membrane technology. Reactive injection molding. Processing of cross-linkable resins. Molding epoxy resins, impregnation, polyester resins reinforced with glass fibers and mats. Phenoplast and aminoplast boards. Rubber technology, tires. Lacquers, adhesives.
10. Application of plastics. Types of plastics used as packaging materials, the corresponding processing technologies, products. The most important characteristics of plastic packaging materials (mechanical properties, aesthetics, permeability, additives, lifetime, etc.). Aspects used in the selection of plastic packaging materials (properties, economy, regulations). Packaging of food and drugs. Legal aspects of using plastic packaging materials. Automotive industry. Body and body parts, bumpers. Suspension, vibration and sound insulation. Under hood parts. Lights and other electric parts. Instrument panel, seats, floor, trunk. Electronics, informatics. Insulators and conducting plastics. Non-linear optical plastics. Light sensitive, piezoelectric and liquid crystal polymers. Household equipment, bowls, plates, utensils. Chemical industry, pipes, pumps, heat exchangers. Agriculture: green houses, irrigation systems, artificial insemination, animal identification plates. Healthcare: disposable products, catheters, etc. Building industry: pipes, wall paper, profiles, electrical parts, etc.
11. Degradation, stabilization, additives. Reasons of degradation: heat, light, oxidation, irradiation. Mechanism of degradation, chain scission, elimination, depolymerization. Type of additives: additives maintaining (stabilizers, lubricants) or modifying properties (plasticizers, fillers, colorants, blowing agents, impact modifiers, etc.). Role and mechanism of additives.
12. Plastics and the environment. Plastic waste. Life cycle analysis. Methods of waste disposal: incineration, chemical decomposition, reprocessing, dumping. Technical and financial questions of reprocessing. Natural polymers and components: starch, cellulose, wood flour. Biodegradable polymers: properties and economy. Legal issues related to the handling of plastic waste.

Laboratory practice
1.   Introduction. Presentation of the goals and method of lab practice. Instructions for the preparation of the reports and information about individual questions. Aspects of the evaluation of the work done in the lab and of the report. Information about the prevention of accidents and fire in the lab.
2.   Identification of plastics. Application of rapid methods for the identification of unknown plastics. Identification based on visual inspection and the burning test (way of burning, odor of burning material, pH, dripping). Identification of heteroatoms, solubility and density.
3.   Thermal analysis of polymers. Application of differential scanning calorimetry (DSC), polarization

optical microscopy, thermo-optical methods for the study of plastic products. Differences between crystalline and amorphous polymers, analysis of correlations between structure and application properties.
4.   Mechanical properties of plastics. Tensile testing of amorphous and crystalline polymers and copolymers, evaluation and interpretation of tensile characteristics. Application of dynamic mechanical thermal analysis (DMTA) for the determination of the relaxation transition of polymers (demonstration).
5.   Extrusion of thermoplastics. Introduction to the construction and operation of the extruder. Processes taking place in the extruder and the factors determining them. Similarities and differences in industrial and laboratory extrusion. Correlations between the technological parameters of the extrusion and the properties of the product.
6.   Injection molding of thermoplastics. Parts, construction and operation of injection molding machines. Detailed presentation of processes taking place during injection molding. Structure and properties of injection molded parts. Effect of injection molding technology on the properties of injection molded parts.
7.   Plastic foams. Production of foams with physical and chemical blowing agents. Preparation of foamed polystyrene blocks. Production of soft and rigid polyurethane foams. Characterization of the structure of the foam.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAA405	Physical Chemistry II	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A6-ER	English	TUE:08:15-11:00(CH307); THU:14:15-17:00
Practice	A7-ER	English	TUE:08:15-11:00(CH307); THU:14:15-17:00

The subject provides theoretical and practical knowledge on the chapters of physical chemistry related to „change”. The rates of processes, as well as equilibrium electrochemistry are discussed. The three main chapters of physical chemistry II are Reaction Kinetics, Transport Processes and Electrochemistry.
Kinetics: rates of chemical reactions – Definitions: molecularity, order of reactions, rate of reaction. Zero-order reactions, first-order reactions, second-order reactions.– Equilibrium reactions. Consecutive and parallel reactions.– Homogeneous catalytic reactions, autocatalysis, enzyme kinetics, oscillating reaction.– Temperature dependence, collision theory, transition-state theory.– Determining the order and rate constant of a reaction.– Kinetics of heterogeneous reactions.– Kinetic salt effects.Electrochemistry – Chemical potentials and activities in electrolyte.– The electrochemical potential.– Electrochemical cells.– Thermodynamics of Galvanic cells, the Nernst equation.– Electrode potentials.– Types of electrodes.– Membrane potentials, glass electrodes.– Conductivity of electrolytes.– Electrode kinetics and polarization.– Corrosion, Protecting against corrosion.Transport phenomena– Definitions, thermodynamic driving forces.– Laws of diffusion: Fick laws, statistical view, steady state diffusion.– Heat conduction.– Viscosity, newtonian and non-newtonian fluids.Physical Chemistry Calculations in kinetics and electrochemistry

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAA506	Physical Chemistry Laboratory Practice	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	A0	English	THU:08:15-12:00(F11FK)

Introductory lecture: students are introduced with the basics of experimental procedures in determination of physicochemical properties of materials, types of experimental errors, calculation and characterization of errors and presentation of experimental results. Mathematical statistics (probability, deviation) will be discussed shortly.The practical part of the subject consists of 8-10 practices in small groups (6 students in one group) which will be chosen from the following practices at the beginning of each semester. Each practice aims to improve the skills of students in individual work, arranging of experimental setups and critical evaluation of results. The knowledge covers various fields in thermodynamic and kinetics as it follows.1. Determination of apparent heat of evaporation in a one-component system. Various organic solvents will be characterized by using the Clausius-Clapeyron-equation and several possible experimental errors will be considered during the measurement. The method of linear least squares regression is used for evaluation.2. Phase equilibrium inliquid-liquid two-component systems. Two-component systems displaying either LCST or UCST will be investigated and the composition-temperaturephase diagram will be constructed. Component balance equation will be discussed and used to determine the volume ratio of phases.3. Adsorption. Two different experiments will be introduced: nitrogen gas adsorption and adsorption of diluted solutions on the carbon surfaces. Theoretical background and limits of the methods will be discussed and results of the methods will be compared with a critical viewpoint.4. Determination of the molecular weight of a linear macromolecule using viscosimetry. The terms dynamic, relative, specific and intrinsic viscosity will be introduced and discussed. The molecular weight of a chosen neutral polymer will be determined by the measurement of its relative viscosity by a capillary viscosimeter. Experimental error and its effect on the molecular weight will be characterized.5. Rheology. Flow and viscosity curves will be discussed and classified. Newtonian and thixotropic fluids will be investigated by using an Ostwald and a rotational viscosimeter. 6. Calorimetry. Various calorimetric methods will be introduced. Heat of an acid-base reaction will be determined by an adiabatic calorimeter while specific heat capacity of an organic liquid will be determined by a heat transfer calorimeter. Experimental results will be compared with

literature data. 7. Conductivity of electrolyte solutions. The basics of conductometry will be introduced and the terms conductivity, specific and molar conductivity will be discussed. The degree of dissociation of a chosen electrolyte will be determined by the measurement of conductivity and thermodynamic functions for the dissociation (enthalpy, Gibbs free energy and entropy) will be calculated.8. Rate constant of iodination of acetone. Basics of reaction kinetics (order, rate constants) will be discussed and the reaction rate constant of a simple chemical reaction will be determined by concentration measurements as a function of time with titration. The rate-limiting reaction step will be determined by linear plot.9. Order of a component in kinetics of decomposition of hydrogen peroxide. Reaction rate of the peroxide will be calculated from the flow rate of the product (oxygen gas) in a continuous reactor. Order of the kinetics will be determined.   10.Kinetics of reaction between ions. Basic of reaction kinetics and the effect of inert ions on reaction rate will be discussed. A simple ion reaction will be investigated and reaction time will be determined by using a colour indicator of reaction end. Reaction rate constant will be determined and the effect of experimental errors will be analysed. 11. Electrochemistry. Both electrochemical equilibrium and kinetics of an electrochemical reaction will be investigated. A simple galvanic cell will be constructed and the validity of the Nernst-equation will be analysed in a wide concentration range of components. Polarization of an other cell will be characterized by recording the polarization curve and the Tafel plot of an electrochemically active organic compound.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM110	Materials science: traditional structural materials and polymers	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	ENG_lab	English	THU:08:15-12:00(HF4)
Lecture	theory	English	WED:14:15-16:00

Materials science explores the relationship between the processing technology, structure and properties of materials in order to meet the requirements of specific applications. The goal of the course is to offer information about the structure, properties and behavior of the frequently used structural and functional solid materials. The subject demonstrates the importance of the design, production and shaping of materials and products through real-lie examples. The course discusses in detail the structure-property correlations of plastics, metals and ceramics, as well as solid structural and functional materials based on renewable resources. This course highlights also the similarities and important differences between the studied structural materials.
8.1.Introduction.What is material science? The importance of the subject. Introduction of the structural materials, similarities and differences. Some interesting examples of structure property correlations.
8.2.Basic definitions of material science: primary bonds, forces between atoms and molecules. Basic properties of materials and their connection to their atomic structure. Basics of crystallography, the structural hierarchy of materials and its consequences.
8.3.Structure-property correlations in solid materials. Mechanical behavior, wave propagation and thermal properties.
8.4.Structure and mechanical properties of metals and polymers. Deformation mechanisms, plastic deformation of metals and its structural explanation. Dislocations and their consequences. Introduction into the continuum mechanics. Structural hierarchy of polymers. Diversity and fine structure of a polymer chain and its effect on the phase structure of the polymers. Physical states of polymeric materials. Structure and properties of semicrystalline polymers. The structural parameters, which deter-mines the mechanical and optical properties. Modeling of structure in order to predict properties.
8.5.Structure and properties of ceramics and wooden materials. Synthesis, processing and sintering. Parameters, which influences the properties of the ceramics, porosity and density. Chemical bonds in ceramic materials and their mechanical properties. Wood as a natural composite material. Structure and direction dependent properties. General correlation between structural parameter and stiffness of different wood types. Characterization of wooden materials, fracture mechanism.
8.6.Electrical conductivity. Structural explanation of electric conductivity, semiconductors. Electron as quasi element. Effective mass of electrons. Superconductivity.
8.7.The effect of processing on the structure of metals. Moving and interaction of dislocations and its consequences. Cold work of metals and its structural explanation. Crystal defects and their effect on the properties. Processing of ceramics and the effect of processing technique on the final properties.
8.8.Complex effects appear during the processing of polymers. Degradation, orientation, internal stresses. Changes of properties during processing. Effect of processing on the crystalline structure. Targeted modification of crystalline structure in order to achieve improved stiffness of better optical properties. Effect of nucleating agents.
8.9.Properties of heterogeneous systems. Basic factors determining the properties of composites. Precondition of reinforcing effect, particulate or fiber filled systems. Critical fiber length. Metal alloys and composites. Steel as composite material. Ceramic matrix composites, preparation and properties.
8.10.Heterogeneous systems based on polymeric materials. Parameters influencing properties. Mechanism of failure, micromechanical deformations. How to explore the limits of a composite material? How is it possible to improve the performance of a composite? Nano-sized fillers, nanocomposites: expectations, possibilities and limitations. Most important difficulties on the field of nanocomposites.
8.11.Non-conventional materials. Shape memory alloys and polymers. Structural explanation of shape memory. Example on applications using shape memory materials. Piezoelectric and electro strictive materials and their application. Magnetostriction.
8.12.Polymer gels and soft materials. Volume changes, swelling and coagulation of gels and their possible

application. Thermoresponsive gels and photoresponsive materials. Unique properties of soft materials, microfluidic valves, reactors.
Laboratory practice
1. Deformation of metals, alloys. Strengthening mechanisms, Effect of cold work on pure metals and alloys. Effect of heat treatment on cold worked metals.
2. Deformation of polymers: Complex processes during plastic deformation of polymeric materials. Tension and fracture tests. Deformation mechanisms in different physical states.
3. Deformation of wooden materials. Mechanical properties of different wood types parallel and perpendicular to the fiber direction. Tension and bending experiments. Effect of water content.
4. Swelling and unique properties of polymer gels.
https://www.ch.bme.hu/oktatas/targyak/BMEVEFAM110/en

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM114	Intellectual Property Management	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	theory	English	

The goals of the course: to develop the IP awareness of the students, to demonstrate the effective usage of the IP information in order to support the literature search activity and to define the monopole IP rights.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM212	Biopolymers	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	lab-ENG	English	
Lecture	theory-ENG	English	MON:10:15-12:00(HF2)

Biopolymers are polymers arising in living organisms (e.g. microorganisms or higher order plants and animals) or synthesized from bio-based building blocks (e.g. acids, amino acids, carbohydrates, natural triglycerides) in a chemical process. The course introduces the students to the most significant biopolymers, their chemical structure, properties and the most important applications.
Introduction
The importance, classification, general characteristics, most significant application areas and economic importance of biopolymers. Research trends in Hungary and abroad. The basics of carbohydrate chemistry.
2.Polysaccharides (plant based) I-II.
The cellulose macromolecule, its chemical structure, intra- and intermolecular interactions, fibrillar structure, crystallinity, accessibility. The most significant cellulose sources. The structure and chemistry of wood. Cellulose production. Cellulose derivatives (cellulose esters, cellulose ethers). The chemical and biological degradation of cellulose. Hemicelluloses. Pectins.
3. Polysaccharides (plant based) III.
Starch. The chemical structure, characteristics and chemical reactions of starch. Starch sources. Starch derivatives. The most significant application areas. Starch based blends.
(2 classes)
4. Polysaccharides (animal based)
Chitin. Chemical structure, availability, isolation. Physical and chemical characteristics, application areas (agriculture, industry, medicine)
Chitosan. Chemical structure, synthesis. Physical and chemical characteristics, application areas (agriculture, industry, horticulture, medicine)
5. Polyphenols
Lignins. The availability, biosynthesis and classification of lignins. The isolation, structure and reactions of lignins. The biodegradation of lignins. The characteristics of the lignin-holocellulose system, the chemistry of delignification. The chemical structure and availability of tannins. Hydrolysable and condensed tannins. The interactions of tannins with macromolecules (carbohydrates, proteins, polysaccharides, enzymes).
6. Proteins (Polyamides)
The primary, secondary and tertiary structure of proteins. Animal and plant based proteins. Wool keratin. The morphology, chemical and physical characteristics of wool. Silk fibroin. Regenerated protein fibers. New application areas. Collagens and gelatins. Enzymes.
7. Polyesters (synthetic) I-II
The importance and chemical structure of linear polyesters. The most significant linear polyesters (poly(glycolic acid), poly(lactic acid), polycaprolactone), isomers, crystallization; the synthesis of poly(lactic acid), its physical ageing and macroscopic properties. The lectures mainly discuss the general characteristics of linear polyesters through the example of poly(lactic acid).
8. Polyesters (microbial)
The chemical structure, synthesis (fermentation, bioreactors) and characteristics of microbial polyesters (polyhydroxyalkanoates); the role of crystallinity and its modification; the most significant polyhydroxyalkanoates (poly(3-hydroxybutyrate), poly(3-hydroxyvalerate), poly(3-hydroxyhexanoate)) and their copolymers.

9. Polyols, polyurethanes
Synthetic biodegradable polyols from natural sources (plant oils, carbohydrates, lignin), their chemical structure, reactions and industrial significance; the synthesis of polyurethanes based on the reaction of conventional isocyanates and natural based polyols.
10. The processing and application of biopolymers I-II.
Specific characteristics of the processing of biopolymers. The most significant application areas of biopolymers. Biopolymer based blends and composites.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM213	Structural chemistry	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EA0	English	WED:10:15-12:00

The description of molecular properties based on quantum mechanical theory, the description of the structures of macroscopic materials and the relationships between the macroscopic and molecular properties, to explain the operation of instruments and experimental methods used to elucidate the chemical structure. The lectures provide a comprehensive system of the experimental methods used in structural chemistry, whereas the project work provides the students with an experience in how to apply their knowledge for solving problems in the field of structural chemistry.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM502	Plastics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	lab-ENG	English	FRI:13:15-17:00(HF4)
Lecture	theory-ENG	English	MON:08:15-10:00(CH301)

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM503	Nonconventional Materials	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A0	English	THU:12:15-14:00(HF2)

In the modern materials science the main goal is designing materials to accomplish multiple properties in a single system. Usually these materials can respond to environmental stimuli by exhibiting particular changes in some of their properties. The aim of this course is to provide theoretical and practical knowledge in the chapters of modern materials science based on the colloids science (“the world of nano”), surface chemistry and physical chemistry of polymers.
1. Introduction:History and definitions.2. Nonconventional hard materials:Metal foams: preparation and application. Shape memory: shape memory alloys, shape memory polymers. Their response to the envi-ronmental stimuli. Structure-property correlations. Application.Special technical ceramics: Piezoelectric and magnetostrictive materials, structure-property correlations. Application.3. Complex fluids:Different types of magnetic behavior. Preparation, structure and properties of ferrofluids, magneto- and electrorheological fluids. Biomedical and industrial applications. 4. Soft materials, polymer gels:Classification, synthesis and characterization of polymer (hydro)gels. Tough hydrogels. Re-sponsive polymer gels. Applications of the responsive polymer gels, focused on the biomedical applications.5. Self-assemblySelf-assembly as a universal process. Molecules and particles capable of self-assembly. Clas-sification of self-assembly processes. Practical importance of self-assembly: Coatings and thin films made with self-assembly. LBL-techniques (layer-by-layer). Langmuir- and Langmuir-Blodgett thin films. 6. Nanoparticles, nanocoatingsFunctional nanoparticles and nanocoatings, their synthesis using wet colloid chemical meth-ods. Properties of nanoparticles, quantum size effects. Core-shell and hollow nanoparticles. Biomedical applications of nanoparticles. The sol-gel method. Characterization of nanocoat-ings – optical methods (optical spectroscopy, scanning angle reflectometry, ellipsometry.)7. Applications of nanocoatings Morphology and water-repellent properties: superhydrophobicity. Wetting models. Self-cleaning, self-healing coatings. Adhesive nanostructured coatings. Coatings and thin films in solar cells. Biomedical applications of nanocoatings.8. Porous nonconventional materials:Classification and characterization (rigid and flexible pores, independent pores vs. pore net-works, composites, possible applications). Brief description of characterization methods and their complementarity.9. Use of templates for porous materials:Soft and hard templates; synthesis, (MCM, zeolites, MIP): Synthesis; new properties related to porosity. 10. Nanotubes (carbon, boron, noble metal, etc); carbon allotropes:Synthesis, physical and chemical properties, present and perspective applications11. Organic and inorganic aerogels:Synthesis; new properties introduced by porosity (thermal and electric conductivity, etc.). 12. Metal organic frameworks (MOFs):3D self-assembly of multivalent metal ions and organic ligands; stiff and flexible porosity; their potential in gas storage, sensing, etc.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFA513	Theory of Separation Processes and Reactors	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	elm_ENG_ER	English	THU:12:15-15:00(CH307)
Practice	gyak_ENG_ER	English	THU:12:15-15:00(CH307)

Characterization and calculation of liquid-liquid and gasliquid-liquid equilibria. Equilibrium ratio, vapor tension, Antoine equation, Raoult-Dalton equation, relative volatility, bubble-point calculations, phase distribution calculations.Use of binary phase plots and equlibrium plots, use of ternary phase plots. Single stage equilibrium distillation and flash. Simple distillation. Rayleigh equation, vapor consumption.
Steam distillation. Continuous multistage distillation. Reflux ratio. MESH equations. CMO. Upper and lower operating lines. Q-line. Graphical determination of the theoretical number of stages. Graphical determination of the minimum number
of theoretical stages. Fenske equation. Minimum reflux ratio, graphical construction. Relations between number of stages, reflux ratio, and product purity. Plates and packings. Stage efficiency, HTU, NTU, HETP. Column capacity. Batch rectification with constant reflux ratio and with constant purity. Azeotropic and extractive distillation methods. Pressure swing distillation. Absorption. Kremser-Souders-Brown equation.
Liquid extraction. Equilibrium ratio, distribution ratio, and phase ratio. Simple extraction. Repeated extraction. Perkolation. Continuous countercurrent multistage extraction.
Counter-solvent extraction. Devices. Computation with constant equilibrium ratio, graphical constraction with constant phase ratio and with non-constant phase ratio.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFBEMK	Technical Chemistry for mobility students	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	elm_ENG_ER	English	WED:14:15-16:00

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFM112	Energy production and its environmental impacts	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	lab_ENG_ER	English	TUE:10:15-12:00
Lecture	elm_ENG_ER	English	TUE:08:15-10:00

The concepts of energy, energy production and the environment, and the relationship between energy production and the environment. Characteristics, role and processing of conventional and alternative fossil fuels for energy production. Use of fossil fuels, thermal power plants, engines, propulsion, other thermal power plant concepts. Efficiency improvement potentials of fossil technologies. Fossil energy related emissions, pollutant management, emission reduction, water treatment and wastewater related to energy production. Current and future technologies for nuclear power generation. Environmental impacts of nuclear power generation, waste management. Types and definitions of renewable energy sources. Solar energy potential, solar collectors, semiconductors. Wind and hydropower potential, geothermal energy. Climate change and the energy sector, current and future opportunities for mobility. Energy storage and transport issues and options, battery technologies and environmental impacts. Prospects and trends in the energy sector in Hungary and the world.

Subject code	Subject name	Requirement	ECTS credit
BMEVEMBM501	Environmental toxicology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	A14	English	TUE:10:15-13:00(CH301)
Lecture	A13	English	TUE:10:15-13:00(CH301)

Environmental toxicology as part of the risk-based environmental management plays an increasingly important role. The main aim of the subject is to give an overview on the effect-based tools of the modern environmental risk management. The course covers both the theoretical background and the detailed practical aspects of environmental toxicology together with its applications in the risk assessment, risk management and in the environmental decision making.
Theory
The role of environmental toxicology, environmental toxicology in risk-based environmental management, the basics of environmental toxicology, the effects of toxic substances and the measurement of the effects.

Classification of environmental toxicity methods: generally applicable methods to water, soil, sediment, methods suitable to pure chemical substances, test organisms, measurement and study endpoints for measurement of the effects and chemical substances and contaminated environmental elements.
Studying of the interaction between chemical substances and the environment, measurement of the actual toxicity of chemical substances, selection of test methods suitable for the environmental problem, test battery for integrated monitoring.
Detailed description of ecotoxicity test methods applied to water, sediment and soil. Single species ecotoxicity tests with bacterial, plant, animal test organisms.
Multispecies environmental toxicity methods: microcosm, mesocosm tests, field studies. Genotoxicity and mutagenicity studies. Innovative and alternative environmental toxicity test methods replacing animal testing.
Evaluation, interpretation and utilisation of environmental toxicity results in the integrated assessment of contaminated sites, in integrated environmental monitoring, in the general risk assessment of chemical substances, in the derivation of environmental quality criteria and limit values, in the local and site specific risk assessment of contaminated sites and generally in environmental management.
The concept and methodology of environmental and human health risk assessment of chemical substances.
Environmental risk assessment of contaminated sites: methods, examples, case studies.
Laboratory practice
The students will learn about five various topics within the laboratory practice of this main subject.
1. Environmental toxicity test methods with aquatic test organisms. We may test the adverse effects of chemical substances on the water ecosystem with test organisms from various trophic levels. The most common test methods include: alga test, single cell animal (pl. Tetrahymena pyriformis) test, plant test (ex. tiny duckweed), animal test (ex. fresh water shell-covered crustacean (Ostracoda), water flea).
2. Respiration measurement of soil microflora in a dynamic and a static system. The activity of soil microflora can be studied by measurement of the amount of CO2produced by soil microbes in a dynamic (ventilated) and static (closed bottle test) system. The methods are suitable for monitoring of bioremediation.
3. Microbiological studies of soil hygiene. Soil microorganisms are involved in numerous essential processes. There are various techniques for their quantitative and qualitative study.
4.Aliivibrio fischeri bioluminescence inhibition test. Aliivibrio fischeriis a marine bacterium, which emits light under favourable conditions. Light emission is inhibited in the presence of toxic substances, which can be detected by luminometer
5. Plant germination and Collembola mortality test. Terrestrial plants represent one of the most important trophic level, the producers. They can be used for ecotoxicity testing of both waters and soils polluted with toxic substances. Folsomia candia (Collembola), the ancient springtails insect can be used for testing of soils polluted with organic contaminants.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA101	General Chemistry	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	E36eng	English	WED:10:15-12:00(CHA10); THU:10:15-12:00(CH304)

Get a basic overwiew of the principles of Chemistry, providing an introductory informations, including definitions etc. to be used in later specific subjects. The course consists of three parts. In the first one the macroscopic properties of the matter is discussed, including phase transitions. In the second part basic chemical priciples as acid-base, redox processes, chemical equlibria, electrochemistry and chemical kinetics will be covered briefly. In the third part the aromic and molecular structure, the chemical bonding and the rules in the periodic table is discussed.
Expression for the composition of solutions and their applications. Operations with solutions, crystallization, recrystallization.
Gases. Properties of gases. Equation of state for ideal gas, and its versions. Boyle’s law, Charles’ laws. Gay-Lussac’s law.
Mixtures of gases, their compositions. Partial pressure, and volume. Dalton’s rule and Amagat’s rule. Vapor pressure.
Colligative properties of dilute solutions. Vapor pressure lowering, boiling-point elevation, and freezing-point depression, osmosis.
Balancing equations. Oxidation numbers, redox equations.
Stoichiometry and its applications. Yield. Avogadro’s law. Calculation of titration.
Basic terms in thermochemistry. Energy, heat and enthalpy. Heat capacity, molar heat capacity.
The heat of reactions and Hess' law.
General description of chemical equilibria. Various forms of equilibrium constants and their connections.
Application of LeChatelier's principle. The shift in the equilibrium composition by the change in the amount of reactants, in the pressure, and in the temperature. Heterogeneous equilibria.
Acid-base equilibria, pH of solutions:
-Strong acids and bases;
-Weak acids and bases;
-Hydrolysis of salts;
-Buffers and buffer capacities
Solubility equilibria: solubility product and its applications, common ion effect; speciation effect; temperature effect.

Electrochemisty:
-Electrolyte solutions. Electrical resistance and conductivity of dilute solutions;
-Electrolysis;
-Electrode potentials: standard hydrogen electrode, simple metal electrodes, redox electrodes,metal-insoluble salt electrodes, gas electrodes
-Composition dependence of electrode potentials in various electrode types: Nernst equation.
-Electrochemical cells, cell diagrams, cell reactions, half-cell reactions. Electromotive force.
-Basic terms in electrochemistry, direction of electrochemical processes.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA104	General Chemistry Calculations for Chemical Engineers	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Practice	A01eng	English	FRI:08:15-11:00(CH308)

The aim of the subject is to increase the knowledge of the freshman students on chemical calculations to the level, which provides competent basis for further chemical and technological disciplines (inorganic chemistry, organic chemistry, physical chemistry, unit operation, chemical technology etc.). The practice is held in small groups, depending on the former skills of the students.
Expression for the composition of solutions and their applications. Operations with solutions, crystallization, recrystallization.
Gases. Properties of gases. Equation of state for ideal gas, and its versions. Boyle's law, Charles' laws. Gay-Lussac's law.
Mixtures of gases, their compositions. Partial pressure, and volume. Dalton's rule and Amagat's rule. Vapor pressure.
Colligative properties of dilute solutions. Vapor pressure lowering, boiling-point elevation, and freezing-point depression, osmosis.
Balancing equations. Oxidation numbers, redox equations.
Stoichiometry and its applications. Yield. Avogadro's law. Calculation of titration.
Basic terms in thermochemistry. Energy, heat and enthalpy. Heat capacity, molar heat capacity.
The heat of reactions and Hess' law.
General description of chemical equilibria. Various forms of equilibrium constants and their connections.
Application of LeChatelier's principle. The shift in the equilibrium composition by the change in the amount of reactants, in the pressure, and in the temperature. Heterogeneous equilibria.
Acid-base equilibria, pH of solutions:
-Strong acids and bases;
-Weak acids and bases;
-Hydrolysis of salts;
-Buffers and buffer capacities
Solubility equilibria: solubility product and its applications, common ion effect; speciation effect; temperature effect.
Electrochemisty:
-Electrolyte solutions. Electrical resistance and conductivity of dilute solutions;
-Electrolysis;
-Electrode potentials: standard hydrogen electrode, simple metal electrodes, redox electrodes,metal-insoluble salt electrodes, gas electrodes
-Composition dependence of electrode potentials in various electrode types: Nernst equation.
-Electrochemical cells, cell diagrams, cell reactions, half-cell reactions. Electromotive force.
-Basic terms in electrochemistry, direction of electrochemical processes.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA302	Analytical Chemistry I.	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	26eng	English	TUE:14:15-16:00(CH307); WED:14:15-16:00(CH305)

To provide thorough understanding of the fundamental principles, main methods and applications of chemical analysis (volumetric, gravimetric and instrumental analysis), as well as their tools of trade. The subject aims to provide a sound bases for later subjects including the Analytical Chemistry Laboratory and other advanced analytical chemistry subjects within Analytical and Structural Chemistry Specialization.
INTRODUCTION
Hours
Fundamental concepts.
2

Example 1: determination of iron in beer, AAS. Standard addition.
1
Example 2: determination of aluminium in cement, AAS. Matrix effect, calibration.

1

Example 3: Ethanol content of blood, measurement by HS-GC. Internal standard method.
1
Example 4: Analysis of hydrocarbon mixtures (engine fuel) by GC
1

Reliability of analysis. Systematic and random errors. Accuracy and precision; limit of detection, limit of quantitation; range
1

VOLUMETRIC ANALYSIS AND GRAVIMETRY
Acid-base titrations. Volumetric analysis of strong acids and bases. Logarithmic equilibrium diagrams, titration curves. Indicator error.
1

Titration of weak acids and weak bases. Logarithmic equilibrium diagram, titration curves. Calculation of the pH of the equivalence point. Buffers. Indicators.
2

Polyprotic acids and bases. Analysis of carbonate- hydrogen carbonate mixtures. Acid-base titrations in non-aqueous media.
2

Complexometric reactions and titrations. Formation constants. Chelates. EDTA titrations. Indicators
2

Precipitation reactions. Precipitation titrations. Gravimetry..
2

Redox reactions and titrations: iodometry, bromatometry, permanganometry, titration curves and their interpretation
2

ELECTROANALYSIS
Introduction. Electrochemical cells. Overview of electroanalytical methods
1

Potentiometry. Galvanic cells. Activity. Reference electrodes.Liquid junction potentials
2

Potentiometry. Indicator electrodes. Redox electrodes. Nernst equation. Redox titrations with potentiometric endpoint detection
1

Ion-selective electrodes. Solid membrane electrodes: Glass electrode. Fluoride-selective electrodes. Precipitate-based electrodes.
2

Ion-selective electrodes. Liquid membrane electrodes. Selectivity. Direct potentiometry. Calibration. Standard addition
1

Conductometry. Introduction. Conductometric cells
1
Conductometric titrations
1

OPTICAL SPECTROSCOPY
Introduction. Properties of light. Spectrophotometers. Spectrum
2

Atomic spectroscopy. Theory of atomic spectroscopy. Introduction to analytical applications of atomic spectroscopy. Concept and benefits. Introduction to Atomic Absorption/Emission/Fluorescence Spectroscopy. Atomization. Thermal processes in atom sources. Boltzmann distribution
2

Atomic spectroscopy. Atomic absorption spectroscopy (AAS) with flame and electrothermal atomization.

Instrumentation.
2
Atomic spectroscopy methods. Flame optical emission spectrometry, flame photometry (F-OES). Inductively coupled plasma optical emission spectrometry (ICP-OES).. Inductively coupled plasma mass spectrometry (ICP-MS)
2

Molecular Spectroscopy. Basics of ultraviolet (UV) and Visible (VIS) Absorption Spectroscopy. Spectrophotometers. Lambert-Beer law, deviations from Lambert-Beer Law
2

MASS SPECTROMETRY
Introduction to mass spectrometry. Main units of mass spectrometers
2

SEPARATION METHODS

Introduction to separation methods. Categorization of separation methods. Chromatography
2

Basics of chromatographic separations. Chromatogram. Parameters characterising the separation efficiency Partition coefficient. Retention time. Number of theoretical plates.Zone broadening. Resolution
2

Gas Chromatography. Introduction. Columns. Capillary columns. Stationary phases. Injectors
2

Main parts of a gas chromatograph. Detectors
1

Quantitative analysis with gas chromatography. Calibration. Internal standard method. Temperature gradient method. Applications
1

Liquid chromatography. Classification and overview of liquid chromatography methods. Eluent strength
2

Main parts of HPLC systems. Pump. Injector. Columns. Detector
1

Electrophoresis. Principles. Instrumentation. Applications
2

IMMUNOANALYSIS
Basic concepts. Structure of antibodies. Antigen- antibody reactions
1

Analytical measurements based on antigen-antibody reactions. Classification and principle of label-based methods. Quantitative analysis by immunoassays
1

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA512	Elucidation of Organic Structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	E18eng	English	TUE:17:15-20:00(CH304)

The main goal is to provide a basic knowledge about the UV, IR, MS and NMR spectroscopic methods used in organic chemistry. The course will be of interest to chemists and analysts in research and industry, especially those engaged in the synthesis and analysis of organic com-pounds including drugs, drug intermediates, agrochemicals, polymers and dyes.
Introduction
The strategy of structure determination of the organic compounds. Basic conceptions of organic structures (configuration, conformation, isomerism, tautomerism, rate processes). Organic microanalysis. Methods to determine the carbon, hydrogen and nitrogen content of the samples. Determination of the sulphur and halogen content. Qualitative and quantitative analysis of some important functional groups.
UV spectroscopy

Electronic structure of the molecules, atomic and molecular orbitals, orbital symmetry, Electronic transitions, and selection rules. Band structures. Chromophores and auxochromic groups. Discussion of some simple chromophores. Conjugation, the Woodward-Fieser rules.
Substituent, solvent and steric effects, Polyenes, aromatic and heteroaromatic structures.
IR spectroscopy
Molecular vibrations, the vibrational and vibrational-rotational spectrum. The two-atomic model, the harmonic and nonharmonic vibrations. Characteristic vibrational frequencies. The correlation between the IR and Raman spectroscopy. Stretching and bending frequencies.
The impact of the structural effects modifying the vibrational frequencies: inductive and mesomeric effects, hyperconjugation, ring strain, steric and isotope effects. Characteristic frequencies of carbonyl compounds, alcohols, amines, nitro compounds, etc. The measurement of the infrared spectra. Sample preparation. The Fourier-transform infrared spectrophotometer.
Mass spectroscopy
The mass spectrometer. Ionization methods (EI, CI, APCI, ESI, MALDI). Isotopes. Ion separation and detection methods. The coupling of the mass spectrometer (GC-MS, HPLC-MS, MS/MS). The importance of the molecule and base peak. Ion chemistry: fragmentation and rearrangement. The most important processes: alpha cleavage, onium reaction, allyl and benzyl-cleavage, McLafferty rearrangement, retro Diels-Alder reaction. Typical fragmentations and rearrangements of organic molecules. Application of isotope abundance determination: halogen compounds.
Nuclear magnetic resonance (NMR) spectroscopy
The nuclear spin. Nuclear spins in magnetic field: the Bloch equations. The measurement of the NMR spectra: CW and PFT. Spectral aquisition. 1H and 13C-NMR spectroscopy. The basic NMR parameters: the chemical shift, the coupling constant. 1H-NMR: Multiplicity and intensity of the signals. The inductive effect, diamagnetic anisotropy, ring currents. Empirical calculation of the chemical shift. The Karplus-curve. 13C-NMR: broadband decoupling, gated decupling. Spectral editing methods: the DEPT and the APT experiments.

Subject code	Subject name	Requirement	ECTS credit
BMEVESZA301	Organic Chemistry I.	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A29-ER	English	MON:10:15-12:00(CH304); WED:12:15-14:00(CH306)
Practice	A30-ER	English	MON:10:15-12:00(CH304); WED:12:15-14:00(CH306)

Modern basic studies in this field of natural sciences for chemical engineering students. During this course the students should learn the basics of organic chemistry, they should develop an organic chemistry aspect and gain proper theoretical and practical grounds for the further studies on material sciences, organic chemistry, chemical technology and biochemistry.
Part I. Basic of organic chemistry, structure and chemistry of hydrocarbons
Basics of organic chemistry, structures of carbon compounds
Development of organic chemistry. Structure of molecules: theory of covalent bonding, rationalization of chemical bonds.Classification of organic compounds. Nomencalture of basic hydrocarbons. Nomenclature of aliphatic and aromatic hydrocarbons.
Configuration, stereochemistry, conformation
Constitutional isomerisms. Stereoisomerism: E/Z isomerism, chirality, enantiomers and diastereomers. Inversion, retention and recemization. Conformation of aliphatic and alicyclic hydrocarbons.
Substitutional and groupfunctional nomenclature. The main functional groups.
Theory of reactions, theories of acid-base, HSAB and FMO theories
Types of organic reactions: substitutions, additions, eliminations and rearrangements. Nature of the reactions: multistep and concerted, ionic and radical reactions. The energy profile of reactions: transition state, parameters for activation, intermediates, concept of kinetic and thermodynamic control. Acid-base equilibria. The concept of electrophilicity and nucleophilicity.
Exercise for nomenclature of organic compounds.
Theory of redox and radical reactions, chemistry of paraffins
Rationalizing the oxidation number. Preparation of paraffins and cycloparaffins by reduction, methods for forming carbon-carbon single bonds. Physical properties, radical reactions and oxidation of paraffins and cycloparaffins.
Exercise for the CIP-system.
Reactivity of olefines and acetylenes, electrophilic addition, oxidation and polymerization
Electrophilic addition and radical reactions of olefines. Reactions of 1,3-dienes. Electrophilic addition and radical reaction of acetylene derivatives. Substitution and adddition reactions of conjugate bases of acetylene derivatives. Preparation of paraffins and cycloparaffins. Exercise for oxidation number. Reactions of paraffins. Conformation of paraffins and cycloparaffins.
Reactivity of monocyclic aromatic compounds, electrophilic substitution
The structure of benzene, aromaticity and aromatic character. The mechanism of electrophilic substitution, halogenation, nitration and sulphonation, Friedel-Craftsalkylation and acylation. Orientation rules.
Preparation and reactions of olefines. E/Z nomenclature of olefins. Elimination reactions. Preaparation and reactions of acetylenes.
Part II. Compound containing carbon-heteroatom single bonds
The theory of substitution and elimination

The mechanisms of aliphatic nucleophilic substitutions and eliminations, their regio- and stereochemistry. Factors influencing these reactions. Ambident nucleophiles. Aromatic nucleophilic substitution.
Test 1.: Nomenclature. Preparation, reactions, conformation and configuration of aliphatic and cyclic paraffins. Preparation and reactions of olefines. Regio- and stereoselectivity. Preparation and reactions of acetylenes.
The chemistry of halogen compounds, alcohols, phenols and ethers
The physical properties of halogen compounds, alcohols, phenols and ethers. Acidity and basicity of these compounds. Reactions of halogen compounds with metals. Preparation and reactions of alcohols, phenols and ethers.
Preparation and reactions of aromatic compounds. Exercises for SEAr and SNAr reactions.
The chemistry of nitro compounds and amines
Preparation and reduction of nitro compounds. The structure, physical and basical properties of amines. Preparation and reactions of amines.
Preparation and reactions of halogen compounds, alcohols, phenols and ethers. Exercises for substitution and elimination reactions.
Part III. Compound containing carbon-heteroatom multiple bonds
Reduction and oxidation of alcohols, carbonyl compounds and carboxylic acid derivatives
Preparation of carbonyl compounds and carboxylic acids by oxidation. Preparation of alcohols and carbonyl compounds by reduction. Using Grignardand related reactions for the preparation of alcohols and carbonyl compounds. Using Friedel-Craftsand related reactions for the preparation of aromatic carbonyl compounds.
Preparation and reactions of nitro compounds. Exercises regarding pKa.
Reactivity of carbonyl compounds, carboxylic acids and carboxylic acid derivatives
Comparison of the reactivities of aliphatic and aromatic carbonyl compounds, carboxylic acids and carboxylic acid derivatives - nucleophilic addition and nucleophilic addition-elimination reactions. Preparation and reactions of ?,ß-unsaturated carbonyl compounds and carboxylic acids. Inverse reactions.
Test 2.: Preparation and reactions of aromatic compounds. Orientation rules. Preparation and reactions of halogen compounds. Mechanism, regio- and stereoselectivity of substitution and elimination reactions. Preparation and reactions of alcohols, phenols, ethers, nitro compounds and amines.
Oxo-enol tautomerism, carboxylic acids
Oxo-enol tautomerism. Comparison of the reactivities of oxo-enol tautomers. Reactions taking place with the conjugate bases of carbonyl compounds and carboxylic acid derivatives (at ?-position). The chemistry of dicarbonyl and related compounds.
Supplementary test 1. or
Chemistry of carboxylic acids and carboxylic acid derivatives
Physical and chemical properties of carboxylic acids. Preparation and reactions of dicarboxylic acids - decarboxylation reactions. Carboxylic acid derivatives: preparation and reactions of ketene, acyl halides, acid anhydrides, azides, esters, amides, nitriles, imid acid esters - nucleophilic addition and nucleophilic addition-elimination reactions.
Preparation and reactions of carbonyl compounds. Preparation of carboxylic acids. Reactions of carbonyl compound and carboxylic acids.
Extra supplementary test 1. or 2.

Subject code	Subject name	Requirement	ECTS credit
BMEVESZM704	Biocatalysis	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	14_ER	English	TUE:15:15-17:00(CH301)

The aim of the subject is to provide high-level scientific and practical knowledge to the future chemical and bioengineers of chemical and biological industries (pharmaceutical, agro- and fine chemical, cosmetic and food industries) with special focus on the development of problem solving skills related to chemical problems by using the tools of biotechnology.
Biotransformations and biocatalysis
Characteristic advantages and disadvantages of processes – Enzyme classification and nomenclature – Coenzymes – Enzyme kinetics – Protein structure and basics of enzyme action – Effect of conditions on enzyme activity – Characteristics of microbial transformations – Enzyme- and cell immobilization
Development of novel biocatalysts
Genetic engineering tools – Production of biocatalysts by recombinant organisms – Novel methods of modifications of enzyme properties by genetic methods: site directed mutagenesis, gene shuffling, directed evolution, metabolic engineering, random DNA cloning – Catalytic antibodies – High throughput test methods
Stereochemical issues related to biocatalytic processes
Basic terms of stereochemistry – Methods to determine enantiomeric composition – Classification of selective transformations
Types of selectivities for biocatalytic processes
Mild conditions – Chemoselectivity – Regioselectivity – Diastereomer selectivity – Diastereotopic selectivity – Enantiomer selectivity – Enantiotopic selectivity – Parallel manifestation of multiple selectivities
Hydrolases
General features of processes performed by hydrolases

Characteristics of hydrolases used for preparative purposes – General features of transformations by hydrolases: hydrolytic processes in aqueous media – non-hydrolytic processes in organic solvents
Preparative application of hydrolases: types of the applicable selectivities
Biotransformations under mild conditions – Substrate specificity, chemoselectivity – Regioselective transformations – Diastereomer and diastereotopic selective processes – Enantiomer selective biotransformations: general considerations, transformations of amino acids and their derivatives, selective transformations of racemic acids (ester hydrolysis, alcoholysis, transesterification), selective transformations of racemic alcohols (ester hydrolysis, acylation, transesterification), racemic lactones, amines, epoxides and other compounds – Enantiotopic selective biotransformations: general considerations, transformations of compounds with a single prochiral center, reactions of meso compounds, enantiotopic and diastereotopic face distinctions by hydrolases
Oxidoreductases
General features of processes by oxidoreductases
Features of oxidoreductases applied for preparative purposes – Processes by oxidoreductases acting without external cofactor – General features of oxidoreductases acting with externally added cofactors – Cofactor regeneration methods by using oxidoreductases
Preparative use of oxidoreductases: types of useful selectivities
Reduction of racemic aldehydes – Oxidation of racemic alcohols – Reduction of achiral carbonyl compounds – Oxidation of prochiral and meso alcohols – Simultaneous manifestation of multiple selectivities in processes with oxidoreductases – Enzymatic Baeyer-Villiger-type oxidations
Baker's yeast as whole-cell system for preparative use
General considerations – Reduction of ketones: achiral ketones, racemic ketones, 1,2-dioxo compounds, 1,3-dioxo compounds, other dioxo compounds – Reduction of oxocarboxylic acid derivatives: 2-oxocarboylic acid derivatives, 3 -oxocarboylic acid derivatives, 2-substituted-3-oxocarboylic acid derivatives, oxocarboxylic acid derivatives with carbonyl function at 4 or more distant position – Reduction of carbon-carbon double bond – Other reductions – Hydrolysis – Lyase activity – Cyclizations
Other preparative application of enzymes and microorganisms
Other enzymes: transferases (glycosidases, aminotransferases, phosphorylases) – Lyases (aldolases, oxynitrilases) – Selected examples of whole-cell biotransformations
Industrial applications of biotransformation
Enzyme and cell immobilization – Bioreactors – Stereoselective biotransformations carried out on an industrial scale

Subject code	Subject name	Requirement	ECTS credit
BMEVEVMA606	Design of Experiments	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	elm_ENG_ER	English	THU:16:15-19:00(CH308)
Practice	gyak_ENG_ER	English	THU:16:15-19:00(CH308)

To teach the basics and methods of mathematical statistical treatment of measurement data.To teach the design and analysis of the most basic full factorial experimental designs.
Random variable, density and distribution function, expected value, variance. Continuous distributions, normal distribution, standard normal distribution, ?2, t and F distribution. Central limit theorem. Population and sample. Parameter estimation. Hypothesis testing, parametric tests. Mutual distribution of several random variables, correlation. Principles of regression, linear regression. Checking adequacy, weighted regression, parameter estimation, partition of SSQ, confidence intervals. Design of experiments. 2p full factorial: the design, orthogonality and rotatability, estimation of parameters, significance tests. 2p-r fractional factorials.

Faculty of Civil Engineering

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
BMEEOAFAS42	Field Course of Structural Geodesy	Mid-semester mark	1

Course type	Course code	Course language	Timetable information
Laboratory	EN2	English	MON:14:15-18:00(KF27k)
Laboratory	EN1	English	MON:14:15-18:00(KF27k)

The main purpose of the subject is introduce the most modern techniques and methods for students in the field of state surveying and movement detection of civil engineering structures. The students apply the skills and knowledges learned in Surveying I, II and Field Course of Surveying to solve more complex structural engineering projects. Project are solved by students team. During the practices students survey some inner parts of a more levelled building, determine the geometry of axis of an about 30 m high brick chimney. Furthermore they determine the deflections of a slab and the distortions of floor. They determine the deflection of a cable bridge caused by traffic. They are introduced into the applications of photogrammetry, remote sensing and laserscanning in the area of construction engineering.

Subject code	Subject name	Requirement	ECTS credit
BMEEOAFAT43	Surveying Field Course	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Practice	EN1	English	

Using the theoretical background of the courses Surveying 1 & 2 students are required to: assess the existing datasets used for mapping; define the necessary surveying activities; practice the surveying observations, planning, data processing and documentation; practice profile boarding, setting out of roads; learn to use modern surveying instruments (total stations, GPS/GNSS receivers, electronic levels, digital photography).

Subject code	Subject name	Requirement	ECTS credit
BMEEOAFAT45	Surveying I.	Exam	3

Course type	Course code	Course language	Timetable information
Laboratory	EN5	English	FRI:08:15-10:00(KF27b); FRI:08:15-10:00(KF27b)
Laboratory	EN3	English	FRI:08:15-10:00(KF27k); FRI:08:15-10:00(KF27k)
Laboratory	EN6	English	THU:10:15-12:00(KF27b); THU:10:15-12:00(KF27b)
Laboratory	EN1	English	THU:08:15-10:00(KF27b); THU:08:15-10:00(KF27b)
Lecture	EN0	English	MON:12:15-14:00(KM30)

Subject code	Subject name	Requirement	ECTS credit
BMEEOAFM201	Surveying ME	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:10:15-12:00(KF27a); TUE:10:15-12:00(KF27a)

Subject code	Subject name	Requirement	ECTS credit
BMEEOAFMB51	Numerical Methods	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	WED:12:15-14:00(K142b); WED:12:15-14:00(K142b)
Laboratory	EN2	English	

Subject code	Subject name			Requirement	ECTS credit
BMEEODHAI42	Technical practice			Signature	0
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	ENI	English			

Subject code	Subject name			Requirement	ECTS credit
BMEEODHAOFO	University Experience			Signature	0
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	EN1	English	WED:13:15-14:00(K375); WED:13:15-14:00(K375)		

Subject code	Subject name			Requirement	ECTS credit
BMEEODHA-PS	Bachelor Thesis Project			Mid-semester mark	15
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	ENA	English			

Subject code	Subject name			Requirement	ECTS credit
BMEEODHA-PT	Preparatory Course for Bachelor Thesis Project			Mid-semester mark	9
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	ENA	English			

Subject code	Subject name			Requirement	ECTS credit
BMEEODHA-QS	Bachelor Thesis Project			Mid-semester mark	15
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	ENVK	English			
Practice	ENUV	English			
Practice	ENVV	English			

Subject code	Subject name			Requirement	ECTS credit
BMEEODHA-QT	Preparatory Course for BSc Thesis Project			Mid-semester mark	9
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	ENVV	English			
Practice	ENUV	English			
Practice	ENVK	English			

Subject code	Subject name			Requirement	ECTS credit
BMEEODHAS41	Design of Structures Projectwork			Mid-semester mark	6
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	EN1	English	THU:12:15-14:00(K375); THU:12:15-14:00(K375)		

Students need to accomplish a complex design projectwork that is based on the knowledge gained through the branch courses. The project work is supervised by three lecturers from three areas of structural engineering.

Subject code	Subject name			Requirement	ECTS credit
BMEEODHAS42	Industrial Practice			Signature	0
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	ENH	English			

20 days of industrial practive at a civil engineering construction company.

Subject code	Subject name			Requirement	ECTS credit
BMEEODHMB5P	Construction Information Technology Engineering Project			Mid-semester mark	6
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	EN1	English	WED:12:15-14:00(K371); WED:12:15-14:00(K371)		

Subject code	Subject name	Requirement	ECTS credit
BMEEODHMB-D	Diploma Project	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENB	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEODHMF-D	Diploma Project	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENFAF	English	
Practice	ENFFT	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEODHMG-D	Diploma Project Structural Engineering MSc Program	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENG	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEODHMN-D	Diploma Project Structural Engineering MSc Program	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENN	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEODHMT-D	Diploma Project Structural Engineering MSc Program	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENT	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEODHMU-D	Diploma Project	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENU	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEODHMV-D	Diploma Project	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENVVK	English	
Practice	ENVVV	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMA301	Building Materials 1	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	WED:08:15-10:00(MMFL2); WED:08:15-10:00(MMFL2)
Laboratory	EN2	English	WED:08:15-10:00(MMFL3); WED:08:15-10:00(MMFL3)
Lecture	EN0	English	FRI:12:15-14:00(K144); FRI:12:15-14:00(K144)

Material properties and classification of building materials (densities, mechanical properties, hydrotechnical properties, thermal properties). Detailed introduction of timber, masonry, mortar, concrete (and constituent materials), metals, polymers, glass used in architecture. Fields of application. Types of commercial products. Material testing methods for building materials (tensile, compressive and bending testing). Observation of basic natural stones and applications.Students work individually or in small groups during the laboratory sessions and study the physical and mechanical properties of building materials.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMA-A1	Building Construction Methodology	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:08:15-09:00(K370); THU:08:15-09:00(K370)
Practice	EN1	English	THU:09:15-10:00(K370); THU:09:15-10:00(K370)

During the semester methodology of planning, methods of design of building constructions are presented. Listing of requirements depend on function of building (building physical, acoustical point of views and fire protection). Designation of structural hierarchy based on the determined requirements. Building constructional relationship and design rules: i) skirtings - connections of load-bearing structures ii) structures of floors (floors on ground, floors of general slabs) - connections of load-bearing structures iii) facade - connections of load-bearing structures iv) thermal insulation and rainwater seepage, soil moisture and waterproofing - connections of load-bearing structures v) special building constructions (windows, doors, gates), structures of fire protection (skylights, suspended walls against fume spreading).

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAS41	Construction Materials II.	Exam	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	THU:12:15-14:00(MMFL4); THU:12:15-14:00(MMFL4)
Laboratory	EN3	English	THU:12:15-14:00(MMFL3); THU:12:15-14:00(MMFL3)
Lecture	EN0	English	THU:10:15-12:00(K183)

Importance of selection construction materals. Ranges of applicability of construction materials. Influencing factors to the strength of concrete. Steam curing. Influencing factors to the water tightness and the freeze-thaw resistance of concrete. Fibre reinforced concrete. Light weight concrete. Metals. Aluminium. Production of iron and steel. Steel-carbon interaction diagram. Martenzite. Heat curing of steel. Steel corrosion. Normal potential. Roads. Road making materials. Aggreagates and possible binders to pavements. Properties of bitumen and asphalt. Concrete pavements. Properties of road marking. Concrete corrosion. Protection against concrete corrosion. Properties of polymers. Polymeric protection layers. Thermal and sound insulations.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAS42	Building Construction I.	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:16:15-18:00(EOEM_TSZ)
Practice	EN1	English	MON:16:15-18:00(EOEM_TSZ); MON:16:15-18:00(EOEM_TSZ)

Students gain knowledge and skills during the semester work in the following topics: Flat and deep foundations, relation to sub-soil insulation of buildings. Masonry works, prefabricated panel systems. Plasters and ETICS. Reinforced concrete, steel and wooden beam slab constructions. Stairs. High roofs. Passable and non-passable flat roofs, green roofs. Insulations against functional water.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAS43	Building Construction II.	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:10:15-12:00(K375)
Practice	EN1	English	TUE:12:15-14:00(K371); TUE:12:15-14:00(K371)

Floor structures, finishes, orders of layers: floors on ground, floors of intermediate slabs, floors of attics, terraces, prefabricated concrete and stone pavings. Tile and plate roof claddings, metal sheet seamed strip claddings: orders of layers, materials, rules of technique, details, rainwater gutter systems. Structures of built-in-roofs: structures and roofing of pitched roofs, orders of layers, foils of vapour-/air-/waterproofing. Facade claddings: plastered, thermal insulated, assembled light and heavy claddings. Posterior thermal insulation of facades. Curtain walls, glass roofs. Structures and materials of dry technologies: assembled walls, ceilings, floors. Building physics: thermal and vapour protection. Acoustics, protection against noise. Building construction solutions of building reconstruction, tasks of refurbishment.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAT41	Chemistry of Construction Materials	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:12:15-14:00(K375); TUE:12:15-14:00(K375)

The importance and necessity of chemistry in civil engineering. The structure of atoms, the electron shell structure, the structure of molecules and chemical bonding models. States of materials - explanation by intermolecular forces. Ideal and real laws of gases. Fluid systems properties. The structure of crystalline solids (ionic, atomic, molecular and metallic lattice crystal structure and properties). Difference between ideal and realistic structure, macroscopic properties of crystalline materials, lattice defects. Structure and properties of non-crystalline (amorphous or glassy)

solids. Macromolecular substances and its chemical properties. Homogeneous and heterogeneous systems. Gibbs law. interfacial phenomena. The types of chemical reactions, speed of chemical reactions. Activation energy and reaction heat. Hess's law. Chemical equilibrium. Acids, bases and salts. The pH concept. Hydrolysis of salts. Electrochemistry. Redox processes, redox potentials. Production of metals, corrosion of metals. Binding materials and binding mechanism. Cement chemistry. Chemical and mineralogical composition of cements. Hydration products, CSH, CAH, CH, primary and secondary ettringite. Application of theoretical knowledge in engineering practice.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAT42	Civil Engineering Representation and Drawing	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:16:15-18:00(KF10); THU:16:15-18:00(KF10)
Practice	EN1	English	MON:10:15-12:00(K144); MON:10:15-12:00(K144)
Practice	EN2	English	

3 main parts of the subject: 1. Descriptive geometry 2. Engineering drawing 3. Freehand drawing. 1. Basics of descriptive geometry course modules: Students gain knowledge and skills in regularities and techniques of descriptive geometry, developing spacial reasoning. Topics: basic constructions in planes of projections, transformations, tasks of intersections, intersections and interpenetrations of plane and curved solids, cast shadows, construction in scale, special revolution solids and skew surfaces. Additional representation systems: dimensioned representations, orthogonal axonometry, perspective projection. 2. Engineering drawing course modules: Students gain knowledge and skills in engineering drawing, specific notations, proportions and scale, magnification, minification, construction of ground plans and sections. 3. Engineering free-hand representation course modules: develop free-hand drawing in scale.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMAT44	Building Construction Study	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:08:15-10:00(K144)
Practice	EN1	English	MON:16:15-18:00(K183); MON:16:15-18:00(K183)

Subject of architectural engineering, fundamental terms and base definitions. elations of buildings and building constructions. Effects on buildings, requirements of building constructions. Building blocks and specific brick connections. Load-bearing wall systems and lintel beams in wall structures. Groups of foundation modes and characteristics. Water insulation of under grade parts of buildings. Slabs and ring beams. Balconies. Basics of mechanical installations of residential buildings. Frame system buildings, construction systems and materials. Structures of stairs, systematization. Railings, main coverings. Types of traditional roof trusses, specialties, rainwater gutters and roof claddings. Order of layers of flat roofs, rainwater drainage, gullies, waterproofing materials. Types and materials of typical external and internal doors and windows. Classic contact facade finishes. Basics of building physics.

Subject code	Subject name	Requirement	ECTS credit
BMEEOEMMB-1	Building Constructions	Mid-semester mark	8

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:08:15-10:00(K144); MON:08:15-10:00(K144)
Practice	EN1	English	MON:16:15-18:00(K183); MON:16:15-18:00(K183); TUE:14:15-16:00(EOEM_TSZ); TUE:14:15-16:00(EOEM_TSZ)

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTAT41	CAD for Civil Engineers	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	EN5	English	THU:10:15-12:00(K142b); THU:10:15-12:00(K142b)
Laboratory	EN1	English	THU:08:15-10:00(K142b); THU:08:15-10:00(K142b)

Besides an overview on CAD systems and application fields, students will learn the 2D drawing commands that enable carrying out basic design tasks. Layer management, block definition and applying annotations and dimensions are discussed in detail. Learning printing options and parameters supports further design works in the BSc civil engineering program. The aim of the course is to let students understand the potential and capabilities of CAD systems and their applications. The course introduces the basic spatial drawing solutions providing bases for high level courses involving 3D constructions, BIM applications.

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTAT43	Geoinformatics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN2	English	THU:16:15-18:00(K142b)
Laboratory	EN3	English	TUE:16:15-18:00(K142a)
Laboratory	EN1	English	THU:16:15-18:00(K142b)
Lecture	EN0	English	THU:08:15-10:00(K389); THU:08:15-10:00(K389)

The aim of Geoinformatics is to introduce the principles and potential application fields of geographic information systems (GIS) in the civil engineering practice. The course discusses the basic concepts and applications of GIS, the modelling process needed to create GIS, the reference systems of geometric data, the spatial data sources and data acquisition methods, the aspects of data quality, the resources, tools, databases of GIS, the basics of data analysis, visualization and implementation of GIS. Through the lectures and labs students learn the GIS workflow based on desktop and web-based solutions, and tools of spatial process modelling, data management and web integration.

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTM041	Geoinformatics	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:08:15-10:00(K389); THU:08:15-10:00(K389)
Practice	EN1	English	WED:08:15-10:00(K375)

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTMB-1	Database Systems	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	MON:16:15-18:00(K142a); MON:16:15-18:00(K142a)
Lecture	EN0	English	MON:14:15-16:00(K144)

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTMB51	Building Information Modelling	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(K144); TUE:08:15-10:00(K144)

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTMEP1	Digital Cities	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:08:15-10:00(K389); THU:08:15-10:00(K389)
Practice	EN1	English	THU:16:15-18:00(K142b)

The course provides an in-depth practical experience of the methods, data and information available to urbanists through investigation of live projects in the built and natural environment. The students will learn how to use the spatial modelling and analysis techniques and identify new data and technologies platforms and apply to design, plan and manage a contemporary city.

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTMK51	Numerical Methods	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	EN5	English	MON:16:15-18:00(K142b); WED:10:15-12:00(K142a); WED:10:15-12:00(K142a)
Laboratory	EN1	English	MON:12:15-14:00(KF27c); THU:08:15-10:00(KF27c); THU:08:15-10:00(KF27c)

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTMKO1	Localization and mapping	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	SH_LAB	English	WED:10:15-12:00(KF30a); WED:10:15-12:00(KF30a)
Lecture	SH_EA	English	WED:08:15-10:00(KF30a); WED:08:15-10:00(KF30a)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAI41	Earthworks and drainage of transportation infrastructures	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:14:15-17:00(K373); WED:14:15-17:00(K373)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAT41	Geology	Exam	3

Course type	Course code	Course language	Timetable information
Laboratory	EN3	English	THU:10:15-12:00(K136); THU:10:15-12:00(K136)
Laboratory	EN4	English	
Laboratory	EN2	English	TUE:08:15-10:00(K136); TUE:08:15-10:00(K136)
Laboratory	EN1	English	TUE:10:15-12:00(K136); TUE:10:15-12:00(K136)
Lecture	EN0	English	MON:12:15-14:00(KM30)

The geology provides the characterisation of geological formations and materials from a civil engineering point of view. It describes the processes and the interactions between the engineering works and the geological environment. The dynamics of the Earth, the description of raw materials and geo-materials used in engineering practice (minerals and rocks), the geological risks such as earthquakes, volcanism, landslides and their effect, characterisation of surface and subsurface waters and related geological problems.

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAT42	Soil Mechanics	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:10:15-12:00(KM21); THU:10:15-12:00(KM21)
Practice	EN1	English	THU:12:15-14:00(K371); THU:12:15-14:00(K371)
Practice	EN2	English	

Origin of soils, soil exploration, soil samples. Components of soils (phase relationships, grain size distribution, consistency limits), soil classification, compaction. Stresses in the soil (under static conditions, conditions of steady vertical flow). Flow of water through soil due gravity (Darcy’s law, coefficient of permeability, flow nets). Compressibility of soil (reasons and types of compression). Shear strength of soil (Mohr-Coulomb failure criterion, determination of shearing strength).

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAT43	Earthworks	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:12:15-14:00(K136); FRI:12:15-14:00(K136)
Practice	EN1	English	FRI:14:15-15:00(K136); FRI:14:15-15:00(K136)

Scope of earth works. Plastic limit states, Rankine earth pressures. Earth pressure and passive resistance of „real” walls. Soilstatical design of retaining structures. Stability of earth works. Construction of earth works. The designal, executional and monitoring questions of construction. Dewatering of earth works. Geosynthetics.

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAT45	Foundation Engineering	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:14:15-17:00(KM21); MON:14:15-17:00(KM21)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG-2	Environmental Geology	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:10:15-12:00(KM21); FRI:10:15-12:00(KM21)
Practice	EN1	English	FRI:12:15-13:00(KM21); FRI:12:15-13:00(KM21)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG63	Numerical Methods in Geotechnics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	FRI:09:15-10:00(KM21); FRI:09:15-10:00(KM21)
Lecture	EN0	English	FRI:08:15-09:00(KM21); FRI:08:15-09:00(KM21)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMS52	Soil-structure interaction	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:08:15-10:00(K370); WED:08:15-10:00(K370); WED:14:15-16:00(K370)
Practice	EN1	English	WED:14:15-16:00(K370)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMS5P	Engineering geological and geotechnical project	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Practice	EN1	English	THU:10:15-12:00(K374); THU:10:15-12:00(K374)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSA-A1	Steel Buildings	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(EL111); TUE:08:15-10:00(EL111); THU:10:15-12:00(EL111)
Practice	EN1	English	THU:10:15-12:00(EL111)

Low rise industrial halls. Lattice girders. Crane girders. Design of secondary members (purlins, sheeting). Analysis and design: Principles, analysis and modelling methods, global analysis of frames.Stability analysis and design of steel structures. Floor systems, design of composite floor systems. Joints and connections in steel and composite building structures. Bracing of steel and composite structures. Seismic design of structures. Fire design. Highrise and tall buildings.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSA-A2	Reinforced Concrete Buildings	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:08:15-10:00(KF12); MON:08:15-10:00(KF12); TUE:10:15-12:00(EL111)
Practice	EN1	English	TUE:10:15-12:00(EL111)

Formation of reinforced concrete buildings, loads and effects, basics of earthquake design. Plastic behaviour of flat slabs, prestressing. Structural systems of highrise buildings. structural elements of the stiffening systems: shear walls, flat-slabs, cores, frames with masonry infill. Formation of timber halls, sizing of prefabricated prestressed and glued laminated timber structural elements. Masonry structures.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSA-B3	Engineering Works	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:08:15-10:00(K374); WED:08:15-10:00(K374)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSA-PP	Structural Design Projectwork	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	WED:10:15-12:00(KF12); WED:10:15-12:00(KF12)
Practice	EN2	English	WED:10:15-12:00(KF12); WED:10:15-12:00(KF12)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS42	RC and Masonry Structures	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(KF12); TUE:08:15-10:00(KF12)
Practice	EN1	English	TUE:10:15-12:00(KF12)

Design principles of reinforced concrete slab and frame structures, exact and approximate design methods, structural details. Bracing systems of reinforced concrete buildings, determination of the forces acting to the individual shear walls, checking of stability. Detailing of reinforced concrete structures (beam end, corbel, frame corner, curved bars, stairs, force transfer between members, expansion joints, etc.). Types and strength characteristics of masonry. Design principles of unreinforced masonry walls according to EC6. Reinforced masonry

walls.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS43	Bridges and Infrastructures	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:08:15-10:00(KF12); THU:08:15-10:00(KF12)

Historical development of bridges. Basic terms of bridges. Classification of bridges. Superstructure systems. Typical superstructures of steel, steel and concrete composite as well as concrete bridges. Composite action between main girders. Basis of bridge design. Traffic load models and their application rules for highway and railway bridges. Testing of bridges. Substructures of bridges: abutments and piers. Bridge equipment. Conceptual design of bridges. Fitting of bridges into environment, bridge aesthetics. Supervision of bridges. Reconstruction and strengthening of bridges. Civil engineering work in traffic infrastructure, systems and hydraulic engineering.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS46	Laboratory Practice of Testing of Structures and Materials	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	EN2	English	
Laboratory	EN1	English	TUE:14:15-18:00(EL111,MMFP); TUE:14:15-18:00(EL111,MMFP)

Experimental demonstration the behaviour of the loaded structural members and joints made from different materials (steel, reinforced or prestressed concrete, composite, glass…). Introduction into different experimental and measurement techniques and equipments. Up-to-date building materials and material testing methods. General and specific analytical and diagnostic methods for building materials and structures.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS47	Steel and Composite Structures	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-13:00(KF12); MON:10:15-13:00(KF12)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAT41	Basis of Design	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:10:15-12:00(KF12); FRI:10:15-12:00(KF12)

Modelling of structures, design process. Selection of structural form and material. Structural model. Thrust line. Probabilistic basics of structural design, partial (safety) factor method. Selection of critical load case, design load. Actions on structures. Material laws. Geometrically linear and nonlinear analysis, Elastic and plastic resistance. Superposition. Limit states. Load-carrying capacity and serviceability. Beams and columns. Design of structures for horizontal actions. Spatial structures. Classification of structures according to their form and static behaviour.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAT42	Steel Structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:14:15-17:00(KM78); THU:14:15-17:00(KM78)

Lectures of Steel Structures have the general aim to study the basics of the design of steel stuctures, which consists of the design of simple structural members, simple joints and the investigation of the basic failure phenomenon, which can occure in steel structures. The program consists of the following topics: Steel grades, mechanical properties of the steel material. Calculation of cross sectional properties. Design of centrically loaded tension members. Design of Centrically loaded compression members. Buckling problem – behaviour – design method. Design of beams: construction, behaviour under bending and shear interaction. Beam structural behaviour - design approaches for lateral torsional buckling.Design of bolted connections. Design of welded connections. Fatigue design and brittle fracture. Plate buckling phenomena, basics of the cross section classification.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAT43	Reinforced Concrete Structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:08:15-11:00(EL111); FRI:08:15-11:00(EL111)

Structural safety of reinforced concrete (RC) structures; loads and effects on RC strucrures, material properties of concrete and reinforcing steel; moment- curvature relation of RC cross sections; Uncracked and cracked cross section; flexural strength theory, strength and ductility; design of RC cross section; eccentric compression; shear failure in beams without and with shear reinforcement; strength in bending and torsion; anchorage and stress development, bar curtailment; deflection and crack width.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMK51	Methods of Engineering Analysis	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:10:15-11:00(KM30); TUE:10:15-11:00(KM30)
Practice	EN1	English	TUE:11:15-12:00(KM30); TUE:11:15-12:00(KM30)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMS51	Structures 1	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:14:15-16:00(K372); THU:14:15-16:00(K373); THU:14:15-16:00(K373)
Practice	EN1	English	MON:14:15-16:00(K372)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMS5P	Structures project	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Practice	EN1	English	THU:10:15-12:00(K371); THU:10:15-12:00(K371)

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAS41	Strength of Materials	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(KM78); WED:12:15-14:00(KM78)

Differential equation of the elastic curve, computation of the deflected shape for various boundary conditions. Virtual displacement systems, virtual work. Theorem of virtual displacements. Computation of external and internal forces of statically determinate structures using the theorem of virtual displacements. Concept of potential energy, theorem of stationarity of potential energy, application of the theorem for the computation of displacements of structures. Concept of complementary potential, theorem of minimum complementary potential energy, using the theorem for the computation of reactions of structures. Revision of common work and energy theorems of mechanics. Characterization of equilibrium states, concept of critical load. Methods of stability analysis: statical, kinematical, and energy methods. Elastic Euler buckling.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAS42	Structural Analysis II.	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:10:15-12:00(EL111); WED:12:15-14:00(EL111); WED:12:15-14:00(EL111)
Practice	EN1	English	WED:10:15-12:00(EL111)

Problem statements for mechanical problems. Solution with approximative displacement functions, Ritz method. Fundamentals of the finite element method. Fundamentals of matrix analysis and application for computation of structures. Equations of the Euler-Bernoulli beam model. Equations of the Timoshenko beam model. Models of bar structures: equations of truss, grid, planar and spatial frame models. Differential equations of the classical plate theory. Differential equations of the Mindlin plate theory. Analytical solution methods for the equations of plate problems, application of the finite element method. Differential equations of discs in the states of plane stress and plane strain. Analytical solutions of discs problems, application of the finite element method. Derivation of shell models, shell elements of the finite element method.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAS43	Dynamics of Structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(K370); WED:12:15-14:00(K370)

Computation of the equivalent mechanical model of structures with a single degree of freedom: stiffness, mass, damping, consideration of friction. Differential equation of motion. Vibration of mechanical systems with a single degree of freedom: free vibration, forced vibrations with harmonic excitation, general excitation, and excitation with support motion for undamped and damped systems. Modeling of systems with multiple degrees of freedom, meaning of the matrices of the system. Differential equation system of motion. Vibrations of mechanical systems with multiple degrees of freedom: free vibration, forced vibrations with harmonic excitation, general excitation, and excitation with support motion. Free vibrations of continua: differential equation of vibrating strings, axial and flexural vibration of beams. Fundamentals of earthquake analysis, response function of structures, meaning and usage of response

spectrum.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAT41	Basics of Statics and Dynamics	Exam	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	MON:14:15-16:00(K376); MON:14:15-16:00(K376); WED:10:15-13:00(K376); WED:10:15-13:00(K376)

Classification of mechanics, basic vector operations. Kinematics of particles, description of motion in Cartesian coordinate system. Newton's laws of motion. Concurrent and general force systems in the plane, distributed forces: reduction, resultant, centroid, equilibration. Mechanical work. Planar motion of rigid bodies. Centroid and moment of inertia of rigid bodies. Kinetics of rigid bodies moving in the plane. Linear momentum, angular momentum, theorems of change of kinetic energy for particles and rigid bodies. Constraints. External and internal forces of planar structures and trusses. Statical determinacy. Spatial force systems: reduction, resultant, equilibration. Spatial structures. Internal force diagrams of statically determinate planar bar structures, relationships between internal force diagrams. Sliding friction and rolling resistance.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAT42	Introduction to Strength of Materials	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	TUE:15:15-18:00(K376); TUE:15:15-18:00(K376); WED:15:15-17:00(KM78); WED:15:15-17:00(KM78)

Internal forces and internal force diagrams of planar and spatial structures (revision, generalization). Moments of inertia and principal directions of planar figures. Strength properties of materials. Concept of stresses and deformations. Material models: linearly elastic material and linerly elastic and perfectly plastic material. Beam element, beam model composed of elastically connected cross-sections. Computation of normal stresses in beams for centric tension/compression, simple bending, skew bending, and tension/compression combined with bending. Computation of shear stresses in beams for pure shearing, torsion, and shearing combined with bending. Eccentric compression of cross-sections of no tension matrials. Shear centre of thin-walled cross-sections. Displacements of bent beams with straight axis. Principal stresses and principal directions.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMAT43	Structural Analysis I.	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:08:15-10:00(KF99); MON:08:15-10:00(KF99); TUE:10:15-12:00(K370); TUE:10:15-12:00(K370)

Principle of small displacements: displacements of rigid body chains using small displacements. Computation of displacements of statically determinate simple and compound structures using displacement equivalency statements. Virtual force systems, concept of virtual complementary work, theorem of virtual forces. Computation of displacements of statically determinate simple and compound structures using the theorem of virtual forces. Influence lines of internal forces and displacements of statically determinate structures. Maximal internal forces. Concept of envelope curves. Computation of statically indeterminate planar structures under fix loads using the force method. Computation of statically indeterminate planar structures under moving load using the force method: influence lines. Computation of statically indeterminate planar structures under fix loads using the displacement method.

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMB-1	Finite Element Modelling	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:10:15-12:00(EOTM_TSZ)
Practice	EN1	English	TUE:10:15-12:00(EOTM_TSZ); TUE:10:15-12:00(EOTM_TSZ)

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMN-2	Nonlinear Mechanics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:11:15-13:00(KM78); FRI:11:15-13:00(KM78)
Practice	EN1	English	FRI:13:15-14:00(KM78); FRI:13:15-14:00(KM78)

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMS51	FEM for Civil Engineers	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(K389); WED:12:15-14:00(K389)

Practice	EN1	English	THU:16:15-18:00(K389); THU:16:15-18:00(K389)

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMS5P	Numerical modeling project	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Practice	EN1	English	THU:10:15-12:00(KM78); THU:10:15-12:00(KM78)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVA-E1	Highway Planning	Exam	3

Course type	Course code	Course language	Timetable information
Practice	EN1	English	MON:12:15-14:00(K373); MON:12:15-14:00(K373)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVA-E2	Railway Planning	Exam	3

Course type	Course code	Course language	Timetable information
Practice	EN1	English	WED:12:15-14:00(KF99); WED:12:15-14:00(KF99)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAI41	Highway and Railway Structures	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:12:15-14:00(K374); MON:12:15-14:00(K374); WED:08:15-10:00(EL111); WED:08:15-10:00(EL111)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAI43	Highway and Railway Design	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:10:15-12:00(K371); WED:10:15-12:00(K371); THU:08:15-10:00(K375)
Practice	EN1	English	MON:10:15-12:00(K374); MON:10:15-12:00(K374)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVA-QP	Transport Infrastructure Design Project	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	WED:08:15-10:00(KF99); WED:08:15-10:00(KF99)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAT41	Railway Tracks	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:12:15-15:00(KF99); TUE:12:15-15:00(KF99)

Basic concepts of the railway tracks and vehicles, most important technical parameters. Features of normal railways, suburban railways, urban railways, classification of different types of railways. Speed, acceleration, changing of acceleration. Horizontal and vertical alignment of the railway tracks, straights, circular curves and transition curves, superelevation, vertical curves. Elements of the substructure and superstructure. Rails, sleepers, rail fastenings, ballast, subgrade, strengthening of the subgrade. Setting out major and detail points of curves and transition curves. Structures and solutions of dewatering and drainage of railway tracks. Basic concepts of conventional and continuously welded rail tracks. Types of turnouts and simple track connections. Basic concepts of railway stations, platforms, passenger access.

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAT42	Roads	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:14:15-16:00(EOUV_TSZ); MON:14:15-16:00(EOUV_TSZ)

History of transportation. Sustainable transportation and transportation policy. The system of tracks, vehicles and drivers/passengers. Design and behavioural patterns and self-explaining roads. Transport facilities. Elements of the

alignment in cross sections, horizontal and vertical alignment. Basic rules and disciplines of planning and design. Transition of superelevation. Planning process: planning, design project, construction, operation. Traffic operation basics: measures of traffic, traffic operation and management. Intersections and junctions. Urban transportation planning, the concept of accessibility. Characteristics, production and installation of asphalt pavements. Types of tracks, layers, materials. Design of new pavement structures. Construction, management and operation of road networks. Project 1: Authorization plan of a curved section of a secondary main road with transition curves: site plan on a contour line map with long section and cross sections. Drainage, earthwork, road marking. Project 2: Feasibility study of a main road between two point on a contour line map.

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAT43	Urban and Regional Development	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-12:00(KF99); MON:10:15-12:00(KF99)

Infrastructure and Regional Development. Historical construction processes of canals, railways, motorways. Aviation and the internet age. Livable, sustainable cities, regions. Computer aided teamwork. Construction projects, mobility measures; parking regulations. Improving traffic safety, Traffic management and intelligent investments. Basics of Land-Use Planning. Cities with road pricing, congestion pricing. Lessons learned in Oslo, London, Stockholm, Singapore. Calculations with demand curves.The city as a system. [Area, core network]. The morphology of the city. Basics on the the Hungarian settlement system. Development of large cities. Concentration, suburbanization. Fundamentals of urban planning. Case studies: Paris, Budapest – Vienna – Prague.The regional development strategy of the European Union. Steps and documents of the implementation in Hungary. Strategic Environmental Assessments. Monitoring of Environmental Effects.

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVAT44	Public Administration and Land Registry	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:12:15-14:00(KF10); TUE:12:15-14:00(KF10)

Preparation of major civil engineering projects. Governance of Civil Engineering activities. World-wide examples. Case studies for Public Transport and/or Water Management. Private and public projects. Investments by modern Public Private Partnerships. Lessons on Civil Engineering “Mega-Projects”. [Major Canals, Bridges. Motorways. Channel Tunnel, Oresund Bridge.] Student studies and presentations on actual projects. Public participation. The Role of Civil Organisations. Chamber of Engineers, Institute of Civil Engineers. International Organisations. [PIARC, IRF, UIC, UITP, IABSE, IAHR]. The process of public procurements. Competition and transparency requirements.Authorisitation processes. Participants and stake-holders. Legal and administrative requirements. Environmental Acts, Decrees and Guidelines. Land registry processes and tasks. Real estate valuation. Elementary Cost – Benefit – Analysis. Financing and banking requirements.

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVMU-1	Strategic Transportation Planning	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:10:15-12:00(KF99); THU:10:15-12:00(KF99)
Practice	EN1	English	THU:12:15-13:00(KF99); THU:12:15-13:00(KF99)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVMU-4	Project Management in Transportation	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(KF99); TUE:08:15-10:00(KF99)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVMU61	Modelling Transport	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:10:15-12:00(KF99); WED:10:15-12:00(KF99)

Subject code	Subject name	Requirement	ECTS credit
BMEEOUVMU62	Operation of Railway Systems	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:08:15-10:00(K144); WED:08:15-10:00(K144)

Subject code	Subject name			Requirement	ECTS credit
BMEEOUVMU64	Railway Structures			Exam	5
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	FRI:08:15-10:00(KF99); FRI:08:15-10:00(KF99); FRI:10:15-12:00 (KF99); FRI:10:15-12:00(KF99)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOUVMU66	Computer Aided Transportation Design			Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	THU:13:15-16:00(KF99); THU:13:15-16:00(KF99)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOVKA-H3	Environmental Impact Assessment			Exam	3
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	TUE:08:15-10:00(KM31); THU:08:15-10:00(KM31); THU:08:15-10:00(KM31)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOVKAI41	Public works 2			Exam	5
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	TUE:14:15-16:00(KM30); TUE:14:15-16:00(KM30)		
Practice	EN1	English	TUE:16:15-18:00(KM30); TUE:16:15-18:00(KM30)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOVKAI42	Urban Environment			Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	THU:10:15-12:00(KM31); THU:10:15-12:00(KM31)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOVKAI44	Water Quality Management			Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	TUE:10:15-12:00(K373); TUE:10:15-12:00(K373)		
Practice	EN1	English	TUE:12:15-14:00(K373)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOVKA-QP	Urban Water Infrastructure Design Project			Mid-semester mark	6
Course type	**Course code**	**Course language**	**Timetable information**		
Practice	EN1	English	WED:08:15-10:00(KM31); WED:08:15-10:00(KM31)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOVKAT41	Basics of Environmental Engineering			Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	MON:10:15-12:00(KM79); MON:10:15-12:00(KM79)		

The aim of the course is to provide basic scientific and engineering background for further studies in environmental engineering by giving introduction to the following subjects: basics of ecology, the natural cycle of ecologically important elements and substances, the environmental effects of human activities, the ecological footprint, energy consumption patterns and energy production technologies, renewable energy sources. Selected environmental problems associated with civil engineering activities (water, air and soil pollution), with focus on the urban environment. Tools and methods for conducting environmental impact assessment.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVKAT42	Public Works I.	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:12:15-14:00(K144); MON:12:15-14:00(K144)
Practice	EN2	English	TUE:08:15-10:00(K376)
Practice	EN1	English	TUE:08:15-10:00(K376)

The main goal of the subject is to provide information about the most important features of the public works. The subject is also including the connections between the different public works and other establishments. Further aim is to provide knowledge for the future general designers and technical managers to make the right decisions on the underground infrastructure of settlements. Main scopes are: system knowledge and design of different publc work types like water acquisiton, drinking water supply, waste water networks, storm water networks and public works asset management.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVKMI51	Environmental system	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:16:15-19:00(K144); WED:16:15-19:00(K144)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVKMI52	Ecology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:12:15-14:00(KM30); TUE:12:15-14:00(KM30)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVKMV-1	Water and wastewater treatment II.	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:13:15-16:00(KM31); THU:13:15-16:00(KM31)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVKMV-2	Water quality monitoring	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:16:15-18:00(KM31); MON:16:15-18:00(KM31)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVKMV64	Reconstruction of public water utility systems	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(K144); WED:12:15-14:00(K144)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVA-F2	River Basin Management	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:14:15-17:00(KM30); MON:14:15-17:00(KM30)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVAI41	Hydrology II.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(KF10); WED:12:15-14:00(KF10)
Practice	EN1	English	TUE:12:15-14:00(K374)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVA-QP	Hydraulic Engineering Design Project	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	THU:14:15-16:00(EOVV_TSZ); THU:14:15-16:00(EOVV_TSZ)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVAT41	Hydrology I.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:08:15-10:00(KF10)
Practice	EN1	English	TUE:08:15-10:00(KF10)
Practice	EN2	English	TUE:08:15-10:00(KF10)

The global water cycle. The water balance. Basic elements of hydrometeorology. Evaporation and its main features. The origin of the precipitation, quantitative characteristics, principles of precipitation. Weather, weather conditions, climate. The concept and principles of runoff. Infiltration. runoff estimation on small and large catchments. Elements of hydrography. Exploration of natural streams. Characterisation of subsurface waters and their principles. Characterisation of groundwater regime.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVMV-1	Modelling of Hydrosystem	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:10:15-12:00(KF10); THU:10:15-12:00(KF10)
Practice	EN1	English	THU:12:15-13:00(KF10); THU:12:15-13:00(KF10)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVMV62	Desing of Water Damage Prevention Structures	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:09:15-11:00(KF10); WED:09:15-11:00(KF10)
Practice	EN1	English	WED:11:15-12:00(KF10); WED:11:15-12:00(KF10)

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVMX61	Integrated Water Management	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:16:15-18:00(K373); THU:16:15-18:00(K373)
Practice	EN1	English	THU:18:15-19:00(K373); THU:18:15-19:00(K373)

Faculty of Economic and Social Sciences

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
BMEGT20A001	Management and Business Economics	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EEN09BM	English	

https://edu.gtk.bme.hu/
The course introduces the essentials of management as they apply within the contemporary work environment and gives a conceptual understanding of the role of management in the decision making process. Particular attention is paid to management theories: principles of management, marketing management, quality management, production and project management. For problem formulation, both the managerial interpretation and the mathematical techniques are applied.
Budapest University of Technology and Economics
Faculty of Economic and Social Sciences
Course Syllabus
and Requirements
Management and Business Economics
2.
Course code
Semester
Hours per week
(Theory/Practice)
ECTS credits
Language of Instruction
Level
(BSc/BA/MSc/MA)

BMEGT20A001
fall/spring
4/0
4
Hungarian
BSc/BA

3. Course supervisor (name, title, department):
János Kövesi, dr. Habil, Professor, Department of Management and Business Economics
4. Lecturers:
Name:
Position:
Department/Institute/availability(Room, e-mail address):
Szilvia Bíró-Szigeti, PhD
AssociateProfessor
Dept. of Management and BusinessEconomics, QB305, szigetisz@mvt.bme.hu
János Kövesi
Professor
Dept.of Management and BusinessEconomics, QA315, kovesi@mvt.bme.hu
Noémi Kalló, PhD
Associate Professor
Dept.of Management and BusinessEconomics, QA308, kallo@mvt.bme.hu
Tibor Szabó, PhD
Assistant Professor
Dept.of Management and BusinessEconomics, QA317, tiborszabo@mvt.bme.hu
5. Preliminary knowledge required:
Basic concept of companies and their operation.
6. Academic prerequisites:

-
7. Objectives and description of the course:
The course introduces the essentials of management as they apply within the contemporary work environment and gives a conceptual understanding of the role of management in the decision making process. Particular attention is paid to management theories: principles of management, marketing management, quality management, production and project management. For problem formulation, both the managerial interpretation and the mathematical techniques are applied.
8. Teaching methods:
Lectures.
9. Requirements and assessment:
4 midterm exams have to be taken during the semester. The grade will be determined by the sum of the midterm exams (4x25=100 %), there are no minimum requirements for the individual exams.
10. Exams, make-up duties and make-up exams:
Maximum 3 of the 4 midterm exams can be repeated or make up at the end of the semester. There are no final make -up exams in this course.
11. Office hours:
By making appointment with the lecturers.
12. Course material, compulsory and recommended readings:
Materials provided by the lecturers: www.mvt.bme.hu/segedanyagok
13. Workload and detailed class schedule:

Topics to be discussed, readings required for the class, other assignments
Week 1
Marketing management:Creating Customer Value and Engagement
Week 2
Consumer behaviour, Analyzing the Marketing Environment
Week 3
Market research, Product and brand management
Week 4
Service management, Promotion management
Week 5
Communication management, Online marketing
Week 6
Quality management: Principles of quality management, the brief history of quality management systems
Week 7
Overview of quality assurance systems based on ISO 9001:2000 Quality Management System.
Week 8
Overview of quality assurance systems based on Total Quality Management System.
Week 9
Production-economics: production systems, manufacturing models, product-process matrix.
Week 10
Inventories, inventory control systems, costs of carrying stocks
Week 11
Principles of management: Resources of a firm, firm as an organization.
Week 12
Functions of managerial processes
Week 13
Corporates strategies, Team work, communication in an organization.
Week 14
Repeat of midterms

Subject code	Subject name	Requirement	ECTS credit
BMEGT20A015	Basics of Quality Management	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EEN05GT	English	TUE:14:15-16:00(QA407)
Practice	GEN05GT	English	TUE:16:15-18:00(QA407)

Students get acquainted with the basic issues of quality management and total quality management. In the second part of the semester those quality management techniques and tools are introduced that can be used effectively and efficiently during the formation and improvement of quality management systems.

Subject code	Subject name	Requirement	ECTS credit
BMEGT20A048	Marketing	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EEN09BM	English	THU:14:15-16:00(QA403)
Practice	GEN09BM	English	THU:16:15-18:00(QA403)

https://edu.gtk.bme.hu/
Learning outcomes: After completing the course, the students will be able to understand the role of marketing in an organization. Students will become familiar with marketing tasks, tools and strategies. Through practical work students will be able to elaborate certain marketing topics using the knowledge acquired during lectures.
Content: Introduction to marketing. Creating customer value. Analyzing the marketing environment. Company and marketing strategy. Marketing information and customer insights. Market segmentation and targeting. Positioning. Creating competitive advantage. Consumer markets and buyer behavior. Business markets and business buyer behavior. Products and services. New product development. Designing pricing strategies. Marketing channels. Integrated marketing communication.
Budapest University of Technology and Economics
Faculty of Economic and Social Sciences
Course Syllabus
and requirements
Marketing
2.
Course code
Semester
Hours per week
(Theory/Practice)
ECTS credits
Language of Instruction
Level
(BSc/BA/MSc/MA)

BMEGT20A048
fall
3/1/0
5
English
BSc/BA

3. Course supervisor (name, title, department):
Zsuzsanna Szalkai, PhD, Associate Professor, Department of Management and Business Economics
4. Lecturers:
Name:
Position:
Department/Institute/availability(Room, e-mail address):
Zsuzsanna Szalkai, PhD
Associate Professor
Department of Management and Business Economics, szakaizs@mvt.bme.hu, Room QB304

5. Preliminary knowledge required: -
6. Academic prerequisites: -
7. Objectives and description of the course:
After the course the students understand the role of marketing in an organization. Students get familiar with the marketing tasks, tools and strategies. Through the practical work the student is able to elaborate certain marketing topic using the knowledge acquired on lectures.
8. Teaching methods:
Lectures and seminars
9. Requirements and assessment:
Team project: 20%
Presentation: 10%
Exercises on Seminars: 10%
Team project has two parts: written report and presentation. Students will work in a maximum of 5-member group on a selected market and company.
10. Exams, make-up duties and make-up exams:
Exam: 60%
Final exam in the exam period. Exam can be repeated in the exam period.
Overall assessment:
87-100%:excellent

75-86%: good
63-74%: satisfactory
50-62%: passed
0-49%: failed
11. Office hours:
Wednesday 10.00-12.00 Bld. Q Room B 304
12. Course material, compulsory and recommended readings:
Ph. Kotler, G. Armstrong, J. (2016): Principles of Marketing. 16th Ed. Pearson
Lecture slides
Handouts
13. Workload and detailed class schedule:

Topics to be discussed, readings required for the class, other assignments
Week 1
Introduction to Marketing. Creating Customer Value
Week 2
Analyzing the Marketing Environment. Marketing strategy
Week 3
Marketing Information and Customer Insight
Week 4
Market Segmentation, Targeting and Positioning. Competitive Advantage
Week 5
Consumer Markets and Buyer Behavior
Week 6
Business Markets and Business Buyer Behavior
Week 7
Product Strategy and New Product Development
Week 8
Marketing services
Week 9
Marketing Channels: Delivering Customer Value
Week 10
Understanding and Capturing Customer Value. Pricing Strategies
Week 11
Integrated marketing communication part I: advertising, sales promotion
Week 12
Integrated marketing communication part II: PR, direct marketing and personal selling.
Week 13
Team presentations
Week 14
Team presentations

Subject code	Subject name	Requirement	ECTS credit
BMEGT20M011	Quantitative Methods	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EEN05BM	English	WED:12:15-14:00(QA403)

https://edu.gtk.bme.hu/
The main objective of the course is to get students acquainted with the basic mathematical and statistical tools and methods widely applied in business practice. The focus is on the practical applications of them. The primary goal is to familiarize students with the essential tools and to enable them to apply them individually both in their studies and during their later work. The three main chapters of the course are probability theory, descriptive and inductive statistics. During the semester we deal with different probability distributions and with decision theory as well. At the end of the course the basics of decision theory are introduced and discussed.

Subject code	Subject name	Requirement	ECTS credit
BMEGT20M013	Production and Operations Management	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EEN05BM	English	TUE:10:15-12:00(QA403); THU:12:15-14:00(QA403)

https://edu.gtk.bme.hu/
The aim of the course is to introduce the basic characteristics of production and service processes, as well as the most important methods necessary for the planning and the efficient realization of tasks in production and service systems. Students learn the methods and issues of such important tasks as demand forecasting, capacity analysis,

inventory control and aggregate production planning. Besides the theoretical background, the course provides case studies to emphasize the practical issues as well.

Subject code	Subject name	Requirement	ECTS credit
BMEGT20MN04	Strategic Management	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN03GT	English	

This course gives you the core concepts, frameworks, and techniques of strategic management, which will allow you to understand what managers must do to make an organization to achieve superior performance. Various components of strategic management, such as tools of strategy analysis, sources of competitive advantage, strategies in different industry contents and the fundamentals of corporate strategy are to be discussed throughout the course.

Subject code	Subject name	Requirement	ECTS credit
BMEGT20MN13	Project Management	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EEN05BM	English	WED:12:15-14:00(QA404)
Practice	GEN05BM	English	WED:14:15-16:00(QA404)

The course provides the students with technical terms, tools and techniques of project management. The curriculum gives an overview of the advanced knowledge necessary for managing a project. The course puts emphasis not only on introducing practical applications (software), but also on delivering broader and more in-depth project management skills.

Subject code	Subject name	Requirement	ECTS credit
BMEGT20MN47	Management and Marketing	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EEN05GT	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGT20MN48	Management Information Systems	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EEN05BM	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGT20MN53	Management	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN02GT	English	WED:08:15-10:00(QA404)

Subject code	Subject name	Requirement	ECTS credit
BMEGT20MN54	Marketing Management	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN02GT	English	WED:10:15-12:00(QA404)

Subject code	Subject name	Requirement	ECTS credit
BMEGT20MW02	Management	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EEN04BM	English	FRI:12:15-15:00(R108)

https://edu.gtk.bme.hu/
The course is designed for engineering students who would like to have a better conceptual understanding of the role of management. The course introduces the essentials of management functions (planning, organizing, control and leadership) as they are applied within the contemporary work environment. Particular attention is paid to the planning and control function elements within the course.

Subject code	Subject name	Requirement	ECTS credit
BMEGT301924	Economics II.	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN44BM	English	TUE:14:15-16:00(K397)

The aim is to allow students to understand today’s economic environment. After having finished the course, students should understand the key concepts of macroeconomics (e.g. national income, unemployment, inflation, budget balance, exchange rates and the balance of payments), master a basic set of tools of economic analysis and demonstrate the ability to apply them to simple practical problems.

Subject code	Subject name	Requirement	ECTS credit
BMEGT30A001	Micro- and Macroeconomics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EEN44BM	English	MON:08:15-12:00(QAF14)

Selected topics and analytical techniques in micro- and macroeconomics tailored for engineering students. Introduction to microeconomics. Some basic economic concepts and analytical tools. Scarcity: source of eternal struggle or the foundation of all economic systems? How does “choice” determine everyday life, and what role does it play in the operation of businesses? Opportunity cost, sunk cost, normal profit. How does the product market work? Consumer choice: what are the options on the demand side, what are the goals of the consumer and how they are achieved? The forms and aims of businesses. Basics of accounting and finance. Cost and profit analysis. Competition and market systems. Introduction to macroeconomics. How does government policy interact with the decisions, profitability and life cycle of businesses? The main issues of macroeconomic study: gross domestic product, changes in the price level, unemployment ratio. Governmental policies: tools and effects. Fiscal policy: direct intervention to the life of the households and firms. Monetary policy: changes in the regulations, workings and major indicators of the financial market, and their effect on the households and firms. Economic growth and productivity. Issues of international trade: exchange rate and exchange rate policy.

Subject code	Subject name	Requirement	ECTS credit
BMEGT411099	Philosophy and Art	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	MON:10:15-12:00(E205)
Practice	GEN01BM	English	MON:10:15-12:00(E205)

The course offers an introduction to the most important topics, problems and methods of the philosophical discourses that focus on art, architecture and urban design. We will examine the theoretical issues of essence, function, space, place, aesthetic value, beauty and relations between power and architecture, how social life changes in built environment, and what are the cognitive and psychological effects of living in built environment.

Subject code	Subject name	Requirement	ECTS credit
BMEGT418959	Logic and Argumentation	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	TUE:16:15-18:00(E205)

The undergraduate course offers a basic introduction to the everyday issues and scientific use of arguments with an introduction to formal and informal methods of analysing argumentations.Itexamines case studies taken from realistic scenarios andsurveys a variety oftopics from standard logic, argumentation and critical thinking. The course discusses issues from the point of view of argumentation and formal analysis in various fields as well as from the point of view of rhetoric and critical thinking. The topics covered give an introduction to core concepts and connect recent contributions that explore contemporary approaches to analysing everyday discourses and theoretical works. Apart from familiarizing the student with the established theories and key concepts in logic and argumentation theory, the course also provides practical training that enables students to analyse complex arguments with the help of various tools.

Subject code	Subject name	Requirement	ECTS credit
BMEGT419709	History of Science	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	MON:10:15-12:00(E201)

This course introduces students to the history of economic thought. It does not present the major theoretical traditions as milestones of a single scholarly endeavor, but as an ambiguous cumulation of socially embedded theoreticians and theories. The course does not develop an abstract (internalist) disciplinary history, but offers a glimpse into multiple down-to-earth (externalist) histories. The ideas, engagements, desires, hopes and fears of

great thinkers offer a thick social layer which might provide a better understanding of their theories. Being more concerned about how these theoreticians perceived their own theories than how others interpreted them later helps to avoid anachronistic accounts. By emphasizing the historical context and the interpretative flexibility of economic ideas, this course aims to develop social and cultural sensitivity in how one handles economic and social theories.

Subject code	Subject name	Requirement	ECTS credit
BMEGT41A001	Philosophy	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	TUE:10:15-12:00(E203)

Subject code	Subject name	Requirement	ECTS credit
BMEGT41A002	Research Methodology	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	MON:14:15-16:00(E205)

The undergraduate course offers a basic introduction to long-standing issues concerning scientific knowledge and methodology. It examines case studies taken from realistic scenarios and surveys a variety of topics from the standard philosophy of science. The course discusses issues from the point of view of empirical research in various fields as well as from the point of view of epistemology and philosophy. The topics covered give an introduction to core concepts and connect recent contributions that explore contemporary approaches (e.g. recent advances in the philosophy of measurement and modelling). Apart from familiarizing the student with theestablished theories and key concepts in philosophy of science and methodology, the course also examines the mechanisms that underlie scientific creativity and discusses the ethical responsibilities of scientists and engineers.

Subject code	Subject name	Requirement	ECTS credit
BMEGT41A010	Techniques of negotiation and presentation	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	THU:10:15-12:00(E205)

The presentation techniques part of the course is designed to give the students some insights into useful presentation techniques that can be used throughout their academic and non-academic career. In the art of negotiations segment of the curriculum we help students to become self-aware and successful negotiators. The basic theoretical foundations of the art of negotiations are also covered (BATNA, competitive arousal etc.).

Subject code	Subject name	Requirement	ECTS credit
BMEGT41M004	Ethics for Engineers	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	MON:10:15-12:00(E1A)

The purpose of this course is to help students recognise and analyse ethical problems, risks andconflicts (recognition and understanding), make the right decision in morally delicate situations(decision) and become committed to the performance of the right action (action). The objectiveof this course is to make students able to act in a morally reflective and correct way and toprepare them to understand, evaluate and handle ethicalproblems apparent on the field ofengineering. Main theoretical objectives: acquiring new factual knowledge, new perspectives forevaluation and new behavioural skills. Main practical objectives: becoming able to analyse and solve complex decision problems with particular attention to their ethical dimension.

Subject code	Subject name	Requirement	ECTS credit
BMEGT41V104	Pseudoscience and Science	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	THU:08:15-10:00(E205)

Subject code	Subject name	Requirement	ECTS credit
BMEGT41V105	Artificial Intelligence and Ethics	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	MON:16:15-18:00(E205)

Subject code	Subject name	Requirement	ECTS credit
BMEGT42A012	Regional Economics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN10GT	English	WED:16:15-18:00

Subject code	Subject name	Requirement	ECTS credit
BMEGT42A022	Environmental Evaluation and Risk Management	Exam	3

Course type	Course code	Course language	Timetable information
Practice	GEN36BM	English	TUE:10:15-12:00

Monetary valuation of natural capital and the concept of sustainable development (weak and strong sustainability). The necessity to valuate natural resources: the problem of public goods and free goods, discounting (social discount rate) and externalities. The areas of application and methodological basics of environmental valuation. The concept and elements of Total Economic Value. A detailed overview of the methods of environmental valuation: cost-based methods, productivity approach, revealed preference methods (hedonic pricing and travel cost method), stated preference or hypothetical methods and benefit transfer. An introduction to risk management: definition and approaches of risk, corporate risk management techniques, corporate social responsibility. Cost-benefit and cost-effectiveness analysis, case studies.

Subject code	Subject name	Requirement	ECTS credit
BMEGT42A410	Environmental Management	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EEN09GE	English	TUE:14:15-18:00; TUE:14:15-16:00

Subject code	Subject name	Requirement	ECTS credit
BMEGT42M104	Sustainable Environmental and Natural Resource Management	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EEN22GT	English	MON:12:15-16:00

The course unit aims to achieve two main goals. Firstly, to teach students the economic theory governing the efficient allocation of environmental and natural resources, based on their scarcity and renewability. Secondly, to offer an insight into the practical use-related questions of the various types of environmental and natural resources, with an overview of best practices currently available.

Subject code	Subject name	Requirement	ECTS credit
BMEGT42M111	Sectorial Sustainability Studies	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EEN15GT	English	WED:10:15-14:00

Subject code	Subject name	Requirement	ECTS credit
BMEGT42M400	Environmental Economics	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN10EO	English	WED:14:15-16:00(QB104)

Subject code	Subject name	Requirement	ECTS credit
BMEGT42V100	Climate Change – Advanced Level	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN22BM	English	MON:14:15-16:00

Subject code	Subject name	Requirement	ECTS credit
BMEGT43A002	Sociology	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	TUE:16:15-18:00(E305ab)

This course will give students an introduction to sociology by discussing a subject that concerns all of us: the global

financial crisis and the ensuing Great Recession (or Slump) whose dire consequences continue to affect the world economy to this day. The objective is to equip students with the tools required to make sense of this crisis in its complexity. A further consideration, specific to engineering and economics students is that a sociological study of the Great Recession provides valuable insights into the social determinants of innovations, most prominently technological and financial. Learning about these issues will also help them develop a basic understanding of late capitalism. They will find that the major subjects in sociology like power, cultural values, violence, symbolic goods, anomy, collective action, etc. touch upon things that profoundly impact our lives without us being aware of their implications. The craft of sociology is to depart from conventional notions by asking hard questions about these things using the methods of rational inquiry.

Subject code	Subject name	Requirement	ECTS credit
BMEGT43A141	Comparative Country Studies	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	THU:12:15-16:00(E505)

The main focus of the course is culture, what kind of effect it has on the development of civilizations, societies and economies of past and present. There will be three major topics, such as „FOOD & TRADITIONS; ABUNDANCE & SCARCITY OF RESOURCES; PEOPLE, ENVIRONMENT& CITIES”, which represent the most challenging areas of development in the 21st century. Under this umbrella topics, we try to explore and compare the culture and life of many continents, regions and countries of the world.

Subject code	Subject name	Requirement	ECTS credit
BMEGT43A378	International Communication	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	TUE:12:15-14:00(E504)
Practice	GEN01ER	English	TUE:14:15-16:00(E504)

Subject code	Subject name	Requirement	ECTS credit
BMEGT51V115		Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EHU03BM	German	

Subject code	Subject name	Requirement	ECTS credit
BMEGT51V118	Analysis of Pedagogical Problems in the Light of International Films	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	GENGT02	English	
Practice	GENGT01	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGT52A001	Ergonomics	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN02BM	English	WED:12:15-14:00(QA240)

Concept of Ergonomics: Man-machine systems, levels of compatibility, characteristics of the human and the technical subsystems, significance and quality of user interface. Workplace design: Basic ergonomic principles and design guidelines for different working environments: workshops in mechanical industry, traditional and open room offices as well as other working places with VDUs, control rooms in the process industry, client service workplaces (governmental organizations, banks and ICT companies). Human factors of safety. Human-computer interaction: Analytical (cognitive walkthrough, guideline review and heuristic) and empirical methods of assessing usability of software and other smart products. Website quality, web-mining. Industrial case studies with the INTERFACE research and assessment workstation.

Subject code	Subject name	Requirement	ECTS credit
BMEGT52V100	Fashion and the Psychology of Advertising	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN03BM	English	WED:12:15-14:00(QA202)

The course aims to have a look behind the scenes of the colorful and glamorous world of fashion and advertising. What we see at first glance is a huge industry where millions of professionals are pushing the maschinery to play upon our instincts. We shall study the methods, reviewing the role of public relations, sales promotion, the role of the

brands, and the templates and stereotypes used in the different media. The vast amount of knowledge piled up by behavioral sciences will help us answer the question why our basic instincts to imitate can be used and abused. Why is it that we are ready to spend billions on shampoo, new clothes, junk food, gadgets ... etc. hoping to buy identity.We will also reveal that the very nature of the social animal - the group - plays an even more decisive role in our preferences and purchases – introducing a variety of approaches from the basic theories of fashion (trickle down, cascade, herd behavior) to network theories.

Subject code	Subject name	Requirement	ECTS credit
BMEGT55A001	Business Law	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN15BM	English	FRI:12:15-14:00

The aim of the course: Characteristics of the Anglo-Saxon and continental systems of business law. The development of the system of the Hungarian business law. Basic legal institutions of the state to manage the economics. Organisations and enterprises as the subjects of law: conceptional questions. International models of company law. The development of the Hungarian company law. General rules of the Hungarian Company Act. Internal organisation of companies. The law of company registration, the registration proceedings and the company registry. Companies with a partnership profile. Companies limited by shares. Concept and types of securities. Competition law. EU directives and regulations on companies and competition: their execution in the Hungarian law.

Subject code	Subject name	Requirement	ECTS credit
BMEGT55M008	Corporate Law	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN08GT	English	TUE:08:15-10:00(QA406)

Subject code	Subject name	Requirement	ECTS credit
BMEGT55M420	Legal Framework of Autonomous Vehicles	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN06KO_SH	English	TUE:12:15-14:00
Lecture	EEN05KO	English	TUE:12:15-14:00

Subject code	Subject name	Requirement	ECTS credit
BMEGT55MN02	Economic Law of the EU	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN08GT	English	MON:12:15-14:00(QA405)

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
BMEVIAUAC12	Microcontroller Based Systems	Exam	5

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIAUAC15	Data-Driven Systems	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	AEe	English	TUE:14:15-16:00
Practice	AGYe	English	THU:10:15-12:00

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	THU:10:15-12:00(R4K,R4D)
Laboratory	AL2	English	THU:12:15-14:00(R4K,R4D)
Lecture	AE	English	WED:08:15-10:00(E1C)
Practice	AG	English	FRI:12:15-14:00

https://portal.vik.bme.hu/kepzes/targyak/VIEEAA00/en/
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
BMEVIEEAB01	Microelectronics	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	AL01E	English	FRI:12:15-14:00
Laboratory	AL02E	English	FRI:14:15-16:00
Lecture	AEE	English	WED:10:15-12:00

Subject code	Subject name	Requirement	ECTS credit
BMEVIEEAV18	Development and Production of Medical Devices	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	01	English	TUE:12:15-14:00(QB309)
Practice	02	English	THU:12:15-14:00(QB-310)

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	10_LA	English	THU:14:15-18:00(V1C)
Lecture	10_EA	English	TUE:12:15-14:00(E305ab); TUE:12:15-14:00(E305ab); WED:16:15-18:00(TANSZEK)

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIETAB01	Electronics Technology	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	2_LA	English	THU:14:15-18:00(V1C)
Lecture	2_EA	English	TUE:12:15-14:00(E305ab)

Subject code	Subject name	Requirement	ECTS credit
BMEVIETMA13	Photonics Devices	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	2_EA	English	WED:08:15-10:00(V1102); WED:08:15-10:00(V1102); THU:08:15-10:00(E305ab)
Practice	2_GyA	English	THU:08:15-10:00(E305ab)

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAA01	Basics of Programming 1	Mid-semester mark	7

Course type	Course code	Course language	Timetable information
Laboratory	LA	English	THU:10:15-12:00(R4L)
Lecture	EA	English	WED:08:15-10:00
Practice	GA	English	FRI:12:15-14:00

https://portal.vik.bme.hu/kepzes/targyak/VIHIAA01/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAC10	The Role of Mobile Networks in Digitization	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EA	English	WED:08:15-10:00
Practice	GA	English	FRI:10:15-12:00

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	E_ERASMUS	English	THU:12:15-14:00

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
BMEVIHIAV38	The Quality of Experience of Systems and Services	Exam	4

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

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_ERASMUS	English	WED:16:15-18:00(IL107)	

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
BMEVIHIAV44	Publication of Scientific Papers		Mid-semester mark	2
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	EA	English	MON:12:15-14:00	

Subject code	Subject name		Requirement	ECTS credit
BMEVIHIMA16	Advanced Mobile and Wireless Networks		Exam	5
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	EA	English	THU:10:15-12:00	
Practice	GA	English	WED:10:15-12:00(IB111)	

Subject code	Subject name		Requirement	ECTS credit
BMEVIHVAB02	Signals and Systems 2		Exam	6
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	EA	English		
Practice	GA	English	WED:12:15-14:00; WED:12:15-14:00; THU:08:15-10:00	

Subject code	Subject name		Requirement	ECTS credit
BMEVIHVAD00	System Theory		Mid-semester mark	5
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	EA	English	MON:10:15-12:00	
Practice	GA	English	FRI:08:15-10:00(V1501)	

Subject code	Subject name		Requirement	ECTS credit
BMEVIIIAC06	Robotized Manufacuring Systems		Exam	5
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	AE	English	WED:14:15-16:00(IL408)	
Practice	AG	English	THU:08:15-10:00(IL406)	

Subject code	Subject name		Requirement	ECTS credit
BMEVIMIAC16	Artificial Intelligence		Exam	5
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	LA_ERASMUS	English	WED:14:15-16:00(IL307)	
Lecture	EA_ERASMUS	English		

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
BMEVITMAK47	Engineering Management Methods	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	AE1	English	WED: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
BMEVIVEAB02	Electrotechnics	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	2425_1_VIVEAB02_lab_angol	English	FRI:09:15-12:00
Lecture	2425_1_VIVEAB02_elm_angol	English	MON:10:15-12:00; MON:10:15-12:00; TUE:08:15-10:00

https://portal.vik.bme.hu/english/students/subjects/VIVEAB02/en/
The students should acquire basic knowledge related to the topic of electrotechnics. It lays the foundation for the Electric Power Engineering subject and at the same time a theoretical and practical foundation for those who continue their studies on the Sustainable Electric Power Engineering specialization.
They will achieve all of this through the transfer of the following knowledge:
Basics of electrotechnics. Calculation methods used in electrotechnical practice. Application of the presented methods by solving practical examples. Operation of single- and three-phase transformers, basic methods suitable for testing their operation in symmetrical steady state. Based on the knowledge of the magnetic field of the basic electromechanical converters, the acquisition of their operating principles. Basics of power electronics and electric drive technology. Programs simulating the operation of electric circuits, machines, power electronic units, with application examples. Environmental aspects of electrotechnics, basics of electromagnetic compatibility. Electrical safety technology and protection against electric shock. Basic methods and devices for electrical energy storage. Current and future essential applications of electrotechnics.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEAC10	Electrical Machines and Drives	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	2425_1_VIVEAC10_elm_angol	English	WED:08:15-10:00
Practice	2425_1_VIVEAC10_gyak_angol	English	THU:08:15-10:00

https://portal.vik.bme.hu/english/students/subjects/VIVEAC10/en/
The purpose of the course is to teach the essential professional knowledge related to the topic of electric rotating

machines and drives, which are necessary for electrical engineering students studying the Sustainable Electric Power Engineering specialization and who intend to work in this field later on. Through the study of operating conditions, the course presents the modelling and calculation methods used in practice, and also conveys comprehensive professional knowledge related to the operation of electric rotary machine systems. It discusses typical and modern applications as well as future ones. It provides a theoretical and practical foundation for those who continue their studies in this field in MSc courses. Its purpose is to learn the basic principles of electromechanical energy conversion, the construction and operation of the most important types of electric rotary machines, their equivalent circuits, and their electrical and mechanical characteristic curves; examination of the steady-state operation of three-phase machines in the case of symmetrical and asymmetrical power supply; presentation of the basics of space vector methods and the basics and typical applications of electric drive technology.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEAC11	Electrical Equipment and Insulations	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	2425_1_VIVEAC11_elm_angol	English	MON:14:15-16:00
Practice	2425_1_VIVEAC11_gyak_angol	English	THU:14:15-16:00

https://portal.vik.bme.hu/english/students/subjects/VIVEAC11/en/
The aim is to provide knowledge about the components of the electric power network, construction of the equipent, their role and requirements, and the most important physical phenomena. The calculations consist of practical cases of the above.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEAC17	Innovative Technologies in Electrotechnics	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	2425_1_VIVEAC17_elm_angol	English	WED:14:15-16:00
Practice	2425_1_VIVEAC17_gyak_angol	English	FRI:10:15-12:00

https://portal.vik.bme.hu/english/students/subjects/VIVEAC17/en/
In the 21st century, one of humanity's greatest challenges is ensuring sustainable growth in the face of growing energy demand. Conventional technologies in the field of electricity are slowly reaching their limits, and the use of innovative technologies in the generation, distribution, storage and use of electricity is essential to ensure sustainability. This course presents innovative technologies and solutions in electrical engineering and electricity. Particular attention will be paid to technologies based on dielectric and electrostatic fundamental phenomena, both on the generation and the user side. Technological solutions to extend the lifetime of existing network equipment will be discussed in detail. The physiological effects of electric and magnetic fields and electromagnetic fields related to power engineering are also discussed.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEMA17	Protection Systems and Measurement Technology	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	2425_1_VIVEMA17_elm_angol	English	THU:10:15-12:00
Practice	2425_1_VIVEMA17_gyak_angol	English	WED:10:15-12:00

https://portal.vik.bme.hu/english/students/subjects/VIVEMA17/en/
The goal of the course is to help students to be familiar with the theory of protection devices and their set-up methodology used to clear faults in power systems, power plants, industrial and communal networks. Understanding state of the art measurement technology and signal processing related to execution of intelligent protection algorithms in power systems. Furthermore, to be familiar with the automation systems.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEMA19	Electrical Insulations and Discharges	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	2425_1_VIVEMA19_elm_angol	English	WED:08:15-10:00; WED:08:15-10:00; THU:08:15-10:00
Practice	2425_1_VIVEMA19_gyak_angol	English	THU:08:15-10:00

https://portal.vik.bme.hu/english/students/subjects/VIVEMA19/en/
Electrical insulation technology is one of the classical branches of electrical engineering. However, in the 21st century, the progress of the field is accelerating, as most applications require insulation and insulating materials that are increasingly resistant to special stresses. In response to these challenges, special polymers, their composites, and nanocomposite polymers have emerged, as it has been found that adding nanoparticles can further enhance the beneficial properties of polymers. In this course, the electrical phenomena are introduced to the electrical in electrical insulating materials and insulations. The phenomenon of dielectric polarisation in different materials and the basics of the elementary processes will be reviewed. The electrical discharges and breakdown processes in different states of matter are presented. For both discharge and dielectric processes, the practical implications are presented in areas of electrical engineering where insulations are subjected to extreme electrical and environmental stresses.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEMA23	Computer Aided Design in Building's Electricity	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	2425_1_VIVEMA23_elm_angol	English	MON:08:15-10:00
Practice	2425_1_VIVEMA23_gyak_angol	English	WED:14:15-16:00

https://portal.vik.bme.hu/english/students/subjects/VIVEMA23/en/
Need for engineers with skills connected to Building’ electricity is very significant. Our goal to give such skills for the student that help to fulfil this need providing knowledge about computer aided design of electric systems of buildings.

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEMB05	Electric Energy Market	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	2425_1_VIVEMB05_elm_angol	English	TUE:14:15-16:00
Practice	2425_1_VIVEMB05_gyak_angol	English	TUE:16:15-18:00

https://portal.vik.bme.hu/english/students/subjects/VIVEMB05/en/
This course is intended to provide basic theoretical and practical training on electricity markets that have already fully integrated with the operation of power systems. The course introduces the power market participants, stakeholders, their connections and interactions, along with market structures, the necessary legal, technical, economical aspects, investment incentive schemes as well as the tradable products and services connected to electricity supply. Through the examples cited from European power markets the obtained knowledge about the methods, principles and mechanisms used in electricity trading and throughout the power markets creates a possibility for the students to join the workforce of an electricity trading company or a market oriented supplier, network or system operator.

Faculty of Mechanical Engineering

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
BMEGEÁTBG04	Air Pollution Control, Wastewater and Solid Wastes Management	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A-2024o-E	English	TUE:08:15-11:00(D316A)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TBG04
http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG04
https://gpk.bme.hu/en/content/42

Subject code	Subject name	Requirement	ECTS credit
BMEGEÁTBG11	Fluid Mechanics	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Laboratory	A-2024o-L1_8-14	English	TUE:14:15-16:00(AE_NAGYLAB)
Lecture	A-2024o-E	English	TUE:10:15-12:00(KF87)
Practice	A-2024o-G1	English	WED:16:15-18:00(R517)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TBG11
http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG11
https://gpk.bme.hu/en/content/42

Subject code	Subject name	Requirement	ECTS credit
BMEGEÁTNW04	Computational Fluid Dynamics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	A-2024o-L2	English	THU:08:15-10:00(AE_CFDLAB)
Laboratory	A-2024o-L3	English	THU:10:15-12:00(AE_CFDLAB)
Laboratory	A-2024o-L1	English	WED:12:15-14:00(AE_CFDLAB)
Lecture	A-2024o-E	English	MON:14:15-16:00(KF82)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNW04
http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW04
https://gpk.bme.hu/en/content/42

Subject code	Subject name	Requirement	ECTS credit
BMEGEÁTNW08	Building and Environmental Aerodynamics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	A-2024o-Lprs	English	WED:10:15-12:00(AE_NAGYLAB)
Lecture	A-2024o-E	English	WED:08:15-10:00(AE_MERLEG-T)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNW08
http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW08
https://gpk.bme.hu/en/content/42

Subject code	Subject name	Requirement	ECTS credit
BMEGEÁTNW10	Advanced Technical Acoustics and Measurement Techniques	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	A-2024o-Lprs	English	THU:12:15-14:00(AE_NAGYLAB)
Lecture	A-2024o-E	English	MON:10:15-12:00(AE_MERLEG-T)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNW10

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW10
https://gpk.bme.hu/en/content/42

Subject code	Subject name	Requirement	ECTS credit
BMEGEÁTNW19	Vehicle Aerodynamics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	A-2024o-L	English	WED:16:15-18:00(AE_NAGYLAB)
Lecture	A-2024o-E	English	WED:14:15-16:00(KM34)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNW19
http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW19
https://gpk.bme.hu/en/content/42

Subject code	Subject name	Requirement	ECTS credit
BMEGEÉEBG51	Transfer processes	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A9	English	WED:13:15-15:00(D102)
Practice	A10	English	WED:15:15-16:00(D102)

URL: https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%89EBG51

Subject code	Subject name	Requirement	ECTS credit
BMEGEENBGEB	Energy Processes and Equipment	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	25-1-ENG-LAB	English	TUE:12:15-14:00(DCS1)
Lecture	25-1-ENG-E	English	MON:13:15-16:00(D224)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBGEB

Subject code	Subject name	Requirement	ECTS credit
BMEGEENBGEK	Energy and Environmental Measurements	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	25-1-ENG-LAB	English	WED:12:15-14:00(DCS1)
Practice	25-1-ENG-G	English	WED:11:15-12:00(DCS1)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBGEK

Subject code	Subject name	Requirement	ECTS credit
BMEGEENBGHG	Heat Engines G	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	25-1-ENG-E	English	TUE:16:15-18:00(D224)
Practice	25-1-ENG-G1	English	FRI:14:15-16:00(D318)
Practice	25-1-ENG-G2	English	FRI:14:15-16:00(D318)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBGEK#

Subject code	Subject name	Requirement	ECTS credit
BMEGEENBGTD	Engineering Thermodynamics G	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	25-1-ENG-E	English	TUE:12:15-14:00(D224)
Lecture	25-1-DEU-E	German	WED:10:15-12:00
Practice	25-1-ENG-G	English	TUE:10:15-12:00(D224)
Practice	25-1-DEU-G	German	THU:14:15-16:00

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBGTD

Subject code	Subject name		Requirement	ECTS credit
BMEGEENBKSD	Final project		Mid-semester mark	15
Course type	**Course code**	**Course language**	**Timetable information**	
Practice	25-1-ENG-G	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBKSD

Subject code	Subject name		Requirement	ECTS credit
BMEGEENBMHO	Thermal engineering		Mid-semester mark	4
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	25-1-ENG-E	English	WED:14:15-15:00(D224)	
Practice	25-1-ENG-G	English	WED:12:15-14:00(D224)	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBMHO

Subject code	Subject name		Requirement	ECTS credit
BMEGEENNKDA	Master Thesis Project A		Mid-semester mark	15
Course type	**Course code**	**Course language**	**Timetable information**	
Practice	25-1-ENG-G	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNKDA

Subject code	Subject name		Requirement	ECTS credit
BMEGEENNKDB	Master Thesis Project B		Mid-semester mark	15
Course type	**Course code**	**Course language**	**Timetable information**	
Practice	25-1-ENG-G	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNKDB

Subject code	Subject name		Requirement	ECTS credit
BMEGEENNKLC	LCA of energy systems		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	25-1-ENG-LAB	English	FRI:13:15-15:00(D216)	
Lecture	25-1-ENG-E	English	FRI:12:15-13:00(D216)	

Subject code	Subject name		Requirement	ECTS credit
BMEGEENNKSG	Internship M		Signature	0
Course type	**Course code**	**Course language**	**Timetable information**	
Practice	25-1-ENG-G	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNKSG

Subject code	Subject name		Requirement	ECTS credit
BMEGEENNWEC	Energy Conversion		Mid-semester mark	5
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	25-1-ENG-E	English	WED:10:15-12:00(D224)	
Practice	25-1-ENG-G	English	THU:16:15-18:00(D216,D224)	

ONLY FOR MSc STUDENTS!
BSc students should choose BMEGEENBGEB„Energy processes and equipments"subject.
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNWEC

Subject code	Subject name		Requirement	ECTS credit
BMEGEENNWME	Measurement in Energy Engineering		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	25-1-ENG-LAB	English	FRI:14:15-16:00(D218)	

ONLY FOR MSc STUDENTS!

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNWME

Subject code	Subject name	Requirement	ECTS credit
BMEGEENNWPR	Teamwork Project	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Laboratory	25-1-ENG-LAB	English	

ONLY FOR MSc STUDENTS!
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNWPR

Subject code	Subject name	Requirement	ECTS credit
BMEGEENNWSE	Dynamic simulation of energy engineering systems	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	25-1-ENG-E	English	MON:16:15-18:00(D216)

ONLY FOR MSc STUDENTS!
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNWSE

Subject code	Subject name	Requirement	ECTS credit
BMEGEENNXTU	Turbines	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	25-1-ENG-E	English	MON:08:15-10:00(KF86)
Practice	25-1-ENG-G	English	MON:10:15-12:00(KF86)

ONLY FOR MSc STUDENTS!
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNXTU

Subject code	Subject name	Requirement	ECTS credit
BMEGEENUVHT	Advanced thermodynamics	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	25-1-ENG-E	English	TUE:12:15-14:00(D216)
Practice	25-1-ENG-G	English	TUE:11:15-12:00(D216)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENUVHT

Subject code	Subject name	Requirement	ECTS credit
BMEGEÉPAG62	Air-Conditioning	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A29	English	WED:08:15-10:00(D126)
Practice	A30	English	WED:10:15-12:00(D126)

Air-Conditioning
BMEGEÉPAG62

Main aims and objectives, learning outcomes of the subject:
The objective is the introduction to the fundamentals of air-conditioning systems in buildings providing a comprehensive knowledge on the theory and practice of system design and dimensioning with particular attention to the most recent technologies.
By the end of this course you will:
- Have knowledge about the aims of air-conditioning: providing comfort - both thermal and good indoor air quality, reduce energy consumption, increase energy performance, etc.
- Be able to apply appropriate mathematical and computer-based methods for the calculation of buildings' heat loads and cooling loads, sizing of air-conditioning elements.
- Be able to apply knowledge of techniques, codes and standards of practice to the design of cooling components and systems.

Method of education:
The theoretical background will be interpreted via lectures, the calculations and tools will be presented during the seminars. Calculation problems/examples will require active participation.

Detailed thematic description of the subject (by topic, min. 800 character):
Date of class

Topics to be discussed, readings required for the class
Week 1

Introduction, AC systems, types
Heat transfer
Week 2

Thermal comfort
Heat load calculation
Week 3

Thermal comfort, examples
Indoor Air Quality
Week 4

Cooling load calculation
h-x diagram, psychrometric chart
Week 5

Elements, heat exchangers, hum.
Volume flow rate calculation
Week 6

Elements, heat exch. cooling, hum
Injection
Week 7

Test 1, HW out
Injection
Week 8
Pressure diagram
Air Inlets, SCHAKO
Week 9
Elements, heat recovery
Week 10
Elements, filters
Week 11
Air handling processes
Duct network, sizing
Week 12
Air handling processes
Week 13
Air handling unit, calc. example
Week 14
Test 2
HW in

Requirements and grading
a) in term-period Knowledge, understanding and skills are assessed through a combination of written tests and homework throughout the semester. Homework will be distributed during the semester and will have to be turned in by the end of the course, before the exam period. Later submission is allowed but a fee has to be paid and homework will have to be turned in by the 3rd week of the exam period. Homework will not be graded but is compulsory in order to receive a grade.
b) in examination period The course ends with an exam in the exam period. Student will be allowed to take the exam if both mid-term and end-term tests are passed.
c) Disciplinary Measures Against the Application of Unauthorized Means at Mid-Terms, Term-End Exams and Homework

URL: <span style="font-size:10.0pt;font-family:"Helvetica","sans-serif"; mso-fareast-font-family:"Times New Roman";mso-ansi-language:HU;mso-fareast-language: HU;mso-bidi-language:AR-SA">https://epget.bme.hu/subjects.php?lepes=2&tid=216

Subject code	Subject name	Requirement	ECTS credit
BMEGEGINWDT	Machine Design and Production Technology	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	FRI:08:15-10:00(R113)
Practice	G1	English	FRI:10:15-12:00(R113)
Practice	G2	English	FRI:10:15-12:00(R113)

https://oktatas.gpk.bme.hu/tad/tantargy/BMEGEGINWDT

Subject code	Subject name	Requirement	ECTS credit
BMEGEGTAG94	Manufacturing processes	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	J2	English	MON:14:15-16:00(G113)
Lecture	J1	English	MON:12:15-14:00(G116)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEGTAG94

Subject code	Subject name	Requirement	ECTS credit
BMEGEGTBG65	CAD/CAM applications	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	EJ2	English	THU:08:15-10:00(G123)
Laboratory	EJ4	English	THU:18:15-20:00(G123)
Laboratory	EJ3	English	THU:16:15-18:00(G123)
Lecture	EJ1	English	THU:10:15-12:00(G113)
Practice	EJ5	English	THU:12:15-14:00(G113)

https://oktatas.gpk.bme.hu/tad/en/tantargyak/BMEGEGTBG65

Subject code	Subject name	Requirement	ECTS credit
BMEGEGTNWNC	NC Machine Tools	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	J1	English	THU:15:15-16:00(T47)
Practice	J2	English	THU:16:15-17:00(T47)
Practice	J3	English	THU:16:15-17:00(G113)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEGTNWNC

Subject code	Subject name	Requirement	ECTS credit
BMEGEGTNWPP	Process Planning	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	J1	English	FRI:08:15-09:00(G113)
Practice	J2	English	FRI:09:15-10:00(G113)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEGTNWPP

Subject code	Subject name	Requirement	ECTS credit
BMEGEHDBSXIMEA-01	Introduction to Mechanical Engineering A	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	EnL	English	THU:10:15-12:00(L-HIDROLAB)
Lecture	EnE	English	THU:08:15-10:00(K155_r)
Practice	EnGy	English	MON:16:15-18:00(D327)

Subject code	Subject name	Requirement	ECTS credit
BMEGEMIBXIT	Control engineering	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	24o_A_E	English	WED:10:15-12:00(D401); THU:08:15-10:00(D401); THU:08:15-10:00(D401)

Practice	24o_A_G	English	WED:10:15-12:00(D401)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEMIBXIT

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMBXM1	Statics	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	LEC	English	MON:10:15-12:00(KF87)
Practice	SEM1	English	THU:12:15-14:00(KF81)
Practice	SEM2	English	THU:12:15-14:00(D316B)

https://oktatas.gpk.bme.hu/tad/tantargy/BMEGEMMBXM1

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMBXM3	Dynamics	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	LEC	English	WED:10:15-12:00(KF87)
Practice	SEM	English	WED:16:15-18:00(KF87)

https://oktatas.gpk.bme.hu/tad/tantargy/BMEGEMMBXM3

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMBXVE	Fundametals of the finite element method	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	AL1	English	THU:12:15-14:00(KF82)
Lecture	AE	English	THU:10:15-12:00(KF82)

Subject code	Subject name	Requirement	ECTS credit
BMEGEMMNWCM	Continuum Mechanics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	E	English	TUE:12:15-14:00(KF81)
Practice	G1	English	TUE:14:15-16:00(KF81)
Practice	G2	English	TUE:14:15-16:00(KF85)

https://oktatas.gpk.bme.hu/tad/tantargy/BMEGEMMNWCM

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTAGE1	Metal forming	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	L2	English	THU:16:15-18:00
Laboratory	L1	English	THU:16:15-18:00
Lecture	Ea	English	THU:14:15-16:00(G120)

BME GPK TAD

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTBGE2	Nondestructive Testing of Materials	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	Ea	English	THU:14:15-16:00(MT103)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEMTBGE2

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTBKSD	Final project	Mid-semester mark	15

Course type	Course code	Course language	Timetable information
Practice	AGy	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTBVS1	Integrity of engineering structures 1	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	Ea	German	THU:16:15-18:00(MT103)

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTBVS2	Integrity of engineering structures 2	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	Ea	German	TUE:12:15-14:00(MT103)

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTNWFF	Fatigue and Fracture	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	Ea	English	THU:10:15-12:00(MT103)

BME GPK TAD

Subject code	Subject name	Requirement	ECTS credit
BMEGEPTBGE2	Injection molding	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	LAB_1	English	MON:08:15-10:00(MT_PTLAB)
Laboratory	LAB_2	English	MON:10:15-12:00(MT_PTLAB)
Lecture	LECT	English	MON:08:15-10:00(T200)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEPTBGE2
Objectives: theoretical and practical understanding of the injection molding technology. Knowledge of production engineering and design aspects of modern plastic products. Understanding of the most advanced design and simulation procedures.
Topics: detailed description of the injection molding technology. Analysis of the process cycle diagram. Construction and operation of injection molding machines. Design for injection molding. Materials for injection molding, and fiber reinforced materials. Methods for the identification and elimination of molding defects. Injection mold design and injection molding simulation.

Subject code	Subject name	Requirement	ECTS credit
BMEGEPTBGE3	Polymer processing	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	LAB_1	English	MON:10:15-12:00(MT_PTLAB)
Laboratory	LAB_2	English	MON:10:15-12:00(MT_PTLAB)
Lecture	LECT	English	MON:10:15-12:00(T200)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEPTBGE3
The aims of this subject is at familiarizing the students with the polymer processing technologies in details: preliminary techniques, extrusion, blow molding, thermoforming, rotational molding, polymeric foams and elastomers technology.
Topics:classification of polymer processing technologies. Basic rheological aspects of polymers. Preliminary techniques of polymer processing (material conveying, drying, mixing, dosing etc.). Calendering. Extrusion. Extruder constructions, single and twin screw extruders. Compounding wit extruder. Extrusion dies (film blowing, flat film-, pipe, sheet, profile extrusion; extrusion blow molding; extrusion coating). Thermoforming: vacuum and pressure forming. Rotational molding. Foams technology: thermoplastic and thermoset foams. Elastomer technologies. Finishing and decoration. Joining technologies: welding and adhesive bonding.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGA4SD	BSc Final Project	Mid-semester mark	15

Course type	Course code	Course language	Timetable information
Practice	EnGy	English	

http://www.hds.bme.hu/oktatas.php?sm=1&lang=EN
One-semester long individual project work. 10 hours/15 credits. * VG in the code stand for the supervising Department of Hydrodynamic Systems.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGAG04	Volumetric Pumps and Compressors	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EnE_AG04	English	THU:10:15-11:00(D126)
Practice	EnGy_AG04	English	THU:11:15-12:00(D126)

http://www.hds.bme.hu/oktatas.php?sm=1&lang=EN
Main aims and objectives, learning outcomes of the subject:
Upon finishing the course, the students will be familiar with the operating principles and basic types of positive displacement pumps and compressors. They will be able to perform simple sizing tasks and design basic hydraulic circuits.
Method of education:
lecture: 1h/w
seminar: 1h/w
laboratory: 0h/w
homework: two design problems
Detailed thematic description of the subject:
Positive displacement pumps. Pump characteristic and performance. Reciprocating and rotary types. Gear pumps. Performance of a gear pump. Characteristics. Pressure balancing. Bearing forces. Screw pumps. Screw pumps for delivery of higher viscosities fluid. Roots blower. Delivery, isentropic and adiabatic power. Reciprocating compressors. Compression efficiency. Valves. Regulation. Pressure-volume diagrams for different methods of regulating and governing compressors. Sliding vanes pump. Characteristic performance. Capacity and efficiency. Effect of viscosity.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGAG14	Analysis of Technical and Economical Data	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EnE_AG14	English	MON:14:15-16:00(R108)
Practice	EnGy_AG14	English	THU:14:15-16:00(R513)

http://www.hds.bme.hu/oktatas.php?sm=1&lang=EN
6. Main aims and objectives, learning outcomes of the subject:

Processing and analysis of technical data is often part of engineering tasks. The data can originate from measurements of economical processes and results or from some technological tests but the main methods of the analysis are basically independent from the data source. Utilizing these methods the valuable information can be extracted from complex data sets through measurements of possible correlations, hypothesis testing and quality assurance tests.
7. Method of education:
Lectures: 2hrs/week
Seminar: 1hr/week
To be able to practice the course material usage of computers is necessary.

8. Detailed thematic description of the subject (by topic, min. 800 character):
1.
Probability theory basic review: relative frequency, probability, probability density and distribution, expected value, standard deviation.

2.
Basic definition in statistics: average, empirical variance, empirical ddensity and distribution functions. Application: quality control, histogram, Pareto-Lorenz diagram.

3.
Data acquisition with sampling: sampling techniques. Sampling in quality control.
Application: calculation of the required dataset sizes for analysis.

4
Operation characteristics curve: product acceptance using statistical sampling.
Application: calculation of economically justifiable fallout rate.

5.
Quality and reliability. Upper- and lower control bounds. Control capability index. Application: Machine settings verification.

6.
Data acquisition with measurement: measurement principles (comparability, equality, disparity). Direct and indirect measurements. Propagation of measurement errors.
Application: evaluation of acceptance measurements, error bounds.

7.
Point and interval estimation: poperties of the estimations. Confidence interval for expected value and variance.
Application: Analysis of technical and economic data with the help of confidence interval.

8.
Correlation coefficient, empirical correlation coefficient. Main properties.
Application: correlation diagram, use of correlation in quality control.

9.
Regression analysis based on generalization of Gauss-Markov theorem.
Application: linear and polynomial regression between the variables of the data of technical processes.

10.
Regression models: Estimation of degree-index. Coefficient of determination. Forecasting economic trends with moving average and exponential smoothing.
Application: prognosis of capacities, production and utilization.

11.
Statistical tests: parametric and non-parametric test. Detailed discussion of the U-test. Critical domain. First and second type errors.
Application: verification of change in consumption trends.

12.
Parametric tests: T-test, F-test, etc.
Application: Quality and production control with parametric tests.

13.
Non-parametric tests: c2 and Wilcoxon tests.
Application: verification of fittings in production and quality control.
14.
Introduction to variance analysis: hypothesis testing with F-test, ANOVA test.
Application: analysis of production quality.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGAV03	Chemical Engineering Fundamentals	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EnE_AV03	English	THU:08:15-10:00(K155)

http://www.hds.bme.hu/oktatas.php?sm=1&lang=EN

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGAV04	Chemical Engineering Practice	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EnL_AV04	English	WED:08:15-10:00(L-HIDROLAB)
Practice	EnGy_AV04	English	WED:08:15-10:00(D327)

http://www.hds.bme.hu/oktatas.php?sm=1&lang=EN

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGBG01	Introduction to mechanical engineering	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	EnL_BG01	English	THU:14:15-16:00(L-HIDROLAB)
Lecture	EnE_BG01	English	THU:08:15-10:00(K155)
Practice	EnGy_BG01	English	WED:10:15-12:00(D327)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBG01

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGBG03	Measurement Technique of Processes	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EnL1	English	THU:08:15-10:00(L-HIDROLAB)
Lecture	EnE	English	THU:08:15-10:00(KF82)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBG03
Main objectives of the subject:
The aim of this subject is to present the fundamental devices and methods of measurement techniques of processes. The course presents the mathematical methods of the measuring techniques and the signal processing; shows the practical usage of them; and points out the achievable results.
Detailed thematic description of the subject:
Lectures: 7*2h
Reviewing the basic concepts of probability theory and mathematical statistics; Error Estimation for indirect measurements; estimating systematic errors
Estimating systematic (accuracy class) and random errors ensemble for indirect measurement results; CalibrationThe fundamentals of measuring time variant signals: Sampling and Quantization Theorems; Theorem's analysis; Consequences in measuring techniquesFourier series and transformation, and their role in signal processing; The Spectrum and it's applications; Recognizing periodic and noise processesApplication of spectrum and cepstrum analysis for investigation operating machinesThe real measurement result; Noise, as the characterization of stochastic processes; Amplitude density function; Autocorrelation and Cross correlation functionsApplication of Autocorrelation and Cross correlation technique for analyzing periodic and transient signals
Laboratory practices: 4*3,5h
Pressure transducer's response to step functionPressure transducer's response to harmonic excitationMeasuring transmission characteristics of an impulse lineInvestigating the effects of sampling parameters

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGBG06	Individual project 1.	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	EnL-ARA	English	
Laboratory	EnL-EGR	English	
Laboratory	EnL-ÉPGET	English	
Laboratory	EnL-HDS	English	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBG06
Independent Study 1
BMEGEVGBG06
One-semester long individual project work. 4 hours/4 credits.

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGBG10	Introduction to mechanical engineering	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	EnL4	English	THU:10:15-12:00(L-HIDROLAB)
Laboratory	EnL3	English	THU:10:15-12:00(L-HIDROLAB)
Laboratory	EnL1	English	THU:14:15-16:00(L-HIDROLAB)
Laboratory	EnL2	English	THU:14:15-16:00(L-HIDROLAB)
Lecture	EnE	English	THU:08:15-10:00(K155)
Practice	EnGy1	English	WED:10:15-12:00(D327)
Practice	EnGy2	English	MON:16:15-18:00(D316A)
Practice	EnGy3	English	MON:16:15-18:00(D327)

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGBG13	Fluid Flow Systems	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	EnL1	English	WED:16:15-18:00(L-HIDROLAB)
Lecture	EnE	English	THU:14:15-16:00(KF83)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBG13

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGBG16	Positive Displacement Pumps and Compressors		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	EnE	English	THU:10:15-12:00(D126)	
Practice	EnGy	English	THU:12:15-13:00(L-HIDROLAB)	

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGBKSD	Final project		Mid-semester mark	15
Course type	**Course code**	**Course language**	**Timetable information**	
Practice	EnGy	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBKSD

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGBKSZ	Summer Internship		Signature	0
Course type	**Course code**	**Course language**	**Timetable information**	
Practice	EnGy	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBKSZ

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGBX14	Analysis of technical and economical data		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	EnL	English	THU:14:15-16:00(R513)	
Lecture	EnE	English	MON:14:15-16:00(R108)	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBX14

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGNKDA	Master Thesis Project A		Mid-semester mark	15
Course type	**Course code**	**Course language**	**Timetable information**	
Practice	EnGy	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGNKDA

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGNKDB	Master Thesis Project B		Mid-semester mark	15
Course type	**Course code**	**Course language**	**Timetable information**	
Practice	EnGy	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGNKDB

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGNWPR	Teamwork Project		Mid-semester mark	6
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	EnL	English		

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGNWPR

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGNX26	Hemodynamics		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	EnE	English	THU:12:15-14:00(R108)	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGNX26

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGNX27	Flow Stability	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EnE	English	THU:10:15-12:00(D327)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGNX27

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGNXPB	Project Work B	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EnL	English	

Faculty of Natural Sciences

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
BMETE11AP58	Mathematical Methods in Physics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	WED:08:15-10:00
Practice	T3	English	THU:12:15-14:00
Practice	T2	English	THU:12:15-14:00
Practice	T1	English	THU:12:15-14:00

The aim of the course is to introduce to students mathematical methods and concepts that play an important role in some branches of advanced physics (e.g. electrodynamics, quantum mechanics) in more detail than taught in general mathematics. The focus is not on rigorous proofs of theorems, but on their illustration and applications to practical problems.
Topics (physical applications will be presented for the topics that overlap with the subjects specified in the prerequisites): Cylindrical, spherical coordinate systems, derivatives in them, the Laplace and Poisson equation, wave equation. Special functions and orthogonal functions with physical applications: Legendre polynomials, spherical harmonics, Bessel functions, Chebyshev polynomials. Physical applications of linear operators, similarity transformation. Distributions: their concepts, Dirac delta, their operations (derivation, convolution, Fourier and Laplace transforms), their use in solving differential equations, Green's function. Basics of complex analysis and some basicapplications.
– G. A. Korn and T. M. Korn: Mathematical Handbook for Scientists and Engineers: Definitions, Theorems, and Formulas for Reference and Review (Dover Civil and Mechanical Engineering, 2000, Revised Edition, ISBN 978-0486411477)
– D. Babusci, G. Dattoli, S. Licciardi, E. Sabia: Mathematical Methods for Physicists (World Scientific Publishing Co, 2019, ISBN 978-9811201578)

Subject code	Subject name	Requirement	ECTS credit
BMETE11AP65	Measurement Techniques	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	THU:10:15-12:00(F3213)

Voltage and current sources, voltage and current meters. Measurement of resistance, four probe resistance measurement. Operational amplifiers. Voltage amplifier, current amplifier, and comparator circuits. A/D and D/A converters, data acquisition cards. Normal and common mode rejection ratio. Analog and digital oscilloscopes, sampling modes, triggering, waveform measurements, aliasing. Function generators.
Suppression of disturbing signals: electrostatic and inductive coupling, grounding and guarding, twisted pairs, thermoelectric power and offset compensation, stray capacitance. Wave propagation in coaxial lines, telegraph equations, wave impedance, reflections at the cable termination.
Fourier analysis considering finite temporal window. The role of various window functions: spectral leakage, frequency resolution, amplitude accuracy. The role of finite sampling, sampling theorem. Discrete Fourier transform, and its implementation by the fast Fourier transform algorithm. Spectrum analyzers. Phase sensitive measurements: lock-in amplifiers, phase locked loops.
The application of PID control from temperature controllers to scanning probe microscopes.
Electronic noise phenomena. The spectral density of noise, and its relation to the current-current correlation function and the Fourier transform of the signal. Thermal noise, the thermal noise limit of current amplifier circuits. Cross correlation noise measurement. Shot noise and 1/f noise. Antialiasing filter.
Fundamental measurement units (SI) and their definitions. Measurement standards: atomic clocks, voltage to frequency conversion by the Josephson effect, current to voltage conversion by the quantized Hall effect, current to frequency conversion by electron pump, measurement of mass by Watt balance. Temperature standards.
Modern sensors. Magnetic field sensors: inductive, magnetoresitive, spin valve, and Hall sensors, SQUID magnetometers. Distance and position sensors: linear differential transformers, capacitive transducers, LASER and ultrasound-based measurement of distance, LIDAR systems. Temperature sensors: thermocouples, resistance thermometers, thermistors. Light sensors: photo diodes, CCD sensors, CMOS active pixel sensors, bolometers. Measurement of acceleration: MEMS accelerometers and gyroscopes, piezoelectric accelerometers.

Fundamentals of nuclear measurement technologies. Interactions between electromagnetic radiation, charged particles and atoms of matter that provide the basis for detection. Detector efficiency, energy resolution, dead time, escape and pile-up phenomenon, response function. Basic instruments of electronic signal processing and their characteristic technical properties, analogue-digital conversion.
– James A. Blackburn: Modern Instrumentation for Scientists and Engineers, Springer-Verlag New York, Inc. 2001, ISBN: 978-0-387-95056-3, DOI: https://doi.org/10.1007/978-1-4613-0103-5
– Sh. Kogan: Electronic Noise and Fluctuations in Solids, Cambridge University Press (1996), ISBN: 9780511551666, DOI: https://doi.org/10.1017/CBO9780511551666
– G. F. Knoll, Radiation detection and measurement, 4th Edition, Wiley, 2010, ISBN: 978-0-470-13148-0
– Low Level Measurements Handbook - 7th Edition Precision DC Current, Voltage, and Resistance Measurements
– C. Rauscher, Fundamentals of Spectrum Analysis, Rohde&Schwarz GmbH&Co. KG, 2001 Mühldorfstrasse 15 81671 München Germany, ISBN 978-3-939837-01-5

Subject code	Subject name	Requirement	ECTS credit
BMETE11AX21	Physics 1	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	VE0	English	MON:14:15-16:00; MON:16:15-17:00
Practice	VE1	English	MON:17:15-18:00

Mechanics: Measurements, units, models in physics. Space, time, different frames of references. Motion of a particle in 3D. Newton's laws. Work, kinetic energy, potential energy. Work-energy theorem. Conservation laws in mechanics. Motion in accelerated frames, inertial forces. Newton's law of gravitation. Basics of the theory of special relativity. System of particles, conservation laws. Kinematics and dynamics of a rigid body. Oscillatory motion, resonance. Wave propagation, wave equation, dispersion, the Doppler effect.
Thermodynamics: Heat and temperature. Heat propagation. Kinetic theory of gases. Laws of thermodynamics. Reversible and irreversible processes, phase transitions. Entropy, microscopic interpretation of entropy. Elements of statistical physics.
Static electric and magnetic fields: Electric charge. Electric field, electric flux, electric potential. Basic equations of electrostatics. Applications of Gauss's law. Capacitors, energy of the static electric field. Dielectrics, boundary conditions. Electric current. Magnetic field. Current carrying wire in magnetic field. Magnetic field produced by an electric current, the Biot-Savart law.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF26	Physics of Semiconductors	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	TUE:12:15-14:00(F3M01)

Introduction: importance of semiconductor physics, modern applications, the limitations of electronics. Charge carriers in semiconductors: band structure, envelope function, lattice distortions, impurities, localized states, shallow and deep levels. Band structure of semiconductors: spin-orbit interaction, kp model. Transport phenomena: quasiclassical dynamics, Boltzmann equation, conductivity, Hall-effect, magnetoresistance, thermoelectric and thermomagnetic phenomena. Diffusive phenomena in semiconductors: inhomogeneous semiconductors, diffusion, diffúzió, Einstein-relation, conduction, Gunn-diode, p-n junction, Zener-diode, tunnel diode, bipolar transistors, JFET. Characterization and engineering of semiconductors: traditional and epitaxial growth, characterization techniques, lattice matching, band-engineering, heterostructures, superlattices, highe electron mobility 2DEG and its high frequency applications, fabrication of semiconductor nanostructures. Field effect and its applications: surface density of states, remote doping, Schottky barrier, Schottky diode, ohmic contacts, MOS-structures, High-k dielectrics, flash memories, solar cells, CCD devices, the fundamentals of CMOS technológy. Optical properties of semiconductors: interaction with light, photoconduction, absorpion of free charge carriers, recombination mechanisms, the principles and applications of light emitting diodes and semiconductor lasers.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF38	Chemistry in Nanotechnology	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	MON:14:15-16:00

The course presents recent developments in nanotechnology and nanoscience using chemical methods. We will overview measurement techniques for nanosclae building blocks, namely transmission electron microscopy (TEM), scanning electron microscopy (SEM), dynamic light scattering (DLS). Synthesis of nanoparticles: chemical, physical and biological methods and chemical stabilization of nanoparticles. Purification and size and shape-selective purification of nanoparticles. The stability of nanoparticles and interactions existing at nanoscale and using them for the self-assembly of nanoscopic components: nanostuctured materials. Usage of nanoparticles in chemistry, medicine and chemical robotics. Targeted drug delivery applications.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF45	Superconductivity	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	WED:14:15-16:00

Phenomenology of superconductors. Meissner effect, London equations, electrodynamics of superconductors. Bardeen-Cooper-Schrieffer theory: ground state, thermodynamic and transport properties. Ginzburg-Landau theory: free energy, GL equations and their solution, Abrikosov vortices, magnetic properties of Type II superconductors. Josephson effect and its applications. High-temperature superconductors. Prerequisites: Modern Solid State Physics.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF55	Modern Solid State Physics	Exam	7

Course type	Course code	Course language	Timetable information
Lecture	T0	English	THU:09:15-12:00(F3M01)
Practice	T1	English	WED:16:15-18:00

Course designed for the Physicist MSc education. Only those with Physics BSc diploma are allowed to register for this course.
This course describes the behavior of interacting many body systems (mainly electron systems) building on solid state physics and statistical physics knowledge gained while earning a BSC degree in Physics. The following topics are discussed: identical particles, second quantization, interacting electron systems in Bloch and Wannier representation, itinerant ferromagnetism, linear response theory, susceptibility of metals, spin density waves, Bose liquid.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF58	Nanotechnology and Materials Science	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	WED:09:15-12:00

This course gives an introduction to the main trends in nanotechnology and material science. We cover advanced fabrication and measurement techniques by giving examples from state-of-the-art research and development results. The course addresses the following topics: Novel concepts and modern material systems in nanotechnology. Advanced imaging methods from electron microscopy to atomic resolution scanning probe techniques. Top-down nanofabrication techniques: photo and electron beam litography, deposition and special patterning techniques. Bottom-up approaches and self-organizing nanostructures. Semiconductor technology and novel concepts in information technologies. Investigation of electronic and vibrational properties by optical spectroscopy. Advanced surface analysis techniques.

Subject code	Subject name	Requirement	ECTS credit
BMETE80MX00	Nuclear and Reactor Physics Fundamentals	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	TUE:14:15-17:00(R215); TUE:14:15-17:00(R215)

Subject code	Subject name	Requirement	ECTS credit
BMETE80NE02	Fusion Devices	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	T1	English	MON:16:15-17:00(R214)
Lecture	T0	English	MON:14:15-16:00(R214)

The course starts with two introductory lectures: the first one summarizes the physics basis needed to understand the criteria for fusion energy producing devices, while the second reviews the main elements of fusion technology and their functions. This is followed by two lectures of introduction to stellarator technology through the German stellarator program, and three leactures dealing with the past, present and future of tokamaks. Spherical tokamaks are discussed in a separate lecture followed by lectures introducing the most important milestones of German, US and Japanese fusion programs. The last lecture presents the rapidly expanding Far-East fusion programs in the context of the history of superconducting tokamaks.

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX00	Mathematics A1a - Calculus	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	EN-EMK-0	English	TUE:14:15-16:00(K372); TUE:14:15-16:00(K372); WED:16:15-18:00(K372); WED:16:15-18:00(K372)
Lecture	EN-VIK-0	English	TUE:12:15-14:00; WED:10:15-12:00
Lecture	EN-VBK-0	English	WED:16:15-19:00(CH302); THU:16:15-17:00(CHA11)
Practice	EN-EMK-1	English	MON:16:15-18:00(K373); MON:16:15-18:00(K373)
Practice	EN-VIK-1	English	FRI:10:15-12:00
Practice	EN-VBK-1	English	THU:17:15-19:00(CHA11)

Algebra of vectors in plane and in space. Arithmetic of complex numbers. Infinite sequences. Limit of a function, some important limits. Continuity. Differentiation: rules, derivatives of elementary functions. Mean value theorems, l'Hospital's rule, Taylor theorem. Curve sketching for a function, local and absolute extrema. Integration: properties of the Riemann integral, Newton-Leibniz theorem, antiderivatives, integration by parts, integration by substitution. Integration in special classes of functions. Improper integrals. Applications of the integral.

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX21	Calculus 1 for Informaticians	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-12:00(QBF09); TUE:10:15-12:00(IB025)
Practice	EN1	English	WED:12:15-14:00

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX33	Mathematics EP1	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(K364)
Practice	EN1	English	FRI:08:15-10:00(K221)

This course covers the elements of single variable calculus and linear algebra. Special emphasis is put on the concepts of linear algebra which are later used by architects in structural design. These are the systems of linear equations, matrices and determinants with their properties. From the elements of calculus, the limit of sequences, the differentiation, the integration and applications belong to the course material.

Subject code	Subject name	Requirement	ECTS credit
BMETE91AM38	Algebra 1	Exam	7

Course type	Course code	Course language	Timetable information
Lecture	A0	English	THU:12:15-15:00
Practice	A1	English	MON:14:15-16:00

Groups, semigroups. Basic properties of groups, group homomorphism, subgroups, cosets. Langrange's Theorem. Examples: diherdral groups, quaternion group, symmetric groups, alternating groups. Decomposition of permutations into disjoint cycles, transpositions. Permutation groups, group actions, transitivity, Cayley's Theorem. Cyclic groups, order of a group element. Cauchy's Theorem. Direct product of groups. Normal subgroups, factor group, Homomorphism Theorem, Noether's Isomorphism Theorems. Important subgroups: derived subgroup, centre, class equation. Subgroup chains, Sylow's Theorems, description of the structure of groups of small size. Nilpotent groups. Fundamental Theorem of Finite Abelian Groups. Free groups. Free algebras over rings, ideals, maximal and prime ideals. Description of the polynomial ring R[x]. Principal ideal domains. Noether rings, unique factorization domains (UFD). Factor rings, field extensions, construction of finite fields. Modules over rings, submodules, module homomorphisms. Semisimple modules and rings. The structure of matrix algebras over division rings. Vector space and module constructions: factor module, direct product, direct sum, tensor product. Linear fuction and the dual space.
– P.J. Cameron: Introduction to Algebra, Oxford Science Publications, 1998.– Atiyah-Macdonald: Introduction to commutative algebra, online textbook

Subject code	Subject name	Requirement	ECTS credit
BMETE91AM42	Informatics 1	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	A1	English	WED:14:15-16:00(H601)
Lecture	A0	English	WED:13:15-14:00(H405A)

The aim of the course is to study the basic notions of information technology. Basics of hardware (CPU, memory, mass storage,...), the hardware environment of the Institute. Basics of operating systems: program, process, file, folder, file system of Linux and Windows (bash, mc, Windows Total Commander). Graphic user interface, terminal user interface, bash language. Internet, network, IP address, wifi, Internet security. Data on machine: number representation, character encodings. Computer algebra, symbolic calculation (Sage, Mathematica,...), variable, recursion instead of iterative programming, deepening the secondary school function concept (factorial, Fibonacci sequence, Euclidean algorithm, exponentiation, quick exponentiation...). Programming paradigms in computer algebra languages. HTML, the markup language concept, homepage. CSS, separation of the content and presentation. Editing mathematical text: TeX, LaTeX, mathematics on the web. Presentation of math (beamer). Basic concepts of graphic file formats, graphics in mathematical text (TikZ).

Subject code	Subject name	Requirement	ECTS credit
BMETE91AM52	Mathematical Logic	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	A0	English	

The language of first order logic, an outlook to higher order languages. Formalization. Structure, valuation. The sets of true valuations. Logical consequence and comparing with the operation implication. Deduction theorem, and characterizations of logical consequence. Normal forms: conjuctive, prenex, Skolem. Compactness theorem and its applications. – Proof theory. Deductive and refutation calculi. Analitic tableaux and its semantical background. Completeness theorem and its importance. Examples for semantical and proof theoretical approaches of some logical properties. The model method. Theorems of Löwenheim-Skolem types. Model constructions. Standard and non-standard models, on the concepts on non-standard real numbers, integers, infinitesimals. Categoricity, and completeness. – Discrete and density orderings. On the limits of first order logic, incompleteness and undecidableness, the famous results of Gödel and Church.On the connection of propositonal logic and Boolean algebras.
– H., A Mathematical Introduction to Logic, Academic Press, 2001.– Ben-Ari, M., Mathematical Logic for Computer Science, Springer, 2012– Ferenczi, M., Szőts, M., Mathematical Logic for Applications, Typotex, 2016– Ferenczi, M., Pataricza, A., Rónyai, L., Formal Methods in Computing, Kluwer-Akadémia Kiadó, 2005

Subject code	Subject name	Requirement	ECTS credit
BMETE91AM56	Programming Exercises for Probability Theory	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	A0	English	THU:09:15-10:00(H507)

The aim of the course is to maintain the students' programming skills through programming problems associated with the topics of Probability Theory course helping the understanding of the basic concepts of probability simulations of random events at the same time.

Subject code	Subject name	Requirement	ECTS credit
BMETE91AP62	Vector and Matrix Algebra	Exam	8

Course type	Course code	Course language	Timetable information
Lecture	T0	English	MON:10:15-12:00; TUE:12:15-14:00
Practice	T3	English	MON:12:15-14:00
Practice	T2	English	MON:12:15-14:00
Practice	T1	English	MON:12:15-14:00

Elementary Real Analysis: The Real Number System. Complex Numbers and Their Arithmetics. Algebraic, Trigonometric and Exponential Representations. Euler's Formula. Elementary Functions. Polynomials. The Fundamental Theorem of Algebra.
Vector Spaces: Motivation. Linear Independence and Bases. Direct Sums. Inner Product Spaces. Orthogonal Sets.
Linear Equations and Matrices: Systems of Linear Equations. Elementary Row Operations. Row and Column Spaces. Solutions to Systems of Linear Equations. Matrix Algebra. Invertible Matrices. Elementary Matrices.
Determinants: Permutations. The Levi-Civita Symbol. Definitions and Elementary Properties. Additional Properties of Determinants. Determinants and Linear Equations. Expansion by Cofactors.
Linear Transformations and Matrices: Linear Transformations and Properties. Matrix Representations. Change of Basis. Orthogonal Transformations. Reflexions, Rotations and Projections.
Eigenvalues and Eigenvectors: Eigenvalues and Eigenvectors. Characteristic Polynomials. Block Matrices. Invariant Subspaces. More on Diagonalization. Diagonalizing Normal Matrices. The Singular Value Decomposition.
Numerical and Algorithmic Approach: The LU and QR Factorizations. The Least Square Method. The Jacobi Eigenvalue Algorithm for Symmetric Matrices.
Operators and Diagonalization: The Adjoint Operator. Normal Operators. More on Orthogonal Transformations. Projections. The Spectral Theorem. Positive Operators. The Matrix Exponential Series.
Multilinear Mappings and Tensors: Symmetric and Antisymmetric Bilinear Forms. Diagonalization of Symmetric Bilinear Forms. Volumes in R^3 and in R^n. Linear Transformations and Volumes.
•Joel G. Broida. Essential Linear Algebra. University of Colorado, Boulder. 2009.
•David C. Lay. Linear Algebra and Its Applications, 4th Edition. Addison-Wesley. 2012

•Derek J. S. Robinson A Course in Linear Algebra With Applications, 2nd Edition. World Scientific. 2006.

Subject code	Subject name	Requirement	ECTS credit
BMETE93BG01	Mathematics G1	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:16:15-19:00(KF82); THU:16:15-17:00(KF82)
Practice	EN1	English	THU:17:15-19:00(KF82)

Algebra of vectors in plane and in space. Arithmetic of complex numbers. Infinite sequences. Limit of a function, some important limits. Continuity. Differentiation: rules, derivatives of elementary functions. Mean value theorems, l'Hospital's rule, Taylor theorem. Curve sketching for a function, local and absolute extrema. Integration: properties of the Riemann integral, Newton-Leibniz theorem, antiderivatives, integration by parts, integration by substitution. Integration in special classes of functions. Improper integrals. Applications of the integral.

Subject code	Subject name	Requirement	ECTS credit
BMETE93BG03	Mathematics G3	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(R501)
Practice	EN1	English	WED:08:15-10:00(D316B)

Classification of differential equations.Separable ordinary differential equations, linear equations with constant and variable coefficients, systems of linear differential equations with constant coefficients. Some applications of ODEs.Scalar and vector fields.Line and surface integrals. Divergence and curl, theorems of Gauss and Stokes, Green formulae. Conservative vector fields, potentials. Some applications of vector analysis.Software applicationsfor solving some elementary problems.

Subject code	Subject name	Requirement	ECTS credit
BMETEAGBsMMMOD-00	Mathematical Methods	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Practice	A1	English	TUE:10:15-12:00; THU:12:15-14:00

– Elementary problems in combinatorics: counting and graphs.– Natural language logic. Propositions, negations, reversing, logical operations.– Single quantifier expressions (syllogisms), sets, their Boolean algebra.– Proof methods. Case separation. Conditional statements. Provablity. Proofs by contradiction. Constructive proofs. Existence proofs.– Pigeonhole principle. Invariants and algorithmic proofs. Isomorphism.– Ordering and relations. Equivalence relations.– Well ordering, principle of induction, infinite descent, recursion.– Descartes product of sets. Equivalence of sets, cardinality. Countable and uncountable sets and their existence. Cantor's diagonal method. Russell's paradox and others.
G. Chartrand, A. Polimeni, P. Zhang: Mathematical Proofs - A Transition to Advanced Mathematics. Pearson 2018.

Subject code	Subject name	Requirement	ECTS credit
BMETEAGBsMVMAL-00	Vector and Matrix Algebra for Mathematicians	Exam	8

Course type	Course code	Course language	Timetable information
Lecture	A0	English	MON:10:15-12:00; TUE:12:15-14:00
Practice	A1	English	MON:12:15-14:00; WED:08:15-10:00

Elementary Real Analysis: Complex Numbers and Their Arithmetics. Algebraic, Trigonometric and Exponential Representations. Euler's Formula. The complex plane. Roots and primitive roots of unity. Elementary Functions. Algebra of polynomials. The Fundamental Theorem of Algebra.
Vector Spaces: Motivation. Linear Independence and Bases. Direct Sums. Inner Product Spaces. Orthogonal Sets.
Linear Equations and Matrices: Systems of Linear Equations. Elementary Row Operations. Row and Column Spaces. Solutions to Systems of Linear Equations. Matrix Algebra. Invertible Matrices. Elementary Matrices.
Determinants: Permutations. The Levi-Civita Symbol. Definitions and Elementary Properties. Additional Properties of Determinants. Determinants and Linear Equations. Expansion by Cofactors.
Linear Transformations and Matrices: Linear Transformations and Properties. Matrix Representations.Change of Basis. Orthogonal Transformations. Reflections, Rotations and Projections.
Eigenvalues and Eigenvectors: Eigenvalues and Eigenvectors. Characteristic Polynomials. Block Matrices. Invariant Subspaces. More on Diagonalization. Spectral theorem. Diagonalizing Normal Matrices. The Singular Value Decomposition.
Numerical and Algorithmic Approach: The LU and QR Factorizations. The Least Squares Method. The Jacobi Eigenvalue Algorithm for Symmetric Matrices.
Operators and Diagonalization: The Adjoint Operator. Normal Operators. More on Orthogonal Transformations. Projections. The Spectral Theorem. Positive Operators. The Matrix Exponential Series.

G Strang: Introduction to Linear Algebra. (Fifth Edition) Wellesley-Cambridge 2016.
R. Irving: Integers, Polynomials, and Rings - A Course in Algebra. Springer 2004.

Faculty of Transportation Engineering and Vehicle Engineering

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
BMEKOKAM103	Electronics - electronic measuring systems	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	ERA_Ea	English	TUE:10:15-12:00(J207)
Practice	ERA_gy	English	TUE:08:15-10:00(J207)

Subject code	Subject name	Requirement	ECTS credit
BMEKOKAM104	Information and communication technology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	ERA_ea	English	MON:14:15-16:00(ST101)
Practice	ERA_gyak	English	WED:16:15-18:00(ST101)

Subject code	Subject name	Requirement	ECTS credit
BMEKOKAM202	Transport Automation	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	ERA_L	English	WED:14:15-16:00
Practice	ERA_P	English	MON:12:15-14:00

Subject code	Subject name	Requirement	ECTS credit
BMEKOKAM326	Algorithm Design	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	ERA_LAB	English	MON:16:15-18:00
Lecture	ERA-EA	English	WED:14:15-16:00

Subject code	Subject name	Requirement	ECTS credit
BMEKOKGA226	Airtransport Management I.	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	ERA_L	English	THU:12:15-14:00
Practice	ERA_P	English	THU:12:15-14:00

Market of air transport. Strategy. Marketing. Controlling. Charges. Airlines and airports.

Subject code	Subject name	Requirement	ECTS credit
BMEKOKKM227	Smart City	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	ERA	English	TUE:12:15-14:00(STFKIS)

Subject code	Subject name	Requirement	ECTS credit
BMEKOKKM228	Transport Infrastructure Management	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	ERA	English	MON:12:15-14:00(ST320)

Subject code	Subject name	Requirement	ECTS credit
BMEKOKUM206	Transport Operation Technology	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	ERA_L	English	WED:08:15-10:00(ST428)
Practice	ERA_P	English	MON:08:15-10:00(ST427)

Subject code	Subject name	Requirement	ECTS credit
BMEKOVRM121	Numerical methods	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	Lab_ERA	English	FRI:10:15-12:00(ST201)
Lecture	EA_ERA	English	FRI:08:15-10:00(ST201)

Subject code	Subject name	Requirement	ECTS credit
BMEKOVRM334	Numerical optimization	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	Lab_ERA	English	FRI:10:15-12:00
Lecture	EA_ERA	English	FRI:08:15-10:00(ST201); FRI:08:15-10:00(ST201); FRI:10:15-12:00(ST201)

Subject code	Subject name	Requirement	ECTS credit
BMEKOVRM606	Computational fluid- and thermodynamics	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	Lab_ERA	English	MON:14:15-16:00
Lecture	EA_ERA	English	THU:10:15-12:00