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
BMEGT61A051	German for Engineers - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k312_nmű	German	WED:12:15-14:00

Subject name German for Engineers Subject code(s) BMEGT61A051 Lesson type, Lessons per week Seminar 2 lessons (90 minutes) once per week Type of Mark mid-semester mark Number of Credits awarded 2 credits Recommended Entrance Requirements Common European Framework of Reference for Languages level B2 (intermediate), or minimum 75 TOEFL IBT score or similar language knowledge It is recommended that students take a level test (available in different languages on the www.inyk.bme.hu website) to determine their language level and choose a suitable course. Programme aims By the end of the course the student will have the language skills and will use lexical resources at B2 level to allow him/her to carry out tasks in the target language in the course of his/her studies and work. Competences Oral comprehension/ Speaking skills: Students will be able to use understand and take notes on the main content points of complex texts related to their professional fields, and to contribute to professional discussions. They will be able to express and justify their opinions on technical topics. Written comprehension/Written composition: Students will be able to comprehend short texts of a technical nature in their entirety, and to extract the main points from longer texts, and to produce texts in the target language or their native language synthesising two or more sources of information. Topics covered Technical style Definitions and Categorizing The shapes of objects and the properties of materials Describing machines, instructions for use Spatial relations Describing processes Cause and effect Comparisons; describing and interpreting data in tables and graphs Changes, trends Problems, solutions Requirements for participation in the lessons “If a student is absent from more than 30% of the total number of lessons of seminars [...] then he/she cannot obtain the credits of the subject.” Code of Studies and Exams, Article 14 (3) Subject requirements 1/3 – the student’s performance during the semester 1/3 – mid-term test (based on the material taught during the course, max. 45 minutes) and an individual talk or a translation 1/3 – 90-minute end of term written test (reading comprehension and written composition)

Subject code	Subject name	Requirement	ECTS credit
BMEGT61A061	Communication skills - German - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k215_nkk	German	TUE:15:15-17:00

BMEGT61A061 Communication Skills– German - B2 - Recommended entrance level: B2 - The subject prepares the student for communication in his/her 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 student will have the skills to speak about his/her studies, professional interests, future plans, different types of work (for example small and large companies) with their advantages and disadvantages, corporate culture, potential problems arising at work. The student will be able to solve situations related to professional discussions, conflicts, corporate design at work (design discussions, presenting results). He/she is familiar with arguing and negotiation techniques and can successfully use them. He/she has the necessary skills to write short, formal letters, to make suggestions, to 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
BMEGT61A091	Crosscultural Communication - German - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k414_nxc	German	THU:14:15-16:00

BMEGT61A091 Cross-Cultural Communication B2 – German - Recommended entrance level: B2 - The course prepares participants for communication needed in intercultural situations occurring more frequently in our globalized world (for work or studies with foreigners or abroad). The focus is on oral skills development (but all skills, such as reading, listening and writing are developed) through topics connected to cultural differences and materials representing such differences. - On completion of the course participants are 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
BMEGT62AF61	Communication Skills - French - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k414_fkomm	French	THU:14:15-16:00

BMEGT62AF61 Communication Skills – French – B2 - Recommended entrance level: B2 - The most important aim of the course is that the student is able to comprehend and react to various everyday and professional topics in the fields of personal and professional life, meanwhile practising and further developing the necessary/required oral and written communication patterns. Those who have already acquired a good command of French either in high school or at the university, approaching the B2 level, can take an active part in the lessons because they can comprehend and speak adequately. - By the end of the course the student is able to write a CV and a cover letter, also they are able to speak about themselves, their studies and their hobbies fairly fluently at a job interview. - 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
BMEGT62AF91	Crosscultural Communication - French B2 level	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k314_fxc	French	WED:14:15-16:00

BMEGT62AF91 Cross-Cultural Communication B2 - French - Recommended entrance level: B2 - The most important aim of the course is to compare specific aspects of the participants' culture with the target culture, as well as to develop participants' intercultural competence and their written and oral communication skills. - By the end of the course participants are able to make comparisons about their own culture and the target culture, provide short description about specific cultural phenomena, such as celebrations, customs, or the situation of the youth in the target culture, and achieve improved argumentation techniques through discussing intercultural issues. - 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
BMEGT62AFCH	Hungarian Culture (in French) - B2 level	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k114_fHC	French	MON:14:15-16:00

BMEGT62AFCH Hungarian culture (for foreign students in French language) - Recommended entrance level: B2 - The most important objective of the course during the semester is that the French or French-speaking student becomes familiar with the different characteristics of Hungarian culture in comparison with the culture of his mother tongue using different approaches. - At the end of the course, the student will be able to comment on the Hungarian culture, history, economy, and briefly describe certain cultural phenomena such as festivals, customs, while significantly developing his discussion and intercultural comparison skills. - 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
BMEGT62AS61	Communication skills - Spanish - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k314_skomm	Spanish	WED:14:15-16:00

BMEGTAS61 Communication Skills – Spanish – B2 - Recommended entrance level: B2 - The subject prepares students for such communication situations that occur in a professional context. During the course we aim to develop all four of the skills (comprehension and text formation both in speaking and in writing), however, we primarily focus on the use and development of oral communication patterns. The subject is intended for such students who wish to activate and further develop their already acquired knowledge in these fields. - By the end of the course the student is able to speak about their studies, their professional plans, also they are able to communicate efficiently at a job interview, or take part in a professional debate at work. The student is also able to apply the acquired negotiation techniques, such as giving an argument effectively, or being persuasive in the course of professional meetings. The student is able to write a formal letter, or e-mail, in which they can make suggestions if needed, but they can also reply to these mails in a cordial style or refuse the suggestions made. - 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
BMEGT62AS91	Crosscultural Communication - Spanish B2 level	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k416_sxc	Spanish	THU:16:15-18:00

BMEGTAS91 Cross-Cultural Communication B2 - Spanish - Recommended entrance level: B2 - This subject intends to raise the interest of students towards other cultures, and to help them navigate intercultural situations. During the course intercultural situations are examined which helps students behave in a more open-minded way while communicating in another language. Increasing their knowledge about the target culture is another aim of the course, as well as developing all four language skills (oral and written comprehension and production) with a focus on speaking. - At the completion of the course students are able to react to unfamiliar situations and manage conflicts resulting from intercultural differences in a sensitive and appropriate manner. They acquire strategies helping them in handling intercultural situations. Their knowledge and vocabulary related to cultural and intercultural topics increases, along with their ability to apply those to everyday situations. - 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
BMEGT62ASCH	Hungarian Culture (in Spanish) - B2 level	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k414_spHC	Spanish	THU:14:15-16:00

BMEGT62ASCH Hungarian Culture – Spanish - Recommended entrance level: B2 - It is a course for foreign students who want to obtain a comprehensive image of the Hungarian culture. According to the academic profile of the students, special emphasis will be put on different fields of science, engineering and economics. The students of the course will have the possibility of meeting Hungarian students (from the other Spanish course) and thus they will be able to have real contact with Hungarians of their age and they will have to carry out group projects with them. - After finishing the course, the students will be able to recognize and speak about the different areas of the Hungarian high culture and everyday culture. They will learn about the most important inventions of Hungarian scientists, the most prominent characters, such as writers, historians, composers within their historical and social framework, and they will gain an understanding of the main behavioral characteristics of Hungarians, so they will be able to understand the environment in which they spend a period of their life more. - 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
BMEGT63A051	English for Engineers - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k408_amű	English	THU:08:15-10:00
Practice	k308_amű	English	WED:08:15-10:00
Practice	k208_amű	English	TUE:08:15-10:00

Subject name English for Engineers Subject code(s) BMEGT63A051 Lesson type, Lessons per week Seminar 2 lessons (90 minutes) once per week Type of Mark mid-semester mark Number of Credits awarded 2 credits Recommended Entrance Requirements Common European Framework of Reference for Languages level B2 (intermediate), or minimum 75 TOEFL IBT score or similar language knowledge It is recommended that students take a level test (available in different languages on the www.inyk.bme.hu website) to determine their language level and choose a suitable course. Programme aims By the end of the course the student will have the language skills and will use lexical resources at B2 level to allow him/her to carry out tasks in the target language in the course of his/her studies and work. Competences Oral comprehension/ Speaking skills: Students will be able to use understand and take notes on the main content points of complex texts related to their professional fields, and to contribute to professional discussions. They will be able to express and justify their opinions on technical topics. Written comprehension/Written composition: Students will be able to comprehend short texts of a technical nature in their entirety, and to extract the main points from longer texts, and to produce texts in the target language or their native language synthesising two or more sources of information. Topics covered Technical style Definitions and Categorizing The shapes of objects and the properties of materials Describing machines, instructions for use Spatial relations Describing processes Cause and effect Comparisons; describing and interpreting data in tables and graphs Changes, trends Problems, solutions Requirements for participation in the lessons “If a student is absent from more than 30% of the total number of lessons of seminars [...] then he/she cannot obtain the credits of the subject.” Code of Studies and Exams, Article 14 (3) Subject requirements 1/3 – the student’s performance during the semester 1/3 – mid-term test (based on the material taught during the course, max. 45 minutes) and an individual talk or a translation 1/3 – 90-minute end of term written test (reading comprehension and written composition)

Subject code	Subject name	Requirement	ECTS credit
BMEGT63A061	Communication Skills - English - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k208_ acs	English	TUE:08:15-10:00
Practice	k308_acs	English	WED:08:15-10:00

BMEGT63A061 Communication Skills– English - Recommended entrance level: B2 - The subject prepares the student for communication in his/her 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 student will have the skills to speak about his/her studies, professional interests, future plans, corporate culture, potential problems arising at work. The student will be able to solve situations related to professional discussions, conflicts, corporate design at work (coordination meetings, design discussions, presenting results). He/she is familiar with different arguing and negotiation techniques and can successfully use them. He/she is able to write his/her CV in a foreign language, has the basic command of a foreign language required to look for a job and is capable of using phrases deliberately in a foreign language acquired during job interview simulations. - 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
BMEGT63A091	Crosscultural Communication - English - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k212_ axc	English	TUE:12:15-14:00
Practice	k510_ axc	English	FRI:10:15-12:00

BMEGT63A091 Crosscultural Communication - English - B2 - Recommended entrance level: B2 - The subject intends to develop communication skills through the theme of cultural differences and prepare participants for managing intercultural situations they might face in their academic and/or professional career in a globalized world. The focus is on oral skills development, though reading and listening comprehensions, as well as writing skills are included. - On completion of the course participants can identify, describe, analyse, discuss and manage intercultural differences with confidence. They become aware of other people's attitudes, motives and behaviours, can adapt their communication style and be more open and tolerant towards people from other cultures. Participants can successfully manage professional and academic discussions, conflicts, planning and execution by being able to adjust their verbal and nonverbal behaviour to maintain communication. - 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
BMEGT63MAPD	Academic English (B2+)	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k310_AC	English	WED:10:15-12:00

BMEGT63MAPD Academic English - B2+ - Recommended entrance level: B2+ - The course aims at developing students' language skills 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 English language studies 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, handouts, and formal letters related to their studies and office routines. 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
BMEGT63MAS4	LSP - Chemical Technology and Biotechnology in English - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	k210_aVE	English	TUE:10:15-12:00

/* Font Definitions */ @font-face {font-family:"Cambria Math"; panose-1:2 4 5 3 5 4 6 3 2 4; mso-font-charset:238; mso-generic-font-family:roman; mso-font-pitch:variable; mso-font-signature:-536870145 1107305727 0 0 415 0;} @font-face {font-family:Garamond; panose-1:2 2 4 4 3 3 1 1 8 3; mso-font-charset:0; mso-generic-font-family:roman; mso-font-pitch:variable; mso-font-signature:647 0 0 0 159 0;} /* Style Definitions */ p.MsoNormal, li.MsoNormal, div.MsoNormal {mso-style-unhide:no; mso-style-qformat:yes; mso-style-parent:""; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:12.0pt; font-family:"Times New Roman",serif; mso-fareast-font-family:"Times New Roman";} .MsoChpDefault {mso-style-type:export-only; mso-default

-props:yes; font-size:10.0pt; mso-ansi-font-size:10.0pt; mso-bidi-font-size:10.0pt;} @page WordSection1 {size:612.0pt 792.0pt; margin:70.85pt 70.85pt 70.85pt 70.85pt; mso-header-margin:35.4pt; mso-footer-margin:35.4pt; mso-paper-source:0;} div.WordSection1 {page:WordSection1;} --> /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:10.0pt; font-family:"Times New Roman",seriBMEGT63MAS4 LSP - Chemical Technology and Biotechnology in English - B2 - Recommended entrance level: B2 - The course prepare the students to be able to take part in communication in their field of studies by mastering the proper skills both orally and in writing. - After finishing the course the students will be familiar with various types of topics related to chemical engineering, and they will be able to participate in discussions about them. The students' vocabulary in their field of studies as well as their knowledge of grammar are going to improve, and in this way the students can become capable of giving presentations in English in their field of studies. - 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
BMEGT658361	Hungarian Culture	Exam	2

Course type	**Course code**	**Course language**	**Timetable information**
Practice	k208_aHC	English	TUE:08:15-10:00

This interdisciplinary course covers a variety of interconnected fields to present a comprehensive survey of Hungarian culture and history. The course is thematically organised and focuses on Hungarian culture as it is expressed through the arts (fine arts, literature, music). Special emphasis is given to the history of Hungarian thought from early to recent times. The concepts of Hungarian poets, writers, composers, and scientists are considered in their historical and social context.

Faculty of Architecture

IMPORTANT NOTES

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Subject code	Subject name	Requirement	ECTS credit
BMEEPAG0236	CAAD and Architects Informatics F	Mid-semester mark	3

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

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	Constructive CAAD F	Mid-semester mark	3

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

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
Practice	EN1-ER	English	

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
BMEEPAGA401	Architectural Informatics 2 - Digital Representation	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	
Practice	EN1-ER	English	

Fundamentals of vector graphics, two-dimensional (2D), and three-dimensional (3D) Computer Aided Design (CAD) systems. Application of Cartesian and polar coordinate systems. CAD principles from simple 2D drafting to the developing of architectural drawings with the use of layers and library elements (blocks). 3D modelling of geometrical shapes and architectural details.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEGA601	Building Service Engineering 2	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	

Calculation of heat loss of buildings. Energy consumption of a heated space. Introduction to fluid flow. Classification of Heating. Central heating. Elements of water heating system. Pipe distributing networks Emitters and surface heating. Controlling. Renewable energy sources for heating and producing domestic dot water. Introduction to psychometrics. Psychometric processes. Ventilation (Classification, natural ventilation and mechanical one, fundamental systems of air inlet and extract) Estimation of the necessary air volume. Air heating and cooling systems. Air conditioning.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEK0626	Real-Estate Development	Exam	2

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

Basics of RE development: The RE Cycle. Contributors and actors in the process. Real estate Market. Descriptive figures of market segments. RE Market, presentation of different markets. Market Valuation, Definition of the Market

Value. Other valuation bases: RICS, TEGOVA. Valuation methodology. Development Process : the process and the Developer. Main international development companies. Feasibility Study, legal, technical and economic analysis. Sensitivity analysis. Development Parameters: GBA, GLA, lot coverage ratio, green area. Functional mix. Potential rental and other revenues. Development Cost, elements of the building costs, structure of the operation costs, yearly CF calculation. RE Marketing: Sales methodology, traditional and new marketing tools. RE Agencies and their activities. Contracting, contract types, contracting process. RE Financing.

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	EN1-ER	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
BMEEPEKA701	CM3 - Planning of Construction Technology	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	
Practice	EN1-ER	English	

The goal of the subject is to present information on the planning of elementary construction technologies related to superstructures and finishing work.The subject introduces how to apply recent innovations of building technologies during design and realisation. It gives a basic knowledge to evaluate construction options and make appropriate decisions about technology. There are case studies of building technologies used in construction of loadbearing structures, finishing and cladding works.The practical part contains workshops on planning of construction technologies: connection of structures and technologies, volume calculation, resource estimation, scheduling and construction site planning.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEKA801	Building and Architectural Economics	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	

Aim: investigate the economic side of a real estate development emphasizing the Social cost and benefit of development.This module concentrates economical computation models, theories dealing with real estate valuation. There is a homework concerning with calculation, valuation of a real estate development. Successful submission is required for the module acceptance. Written mid-semester test as indicated, minimum pass grade required. Following main topics are discussed: construction cost, estimates, time value of money, building life cycle cost , measuring the worth of real estate investments.

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(ONLINE); TUE:12:15-14:00(ONLINE)
Practice	EN1	English	WED:10:15-12:00(ONLINE)

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
BMEEPEKK801	CM4. Controlling of Construction technologies	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	
Practice	EN1-ER	English	

Subject obligatory for BSc degree - The goal of the subject is to present information on the controlling process of the whole construction activity and the applied technologies involving the legal environment, the quality management, the quality survey, the work safety and the fire protection. Site and company visits are integrated in the theoretical lectures. Main topics: Regulations concerning to the construction Building permission/building consentQuality in

construcion, Fire protectionDry construction systemsThe work of the quality surveyorHealth and safety during building constructionControlling activities in Construction Projects

Subject code	Subject name	Requirement	ECTS credit
BMEEPESA201	Building Constructions 1.	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	
Practice	EN1-ER	English	

This subject presents the details of the main load-bearing constructions (walls, floors, stairs) and the joints between them. Wall supported / skeleton frame, or mixed construction. Walls: Effects on walls, and how to fulfil the requirements. Sorting the walls by function, position, material, by layer-order. Walls built from elements, the development of walling elements. Floors: Functions, effects on floors, how to fulfil the requirements. Elements of floor construction. Types: plain floors (in details), arches (overview). The materials, construction lines, building methods, About the future of floors Joints between walls – floors, skeleton frames – floors. Methodology of the floor design. Stairs: Functions, effects on staires, how to fulfil the requirements, principles of stressing and how to choose construction. Sorting the constructions by material, load bearing method, building method … etc. Design possibilities.

Subject code	Subject name	Requirement	ECTS credit
BMEEPESA401	Building Constructions 3	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	
Practice	EN1-ER	English	

General and detailed review of the structures of the elevation constructions. The most important aim of the subject is the analysis of the external separating constructions. Principles of the continuity of the protecting levels depending on the position in the structure. Multi-layer external separating walls, construction methods of the elevation claddings and elevation coverings, the ordinary and special external doors and windows. Complementary structures for the external doors and windows, especially the shading devices. Requirements for the external separating structures and performances of the different constructions. Building physics: heat and vapour physics, acoustic features of the external separating structures.

Subject code	Subject name	Requirement	ECTS credit
BMEEPEST602	Building Constructions 5T	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	
Practice	EN1-ER	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEPET0408	History of Theory of Architecture 2	Exam	2

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

HISTORY OF THEORY OF ARCHITECTURE 2. BMEEPET0408 The course presents, exposes and explains the most important constituent facts, selected from the innumerable different intellectual reflections of the twentieth century and the second millennium, as a rich and simultaneous interplay of parallel stories, either promoting, or opposing each other. It doesnrsquo;t interpret history as a homogeneously evolving story, emerging from the past, but at the same time, it doesnrsquo;t deny the importance and operative function of creating histories. Instead of a simple, successive presentation of well-known historical facts, or a collection of fashionable notions, topics and themes, it rather concentrates on exploring their synchronic functional relationships and finding creative and relevant conclusions. 1. Introduction, theory and history in the 20th century. 2. Dominant modern reflections: Riegl, Loos Corbusier 3. Science, technology, art, future, constituent parts of the modern identity Submission and discussion of first paper. 4. Great histories of modern architecture. History, or theory? 5. The destructions of modern technologies. Totalitarian regimes, and the war. Post war time, neo-technicism and total utopias of the sixties, Banham, Archigram. 6. Rediscovery of the operative function of history. Kahn, Venturi. Vulgar modernism and vulgar historicism. Submission and discussion of second paper. 7. The global, the regional, the rural, the archaic. Structuralism, accidentism. 8. Positive and negative side of modern urbanism. 9. Beyond modern histories. Critical theories anthologies. Presence and representation. Deconstruction, phenomenology, hermeneutics. Submission and discussion of third paper.

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	

Architectural Research for Exchange Students – BMEEPET0995BME Department of History of Architecture and of Monuments Similarly to the international practice the course aims primarily research activity in 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 the course will give an appreciation of interdisciplinary and special fields in international environment too. The project work will demonstrate 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 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 to the teachers, but the essay should write 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 agreeing with the proposal.Course list 2018/2019/fall semesterconsultants in the following languages for the following topicsDr. habil. KRÄHLING, János Associate professor English max. 3 Architectural analysis of sacral buildingsDr. habil. MEZŐS, Tamás Professor English max. 3 Architectural researchDARAGÓ, László DLA Associate professor English max. 2 Architectural analysis of historic ensemblesSZALAI, András DLA Associate professor English max. 1 Contemporary architectureVUKOSZÁVLYEV, Zorán PhD Associate professor English max. 2 Contemporary architectureGY. BALOGH, Ágnes PhD Assistant professor English max. 1 19th century architectureHALMOS, Balázs PhD Assistant professor English max. 2 Historical building researchMARÓTZY, Katalin PhD Assistant professor English max. 1 19th century architecturePAZÁR, Béla DLA Assistant professor English Deutsch max. 1 Contemporary architecture Zeitgenössische ArchitekturRABB, Péter PhD Assistant professor English max. 1 Norman architecture in South ItalyZSEMBERY, Ákos PhD Assistant professor Italiano English max. 1 Restauro dei monumenti. Principi e metodoKISS, Zsuzsanna Emília Assistant research fellow English max. 1. Turn of the century architecturePILSITZ, Martin PhD Assistant research fellow Deutsch English max. 1 Historische Industriearchitectur Historic industrial architectureFEHÉR, Krisztina Assistant lecturer English French max. 1 Mediaeval architecture

Subject code	Subject name	Requirement	ECTS credit
BMEEPETA201	History of Architecture 2. (Antiquity)	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	
Practice	EN1-ER	English	

The intended task of the subject is to investigate the evaluation and formation of the European architecture of the four main cultures as Mesopotamia, Egypt, Greece and Rome. Before introducing to the evaluation of architecture we are speaking the used building materials and the structures involved. The presentation of architecture follows chronological order, analysing the functional expectation of the building types used. In Mesopotamia we discuss the space demands of the sacral, the dwelling and the palace architecture. The analysis makes possible to prove the early use of space systems in architecture. The accented topic in Egypt is the evaluation of monumental architecture in stone. It is important to understand, that the later funerary buildings are not unique architectural constructions, but part of a composition. The Hellenic and the Roman civilisation is basically an urbanistic culture. That is the reason, that both cultures are discussed through their developments in settlements. The analysis of Hellenic temple construction gives opportunity to discuss the evaluation of the Greek and Roman orders.

Subject code	Subject name	Requirement	ECTS credit
BMEEPETA401	History of Architecture 4	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	
Practice	EN1-ER	English	

Brunelleschi and the early renaissance architecture in Tuscany. The evolution of the renaissance palace in Florence and in the Northern regions of Italy. The architect and scholar Leon Battista Alberti. Bramante and and the influence of his circle in the first half of the 16th century. Michelangelo Buonarroti architect. Renaissance in Lombardy and Venice. Mannerist architecture. The late sixteenth century: Palladio and Vignola. Urban development and early baroque architecture in Rome under Pope Sixtus V. The architecture of Lorenzo Bernini and Francesco Borromini. Baroque in Venice and in Piemont. Architecture in France in the 16-17th centuries. Baroque in central Europe: Austria, Bohemia and Germany.

Subject code	Subject name	Requirement	ECTS credit
BMEEPETO601	History of Architecture 6	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	

The course gives an overview of the architecture in the 20-21st centuries. The classes follow chronology with focusing on the works of some great architects: Modernism and Modern Movement. Architecture between the two world wars – De Stijl, Bauhaus, Russian Constructivism, Less is more – Architecture of Ludwig Mies van der Rohe,

Toward a New Architecture – Architecture of Le Corbusier. The Nordic Classicist Tradition – Architecture of E. G. Asplund and S. Lewerentz. Alvar Aalto and the modern Finnish architecture. In the second part the course picks up some relevant architectural trends: New Empiricism, New Humanism, New Brutalism and the Team X, the way from large housing estates to architecture without architects. Unfolding post-modern architecture, participation and the Las Vegas strip, Colin Rowe's studio, Critical Regionalism. The third part concentrates on timely problems: new materials or the multi-sensorial experience of space and surface, Rem Koolhaas's Dirty Realism, new technology and digital perception, architecture of seduction.

Subject code	Subject name	Requirement	ECTS credit
BMEEPETO801	History of Architecture in Hungary 1	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	

The subject History of Architecture in Hungary I. aims to present and analyze the architecture of historic Hungary in European and domestic context from the history of Pannonia to the end of Baroque. The principle of the presentation is the chronological interdependence, however, particular attention is given to the main trends within the different periods as the main stylistic tendencies or external and internal factors that determine the historical and architectural context. A great emphasis is given to the exploration of the connections between the European and Hungarian history of architecture. Lecture topics include: The beginnings of architecture in the Carpathian Basin. Roman architecture in Hungary. Early medieval architecture in Hungary - Christian Architecture between West and East. The flourishing Romanesque and the beginnings of Gothic Architecture. The rise of Gothic Architecture - architecture in towns and Gothic architecture of the orders. The beginning and the first period of the renaissance till the middle of th 16th century. The architecture of fortified palaces and fortifications. The renaissance architecture in Transylvania. The beginnings of the baroque in Western Hungary in the 17th century. The High Baroque in Hungary.

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	

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 Ruskinrsquo;s work, over Boitorsquo;s ldquo;Prima carta del restaurordquo; (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 ndash; 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
BMEEPIP0893	Contemporary Architect Offices	Exam	2

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

This subject is about contemporary Hungarian architecture. The course is set up of weekly lectures or a site visits by a famous/talented Hungarian architects. The lectures are Hungarian language, for the international students it will be translated by an interpreter. For execution of the subject an essay is to be written about one of the lectures. The topics will be personalized for everyone during the last lecture.

Subject code	Subject name	Requirement	ECTS credit
BMEEPIPA401	Architecture of Workplaces 1	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	

The history of industrial architecture, the history of Hungarian industrial architecture. Load-bearing structures of halls and of multi-storey buildings. Size standardization. Constructions of space separation, facades, subsytems of space separation constructions (foundations, roof structures, intermediate floors, external wall systems, finishes. Characteristic architectural requirements, social facilities. Logistics: transport, storage. From location to layout, emplacement of industrial plants. Design methodology, re-use, reconstruction. Offices.

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
BMEEPRAA401	Drawing and Composition 4	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	
Practice	EN2-ER	English	

The main topic in the syllabus of the subject is the rsquo;analyticrsquo;representation of external spaces: students learn how to recognise the invisible geometrical-structural relations beloww the surface of buildings through preparing rsquo;X-ray drawingsrsquo;. Not only the views but also the sections of buildings are studied in order to understand and grasp the gist of the architectural structure behind the view, and to prepare such rsquo;X-ray drawingsrsquo;that represent more complex architectural compositions than what the eyes can see. Students prepare drawings on external sites (such as the Museum of Fine Arts, the Great Market Hall, and the assembly halls of BUTE and Corvinus University) to investigate the options of perspective drawing and the versions of plane representation of large spaces.

Subject code	Subject name	Requirement	ECTS credit
BMEEPRAA601	Drawing and Composition 6	Mid-semester mark	2

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

The main topic in the syllabus in this semester is the intuitive representation of internal and external spaces: this subject aims at teaching students perspective representation at a higher level (applying 3-6 vanishing points). While drawing the streets and squares of the Buda Castle and the internal spaces of some atmospheric old public building sin Budapest (e.g. Saint Stephen Cathedral, Opera House, Hungarian National Museum) students investigate invisible geometrical and structural relations and improve their drawing skills (applying lead pencil, ink and crayon techniques). The objective is not to simply represent a naturalistic view as a camera, but to prepare a drawing of the architectural structure of a real space after grasping the gist of the compostion.

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
BMEEPSTA201	Statics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	
Practice	EN1	English	

The basic laws and theorems of statics are presented and applied to engineering structures. We learn to determine reactions and internalforces (stress resultants) of 2D and 3D line structures including statically determinate trusses, beams, frames, cables, vaults and assembled structures.

Subject code	Subject name	Requirement	ECTS credit
BMEEPSTA401	Strenght of Materials 2	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	
Practice	EN1	English	

Strength of materials is a compulsory engineering subject for second year students in architecture. The goals of the subject are to show how to - determine the deformations of load-bearing structures- find the internal forces of

statically indeterminate structures. In addition to theoretical methods, we also show examples in structural engineering.

Subject code	Subject name	Requirement	ECTS credit
BMEEPSTT601	Special Load-Bearing Structures	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	
Practice	EN1	English	

The subject introduces the special load-bearing structures, such as large span, tall and spatial structures. We introduce the trusses, box-beams, wall-beams and arches as large span structures. We show the static behavior of tall buildings: the concept of the vertical and horizontal load-bearing structures. The behavior of spatial structures is the main topic of the semester. We introduce the RC shells, the brick-shells, the cable and textile membranes, space -trusses, grid shells

Subject code	Subject name	Requirement	ECTS credit
BMEEPTCEP02	Interdisciplinary, Project based Design S	Mid-semester mark	16

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	
Practice	EN2-ER	English	

The subject is based on the cooperation of the departments of the Faculty of Architecture. Students work in studios in groups with individual tasks as well instructed by teachers of the departments involved. There are two design tasks to be solved during the semester, that can be chosen freely from the offered opportunities. Each task is to solve in seven weeks. Some of the tasks are: sport hall for Olympic Games in Budapest, Dwelling Underground, Suspension in Architecture, The Green in the Metropolitan Area (green walls, green roofs) etc.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUI0801	Contemporary Urban Design	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN-ER	English	

The course gives a stable theoretical background not only for understanding contemporary urban design theory but also to practice urban design. The semester divided into three main parts: the first focuses on contemporary housing neighborhood developments, new constructions and regenerations projects from Europe; the second is an introduction to the background of the notion of public space and how this notion requalified the use of the contemporary city; the third is about the re-use of historic urban cores in Europe, focusing Berlin, Amsterdam and Zurich.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUI0805	Urbanism	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EN-ER	English	

The goal of the course is to get students acquainted with the multidisciplinary characteristics of Urban Studies. The semester is divided into two blocks dealing with: urbanisation processes in the world, in Hungary and Budapest; the issues of contemporary urbanity; related fields of science and planning tools in various field of the profession. In the series of lectures professors of the Department of Urban Planning and Design and some invited experts of various fields are presenting lectures on various topics. On the end of the semester, you have to present a specific urban topic of your home city.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUI0904	Landscape Architecture	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	EN	English	

The lecture series analyzes the transformation of green spaces along the three sides of ldquo;positions, visions, conceptsCloseCurlyDoubleQuote; that can be understood as a model of landscape theory, through which the viewpoints of the different disciplines (landscape architect, garden designer, urban designer, architect, etc.) can be used to examine the urbanized landscape and the green spaces appearing in the urban environment. Contemporary gardening and landscape architecture projects are presented during short on-site study trips with special regard to the practical experience in creative work.The motto of the subject assumes the active participation of the students also, and in connection with the lectures topics, a presentation of a case study based on a personal experience has to be done once during the semester. Each occasion ends with a common debate, discussing the different points of view on the topics.

Subject code	Subject name	Requirement	ECTS credit
BMEEPUI0906	Participation, simulation, activism: new methods in urban design	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	EN	English	

The elective course aims to teach students the practice of participatory design, focusing on urban public space design involving local communities. Students ndash; after analyzing the European best practices ndash; will get experience in involving different social groups and interest-groups into the design process of a public space. Students will get an extensive knowledge on the international practice of participatory design, reading much of itCloseCurlyQuote;s English literature, analyzing completed European public spaces designed with this method. During the practical classes the students will make a design proposal or activity process simulation for a selected public space in Budapest, either in a dense urban context or on the spaces of a housing estate, or in a suburban situation.

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	EN-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
BMEEPUIQ601	Department's Design 1.	Mid-semester mark	3

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

A special urban design course focusing mainly on urban public space design with the help of invited lecturers and landscape designer consultants. The course is a partly theoretical and partly practical where students get acquainted with special issues and problems of public space definition, basic notions and tools of public realm and public space design. In the design assignment students deal with a smaller spatial entity, where they start from the analysis of the urban problem and provide a possible solution for the publicly attainable zones in between buildings.

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
BMEVEFAA409	Colloid Chemical Approach to Nanotechnology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A0-ER	English	TUE:14:15-17:00

Short history of colloid chemistry: from colloids to nanotechnology. Classification of colloid systems. Interfaces, surface tension. Curved surfaces, capillarity. Surface tension of solutions. Adsorption, adsorbents. Solution of macromolecules. Micelles and membranes. Biological aspects of colloids. Dispersions, micro- and macroemulsions, foams. Particle size measurements. Colloid stability. Rheology. Colloids in Nanotechnology

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	16A_lab	English	MON:14:15-18:00
Lecture	16A	English	TUE:12:15-14:00

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.
https://www.ch.bme.hu/oktatas/targyak/BMEVEFAM110/en

Subject code	Subject name	Requirement	ECTS credit
BMEVEFKA304	Physical Chemistry I	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A0-ER	English	MON:10:15-12:00; WED:10:15-12:00
Practice	A1-ER	English	MON:10:15-12:00; WED:10:15-12:00

Thermodynamics: Characterization of thermodynamic systems. Internal energy, the first law of thermodynamics. Enthalpy, thermochemistry. Ideal and real gases. Entropy, the second law of thermodynamics. Gibbs free energy and Helmoltz free energy. One component phase equilibria. Thermodynamics of solutions, the chemical potential. Two component liquid-vapor and solid-liquid equilibria, phase diagrams. Distribution equilibrium. Chemical equilibrium.

Subject code	Subject name	Requirement	ECTS credit
BMEVEFKA603	Physical Chemistry of Surfaces	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	A06-ER	English	WED:08:15-10:00

Fundamentals of solid/fluid interfaces. The qualitative description of the surface layer, the concept of surface excess. Thermodynamics of the interfaces, surface tension and interaction potential. Interactions at solid/gas and solid/liquid interfaces. Adsorption isotherms, their interpretation (Langmuir, BET, Dubinin-Radushkevich and DFT models). Experimental methods, including calorimetry. Particle size analysis. Applied surface science: the role of interfaces in material science, environmental and industrial processes. Heterogenous catalysis, Pressure/Temperature Swing Adsorption

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFA203	Chemical Technology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	ENGLISH-ER	English	MON:12:15-14:00

Definition, role, characteristics of chemical technologies, industrial branches using chemical technologies, characteristics of the chemical industry, classification of chemical products, inorganic chemical technologies, basic

concepts of energy production, energy sources, coal, crude oil, natural gas, nuclear energy, renewable energy sources. Burning technology. Water treatment technologies. Hydrocarbon production and technology. Fuels and raw materials for the chemical industry. Laboratory practice 28 hours, 7 lessons, 4 hours each: water treatment, ion exchange, membrane filtering, measurement of boiler efficiency, analysis of exhaust gases, hydrocarbon tests, flammability, viscosity, engine exhaust gas analysis, corrosion test, catalytic reformation.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFA403	Environmental Chemistry and Technology	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	english-ER	English	THU:14:15-17:00

Elements of the environment, dangerous factors. The process of pollution: emission, transmission, imission. The aim and the instruments of environmental protection. Technical solutions. Economical instruments, fees, fines, supports. Air polluting materials (carbonmonoxide, nitrogen oxides, sulfur oxides, ozone, hydrocarbons, photochemical oxidants, particulates, dioxins, water polluting materials (materials with high oxygen demand, detergents, mineral oils, organic compounds, inorganic compounds, chemistry of their formation, parameters influencing their rate of formation, their chemical and physical interaction with the atmosphere, hydrosphere, litosphere and biosphere. Biologycal degradation of polymers. Heat pollution. Techniques of air and water pollution control. Classification of wastes, dangerous wastes, treatment and disposal technologies.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFM104	Modern Separation Technologies	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	eng_pract_ER	English	THU:14:15-17:00
Lecture	theory+prac_ER	English	THU:14:15-17:00

The subject gives an overview of environmentally friendly processes and unit operations of the chemical, biochemical and food industries. It deals with widely applied and currently researched technologies as well. During the course we will focus on how the development, selection and optimisation of a novel technology are influenced by environmental aspects besides selectivity and improved yield. By new separation technologies, adding different modifiers, solvents, etc. are not favoured and toxic adducts are one by one substituted to less harmful analogues. Modelling and design aspects will be also considered and explained through detailed description and evaluation of main application examples.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFM105	Chemical Process Design and Control	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	eng_ER	English	TUE:10:15-12:00

Chemical process synthesis and analysis, levels of chemical process design, batch vs. continous systems, input-output structure, reactor system, recycling system, separation systems, heat exhanger network, pinch technology, flowsheeting and flowsheeting softwares, advanced process control system, control structure design, selective control, examples for design and controls, individual computer aided process design.

Subject code	Subject name	Requirement	ECTS credit
BMEVEKFM501	Environmentally Benign Chemical Processes	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	eng_ER	English	WED:11:15-14:00

The course gives an overview of possibilities to evaluate, understand and take into account the environmental impact of various technologies. Furthermore, through case studies the best available technique concept is demonstrated and discussed in details. Concepts and typical applications of separation methods from high vacuum to high pressure techniques are explained.

Subject code	Subject name	Requirement	ECTS credit
BMEVEMBM301	Biology, biotechnology	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A8	English	WED:14:15-16:00

1. Introduction, special features of biotech: de novo fermentations and biotransformations. 2. Cell biology summary: cell structure and function 3. Microbiology and physiology survey: kinds of industrial microorganisms, their biochemistry: aerobes eacute;s anaerobes, basic microbial metabolic paths. 4. Introduction to enzyme engineering. 5. Techniques and unit operations applied in bioindustries: cultivation methods of microorganisms, culture media, sterilization, bioreactors: mass transfer. 6. Special methods of product isolation and purification: cell homogenization, affin (biocpecific) methods. 7. Some examples in white and green biotechnology: ethanol, citric acid, lactic acid fermentations, etc., biotransformations (semisynthetic antibiotics, enzymatic resolution methods) 8. Biotechnological waste water treatments:removal of organic materials, removal of phosphorus and nitrogen.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA208	Inorganic Chemistry	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	A11-ER	English	WED:13:15-16:00

Reactions and properties of elements and their major compounds; Qualitative inorganic analysis: detecting the most important cations and anions: alkaline metals (Li+, Na+, K+); alkaline earth metals (Mg2+, Ca2+, Sr2+, Ba2+); boron group (BO33ndash;, Al3+); carbon group (CO32-, HCO3ndash;, SiO32ndash;, Sn2+, Sn4+, Pb2+); nitrogen group (NH4+, NO2ndash;, NO3ndash;, PO43ndash;, As3+, As5+); oxygen group (OHndash;, S2ndash;, SO32ndash;, SO42ndash;); halogens (Fndash;, Clndash;, Brndash;, Indash;); some transition metal ions (Cr3+, Mn2+, Fe2+, Fe3+, Ni2+, Cu2+, Zn2+, Ag+, Cd2+, Hg2+, Hg22+); Analytical system of Fresenius and Bunsen, analysis of mixed cations, mixed anions, mixed compounds, and polluted compound

Subject code	Subject name	Requirement	ECTS credit
BMEVESAA403	Analytical Chemistry Laboratory Practice	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	A13-L	English	WED:14:15-18:00
Lecture	A13-E	English	WED:14:15-18:00

Gravimetric and titrimetric (acid-base, argentometry, complexometry, redoxi) determinations of different inorganic ions and organic compounds. Determination of inorganic and organic compounds using various instrumental analytical (potentiometry, conductometry, liquid-, gas- and thin layer chromatography, flame photometry, atomic absorption spectrometry, fluorimetry, ultraviolet/visible spectroscopy,) methods.Gravimetric and titrimetric (acid-base, argentometry, complexometry, redoxi) determinations of difinorganic ions and organic compounds. Determination of inorganic and organic compounds using various instrumental analytical (potentiometry, conductometry, liquid-, gas- and thin layer chromatography, flame photometry, atomic absorption spectrometry, fluorimetry, ultraviolet/visible spectroscopy,) methods. Literature: Skog D.A., West D. M., Holler F. J.: Fundamentals of Analytical Chemistry.5th Edition, Sounders College Publishing, New York, USA, 1988. Willard H. H., Merritt L. L., Dean J. A., Settle F. A.: Instrumental Methods of Analysis. 7th. Edition, Wadsworth Publ. Comp., Belmont, California, USA, 1988. Lecture material in electronic form ravand titrimetric (acid-base, argentometry, complexometry, redoxi) determinations of different inorganic ions and organic compounds. Determination of inorganic and organic compounds using various instrumental analytical (potentiometry, conductometry, liquid-, gas- and thin layer chromatography, flame photometry, atomic absorption spectrometry, fluorimetry, ultraviolet/visible spectroscopy,) methods. Gravimetric and titrimetric (acid-base, argentometry, complexometry, redoxi) determinations of difinorganic ions and organic compounds. Determination of inorganic and organic compounds using various instrumental analytical (potentiometry, conductometry, liquid-, gas- and thin layer chromatography, flame photometry, atomic absorption spectrometry, fluorimetry, ultraviolet/visible spectroscopy,) methods.

Subject code	Subject name	Requirement	ECTS credit
BMEVESAM101	Complex and Inorganic Chemistry	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	A12-ER	English	TUE:14:15-16:00

The subject provides an overview about organometallic chemistry and application of organometallic compounds. It discusses the special properties of orgamometallic compounds (different from those of classical inorganic and organic compounds) and their role in applications as chemical reagents and catalysts. It discusses the basics of homogen catalysis and the mechanism of industrial homogen catalytic processes.The organometallic chemistry of the following elements is discussed in detail: Li, Mg, Al, Sn, Ti, Cr, Fe, Co, Ni, Cu, Zn, Rh, and Pd. Discussion involves stability, structure, synthesis, physical and chemical properties, characteristic reactions, and application (industrial and laboratory). Short syllabus of the subject: History of organometallic chemistry. Definitions. Grouping of organometallic compounds. General properties of organometallic compounds. Synthesis of organometallic compounds. Characteristic reactions. Homogen catalysis. Synthesis, structure and characteristic reactions of Li- and Mg-organic compounds (substitution and addition reactions, metalation and transmetalation, catalytic reactions). Synthesis, structure and characteristic reactions of Al-organic compounds (polymer catalyst, Ziegler-Natta catalyst, synthesis of alpha;-olefins and alpha;-alcohols, olefin dimerization, preparation of organometallic compounds, preparation of high purity inorganic materials). Sn-organic compounds: synthesis, structure, and characteristic reactions (hydrostannation, hydrostannolysis, radical reactions, organostannylenes, redistribution reactions). Application as polymer catalyst, stabilizer, curing agent, and pharmaceutical. Ti-organic compounds: synthesis and characteristic reactions (substitution and insertion reactions of alkines, reactions of aldehydes and ketones, reductiv coupling and elimination with Ti-organic compounds, polymer catalysts). Cr-organic compounds: synthesis, characteristic reactions, substitution reactions, reactions on the organic ligand, rections of carben complexes. Fe-organic compounds: synthesis, characteristic reactions, Friedel-Crafts acylation, Mannich reaction, metalation, cyclization, polymerization. Co-organic compounds: synthesis, characteristic reactions, cyclization of acetylenes and olefins, Pauson-Khand reaction, carbonylations. Rh-organic compounds: synthesis, characteristic reactions, hydrogenations, hydrometalations, decarbonylations, carbonylations, hydroformylations, cyclizations. Ni-organic compounds: sysnthesis, characteristic reactions, substitution reactions, carbonylation, oligomerization of unsaturated

hydrocarbons, catalytic reactions, coupling reactions with organic halides. Pd-organic compounds: synthesis, characteristic reactions, insertions, cyclic dimerizations, oxidative reactions with Pd(II),catalysts, Wacker process, reactions with Pd(0) catalysts, coupling reactions, Heck arylation, cyclization and carbonylation, cascade reactions. Cu- and Zn-organic compounds: sysnthesis, characteristic reactions (substitution, addition and transmetalation).

Subject code	Subject name	Requirement	ECTS credit
BMEVESAM301	Computational Chemistry	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	A9-ER	English	MON:09:15-12:00

Aim of the subject: The subject gives an overview about the principles used to describe the structure of molecules and bulk phases. The modeling of physico-chemical parameters, chemical processes will be presented together with the usual techniques. Solution of practical problems by computer modeling. Short syllabus of the subject: 1./ Basic principles of quantum mechanics: The axioms, the hydrogen atom, the Born-Oppenheimer approximation, the independent particle model, and the MO theory. Hyerarchy of the theoretical models: Molecular mechanics, semiempirical, Hartree-Fock and post HF methods. Oniom and QM-MM methods. Density functional methods. The concept of the electron density. 2./ Application possibilities. Energy and electronic structure of atoms and molecules. Computation of measures related to physico-chemical or chemical concepts. Molecular geometry, conformation, conformational space. Modeling chemical reactions, thermodynamics and transition structures. Large systems, solutions and crystal structures. Molecular dynamics.

Subject code	Subject name	Requirement	ECTS credit
BMEVESKA504	Organic Chemistry III	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	A7-ER	English	WED:08:15-10:00

Based on the knowledge of subjects Organic Chemistry I and II, this subject puts major emphasis on all aspects of chemical problems associated with chiral compounds. By systematic classification of all major stereochemical terms and stereoselective syntheses, this subject adds solid knowledge to the existing understanding of organic chemistry for the future chemical engineers of pharmaceutical and fine chemicals industry. Short syllabus of the subject: Stereochemistry, the stereostructure of organic compounds:Constitution, configuration, conformation and the order of chemical bonds. Chirality and symmetry elements. Configuration of stereocenters and bonds. Chiral and achiral conformations and molecules. Constitutional and stereoisomers. Enantiomerism and diastereomerism. Enantiomeric and diastereomeric conformations and molecules. Symmetry of groups and faces: diastereotopic, enentiotopic and homotopic relations. Physical and chemical requirements of enantiomerism: stereoselective and stereospecific reactions, optical activity. Relative and absolute configuration. Optical inactivity of the achiral molecules. Substitution reactions at centers of asymmetry: inversion, retention, racemization. Racemic and mezo compounds. Atropisomerism. Nitrogen inversion. Center of asymmetry, axis of asymmetry, pseudoasymmetric centers. Dynamic properties. Tutomerism. Effects influencing tautomeric equilibria. Types of tautomers. Mutarotation. Asymmetric synthetic methods Definition and classification of stereoselective transformations. Background and methods of enentiomeric composition determination. Enantiomer selectivity. Principle of resolution. Chiral reagents and catalysts. Kinetic resolutions by biological systems. Dynamic kinetic resolutions by biological systems. Basics of diastereotopic and enentiotopic selectivity. Basic principles of asymmetric reactions by chemical and biological systems. Stoichiometric and heterogeneous catalytic asymmetric reactions. Asymmetric reactions by homogenous catalytic systems and by biological systems. Asymmetric reactions of industrial importance.

Subject code	Subject name	Requirement	ECTS credit
BMEVESTA411	Organic Chemical Technology	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	28a	English	MON:10:15-12:00

The subject shows the typical fields, equipment and transformations of the organic chemical industry. The relevant fields discussed are: C1-, C2- and C3- intermediates, as well as aromatic substrates; detergents, washing powders and environmental considerations; pesticides, such as insecticides, fungicides and herbicides, toxicity and environment; features of the pharmaceutical industry, typical syntheses and technologies illustrated by the examples of some drugs selected; principles of green chemistry, environmental-friend considerations; characteristics of the plastic and rubber industry, recycling of thermoplastics; the textile and dye industry, natural and synthetic dyes.

Subject code	Subject name	Requirement	ECTS credit
BMEVESZA401	Organic Chemistry II.	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A10-ER	English	TUE:10:15-13:00

Derivatives of carbonic acid; Diazomethane, diazonium salts; Sulfur and phosphor-containing compounds; Unsaturated carboxylic acids, lipids; Substituted acids; alpha;-, beta;-, gamma;-, and delta;-halogen, hydroxy, and oxo acids and derivatives. Stereochemistry; Amino acids and proteins; Carbohydrates; Nucleic acids; Polycyclic aromatic compounds; Heterocycles;

Subject code	Subject name	Requirement	ECTS credit
BMEVESZA403	Medicines	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	8a	English	TUE:08:15-10:00

The subject gives a breaf introduction to the medicinal chemistry and pharmacology. The fundamental pharmacological definitions and ideas as well as a historical outline of drug discovery and design are presented. Selected examples of drug action at some common target areas demonstrate the importance of the special receptor-drug interactions and the improtance of chemical modifications of the leading molecules to produce highly selective medicines. Typical examples are also discussed for drug metabolism including several organic chemicals and solvents which are important for the organic chemists.

Subject code	Subject name	Requirement	ECTS credit
BMEVESZM101	Organic Chemistry	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A10-ER	English	THU:10:15-13:00

In the frame of this subject the teaching of basic knowledge in modern organic chemistry is carried out at an advanced level. The aim of the subject is to make acquainted the M.Sc students with the theory, the molecular structures, the stereochemistry, the kinetics and the synthetic strategies applicable in organic chemical reactions taking place in idustrial sytheses, in plastic industry, in biochemical processes and in the environment. Short syllabus of the subject: The theory and application of the most important types of reactions: nucleophilic and electrophilic substitutions, addition to multiple carbon-carbon bonds, polymerization, elimination, nucleophilic addition and addition-elimination at carbonyl groups, nucleophilic addition and addition-elimination at conjugated systems, polycondensation, ring closing and ring opening reactions, processes accompanied by rearrangements. Simple reactions and polimerizations taking place by radical mechanism. Static stereochemistry and dynamic stereochemistry. Basics of planning synthesis; kinetical, molecule structural and stereochemical aspects in planning synthesis. Planning of synthesis: retrosynthetic analysis. Synthetic strategies: linear and convergent syntheses, synthons, inverse synthons, synthetic equivalents, stereochemical questions. Using of heterocycles and natural products (sugars, amino acids, alkaloids and their synthetic analogues) in organic syntheses. Bio- and chemo-catalysis: regio- and stereoselectivity. Applying of enantioselective synthetic methods in building up of complex natural products containing more than one stereocenters. Special synthetic technics. Chemical syntheses using solid supports. The basics of combinatorial chemistry. The theory of molecular recognition and its use in analytical and separation technics

Subject code	Subject name	Requirement	ECTS credit
BMEVEVMA504	Chemical Process Control	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	lab.prac_ER	English	THU:12:15-14:00
Lecture	theor_ER	English	TUE:14:15-16:00
Practice	prac_ER	English	THU:12:15-14:00

Aims of the chemical process control. Areas and methods of process control, feed forward control, feed back control. Mathematical basics, dynamic behaviours. Transfer function, frequency function. Model and modelling of chemical units and process from control point of view. Stability, its definitions in time, frequency, and Laplace domain. Controllers, controller algorithms, different controls and their characterizations. Controller tuning. Actuators, control valves. Basic controls: level, flow, pressure, temperature controls. Cascade controls. Control of multivariable processes. Interaction among control loops. Examples and solutions for the control of chemical units and processes.

Subject code	Subject name	Requirement	ECTS credit
BMEVEVMA607	Environmental Benign Chemical Process	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	english_ER	English	WED:11:15-14:00

Green chemistry metrics: The concepts of green chemistry, green engineering and sustainability. The necessity of quantifying a green reaction/process/product/firm. E factor, EQ factor, CI. Atom selectivity, atom efficiency, stoechiometric factor, conversion, reaction mass efficiency, material recovery parameter. Metrics to be applied for a process/production: mass index; energy factors: life cycle, waste treatment, solvent recovery; intensity factors: solvent, waste, energy; Emission control ndash;Example: Gas purification: Regulation aspects, Best available technology concept, Nitric acid production, environmental considerations in process development; Processes under vacuum: Sublimation, Freeze drying, lyophilization, Evaporation under vacuum, Short-path distillation, Molecular distillation; High-pressure processes: High-pressure distillation, Pressure-sensitive distillation (breaking azeotropes), High pressure processing of food; Supercritical fluid extraction and other processes: Supercritical fluids, properties, Solubility in supercritical fluids, Supercritical fluid extraction and fractionation, Chemical and biochemical reactions in supercritical fluids, Particle formation (crystallization) using supercritical fluids, Supercritical fluid chromatography; Biofuels (raw materials, by-products): Bioethanol, Biodiesel: trans-estherification; gasification; Fischer ndash; Tropsch synthesis, Biogas: hydrolysis; fermentation/digestion; purification; Recovery of organics from water:

Separation of ethanol: azeotropic distillation, extractive distillation, liquid-liquid extraction, adsorption, membrane separations; Separations in fine chemical ndash; biochemical industry: Aqueous biphasic extraction, Chromatographic techniques (size exclusion, ion-exchange), Example: IgG purification from a fermentation broth.

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
BMEEOAFAT42	Surveying II.	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:12:15-14:00(ONLINE); MON:12:15-14:00(ONLINE)
Practice	EN6	English	THU:12:15-14:00(KF27k); THU:12:15-14:00(KF27k)
Practice	EN3	English	THU:08:15-10:00(KF27a); THU:08:15-10:00(KF27a)
Practice	EN5	English	THU:12:15-14:00(KF27a); THU:12:15-14:00(KF27a)
Practice	EN4	English	THU:08:15-10:00(KF27k); THU:08:15-10:00(KF27k)
Practice	EN1	English	THU:10:15-12:00(KF27a); THU:10:15-12:00(KF27a)
Practice	EN2	English	THU:10:15-12:00(KF27k); THU:10:15-12:00(KF27k)

Properties of analogue and digital maps, the application of maps in engineering practice.Traversing, the types of traverse lines. Localizing blunder in traverse lines: the linear and angular error.Offset surveys. The determination of the horizontal and vertical positions of detail points: the tacheometry. Total stations and their application in surveying. Topographic surveys: reconnesaince, sketch, detail survey and mapping. Free stationing. The principles of computational adjustments, the law of error propagation. Construction tolerances and the fundamental of geometrical quality control. Horizontal and vertical deformation monitoring. Setting out straight lines, curves, transition curves and points in a given elevation.The global navigation satellite systems (GPS, GLONASS, Galileo, …) and their application in surveying.Building surveys. The localization of underground public utilities. Mapping public utilities and the public utility register.

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	
Practice	EN2	English	
Practice	EN3	English	

Using the theoretical background of the courses Surveying 1 amp; 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
BMEEOAFPRE4	Basic Surveying	Mid-semester mark	0

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:10:15-12:00(ONLINE); WED:10:15-12:00(ONLINE); THU:08:15-10:00(ONLINE); THU:08:15-10:00(ONLINE)

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
BMEEODHAS41	Design of Structures Projectwork	Mid-semester mark	6

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

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
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
BMEEOEMAS42	Building Construction I.	Exam	3

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

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(ONLINE)
Practice	EN1	English	MON:12:15-14:00(ONLINE); MON:12:15-14:00(ONLINE)

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
BMEEOEMAT42	Civil Engineering Representation and Drawing	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:10:15-12:00(K174); FRI:10:15-12:00(K174)

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
BMEEOEMAT43	Construction Materials I.	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	EN3	English	THU:10:15-12:00(MMFL4); THU:10:15-12:00(MMFL4)
Laboratory	EN2	English	THU:08:15-10:00(MMFL3); THU:08:15-10:00(MMFL3)
Laboratory	EN1	English	THU:08:15-10:00(MMFL2); THU:08:15-10:00(MMFL2)
Laboratory	EN4	English	THU:10:15-12:00(MMFP); THU:10:15-12:00(MMFP)
Lecture	EN0	English	WED:10:15-12:00(ONLINE); WED:10:15-12:00(ONLINE)

Basic physical and hydrotechnical characteristics of the most important structural materials: stress, strength, deformation, fatigue, creep, shrinkage, toughness, relaxation, brittleness, hardness. Binding materials: Lime, gypsum, production of cements, the klinker minerals, hydration and properties. Mortar. Concrete: Aggregates, admixtures. Fresh concrete: consistency, mix design. Hardened concrete: Interpretation of strength, and its evaluation. Metals: iron, steel yield strength, ultimate tensile strength, ultimate strain, influence of temperature, weldability. Timber. Mechanical properties, shrinkage, swelling. Bricks and masonry . Main constituents and porperties of glass. Types of polymers.

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	TUE:14:15-16:00(ONLINE)
Practice	EN2	English	MON:10:15-12:00(ONLINE); MON:10:15-12:00(ONLINE)
Practice	EN1	English	MON:10:15-12:00(ONLINE); MON:10:15-12:00(ONLINE)

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
BMEEOEMK601	Building Materials 2.	Exam	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	
Lecture	EN0	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEOFTAT42	Civil Engineering Informatics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	MON:14:15-16:00(ONLINE); MON:14:15-16:00(ONLINE)
Laboratory	EN2	English	MON:14:15-16:00(ONLINE); MON:14:15-16:00(ONLINE)
Laboratory	EN3	English	WED:14:15-16:00(ONLINE); WED:14:15-16:00(ONLINE)
Laboratory	EN4	English	WED:14:15-16:00(ONLINE); WED:14:15-16:00(ONLINE)
Lecture	EN0	English	THU:16:15-18:00(ONLINE); THU:16:15-18:00(ONLINE)

The course gives an overview on the major areas of informatics, on the components of information technology systems. Besides supporting the labs, some practical problems and particular tasks are also discussed on the lectures. On the labs, students use spreadsheet application to solve different tasks, then learn the basics of numerical and non-numerical methods in mathematical software environment. Students also learn the basics of programming; most of the tasks have to be solved by own scripts, routines, programs. Civil engineering informatics discusses 2D and 3D computer graphics and the basics of database management that supports high level courses involving spatial construction and database systems.

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

Course type	Course code	Course language	Timetable information
Practice	EN1	English	MON:08:15-10:00(ONLINE); MON:08:15-10:00(ONLINE); FRI:10:15-12:00(ONLINE)
Practice	EN2	English	WED:10:15-12:00(ONLINE); WED:10:15-12:00(ONLINE); FRI:12:15-14:00(ONLINE)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAS41	Rock Mechanics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN3	English	FRI:08:15-10:00(KM26Olt)
Laboratory	EN2	English	FRI:08:15-10:00(KM79)
Laboratory	EN1	English	FRI:08:15-10:00(KM79)
Lecture	EN0	English	FRI:10:15-12:00(K234)

Petrophysical properties of solid rocks, the characterisation of rock blocks and rock masses, the jointing system in the rock environment. The deformation processes and rheological characters in rock mechanics, the influence of joint spacing. The durability and effect of rock environment on the engineering structures. The evaluation of geological conditions in rock environment at tunnels foundations and rocky slopes. The influence of material properties on the petrophysical properties of rocks.

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAS42	Underground Structures, Deep Found.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:12:15-14:00(ONLINE); TUE:12:15-14:00(ONLINE)
Practice	EN1	English	FRI:10:15-12:00(K234)

Types and field of application of deep foundations (stone columns, diaphragm walls). Load transfer mechanizm of deep foundations. Determination the bearing capacity and settlement by different methods (by theoretical formulas,load tests,sounding).Design and construction of Pedestrian subways,Underground garages. Analysis against uplift. Insulations.

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	WED:12:15-14:00(ONLINE); WED:12:15-14:00(ONLINE)
Practice	EN1	English	TUE:14:15-16:00(ONLINE); TUE:14:15-16:00(ONLINE)

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	WED:12:15-14:00(ONLINE); WED:12:15-14:00(ONLINE)
Practice	EN1	English	FRI:08:15-10:00(KF88)
Practice	EN2	English	FRI:08:15-10:00(KF88)

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
BMEEOGMMG-1	Engineering Geology MSc	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:08:15-10:00(ONLINE); MON:08:15-10:00(ONLINE)
Practice	EN1	English	TUE:08:15-10:00(KF88)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG-3	Geotechnical design	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:14:15-16:00(ONLINE); THU:14:15-16:00(ONLINE)
Practice	EN1	English	THU:16:15-17:00(ONLINE); THU:16:15-17:00(ONLINE)

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG-4	Earthworks of Infrastructures	Mid-semester mark	4

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG61	Tunneling	Mid-semester mark	3

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG62	Hidrogeology	Mid-semester mark	3

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMG64	Engineering Geology of Hungary	Mid-semester mark	3

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMMS51	Geodynamics	Mid-semester mark	3

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

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:12:15-14:00(ONLINE); THU:12:15-14:00(ONLINE)

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:10:15-12:00(ONLINE); THU:14:15-16:00(ONLINE); THU:14:15-16:00(ONLINE)
Practice	EN1	English	THU:10:15-12:00(ONLINE)

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	TUE:08:15-10:00(ONLINE); TUE:08:15-10:00(ONLINE); THU:08:15-10:00(ONLINE)
Practice	EN1	English	THU:08:15-10:00(ONLINE)

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-B2	Reinforced Concrete Bridges	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:12:15-14:00(KF88); FRI:12:15-14:00(KF88)
Practice	EN1	English	FRI:14:15-15:00(KF88); FRI:14:15-15:00(KF88)

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

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

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
BMEEOHSAS44	Timber Structures	Mid-semester mark	3

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

Introduction and comparative analysis of existing timber structures. Material characteristics and strength grades of timber material. Design of timber structural members for ULS according to EC5 (compression, tension, bending, shear, torsion, combined actions, stability analysis). Design of timber structural members for SLS according to EC5 (deformations, durability). Basis of the fire design of timber structures. Design of single and multiple shear plane connections with metal dowel-type fasteners (nailed and bolted connections). Design of connections with punched metal plate fasteners, split ring connectors and toothed plate connectors. Bonded connections, design of glued-laminated timber structures. Analysis of stress concentration sites in timber structures. Constructive protection methods and typical construction details of timber structures.

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSAS45	3D Constructional Modelling of Structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	WED:10:15-12:00(ONLINE); WED:10:15-12:00(ONLINE)

The aim of the course is to introduce the 3 dimensional detailing of steel-, reinforce concrete- and timber structures to the students. The course intends to develop basic practical skills by real 3D modelling of structures where the model is able to provide drawings and lists automatically for fabrication and construction processes. The course provides insight into the integration of the 3D constructional model of structures with other branches like architectural, mechanical, electrical and plumbing models into a BIM (Building Information Modelling) model. The students will learn the necessary knowledge and also obtain experience for the later project home works and diploma works by the help of presentations, small examples and a modelling home work.

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:12:15-14:00(ONLINE); MON:12:15-14:00(ONLINE); MON:14:15-16:00(ONLINE)

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	TUE:08:15-10:00(ONLINE); THU:10:15-12:00(ONLINE); THU:10:15-12:00(ONLINE)

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	TUE:08:15-10:00(ONLINE); WED:08:15-10:00(ONLINE); WED:08:15-10:00(ONLINE)

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	FRI:08:15-09:00(ONLINE); FRI:08:15-09:00(ONLINE)
Practice	EN1	English	FRI:09:15-10:00(ONLINE); FRI:09:15-10:00(ONLINE)

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:08:15-10:00(K234); THU:08:15-10:00(K234)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMT-1	Structures 2	Exam	4

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMT-2	Stability of Structures	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(ONLINE); TUE:08:15-10:00(ONLINE)
Practice	EN1	English	TUE:10:15-11:00(ONLINE); TUE:10:15-11:00(ONLINE)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMT-3	Seismic Design	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:13:15-15:00(KM26Olt); THU:13:15-15:00(KM26Olt)
Practice	EN1	English	THU:15:15-16:00(KM26Olt); THU:15:15-16:00(KM26Olt)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMT61	Applied Fracture Mechanics	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:10:15-12:00(KM26Olt); THU:10:15-12:00(KM26Olt)
Practice	EN1	English	THU:12:15-13:00(KM26Olt); THU:12:15-13:00(KM26Olt)

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMT62	Prestressing Technologies	Mid-semester mark	3

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOHSMT63	Strengthening of Structures	Mid-semester mark	3

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

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:16:15-18:00(ONLINE); WED:16:15-18:00(ONLINE)

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
BMEEOTMAT41	Basics of Statics and Dynamics	Exam	6

Course type	Course code	Course language	Timetable information
Practice	EN1	English	MON:10:15-12:00(ONLINE); MON:10:15-12:00(ONLINE); MON:14:15-16:00(ONLINE); TUE:12:15-14:00(ONLINE); TUE:12:...

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	EN2	English	THU:12:15-14:00(K174); THU:12:15-14:00(K174); THU:14:15-16:00(K174); FRI:08:15-10:00(K174); FRI:08:15-10...
Practice	EN1	English	THU:12:15-14:00(K234); THU:12:15-14:00(K234); THU:14:15-16:00(K234); FRI:08:15-10:00(K234); FRI:08:15-10...

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	FRI:10:15-12:00(KM26Olt); FRI:10:15-12:00(KM26Olt); FRI:12:15 -14:00(KM26Olt); FRI:12:15-14:00(KM26Olt)

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
BMEEOTMMN-1	Structural Dynamics	Mid-semester mark	4

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMN61	Plasticity	Mid-semester mark	3

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMN62	Nonlinear FEM	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:11:15-13:00(ONLINE); TUE:11:15-13:00(ONLINE)

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMN63	Analysis of Rods and Frames	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:15:15-16:00(ONLINE); MON:15:15-16:00(ONLINE)
Practice	EN1	English	MON:16:15-17:00(ONLINE); MON:16:15-17:00(ONLINE)

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMMN64	Discrete Element Method	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:17:15-18:00(ONLINE); MON:17:15-18:00(ONLINE)
Practice	EN1	English	MON:18:15-19:00(ONLINE); MON:18:15-19:00(ONLINE)

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	MON:08:15-10:00(ONLINE); MON:08:15-10:00(ONLINE)

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMOM04	Biomechanics	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	00	English	
Practice	01	English	

Subject code	Subject name	Requirement	ECTS credit
BMEEOTMPRE3	Basic Mechanics	Mid-semester mark	0

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:08:15-10:00(K389); FRI:08:15-10:00(K389); FRI:10:15-13:00 (K389); FRI:10:15-13:00(K389)

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

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

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(ONLINE); MON:14:15-16:00(ONLINE)

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
BMEEOVKAT41	Basics of Environmental Engineering	Mid-semester mark	3

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

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	TUE:16:15-18:00(ONLINE); TUE:16:15-18:00(ONLINE)
Practice	EN1	English	WED:14:15-16:00(ONLINE)

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
BMEEOVVAT41	Hydrology I.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-12:00(ONLINE); MON:10:15-12:00(ONLINE)
Practice	EN1	English	WED:14:15-16:00(ONLINE)

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
BMEEOVVAT42	Hydraulics I.	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:10:15-12:00(ONLINE); TUE:10:15-12:00(ONLINE)
Practice	EN2	English	WED:12:15-14:00(ONLINE)
Practice	EN1	English	WED:12:15-14:00(ONLINE)

Physical properties of water. Hydrostatics: pressure distribution, absolute and relative equilibrium. Equilibrium of submerged and floating bodies. The flow of fluids: velocity, discharge, continuity, specific energy head, other properties. Laminar and turbulent motion. Behaviour of ideal and real fluids. Outflow, through-flow. Channel flow. Hydraulic jump, energy breaker. Weirs, sluice-gates. Steady-state flow in pipes. Seepage in porous media. Wells. Turbo-machines.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVAT43	Hydraulic Engineering, Water Management	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:08:15-10:00(ONLINE); THU:08:15-10:00(ONLINE)
Practice	EN2	English	THU:16:15-18:00(ONLINE)
Practice	EN1	English	WED:10:15-12:00(ONLINE)

The tasks, methods and tools of water management. Hungarian and European specialities of water management. Types and tasks of hydraulic engineering structures with the following topics: Watershed management of lowland and hilly areas, regulation of lakes and rivers, reservoirs and storage, flood control and land drainage, inland navigation, water power development, water intake and pumping stations, small hydraulic engineering structures, caracteristic environmental impacts of hydraulic engineering structures. During the practical lessons four design works will be elaborated.

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVPRE5	Basic Hydraulics	Mid-semester mark	0

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

Basic knowledge on the mechanics of fluids: basic physical quantities and their measurement, standard units of measurements, behaviour of fluids at rest and in motion, fundamental laws of hydrostatics and fluid dynamics /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:10.0pt; font-family:"Times New Roman",serif;}

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	EEN02BM	English	TUE:08:15-10:00; THU:08:15-10:00

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 Associate Professor Dept. of Management and Business Economics, QB305, szigetisz@mvt.bme.hu János Kövesi Professor Dept.of Management and Business Economics, QA315, kovesi@mvt.bme.hu Noémi Kalló, PhD Associate Professor Dept.of Management and Business Economics, QA308, kallo@mvt.bme.hu Tibor Szabó, PhD Assistant Professor Dept.of Management and Business Economics, 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
BMEGT20A048	Marketing	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EEN02BM	English	
Practice	GEN02BM	English	

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
BMEGT20MN03	Quality Management	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EEN02BM	English	

During the semester students get acquainted with the most important issues and methods of the improvement of quality management systems. They are provided with an overview of the most common quality philosophies applied for the improvement of quality in the productive and service industry. We elaborate the application and requirements of self-evaluation models and their roles in total quality management philosophy. Another objective is to improve the skills of students regarding the application of quality management tools and techniques.

Subject code	Subject name	Requirement	ECTS credit
BMEGT301004	Economics I.	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN32BM	English	

Objectives and description of the course: The aim is to allow students to understand todayrsquo;s economic environment. After having finished the course, students should understand the key concepts of microeconomics (e.g. opportunity cost, supply and demand, market equilibrium, prices, cost functions, profit, competition and monopoly), master a basic set of tools of economic analysis and demonstrate the ability to apply them to simple practical problems. This course is primarily designed as an introduction to microeconomic theory for undergraduate students pursuing a bachelorrsquo;s degree in engineering. Both the course and the recommended textbook are accessible to students without a strong math background. Integral calculus is not used and the most important ideas are also demonstrated in graphs.

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

Course type	Course code	Course language	Timetable information
Lecture	EFR15BM	French	
Lecture	EEN31BM	English	WED:08:15-10:00; THU:12:15-14:00

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 ldquo;choicerdquo; 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
BMEGT30MS07	Economic Analysis of Technology	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EEN14VE	English	TUE:08:15-10:00

Objectives and description of the course: Recently the education in different fields of engineering does not contain only the traditional topics of technology, but also elements from economic sciences. Thus engineers will be engaged to understand economic consequences of their decisions. The aim of the present subject is to give an introduction into this field based on empirical investigations as well as on theoretical approaches. After a short introduction it will be shown how basic categories could be used to describe the situation being under consideration. It follows the detailed investigation of the special relationship between technology and costs, again based on empirics and on traditional models. The next block contains questions dealing with the economic consequences of technological decisions, e. g. exhausting of natural resources, transport problem, environmental decisions, choosing production places, etc. Finally, problems of market structure (free competition, monopoly, monopolistic competition, oligopoly, etc.) caused by technology will be analyzed.

Subject code	Subject name	Requirement	ECTS credit
BMEGT30N002	Industrial Organization	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	EEN14BM	English	THU:14:15-16:00(QAF16)

This course is about different theoretical approaches to the organization and institutions of a market economy. The of the course is to get students acquainted with the most recent theories of different market structures and to their potential applications to practical problems related to market strategy and market regulation. After having finished the course, students should understand the key concepts of monopolistic and oligopolistic markets, the ways companies play their strategic games under different market conditions and the role a government can and should play in correcting market failures. /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:10.0pt; font-family:"Times New Roman",serif;}

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

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	

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Subject code	Subject name	Requirement	ECTS credit
BMEGT41M410	Epistemology	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	

Epistemology, especially naturalized epistemology and the neuroscience of epistemology witnessed exceptional measures of development in the last decade. This lecture introduces students to the basic issues of epistemology in order to make them understand the deeper levels of debates on the field. Accordingly the teaching material covers the problem of justification, especially the different sources of knowledge and their cognitive grounds. Further topics, such as the problem of extended minds, the knowledge of mixed systems such as computer-human cooperation, group knowledge and the knowledge attribution to agents in dynamic game-theoretical models are discussed in order to provide an insight to the most recent topics in epistemology. The course teaches students to write a paper in English eligible for later publication and also provides an introduction to the main questions of recent epistemological disputes relevant to the traditional problems of philosophy of mind, cognition and science.

Subject code	Subject name	Requirement	ECTS credit
BMEGT42A003	Environmental Management Systems	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN31GE	English	

The course covers the topics relevant to the protection of environmental compartments, environmental pressures and pollution in a global context. The course introduces the concepts, indicators and tools of environmental protection, and the environmental management systems (EMS) at enterprises and other organizations. EMS topics include the assessment of environmental aspects and impacts, environmental audits, reporting, environmental performance evaluation, life cycle assessment.

Subject code	Subject name	Requirement	ECTS credit
BMEGT42A011	Environmental Economics	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EEN05GT	English	THU:12:15-14:00

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

Course type	Course code	Course language	Timetable information
Lecture	EEN26BM	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
BMEGT42M105	Environmental and Regional Politics of the EU	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EEN07GT	English	MON:12:15-16:00

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

Course type	Course code	Course language	Timetable information
Lecture	EEN05GT	English	MON:10:15-14:00

Subject code	Subject name	Requirement	ECTS credit
BMEGT42N003	Environmental Management of Energy	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN15BM	English	THU:10:15-12:00

The aim of the subject is to introduce and expand the scope of sustainable energy and resource management both on a domestic, EU and global scale, primarily from the corporate and policy aspects. The course will give an

overview of the energetic status and trends in the EU and the world. It will give an introduction to Energetic Life Cycle Analysis. Business model of energetics and energy enterprises. EU energy policy, environmental and sustainability strategies. Energy strategies and energy-saving programmes. A Sustainability analysis of the environmental effects of the different kinds of sources of energy. Energetic interrelations in climate protection. Pollutions from energetic sources in Hungary and the EU. State institutions of energy and environmental protection policy. Summary and future perspectives.

Subject code	Subject name	Requirement	ECTS credit
BMEGT42V101	BME International Climate Change Role-Play	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN03BM	English	TUE:16:15-19:00

Subject code	Subject name	Requirement	ECTS credit
BMEGT431143	Sociology of Culture	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	WED:16:15-18:00(E202)

SOCIOLOGY OF CULTURE The course introduces basic theories of the Sociology of Culture relating to identity, subcultures, cultural differences and ethnicity, as well as presenting and discussing their practical relevance. Throughout the term, we will critically examine the concepts of high, mass and subculture, as well as those of nation, tradition, and community. The aim of this critical inquiry is not the relativisation of the mentioned concepts, but the introduction of those processes of social construction that lead to the emergence, consolidation and at times (re) negotiation of these categories and the related values and emotions. Through such inquiry, we are aiming towards a more nuanced understanding of the social- cultural conflicts of todayrsquo;s globalised society by the end of the term. Beyond presenting relevant theories and literature, the goal is to discuss the practical relevance and applicability of the observations through examples taken from across the globe.

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:12:15-14:00(E602)

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
BMEGT43A044	Sociology for Architects	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	WED:12:15-14:00(E505)

The course aims at giving an insight for the students into the nature of major social phenomena by demonstrating their main characteristics and their key interpretations in social sciences through the standard as well as the most up -to-date frameworks, methods and results with a clear and distinct focus on urbanisation and urban affairs. Major themes discussed during the course are Modernisation, Society and People, The Social Perspective, The Foundation and Construction of the Society, Social Stratification, Economy and Society, Community and identity, Social Institutions, Transformations of the Society, Globalisation, Urbanisation and Society, Metropolis and urban changes, Urban space and place.

Subject code	Subject name	Requirement	ECTS credit
BMEGT43A186	Philosophy of Art	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	WED:14:15-16:00(E301)
Practice	GEN01ER	English	WED:16:15-18:00(E301)

The course will introduce students to some major issues and problems in aesthetics and the philosophy of art. We will study a number of philosophical questions about the nature, the production, the interpretation and the appreciation of works of art. After studying the basic philosophical categories concerning art and artworks we will concentrate on specific aspects of the creation and appreciation of paintings, drawings, photographs, moving

images, digital images, fictions, music etc. For instance, we will consider questions and arguments about bdquo;realismrdquo; with respect to pictorial works of art, about literature and fictional works, and about the understanding and appreciation of music. Although most of the course will be devoted to the analytic philosophy art, we will also examine issues concerning design practices and products.

Subject code	Subject name	Requirement	ECTS credit
BMEGT43M302	Local Development and Social Policy	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	TUE:08:15-10:00(E501)

Subject code	Subject name	Requirement	ECTS credit
BMEGT43MS07	Social and Visual Commucation	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	WED:12:15-14:00(E301)

Subject code	Subject name	Requirement	ECTS credit
BMEGT43V104	Popular Music	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01ER	English	WED:14:15-16:00(E201)

Subject code	Subject name	Requirement	ECTS credit
BMEGT51A020	(Lifelong) Learning and Working Life	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EHU01GT	English	WED:16:15-18:00(QA139)

(Lifelong) Learning and Working Life Neptun code: BMEGT51A020 (BSc/BA) Credit: 2 credits Responsible Department: Department of Technical Education Semester: autumn/spring Emphasizing the development of independent problem-identifying and problem-solving skills by analysing the global labour market challenges. In the framework of optional exercises and self-controlled learning processes and by acquiring the steps of program planning concentrating on the field of technology, training orientation possibilities are granted to participants in their fields of interest. During the training period we will present the practical applicability and large scale practice orientation through theoretical knowledge, wide-range technological examples, case-studies and the analysis of changes. The participants of the course will gain the necessary knowledge and competences for understanding the importance of sustaining the lifelong competitive knowledge.by making individual job and scope of activities analysis based on their own learning competences and methods. They will understand the problems of learning skills as life skills, a new type of human capital, networking, teamwork and working methods in the context of lifelong learning. What does not only surviving but being successful in the dynamically changing professional and global environment today mean? What does it mean:” to be locally engaged while visible globally’ , What does the New Deal of Lifelong Learning means for the new generation. What are the key massages and trends after the World Economic Forum 2017/

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

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	

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
BMEGT52A002	Psychology	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN01BM	English	

Human cognition: Sensation: sensory systems, vision, hearing, the chemical senses, somatic senses and the vestibular system. Perception: organising the perceptual world, theories and illusions. Attention, focussed and

divided attention. Memory: three stages of memory: sensory, short-term and long-term. Some phenomena of memory: mnemonics, peg word system, interferences. Thinking: human information processing system. Decision making and problem solving. Mental abilities, intelligence and creativity, cognitive styles. Learning, classical and instrumental theory of conditioning. Cognitive processes in learning: insight, latent learning and cognitive maps. Social learning. Motivation: Basic concepts of motivation. Work and motivation: achievement, satisfaction and procrastination. Emotion, emotional intelligence (Goleman). Stress and coping system, some stress-coping programmes. Type A behaviour. Personality: Studying personality (tests), psychodynamic (Freud, Jung), behavioural, and phenomenological (Rogers, Maslow) approaches. The individual in the social world: Some basic sources of social influence, social perception, first impressions, group stereotypes and prejudice, attribution theory. Attitudes and persuasion. Group influences and interpersonal behaviour. Communication: assertiveness, social skills in communication.

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	EEN01BM	English	

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. /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:10.0pt; font-family:"Times New Roman",serif;}

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

Course type	Course code	Course language	Timetable information
Lecture	EEN05ER	English	MON:10:15-12:00

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.

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
BMEVIEEAV99	Solar Cells and Renewable Energy Sources	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	a1	English	

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAA02	Computer Architectures	Exam	4

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	EA	English	THU:09:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIHIAC01/en/ This course gives an overview of the different areas of IT security with the aim of increasing the security awareness of computer science students and shaping their attitude towards designing and using computing systems. The course prepares BSc students for security challenges that they may encounter during their professional carrier, and at the same time, it provides a basis for those student who want to comtinue their studies at MSc level. We put special emphasis on software security and the practical aspects of developing secure programs.

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

Course type	Course code	Course language	Timetable information
Lecture	E	English	

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAV37	V2X Communication Technologies of Autonomous Vehicles	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	
Practice	GA	English	

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

Course type	Course code	Course language	Timetable information
Laboratory	LA2	English	
Laboratory	LA1	English	

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

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

https://portal.vik.bme.hu/kepzes/targyak/VIHIMA07/en/ The objective of this course is to introduce today’s modern wireless and mobile systems to our students. This contains basic knowledge needed to operate and maintain such networks. Further goal of this course is to show the possibilities and operations of advanced radio and wireless solutions, through practical examples.amp;lt;!-- --amp;gt; amp;lt;!-- /* Font Definitions */ @font-face {font-family:"MS Mincho"; panose-1:2 2 6 9 4 2 5 8 3 4; mso-font-alt:"MS ??"; mso-font-charset:128; mso-generic-font-family:modern; mso-font-pitch:fixed; mso-font-signature:-536870145 1791491579 18 0 131231 0;} @font-face {font-family:"MS Mincho"; panose-1:2 2 6 9 4 2 5 8 3 4; mso-font-alt:"MS ??"; mso-font-charset:128; mso-generic-font-family:modern; mso-font-pitch:fixed; mso-font-signature:-536870145 1791491579 18 0 131231 0;} @font-face {font-family:Cambria; panose-1:2 4 5 3 5 4 6 3 2 4; mso-font-charset:0; mso-generic-font-family:roman; mso-font-pitch:variable; mso-font-signature:-536870145 1073743103 0 0 415 0;} @font-face {font-family:"\@MS Mincho"; panose-1:2 2 6 9 4 2 5 8 3 4; mso-font-charset:128; mso-generic-font-family:modern; mso-font-pitch:fixed; mso-font-signature:-536870145 1791491579 18 0 131231 0;} /* Style Definitions */ p.MsoNormal, li.MsoNormal, div.MsoNormal {mso-style-unhide:no; mso-style-qformat:yes; mso-style-parent:""; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:12.0pt; font-family:"Cambria","serif"; mso-ascii-font-family:Cambria; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:"MS Mincho"; mso-fareast-theme-font:minor-fareast; mso-hansi-font-family:Cambria; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-ansi-language:EN-US; mso-fareast-language:EN-US;} p.MsoCommentText, li.MsoCommentText, div.MsoCommentText {mso-style-noshow:yes; mso-style-priority:99; mso-style-link:"Jegyzetszöveg Char"; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:12.0pt; font-family:"Cambria","serif"; mso-ascii-font-family:Cambria; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:"MS Mincho"; mso-fareast-theme-font:minor-fareast; mso-hansi-font-family:Cambria; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-ansi-language:EN-US; mso-fareast-language:EN-US;} span.MsoCommentReference {mso-style-noshow:yes; mso-style-priority:99; mso-ansi-font-size:9.0pt; mso-bidi-font-size:9.0pt;} span.JegyzetszvegChar {mso-style-name:"Jegyzetszöveg Char"; mso-style-noshow:yes; mso-style-priority:99; mso-style-unhide:no; mso-style-locked:yes; mso-style-link:Jegyzetszöveg;} .MsoChpDefault {mso-style-type:export-only; mso-default-props:yes; font-size:12.0pt; mso-ansi-font-size:12.0pt; mso-bidi-font-size:12.0pt; font-family:"Cambria","serif"; mso-ascii-font-family:Cambria; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:"MS Mincho"; mso-fareast-theme-font:minor-fareast; mso-hansi-font-family:Cambria; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-ansi-language:EN-US; mso-fareast-language:EN-US;} @page WordSection1 {size:612.0pt 792.0pt; margin:72.0pt 72.0pt 72.0pt 72.0pt; mso-header-margin:35.4pt; mso-footer-margin:35.4pt; mso-paper-source:0;} div.WordSection1 {page:WordSection1;} --amp;gt; /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:12.0pt; font-family:"Cambria","serif"; mso-ascii-font-family:Cambria;

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

Course type	Course code	Course language	Timetable information
Lecture	A2	English	MON:14:15-16:00; MON:14:15-16:00; TUE:10:15-12:00
Practice	C2	English	FRI:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIHVAA00/en/ The objective of the two semester Signals and Systems classes is to introduce the basic concepts of signal and system, and to provide computational methodologies to continuous and discrete time systems. The first semester (Signals and Systems I) presents the time domain and the sinusoidal steady state analysis. The examples refer to continuous systems represented by Kirchoff type electric circuits. The principles to formulate the models and the methods to solve the resulting equations are discussed. The students fulfilling the requirements of this class will be able to apply the methodologies of system and network analysis in the time domain and in the frequency domain in case of sinusoidal excitation. Synopsis: 1-2. classes (1. week) Basic concepts: signals, systems and circuits. System properties: linearity, causality and time – invariance. Input – output relationship. Systems represented with electric circuits. Two poles. Kirchhoff type systems. 3-4. classes (2. week) The full set of circuit equations. Series resistors and voltage division. Parallel resistors and current division. The principle of superposition. Node voltage analysis. Mesh current analysis. Source transformations. Maximum power transfer. 5-6. classes (3. week) Coupled two poles: ideal transformer, controlled sources, ideal

operational amplifier and gyrator. 7-8. classes (4. week) Two-Port Resistive Networks. Equations of the Two-Port Networks. Reciprocity, symmetry and passivity of the Two-Ports. Equivalent circuits of reciprocal and nonreciprocal Two-Ports. Two-Ports terminated with Two- Poles. Calculation of the input and transfer characteristics. 9-10. classes (5. week) Dynamic circuits. Capacitors, inductors, coupled capacitors and coupled inductors. Circuit equations. Regularity. Initial conditions. State variables. The normal form of the continuous time state equations. Generation of the continuous time state equations from the full set of circuit equations. 11-13. classes (6-7. week) Solution of the continuous time state equations. The natural response and the forced response. First-order circuits. The time constant of first-order circuits. Sequential switching. Second and higher order dynamic systems and circuits. Higher order dynamic circuits with complex or equal eigenvalues. The concept of stability. 14-16. classes (7-8. week) Step function and Dirac delta function. Generalized derivatives. The Step response and Impulse response of dynamic systems. Calculation of linear time invariant dynamic systems response to arbitrary input with convolution. The concept of bounded-input, bounded-output (BIBO) stability. 17-20. classes (9-10. week) Sinusoidal steady state analysis. Phasor notation. The concept of impedances. The methods of circuit analysis with phasors (node voltage and mesh current analysis, source transformations). Resonant circuits, quality factor, Wheatstone-bridge. Coupled inductors (the model of a transformer). Phasor diagrams. AC Steady state power analysis: averaged power, reactive power, complex power, apparent power, power factor. Maximum power transfer. 21-22. classes (11. week) The concept of the Network Function. Logarithmic units and quantities. The Bode- and the Nyquist- diagram. Two-Port Network equations in frequency domain. The scattering parameters of Two-Ports. Interconnection of Two-Ports and equivalent equations. 23-26. classes (12-13. week) Periodic steady state analysis. Fourier series of periodic signals. The trigonometric, the engineering and the complex Fourier series. Calculation of systems response to periodic excitation. Properties of periodic waveforms: definitions and relations to Fourier series. Periodic steady state power analysis. Averaged power calculations based on Fourier series. 27-28. classes (14. week) Summary, auxiliary.

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVAC04	High Frequency System Techniques	Exam	4

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

https://portal.vik.bme.hu/kepzes/targyak/VIHVAC04/en/ The objective of the subject is to give an overview of the fundamental design considerations applied in high frequency systems (extending up to 3 GHz), along with the properties of common analog and digital modulations schemes, including also OFDM.the following major topics are covered: General radio technology: -noise figure, -linearity, compression of amplifiers, intermodulation, passive intermodulation, linear and nonlinear distortions -mixers, superheterodyne principle, (test) receivers and spectrum analyzers Modulations: -AM, FM, PM (waveforms and spectra), analog QAM -single carrier digital modulations (I/Q-signals, xFSK, xQAM, xPSK) -multi carrier (OFDM) systems: orthogonality, guard interval, transmisison cells /* Font Definitions */ @font-face {font-family:Calibri; panose-1:2 15 5 2 2 2 4 3 2 4; mso-font-charset:238; mso-generic-font-family:swiss; mso-font-pitch:variable; mso-font-signature:-536870145 1073786111 1 0 415 0;} /* Style Definitions */ p.MsoNormal, li.MsoNormal, div.MsoNormal {mso-style-unhide:no; mso-style-qformat:yes; mso-style-parent:""; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:11.0pt; font-family:"Calibri","sans-serif"; mso-ascii-font-family:Calibri; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:Calibri; mso-fareast-theme-font:minor-latin; mso-hansi-font-family:Calibri; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-fareast-language:EN-US;} p.MsoPlainText, li.MsoPlainText, div.MsoPlainText {mso-style-noshow:yes; mso-style-priority:99; mso-style-link:"Csak szöveg Char"; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:11.0pt; mso-bidi-font-size:10.5pt; font-family:"Calibri","sans-serif"; mso-fareast-font-family:Calibri; mso-fareast-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-fareast-language:EN-US;} span.CsakszvegChar {mso-style-name:"Csak szöveg Char"; mso-style-noshow:yes; mso-style-priority:99; mso-style-unhide:no; mso-style-locked:yes; mso-style-link:"Csak szöveg"; mso-bidi-font-size:10.5pt; font-family:"Calibri","sans-serif"; mso-ascii-font-family:Calibri; mso-hansi-font-family:Calibri;} .MsoChpDefault {mso-style-type:export-only; mso-default-props:yes; font-family:"Calibri","sans-serif"; mso-ascii-font-family:Calibri; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:Calibri; mso-fareast-theme-font:minor-latin; mso-hansi-font-family:Calibri; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-fareast-language:EN-US;} @page WordSection1 {size:612.0pt 792.0pt; margin:70.85pt 70.85pt 70.85pt 70.85pt; mso-header-margin:35.4pt; mso-footer-margin:35.4pt; mso-paper-source:0;} div.WordSection1 {page:WordSection1;} --> /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:11.0pt; font-family:"Calibri","sans-serif"; mso-ascii-font-family:Calibri; mso-ascii-

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVAC06	Radio Systems and Applications Laboratory	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	CD	English	WED:16:15-20:00

https://portal.vik.bme.hu/kepzes/targyak/VIHVAC06/en/ The objective of the laboratory is to perform practical experiments related to the topics presented in the subject "High Frequency System Techniques". Besides basic exercises, the measurements focus on demonstrating the theoretical notions on the examples of live practical systems. The following topics are covered: -analog FM systems (mono and stereo broadcasting systems, including RDS as well) -analog TV (optional) - DAB/DAB+, DVB-T/T2/C2, DVB-S/S2/C systems (stream generation, transmission and reception techniques) -digital measurement technology (MER/EVM, CCDF, constellation anlysis, channel analysis, CIR, MER/EVM spectra) /* Font Definitions */ @font-face {font-family:Calibri; panose-1:2 15 5 2 2 2 4 3 2 4; mso-font-charset:238; mso-generic-font-family:swiss; mso-font-pitch:variable; mso-font-signature:-536870145 1073786111 1 0 415 0;} /* Style Definitions */ p.MsoNormal, li.MsoNormal, div.MsoNormal {mso-style-unhide:no; mso-style-qformat:yes; mso-style-parent:""; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:11.0pt; font-family:"Calibri","sans-serif"; mso-ascii-font-family:Calibri; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:Calibri; mso-fareast-theme-font:minor-latin; mso-hansi-font-family:Calibri; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-fareast-language:EN-US;} p.MsoPlainText, li.MsoPlainText, div.MsoPlainText {mso-style-noshow:yes; mso-style-priority:99; mso-style-link:"Csak szöveg Char"; margin:0cm; margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:11.0pt; mso-bidi-font-size:10.5pt; font-family:"Calibri","sans-serif"; mso-fareast-font-family:Calibri; mso-fareast-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-fareast-language:EN-US;} span.CsakszvegChar {mso-style-name:"Csak szöveg Char"; mso-style-noshow:yes; mso-style-priority:99; mso-style-unhide:no; mso-style-locked:yes; mso-style-link:"Csak szöveg"; mso-bidi-font-size:10.5pt; font-family:"Calibri","sans-serif"; mso-ascii-font-family:Calibri; mso-hansi-font-family:Calibri;} .MsoChpDefault {mso-style-type:export-only; mso-default-props:yes; font-family:"Calibri","sans-serif"; mso-ascii-font-family:Calibri; mso-ascii-theme-font:minor-latin; mso-fareast-font-family:Calibri; mso-fareast-theme-font:minor-latin; mso-hansi-font-family:Calibri; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi; mso-fareast-language:EN-US;} @page WordSection1 {size:612.0pt 792.0pt; margin:70.85pt 70.85pt 70.85pt 70.85pt; mso-header-margin:35.4pt; mso-footer-margin:35.4pt; mso-paper-source:0;} div.WordSection1 {page:WordSection1;} --> /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:11.0pt; font-family:"Calibri","sans-serif"; mso-ascii-font-family:Calibri; mso-ascii-theme-font:minor-latin; mso-hansi-font-family:Calibri; mso-hansi-theme-font:minor-latin; mso-

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVAL03	Project Laboratory	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	CD	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHVAL03/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVAT01	BSc Thesis Project	Mid-semester mark	15

Course type	Course code	Course language	Timetable information
Practice	B2	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHVAT01/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVAV09	Windows Native Programming	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	CD	English	THU:12:15-14:00

Microsoft Windows is one of the best known operating systems for PCs. Writing applications for this system requires special programming knowledge, supported by different programming languages and platforms. This subject introduces to native mode programming for Microsoft Windows using the Win32 API (Application Programming Interface) and offers to extend the theoretical and practical knowledge of the students in visualizing, data processing, data communications, etc. The subject provides also the basics of WinRT (Windows Runtime Library) that is supported with Windows 8, and the later UWP (Universal Windows Platform) that has several new functionalities similar to Win32 API but using C++ language. An overview is also gives basic skills in driver development the earlier DDK (Windows Driver Development Kit) and the actual WDK (Windows Driver Kit) /* Style Definitions */

table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:10.0pt; font-family:"Times New Roman","serif";}

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVMA01	Broadband Wireless Telecommunication and Broadcasting Systems	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	A2	English	MON:14:15-16:00
Practice	C2	English	FRI:10:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIHVMA01/en/

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

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVMA07	Communication Theory	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	A2	English	WED:09:15-12:00

https://portal.vik.bme.hu/kepzes/targyak/VIHVMA07/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVML02	Project Laboratory 1	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	CD	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHVML02/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVML03	Project Laboratory 2	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	CD	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHVML03/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVMT02	Diploma Thesis Design 1	Mid-semester mark	10

Course type	Course code	Course language	Timetable information
Practice	HV_a	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHVMT02/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVMT03	Diploma Thesis Design 2	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	HV_a	English	

https://portal.vik.bme.hu/kepzes/targyak/VIHVMT03/en/

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

Course type	Course code	Course language	Timetable information
Laboratory	ALER	English	MON:14:15-18:00
Lecture	AER	English	MON:12:15-14:00

https://portal.vik.bme.hu/kepzes/targyak/VITMAB01/en/To provide both theoretical and practical knowledge about communication networks, especially about telecommunication networks. Starting from the classical telephony networks, through mobile (cell) phone systems and IP access networks, to high speed backbones, the students of this course will get acquainted with the architecture of these networks, along with their main building blocks as well as the communication protocols they apply. This course, in accordance with Communication Networks 1, aims to provide strong foundation for the relevant specialization courses. Synopsis: Introduction to the course Basics

Overview of telephony networks Analog and digital speech transfer Architecture of telephony switches Wired IP access networks Digital subscriber loops (xDSL) Cable television Internet access Optical access networks Voice over IP (VoIP) speech codecs, SIP and H.323 protocols 3play services: Video on Demand, IPTV, etc. Mobile telephony networks overview, GSM, UMTS, HSPA, LTE, satellite telephony systems Signaling Backbone network technologies MPLS and its extensions, optical wavelength- and waveband switching Outlook: Peer-to-peer, AdHoc networks, Machine to machine communication – Internet of Things The lectures are accompanied by laboratory measurements: 3 measurements, each 4x45 minutes, allowing the students to exercise with some of the technologies discussed above (e.g. VoIP, DSL, telephony switches).

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

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

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

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

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

Engineer as a leader (situations and solution): role of informaticians and electrical engineers in the information based society. General trends, business models and the development of value chains. Leader roles, leader tasks and situations. Management of IT based, communication related and business functions in a company. Complex engineering methods in the information transmission and processing, technological and economical optimization of the related processes. Management problems of resource and time allocation, task distribution and scheduling, and workforce placement. Decision preparation techniques: statistical and heuristics based methodologies.Innovation management: tools of innovation management, institutions of innovation management, funding models and typical calls for applications. Organizations of scientific research and technology development, business models of spin-off companies. Conception of technological visions about the future, ways to identify technological breakthroughs, management of generation changes. The process of standardization, its organization and its consequences on technological markets. Intellectual property rights during the innovation process: protection of technical creations, neighboring rights, protection of databases. New trends in IP rights: free software licensing models. Processes of product development and product introduction to the market, market study and marketing methodology. The role of IT technologies in the product and business development, their contribution to the value creation.
https://portal.vik.bme.hu/kepzes/targyak/VITMAK47/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVITMAV24	Performance Evaluation of Infocommunication Systems	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	AE1	English	
Practice	AG1	English	

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

Course type	Course code	Course language	Timetable information
Lecture	AE1	English	TUE:10:15-12:00
Practice	AG1	English	THU:08:15-10:00

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

Subject code	Subject name	Requirement	ECTS credit
BMEVITMMA09	Sensor Networks and Applications	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	AEER	English	
Practice	AGER	English	

https://portal.vik.bme.hu/kepzes/targyak/VITMMA09/en/

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

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

Engineering management (EM) in the knowledge-based society. Definition, role and areas of the EM. The evolution of the EM discipline. Peculiarities, generic trends and EM of the information, communication and electronic media technologies (ICT). Managerial elements of the engineering activity. Components and principles of the managerial activity. Managerial situations, methods and tools. Strategic management. Strategy types and parts. Business strategic planning methods. Classes of competitive strategies. Implementation of strategy: success factors, progress tracing. Methods of the strategic direction and control. Complex engineering decision problems, customer-oriented and systemic approaches, solutions, procedures. Planning and allocation of resources, multi-project management. Management of organizations. Organization types in the ICT sector. Lifecycle, decision culture of organizations, change management. Managing cooperation of organizations, complex working groups. Knowledge management. Knowledge process: accumulation, internalization, adaptation, externalization. Competence. Knowledge sharing and transfer. Knowledge based systems. Types of the intellectual property, principles of intellectual property rights. Open access software. Exploitation of the intellectual properties. Intellectual public utilities. ICT specific EM. Technology management. Technological planning, forecast, transfer, launching, change. Making technology vision, analyzing driving forces, scenarios. Technology-driven business strategies. Corporate ICT functions. Application of the ICT in shaping new business strategies, global work-flows, efficient organization structures. Innovation management. Goals of research, development and innovation. Innovation models and metrics. Management of the innovation process, quality and risks. Innovation chain: university-industry partnership, role of the government. Multi-tier organization and operation of the research-development-innovation management. Innovation financing. National and EU sources, grants, funds, tenders. Development projects. Technological incubators, innovation centers, start-up companies, technological consortia in the ICT sector. Product management. Goals and process of the product development. Markets of the ICT products and services. Market players, competitive environment. Market segmentation. Life-cycle of the product, and its management. Product pricing, price-sensitivity of the customers. Market-research, sale and sale-support methods. Business process management. Analyzing, planning, regulating, improving and transforming corporate business process. Criteria of the process-based management systems. Methods for developing processes. IT in the corporate value creation. Customer relationship management (CRM), operation support systems, supply chain management, business continuity management. Special business functions (e.g. billing), industry-specific systems, IT system architecture of telecommunication service providers. Regulatory environment. Sector regulation. Goals and principles of the regulation in general and in the networked and public service sectors. Competition regulation, consumer protection. Regulatory institutions and procedures, ex-ante and ex-post regulation, self-regulation, public hearing, standards. Regulation of the information and communication technologies and markets. Technology and marker regulatory models in the ICT sector. Regulatory tasks for deploying the convergence of the telecommunications, information and media technology sectors. Community and national regulation of the electronic communications network and services. Framework and specific directives. Rules for the cooperation of the network operators and service providers. Regulation for managing scarce resources, frequency, number and address management. Concept for regulating information security, data protection and content.https://portal.vik.bme.hu/kepzes/targyak/VITMMB03/en/

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
BMEGEENBGHK	Heat transfer G	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	21-2-DEU-E	German	
Practice	21-2-DEU-G	German	

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

Course type	Course code	Course language	Timetable information
Lecture	21-2-ENG-E	English	
Practice	21-2-ENG-LAB	English	
Practice	21-2-ENG-G	English	

The course aims to give a general overview about operation of equipmentsbased on thermodynamical cycles and shows how real processes arerunning inside these equipments. Basics of combustion technology will be introduced also, because in most of the cases heat is gained from combustion. A lot of everyday life energy utilization procedure or system operation is made understandable e.g. principals of firing from camp-fires or domestic heaters to power station boilers, operation principals of air-conditioning, heat pump, steam- and gas-turbine internal combustion engine. Environmental effects and pollution if any will be introduced as well.

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

Course type	Course code	Course language	Timetable information
Lecture	21-2-ENG-E	English	
Practice	21-2-ENG-G	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMLCA	LCA of Power Generation Systems	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	21-2-ENG-LAB	English	
Lecture	21-2-ENG-E	English	

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

Course type	Course code	Course language	Timetable information
Practice	21-2-ENG-G	English	

In course of the Final Project A one student or group of 2 students will work on one selected challenging problem of mechanical engineering. Several experimental and/or numerical project proposals will be announced by the project leaders. The aim of the course is to develop and enhance the capability for complex problem solving of the students under advisory management of their project leader. At the end of each semester a written Project Report is to be submitted and the summary and findings of the investigations on the selected problem is to be presented as Project Presentation.

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

Course type	Course code	Course language	Timetable information
Practice	21-2-ENG-G	English	

The aim of the subject of is to demonstrate the ability of the student to solve high level, practical engineering problems, based on acquired knowledge in the fields of mechanical engineering. The projects have to be prepared by the students under the guidance of supervisors. The Final Projects include tasks in design, simulations, laboratory tests, manufacturing as well as controlling, interfacing and software tasks. The expected result is mostly a Final Report prepared according to written formal requirements. During the Final Exam, the results have to be explained in an oral presentation.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENMWPR	Teamwork project	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	21-2-ENG-LAB	English	

The complex task covers a semester project in the diverse topics of energetics.

Subject code	Subject name	Requirement	ECTS credit
BMEGEENNWAT	Advanced Thermodynamics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	21-2-ENG-E	English	
Practice	21-2-ENG-G2	English	
Practice	21-2-ENG-G1	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEENNWCO	Combustion	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	21-2-ENG-E	English	
Practice	21-2-ENG-G	English	

Important note: According to the rules, any MSc student can be enrolled. However, this subject strongly builds on your existing Fluid dynamics, Thermodynamics, and Heat transfer knowledge. Completion of Heat engines is recommended. CONTENTS This subject is discussing combustion from both fundamental (first half of the semester) and practical point of views (second half of the semester). 1. Introduction, administration. State-of-the-art devices and technologies. Gross reactions. 2. Flame stabilization, fluid dynamics, and non-dimensional numbers. 3. Reaction pathways and pollutant formation. 4. Fuel properties in general. 5. Gaseous, liquid, and solid fuels. 6. Fuel evaporation. 7. Midterm exam 1. 8. Combustion modes and turbulence. 9. Combustion safety and control. 10. Free jet and gas burners. 11. Atomization and liquid fuel burners. 12. Solid fuel burners. 13. Modern combustion chambers. 14. Midterm exam II. REQUIREMENTS 2 midterm exams 1 project/homework

Subject code	Subject name	Requirement	ECTS credit
BMEGEENNWTP	Thermal Physics	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	21-2-ENG-LAB	English	
Lecture	21-2-ENG-E	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEGEAGMD	Machine design	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	
Practice	G1	English	

Mechanical engineering design, development, behavior analysis (stress and stiffness analysis, reliability and service life estimates), knowledge of the behavior of mechanical structures, modeling opportunities, various aspects of the design. Learning the modeling of different characteristics, and of the finite element model creation process and the evaluation of the stress state practicing on simple structural elements.

Subject code	Subject name	Requirement	ECTS credit
BMEGEGIBGG2	Machine elements 2.	Exam	6

Course type	Course code	Course language	Timetable information
Laboratory	AL1	English	
Laboratory	AL2	English	
Lecture	A_EA	English	
Practice	AG2	English	
Practice	AG1	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEGIBXCA	Introduction to cad	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	AL2	English	
Laboratory	AL3	English	
Laboratory	AL1	English	
Lecture	A_EA	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEGTAG92	Machine tools and manufacturing systems	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	1	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEGTNWAM	Advanced Manufacturing	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	A2	English	
Lecture	A1	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEMIAGE1	Control Engineering	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	21t_A_E	English	
Practice	21t_A_G	English	

Modeling dynamical systems with differential equations, frequency response functions, transfer functions and state space models. Stability analysis. Basic aspects of feedback control. Analysis of dynamical control systems. PID controller design and tuning.Topics:Introduction. Modeling physical and technical systems by differential equations. Extensive and intensive variables. Dynamic balance equations.General features of linear input-output systems. Linearization methods. Closed form solutions of first order and second order ordinary differential equations. Step response and impulse response of basic systems.State-space models of linear and nonlinear dynamic systems. Signal flow graphs. Basic principles of numerical simulation. Euler and Runge-Kutta methods. Computer program practices (MATLAB, Excel / Visual Basic, C/C++).Laplace transform, its main properties and applications.Transfer function of linear dynamic systems. Resultant transfer function of complex systems (serial, parallel connections, feedback etc.).Frequency response function. Origination from harmonic input-output. Nyquist plot and Bode plots for basic systems. (MATLAB illustrations.)Asymptotic stability, stability and instability. Conditions for the characteristic roots. Stability criteria: Mikhailov-Leonhard and Routh-Hurwitz.Stability analysis of a pendulum (normal and inverted) balancing with a proportional-integrating (PI) controller. Liquid level controlling solutions.Simplified block diagram of a general closed loop control system. The four most important transfer functions. Description with block diagrams.Type number of signals (power of time) and systems (order of integrating). Required type number of the controller for a desired steady state error.Tuning PID controller parameters for simple plants. Creating an approximately integrating open loop. Using system identification methods. Controlling a dead zone system by integrating (I) controller.Hardware devices of control (sensors, actuators, controllers).Discrete time description of dynamic systems (z-transformation). Basic principles of computer controlled systems.On-off control systems. Real world control applications.

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTAGE3	Novel engineering materials	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	Ea	English	

BSc in Mechanical Engineering 2N-AG0/2NAAG0 Design and Technology Specialization compulsory / elective subject SUBJECT DATA SHEET AND REQUIREMENTS last modified: 29th May 2014 NOVEL ENGINEERING MATERIALS KORSZERŰ MÉRNÖKI ANYAGOK 1 Code Semester Nr. or fall/spring Contact hours/week (lect.+semin.+lab.) Requirements p / e / s Credit Language BMEGEMTAGE3 spring 2+0+0 p 3 English 2. Subject's responsible: Name: Position: Affiliation (Department): Dr. István Mészáros associate professor Dept. of Materials Science and Engineering 3. Lecturer: Name: Position: Affiliation (Department): Dr. István Mészáros associate professor Dept. of Materials Science and Engineering 4. Thematic background of the subject: The subject gives an introduction to the up-to-date research fields of materials science. Special attention is paid to the novel materials used in engineering appications. 5. Compulsory / recommended prerequisites: Compulsory: (subject's name, code) Suggested: (subject's name, code) 6. Main aims and objectives, learning outcomes of the subject: The structure, properties of novel structural and functional materials used in mechanical and electrical engineering applications and their testing methods are discussed. The technological processes and their practical aspects are discussed. Fundamental concepts of material structures and the principles of material properties and their relations. Special attention is paid to materials used in the electronics industries including their production and technological usability. 7. Method of education: Lecture 2 h/w, seminar 0 h/w, laboratory 0 h/w 8. Detailed thematic description of the subject (by topic, min. 800 character): Topics include: Basics of crystallography, crystal defects, dimensional effects, nano-, micro-, and macrostructures, multi-component systems. Thermal behavior, diffusion mechanisms. Phase transformations, heat treatments, recrystallization. Mechanical properties and their measurements. Types and properties of novel structural and stainless steels. Fundamental new concepts in steel development. High entropy alloys. Alloys used in biomedical engineering applications. Materials deterioration processes such as corrosion, fracture, fatigue (mechanical, thermal, etc.), creep, migration. Microscopy, electron microscopy, X-ray diffraction. Conduction properties, conductive, superconductive, resistive, and insulator materials. Semiconductor materials. Effects of material properties on semiconductor materials used in microelectronics and in integrated optoelectronics. Insulator, dielectric and ferro-electric materials. Production of semiconductor single crystals and the related measurement techniques (Hall, CV). Non-metallic materials in electrotechnics. Magnetic properties and the types of magnetic materials used in industrial applications. Intelligent materials. Shape memory and superelastic alloys. 9. Requirements and grading a) in term-period: participation on lectures, mid-semester test in the 7th week of the semester b) in examination period: written and oral exam c) Disciplinary Measures Against the Application of Unauthorized Means at Mid-Terms, Term-End Exams and Homework Supplement to 1/2013. (I. 30.) Dean's Order (Codicil): The following students are subject to disciplinary measures. (a). Those students who apply unauthorized means (book, lecture notes, etc.), different from those listed in the course requirements and/or adopted by the lecturer in charge of the course assessment, in the written mid-term exams taken, and/or invite/accept any assistance of fellow students, with the exception of borrowing authorized means, will be disqualified from taking further mid-term exams in the very semester as a consequence of their action. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission option. Final term-end results in courses with practical mark will automatically become Fail (1), the ones with exam requirements will be labelled Refused Admission to Exams. (b). Those students whose homework verifiably proves to be of foreign extraction, or alternatively, evident results or work of a third party, are referred to as their own, will be disqualified from taking further assessment sessions in the very semester as a consequence of their action. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission options. Final term-end results in courses with practical mark will automatically become Fail (1), ones with exam requirements will be labelled Refused Admission to Exams. (c). Those students who apply unauthorized means (books, lecture notes, etc.), different from those listed in the course requirements and/or adopted by the lecturer in charge of the course assessment, in the written term-end exams taken, and/or invite/accept any assistance of fellow students, with the exception of borrowing authorized means, will immediately be disqualified from taking the term-end exam any further as a consequence of their action, and will be inhibited with an automatic Fail (1) in the exam. No further options to sit for the same exam can be accessed in the very same exam period. (d) Those students who alter, or make an attempt to alter the already corrected, evaluated, and distributed test or exercise/problem, i.) as a consequence of their action, will be disqualified from further assessments in the respective semester. Further to this, all of their results gained in the very semester will be void, can get no term-end signatures, and will have no access to Late Submission options. Final term-end results in courses with practical mark will automatically become Fail (1), the ones with exam requirements will be labelled Refused Admission to Exams; ii.) and will immediately be inhibited with an automatic Fail (1) in the exam. No further options to sit for the same exam can be accessed in the very same exam period. 10. Retake and repeat 11. Consulting opportunities: Consultation hours: By email appointments 12. Reference literature (compulsory, recommended): · Books: W.D. Callister: Materials Science and Engineering (John Whiley and Sons, ISBN: 0-471-32013-7), D.C. Jiles: Principles of Materials Evaluation (CRC Press, ISBN: 13-978-0-8493-7392-3) · Downloadable materials: www.att.bme.hu 13. Home study required to pass the subject: Contact hours 28 h/semester Home study for the courses 28 h/semester Home study for the mid-semester checks 10 h/check Preparation of mid-semester homework - h/homework Home study of the allotted written notes 9 h/semester Home study for the exam 15 h/semester Totally: =90 h/semester 14. The data sheet and the requirements are prepared by: Name: Title: Affiliation

(Department): Dr. István Mészáros associate professor Dept. of Materials Science and Engineering v\:* {behavior:url (#default#VML);} o\:* {behavior:url(#default#VML);} w\:* {behavior:url(#default#VML);} .shape {behavior:url (#default#VML);} /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Normál táblázat"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshow:yes; mso-style-priority:99; mso-style-qformat:yes; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:.0001pt; mso-pagination:widow-orphan; font-size:10.0pt; font-family:"Times New Roman","serif";}

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTBGA1	Materials science and testing	Exam	6

Course type	Course code	Course language	Timetable information
Laboratory	AL1B	English	
Laboratory	AL1A	English	
Laboratory	AL2B	English	
Laboratory	AL2A	English	
Lecture	AEa	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEMTNWMS	MATERIALS SCIENCE	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	Ea	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEPTAG0P	Polymer Materials Science and Engineering	Exam	6

Course type	Course code	Course language	Timetable information
Laboratory	LAB_ERASMUS	English	
Lecture	LECT_ERASMUS	English	

The objective is to familiarize the students with the following subjects: structure of polymers; the dependence of their properties on structure, temperature and environment; the characteristics of their stressndash;strain relationships; their basic application, processing and recycling possibilities. Introduction on materials science and polymer engineering. Evolution of polymer engineering, main directions of its development and achievements. Application of polymers as structural materials. Molecular structure of polymers, structural levels. Polymerization techniques, building of macromolecules, 3D formations of macromolecules, solubility. Polymers classification, related applications and products. Morphology of polymers. Correlation between structure and mechanical properties in polymers. Time dependency of the mechanical properties, modeling the viscoelastic properties. The effect of environmental variables on the properties of polymers. Basics of melt rheology, flow and viscosity curves. Flow of polymer melts in capillaries and in slit dies. Measure of fluidity and viscosity. Flow deviations from steady state. Polymer processing technologies, common steps of fabrication. Extrusion technology, extruder and related equipments, physical processes in the plastication unit, thermal conditions in the extruder, extruded products. Pipe extrusion die, coathanger sheet dies, extrusion blow molding, blown film extrusion, coextrusion. Film calendering. Bending of rolls, compensation possibilities. Improving the properties of films. Thermoforming of plastic sheets. Development and basics of injection molding technology. Reciprocating screw injection molding. The role, structure and types of the mold. Special (multicomponent) injection molding technologies. Synthetic fibers. Processing technologies of crosslinked polymers: hand lay-up method, filament winding, pultrusion, moulding compounds, prepregs. Processing of elastomers (rubbers) and related machines. Polymer matrix composites. Subjects of the laboratory practices: Tensile testing of polymers, Bending of polymers, Polymer composites, Thermoforming, Injection molding, Extrusion, Melt Flow Index, Rapid prototyping and Rapid Tooling. Url/details: http://www.pt.bme.hu/targyalapadat/44_BMEGEPTAG0P_targyleiras.pdf

Subject code	Subject name	Requirement	ECTS credit
BMEGEPTAGE1	Composites technology	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	LAB_ERASMUS	English	
Lecture	LECT_ERASMUS	English	

Main objective is getting familiar with the matrices and reinforcing materials of polymer composites. Gaining knowledge about the manufacturing technologies of thermoplastic and thermoset matrix composites. Learning the basics of composite mechanics and composite specific design guidelines. Topics: thermoset and thermoplastic composite matrix materials, properties and applications. Typical reinforcing materials of polymer composites.

Reinforcing structures, properties and applications. Manufacturing technologies of thermoset matrix polymer composites: overview, typical products, tooling materials. Wet manufacturing technologies of thermoset matrix polymer composites: hand layup, spraying, RTM, pressing, pultrusion, filament winding, braiding, centrifugal casting. Dry manufacturing technologies of thermoset matrix polymer composites: autoclave curing of prepregs, out of autoclave prepreg curing, BMC pressing, SMC pressing, sandwich manufacturing. Manufacturing technologies of thermoplastic matrix polymer composites: extrusion, injection moulding, pressing, vacuum forming, GMT. Damage and failure of polymer composites: testing and approving methodologies. Basics of composite mechanics: types of material behaviour, rules of mixtures, laminate properties for different stacking sequences, composite plates under tension, composite plates under bending, failure criteria for composites. Example problem solving.

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	AnE	English	
Practice	AnGy1	English	

http://www.hds.bme.hu/oktatas.php?sm=1amp;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
BMEGEVGBG06	Individual project 1.	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	AnL-HDR	English	
Laboratory	AnL-ÉPGET	English	
Laboratory	AnL-ARA	English	
Laboratory	AnL-EGR	English	

http://www.hds.bme.hu/oktatas.php?sm=1amp;lang=EN Independent Study 1 BMEGEVGAG06 One-semester long individual project work. 4 hours/4 credits.

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

Course type	Course code	Course language	Timetable information
Practice	AnGy	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGBX01	Fluid Machinery	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	AnLlan	English	

Laboratory	AnLpar	English	
Lecture	AnE	English	
Practice	AnGypar	English	
Practice	AnGylan	English	

http://www.hds.bme.hu/oktatas.php?sm=1amp;lang=EN

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	AnL2	English	
Laboratory	AnL1	English	
Lecture	AnE	English	

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	AnGy	English	

http://www.hds.bme.hu/oktatas.php?sm=1amp;lang=EN

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	AnGy	English	

Subject code	Subject name	Requirement	ECTS credit
BMEGEVGNW21	Unsteady Flow in Pipe Networks	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	AnE	English	
Practice	AnGy	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
BMETE119779	MATLAB Programming	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	E1	English	

MATLAB programming course (2020 / spring) Educator: Gabor Varga PhD, Associate Professor, Department of Physics, BUTE E-mail: vargag@phy.bme.hu Course frequency: 2-hour/week LAB work near the computer using MATLAB Semester duration: 14 weeks Semester requirement and mark: 90 minutes test at the end of semester: writing a MATLAB code for a given algorithm (100 point) and semester project (100 points) Marks: 0-79 failed (1), 80-109 poor (2), 110-139 average (3), 140-169 good (4), 170-200 excellent (5) Thematics: 1. MATLAB environment and programming: matrix operations, basics of linear algebra, rendering of one-, two- and three-dimensional functions, printing, file operation, control commands, graphical user interface (GUI). Basics of object-oriented programming. 2. MATLAB data types and operations: matrices, arrays, structure, cell, character, string, logical 3. Get skill in MATLAB programming by writing numerical algorithms of derivation, integral and ordinary differential equations. Debugging of MATLAB programs. 4. Program design and writing within the semester project: core of numerical solver, handling of file input/output, character and graphical based user interface. 5. Program testing. Validation of MATLAB code and simulation. Optimization of speed and memory. 6. Scientific style program documentation. Inserting help and demo in MATLAB code of semester project. 7. Short presentation of semester project.

Subject code	Subject name	Requirement	ECTS credit
BMETE11AF11	Applied Solid State Physics	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	T0	English	THU:10:15-12:00

Band structure of metals and semiconductors, electron transport, electron scattering mechanisms, 2 dimensional electron gases, Si technology (FET, SSD memory), semiconductor heterostructure (semiconductor laser, MEMT), nanoelectronics, single electron transistor. – Magnetic materials, origin of magnetic momentum and interaction between moments, magnetic structures. Magnetism of metals, spin polarized bands, spintronics devices (spin valve, MRAM). Spin transistor, magnetic semiconductors.– Jenő Sólyom: Fundamentals of the Physics of Solids (Springer 2007) – Thomas Ihn: Semiconductor Nanostructures: Quantum States and Electronic (2009)

Subject code	Subject name	Requirement	ECTS credit
BMETE11AF38	Computer Controlled Measurements	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	T1	English	MON:14:15-18:00(F3213)

The participants gain experience in computer controlled measurements and in the programming of scientific instruments and data acquisition system. To this end the following topics are covered: communication with the instruments via serial, GPIB, and USB ports. Programming of data acqusitin cards. Programming of complex measurement control platforms, plotting and saving the data, programming of timelines, in situ data analysis. The course consists of 4 hour long computer laboratory exercises every second week. In the first part of the semester fundamental programming skills are obtained through simple example programs. In the second part the participants individually program complex measurement control and data analysis platforms, like nonlinear curve fitting by Monte Carlo method, full computer control of a digital multimeter, digital oscilloscope program using a data acquisition card.

Subject code	Subject name	Requirement	ECTS credit
BMETE11AF51	Research Project	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	T1	English	

During the semester, the student conducts research work under the guidance of a supervisor. The aim of the project is to get acquainted with the methodology of scientific research and to acquire professional knowledge beyond the curriculum. In order to complete the subject, the results of the independent work must be summarized in an essay of at least 20 pages, which cannot overlap with the diploma work. The results must be also presented in a lecture at the end of the semester. The dissertation and the presentation can be replaced by submitting a TDK dissertation at the

TDK conference.

Subject code	Subject name	Requirement	ECTS credit
BMETE11AX14	Nobel Prize Physics in Everyday Application	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	T0	English	TUE:14:15-16:00

Scope: The amazing and explosive development of technology is our everyday experience in various fields of life from informatics and medicine. It is less well known how this development is supported by scientific research. As an example a notebook computer applies numerous Nobel Prize awarded ideas, like the integrated circuits (2000), semiconducting laser (2000), liquid crystal display (1991), CCD camera (2009), GMR sensor of the hard disk (2007) and several further achievements from earlier days of quantum mechanics and solid state physics. The course is intended to give insight to a range of amazing everyday applications that are related to various Nobel Prizes with a special focus on recent achievements. The topics below are reviewed at a simplified level building on high school knowledge of physics. Syllabus:- Textbook applications from the early days of Nobel prizes: wireless broadcasting, X -rays, radioactivity, etc.- Optics in everyday application: lasers, CCD cameras, optical fibers, liquid crystal displays, holography- Quantum physics: from atom models to quantum communication- Measurements with utmost precision: application of Einstein's theory of relativity in GPS systems, atomic clocks, Michelson interferometry, etc.- Nuclear technology from power plants to medical and archeological applications- Advanced physics in medicine: magnetic resonance imaging, computer tomography and positron emission tomography- Semiconductors from the first transistor to mobile communication- Fundamental tools of nanotechnology (scanning probe microscopes, electron beam lithography, etc)- Spintronics from the discovery of electron spin to everyday application in data storage devices- Exotic states of solids in everyday application: superconducting magnets and levitated trains- Towards quot;all carbon electronicsquot;: envisioned and already realized applications of graphene

Subject code	Subject name	Requirement	ECTS credit
BMETE11AX22	Physics 2	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	VN0	German	
Lecture	VE0	English	TUE:12:15-14:00
Practice	VN1	German	
Practice	VE1	English	TUE:14:15-16:00

Elektrodynamics: Faradayrsquo;s law. Self induction, mutual induction. Magnetic properties of materials. Magnetic data storage. Maxwell equations. Generation, propagation and reflection of electromagnetic waves. Basics of geometrical optics. Wave optics, interference, diffraction. Polarized light. Basics of atomic Physics: Natural and coherent light sources. Physical foundations of optical communication. Matter waves of de Broglie. The Schrouml;dinger equation. The electron structure of atoms. Electron spin. Free-electron theory of metals. Band structure of solids. Superconduction. Quantum-mechanical phenomena in modern electronics. Basics of nuclear physics. Nuclear reactors. Elementary particles. Curiosities in cosmology. Fundamentals of the physics of the atomic kernel, elementary particles, selected topics in cosmology.

Subject code	Subject name	Requirement	ECTS credit
BMETE11AX24	Physics 2i	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	IE0	English	TUE:12:15-14:00
Lecture	IN0	German	
Lecture	IT0	English	TUE:12:15-14:00
Practice	IN1	German	
Practice	IE1	English	TUE:14:15-16:00
Practice	IT1	English	TUE:14:15-16:00

ELECTRIC FIELDS: Electric charges. Coulomb's law. Coulomb's constant and the dielectric constant. Electric field. Electric field of a point charge, a dipole, a group of charges, continuous charge distributions. Electric field lines. GAUSS' LAW: Electric flux. Gauss' law. Applications for charge distributions having a large degree of symmetry. Conductors in electrostatic equilibrium. ELECTRIC POTENTIAL: Potential energy associated with the electrostatic force. Electric potential difference (voltage) and electric potential. Equipotential surfaces. The electric potential of a point charge, a group of charges, a continuous charge distribution. Mathematical relationship between the electric field vector and the electric potential. Charged conductors in electrostatic equilibrium. CAPACITANCE AND DIELECTRICS: Capacitance. Parallel plate capacitor, cylindrical capacitor, spherical capacitor. Parallel and series combination of capacitors. Energy stored in a charged capacitor. The electric dipole in an external electric field: torque, potential energy. Dielectrics. Atomic dipole moments and the polarization vector. Electric susceptibility, relative dielectric constant. The electric displacement vector. Boundary conditions for the electric field vector and the displacement vector. Energy density of the electric field. CURRENT AND RESISTANCE, DIRECT CURRENT CIRCUITS: Electric current. Current density. Ohm's law. resistivity, conductivity, resistance. Power supplied by a battery. Power dissipated in a resistor. Parallel and series combination of resistors. Kirchhoff's rules. RC circuits:

charging and discharging a capacitor. MAGNETIC FIELDS. SOURCES OF THE MAGNETIC FIELD: Magnetism. Magnetic field. Magnetic force on a moving charge. Applications: cyclotron, velocity selector. Magnetic force on a current-carrying conductor. Torque on a current loop. The magnetic dipole. The magnetic field strength. The permeability of free space. Analogy between electricity and magnetism (electricity: acts on charges, is created by charges; magnetism: acts on moving charges, is created by moving charges). The Biot-Savart law and some of its applications. Magnetic force between two parallel conductors. The paradoxical nature of the force acting on a moving charge (resolution of the paradox using special relativity). Ampere's law. Applications for a long straight wire and a solenoid. The magnetic flux. Gauss' law in magnetism. The displacement current and the general form of Ampere's law. Magnetism in matter. The magnetization vector. Ferromagnetism, paramagnetism, diamagnetism. Boundary conditions for the magnetic field and the magnetic field strength. FARADAY'S LAW: Faraday's law of induction. Motional emf: a straight conductor moving through a perpendicular magnetic field; emf induced in a rotating bar. Lenz's law. Induced emf and the associated nonconservative electric field. Eddy currents. Maxwell's four equations in integral and differential form. Electromagnetic waves. INDUCTANCE: Self-induction. Self-inductance. RL circuits. Energy stored in an inductor. The energy density of the magnetic field. Mutual inductance. Oscillations in an LC circuit. The RLC series circuit. LIGHT AND OPTICS: Measurements of the speed of light (Roemer, Fizeau). Geometric optics, ray approximation. Reflection. Refraction and Snell's law. Total internal reflection. Huygens' principle. Fermat's principle. Dispersion. INTERFERENCE OF LIGHT WAVES: Spatial and temporal coherence. Young's double slit experiment, the intensity distribution on the screen. Phasor addition of waves. Generalization for N slits. Interference in thin films. Newton's rings. The Michelson interferometer. DIFFRACTION AND POLARIZATION: Fraunhofer diffraction on a single slit, the intensity distribution on the screen. Resolution of a single slit and a circular aperture. Rayleigh's criterion. Diffraction grating. The spectral resolving power of a grating. X-ray diffraction in crystals, the Laue condition. Fresnel zones. Zone plates and phase Fresnel lenses. Polarization of light waves: elliptical, linear, circular polarization. Polarization by selective absorption, reflection (Brewster's law), birefringence, scattering. Optical activity. LASERS AND HOLOGRAPHY: Interaction between light and matter: spontaneous emission, stimulated emission, absorption. Light amplification by population inversion. Resonators. 3-level and 4-level optical pumping. Electrical pumping. Laser types (solid-state, gas, liquid, semiconductor). Properties of laser beams. The basic idea of holography and its difference from conventional photography. Applications of holography. INTRODUCTION TO QUANTUM PHYSICS: Blackbody radiation and Planck's hypothesis. The photoelectric effect. The Compton scattering. Atomic spectra of low pressure gases. Bohr's quantum model of the hydrogen atom. QUANTUM MECHANICS: Wave properties of particles, de Broglie's hypothesis. The double slit experiment with massive particles. The wave function. The uncertainty principle. Particle in a 1D box. The Schrouml;dinger equation. Particle in a well of finite height. Tunneling and its applications. The simple harmonic oscillator.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF04	Seminar RP2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	T1	English	

In this seminar course, each student will process, and give a presentation about, a selected topic in modern physics. Knowledge of classical physics (mechanics, electromagnetism, thermodynamics, statistical physics) as well as basics of modern physics (quantum mechanics, quantum solid-state physics, special relativity) is essential.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF06	Seminar RP4	Signature	0

Course type	Course code	Course language	Timetable information
Practice	T1	English	

In this seminar course, each student will process, and give a presentation about, a selected topic in modern physics. Knowledge of classical physics (mechanics, electromagnetism, thermodynamics, statistical physics) as well as basics of modern physics (quantum mechanics, quantum solid-state physics, special relativity) is essential.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF07	Independent Laboratory RP1	Mid-semester mark	7

Course type	Course code	Course language	Timetable information
Laboratory	E1	English	

The student must have chosen a diploma work topic before registering to this course. The student performs research tasks related to the diploma work topic during the semester, under the guidance of the thesis advisor.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF12	Group Theory in Solid State Research	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	THU:14:15-16:00

Introduction: point groups, fundamental theorems on finite groups, representations, character tables. Optical spectroscopy: selection rules, direct product representations, factor group. Electronic transitions: crystal field theory, SO(3) and SU(2) groups, correlation diagrams, crystal double groups. Symmetry of crystals: space groups,

International Tables of Crystallography. Electronic states in solids: representations of space groups, compatibility rules.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF25	Seminar on Nanophysics 1	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	T1	English	

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF33	Diploma Work RP	Mid-semester mark	30

Course type	Course code	Course language	Timetable information
Laboratory	E1	English	

The prerequisit to registering this course is successful completion of the course Independent laboratory RP2. The student performs research tasks related to the diploma work topic during the semester, under the guidance of the thesis advisor.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF42	Quantum Information Processing	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	

Quantum bit, quantum computing, quantum algorithms. Spin-based quantum bits in solids: quantum dots, interactions, energy scales. Realization of single- and two-qubit quantum-logical operations. Mechanisms of information loss: relaxation, dephasing, decoherence. Experiments.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF48	Seminar NA2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	T1	English	

The students process a leading field of modern physics, and present their part to the others as a scientific talk.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF50	Seminar NA4	Signature	0

Course type	Course code	Course language	Timetable information
Practice	T1	English	

The students process a leading field of modern physics, and present their part to the others as a scientific talk.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF53	Fundamentals of Nanophysics	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	WED:09:15-12:00(F3213)

The building blocks of nowadays electronic devices have already reached a few tens on nanometers sizes, and further miniaturization requires the introduction of novel technologies. At such small length-scales the coherent behavior and the interaction of electrons, together with the atomic granularity of matter induce several striking phenomena, that are not observed at the macroscopic scale. The course gives an introduction to a broad set of nanoscale phenomena covering the following topics: characteristic length-scales; basic concepts of quantum transport, conductance quantization; coherent and incoherent transport, interference phenomena in nanostructures; mesoscopic phenomena in atomic and molecular nanojunctions; quantized Hall effect; noise phenomena in nanostructures; graphene nanostructures, 2D heterostructures; quantum dots.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF54	Optical Spectroscopy in Materials Science	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	

Electromagnetic waves in vacuum and in a medium; complex dielectric function, interfaces, reflection and transmission. Optical conduction in dipole approximation; linear response theory, Kramers-Kronig relation, sum rules. Simple optical models of metals and insulators; Drude model, Lorentz oscillator. Optical phonons, electron-phonon interaction. Optical spectroscopes: monochromatic- and Fourier transformation spectrometers. Optical spectroscopy of interacting electron systems: excitons, metal-insulator transition, superconductors. Magneto optics: methods and current applications.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MF57	Theory of Magnetism	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	THU:11:15-13:00
Practice	T1	English	THU:13:15-14:00

Magnetic phenomena are considered as electron correlation effects. This course builds heavily on knowledge gained by successful completion of the course “Modern solid state physics”. The following topics are discussed: Landau levels in magnetic field, magnetism of extended electron states, magnetism of atoms and ions, magnetite, direct exchange, kinetic exchange, Mott transition, Mott insulators, mean field theory of magnetic ordering, the ferromagnetic Heisenberg model, the antiferromegnetic Heisenberg model.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MX22	Physics Laboratory for Civil Engineers	Mid-semester mark	1

Course type	Course code	Course language	Timetable information
Laboratory	EA2	English	TUE:14:15-18:00(ONLINE); TUE:14:15-18:00(ONLINE)
Laboratory	EA1	English	WED:14:15-18:00(ONLINE); WED:14:15-18:00(ONLINE)

In the semester three measurements are to be performed: studying of standing waves on a stretched string; measuring specific heat, latent heat; measurements with thin lenses, prism, polarizers, and interferometer. The purpose is to get to know basic measurement techniques and simple equipment. The course is based on BSc physics knowledge.

Subject code	Subject name	Requirement	ECTS credit
BMETE11MX33	MSc Physics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	VE0	English	MON:10:15-12:00; MON:10:15-12:00; THU:10:15-12:00
Practice	VE1	English	THU:10:15-12:00

The course covers introduction to two disciplines: Quantum Mechanics and Solid State Physics. After the semester students should be able to understand the basic principles behind these two disciplines and solve some simple problems. This will contribute to the understanding of the workings of modern electronics and nanotechnology. Quantum mechanics: Experimental antecedents.The Wave function.Time dependent and time independent Schrouml;dinger's equation.Simple problems. Tunneling. Angular momentum. The hidrogen atom. Perturbations. Formal quantum mechanics. Operator calculus. Commutators, canonical conjugates and uncertainity relations. Harmonic oscillator. Selection rules and spectrum of H. The He atom, the independent particle approximation. The exclusion principle. Periodic system of elements. Molecules. molecular orbitals, chemical bonding, H-H bond. Molecules of many atoms. Orbital hybridisation. Conjugated molecules, cyclic conjugated molecules. Rotation and vibration of molecules. Franck-Condon principle, Rayleigh amp; Raman scattering. Classical and quantum statistics. Solid State Physics: The solid state. Short and long range order. Crystallography. Bonds in crystals. Real and point lattices. Symmetries and unit cells. The reciprocal lattice. Bravais lattices. X- ray diffraction methods. Electrical conductivity. Drudel model. Sommerfeld model. Band theory of solids.Work function. Contact potential. The adiabatic principle. Electrons in periodic lattices. Charge carrier characteristics. Crystal momentum. Effective mass. Band theory. The tight binding model. Intrinsic and doped semiconductors. Semiconductor structures. Superconductivity. Thermal properties. The transport equation. Onsager relations. Quantum theory of lattice vibrations. Optical properties. Magnetic and dielectric properties of solids.

Subject code	Subject name	Requirement	ECTS credit
BMETE12MF52	Selected Topics of the Modern Materials Science	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	TE0	English	TUE:12:15-14:00

Subject code	Subject name	Requirement	ECTS credit
BMETE14MX00	Modern Physics for Chemical Engineers	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	E0	English	MON:12:15-14:00; THU:10:15-12:00

Topics: The course covers introductions to two disciplines: Quantum Mechanics and Solid State Physics. After the semester students should be able to understand the basic principles behind these two disciplines and solve some simple quantum mechanical and solid state physics problems. This will contribute to the understanding of the workings of modern electronics and nanotechnology. To follow the course no higher mathematics than algebra and the basics of the differential and integral calculus is required. Detailed thematics: Quantum Mechanics. Blackbody radiation, photoelectric effect, Compton effect, stability and line spectra of atoms, Frank-Hertz experiment, Time dependent and independent Schrödinger's equation, stationary states, wave function, "wave - particle duality", electron diffraction, two-slit experiment, uncertainty relations, electron wavefunction probability distribution in an

atom, solving the Schrödinger equation, tunneling, the ammonia molecule, electron emission from metals, perturbation calculus, selection rules, operator calculus, eigenstate problems, measurement, quantum mechanics of the hydrogen atom, quantum numbers, H spectrum and selection rules, electron spin, Zeeman-effect, Stern-Gerlach experiment, spin-orbit coupling, atoms with more than one electron, the exclusion principle, indistinguishable particles, periodic table of elements, buildup of shells, Hund's rule, valence and core electrons, molecules, molecular orbitals, chemical bonding, H-H bond, H2+ molecule ion, bonding and anti-bonding states, orbital hybridisation, heteronuclear molecules, sp3 hybridization, rotation and vibration of molecules, Franck-Condon principle, Rayleigh and Raman scattering, Stokes and anti-Stokes scattering, Statistical physics. Classical and quantum statistics. Distribution functions, distinguishable and indistinguishable particles, photon gas, Einstein model, laser principle. Solid State Physics. Short and long range ordering, amorphous and crystalline solids, crystal structures, lattices (point lattice and basis), symmetries and unit cells, primitive, conventional and Wigner-Seitz cells, primitive vectors, Miller indexes, Bravais lattices, close packing structures, reciprocal lattice, k-space, X-ray diffraction, Laue formulae, classical physical models for crystals: lattice vibrations, monatomic and diatomic linear chain model, boundary conditions, form of the solution, dispersion relation, generalization for 3 dim., QM handling of lattice vibrations, phonons, momentum and energy of phonons, relative to the momentum and energy of Bloch electrons, specific heat of solids, equipartition principle and the Debye model, specific heat from electrons, conductors and insulators, band theory of solids, formation of bands, insulators, conductors, real band structures, conduction models, Drude model, collision time, mean free path, Wiedmann-Franz law, Sommerfeld model of metals, Fermi energy, electrons and holes, equivalence of electron and hole conductivity in a completely filled band, metals with hole conduction, work function, thermionic emission, contact potential, crystal potential, double layer at the surface, Bloch functions, Hartree-Fock method, dispersion relation, Brillouin zone, reduced zone picture, kinematics of electrons and holes, Bloch oscillations, effective mass, tight binding model, semiconductors, intrinsic conductivity, density of states in the conduction and valence bands, position of the Fermi level, donors and acceptors, charge carrier concentrations, extrinsic conductivity, Fermi level in doped semiconductors, p-n junction, application of p-n junctions, diode, (MOS) FET, bipolar transistors, Schottky and ohmic structures, characteristics.

Subject code	Subject name	Requirement	ECTS credit
BMETE15AF32	Mechanics 2	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	T0	English	MON:10:15-12:00

Relativistic mechanics: Lorentz-transformations, four-vectors and Minkowski space, relativistic collisions, relativistic action and equations of motion. Relativistic particle in an electromagnetic field. Lagrange-theory of continuum mechanics: Lagrange density of a string, Euler-Lagrange equations, energy density. Application to quantum mechanics and to harmonic media, Klein-Gordon equations. Hamiltonian formulation of continuum mechanics. Symmetries: Noether's theorem, symplectic formulation of Hamiltonian mechanics. Poisson's brackets, integrability. Canonical transformations, Hamilton-Jacobi equations, action-angle variables. Nonlinearity, second harmonic generation, parametric resonance. Basics of dynamical systems and chaos. – H. Goldstein: Classical Mechanics (Addison-Wesley)– J.R. Taylor, Classical Mechanics (University Science Books)

Subject code	Subject name	Requirement	ECTS credit
BMETE15AF34	Electrodynamics 2	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	T0	English	MON:12:15-14:00(F3M01)

Electrostatics: Solving Laplace's equation in spherical and cylindrical coordinates. Grounded sphere in external field, electric field near a sharp cone. Multipole expansion in spherical harmonics. – Magnetic and quasistatic fields: magnetic scalar potential, solution methods in nonlinear materials. – Electromagnetic waves in vacuum and matter. Microscopic model for polarizability. Dispersion, plasma frequency, Kramers-Kroing relations. – Wave guides, resonant cavity. Losses, quality factor. – Radiation field of oscillating charges. Electric dipole and quadrupole, magnetic dipole radiations. – Scattering of electromagnetic waves, cross section. Scattering on solids and gases. – Lienard-Wiechert potential of moving charge, field strength, radiated power, angular distribution, spectrum. Synchrotron radiation. Cherenkov and transitional radiations. – Elements of relativistic electrodynamics. – David J. Griffiths: Introduction to Electrodynamics (Pearson)– John D. Jackson: Classical Electrodynamics (Wiley)

Subject code	Subject name	Requirement	ECTS credit
BMETE15AF42	Practical Course in Electrodynamics 2	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Practice	T1	English	WED:14:15-16:00

Problem solving class accompanying Electrodynamics 2. – David J. Griffiths: Introduction to Electrodynamics (Pearson)– John D. Jackson: Classical Electrodynamics (Wiley)

Subject code	Subject name	Requirement	ECTS credit
BMETE15AF44	Practical Course in Mechanics 2	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Practice	T1	English	TUE:12:15-14:00

Problem solving class accompanying Mechanics 2. – H. Goldstein: Classical Mechanics (Addison-Wesley)– J.R. Taylor, Classical Mechanics (University Science Books)

Subject code	Subject name	Requirement	ECTS credit
BMETE15AF46	Theory of Relativity	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	WED:10:15-12:00(F3M01)

Subject code	Subject name	Requirement	ECTS credit
BMETE15AF48	Electrodynamics 2	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	MON:12:15-14:00

Electrostatics: Solving Laplace's equation in spherical and cylindrical coordinates. Grounded sphere in external field, electric field near a sharp cone. Multipole expansion in spherical harmonics. – Magnetic and quasistatic fields: magnetic scalar potential, solution methods in nonlinear materials. – Electromagnetic waves in vacuum and matter. Microscopic model for polarizability. Dispersion, plasma frequency, Kramers-Kroing relations. – Wave guides, resonant cavity. Losses, quality factor. – Radiation field of oscillating charges. Electric dipole and quadrupole, magnetic dipole radiations. – Scattering of electromagnetic waves, cross section. Scattering on solids and gases. – Lienard-Wiechert potential of moving charge, field strength, radiated power, angular distribution, spectrum. Synchrotron radiation. Cherenkov and transitional radiations. – Elements of relativistic electrodynamics. – David J. Griffiths: Introduction to Electrodynamics (Pearson)– John D. Jackson: Classical Electrodynamics (Wiley)

Subject code	Subject name	Requirement	ECTS credit
BMETE15MF21	Crystalline and Amorphous Material	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	

1. Introduction 1.1. Historical overview: Science and applications 1.2. Definitions Crystalline, non-crystalline, amorphous, glassy materials, 2. Preparation techniques 2.1. Growth of thin-film forms 2.2. Melt-quenched glasses 2.3. Other techniques 2.4. Phillips constraints theory 3. Structure 3.1. Differences between amorphous and crystalline semiconductors 3.2. Projection from three dimensional structures to one dimensional functions Diffraction measurements 3.2. Three dimensional structure derivation from one dimensional function 3.3. Atomic interactions. Computer simulation methods, Models 3.4. Phase change materials and its application 4. Electronic structure 4.1. Chemical bonds, 4.2. Electronic density of states, 4.3. Defects 4.4. Optical and electronic properties 5. Photo induced phenomena 5.1. Photoinduced volume changes (PVE), photodarkening, photobleaching (PD), 5.2. Photoinduced defect creation (PDC): the Staebler-Wronsky effect, 5.3. In-situ simultaneous measurements of PVE, PD, and PDC 5.4. Photoinduced amorphization or crystallization, 5.5. Some applications of photo-induced effects (solar cells, XEROX, sensors, DVD, etc.)

Subject code	Subject name	Requirement	ECTS credit
BMETE15MF65	Quantum Field Theory	Exam	7

Course type	Course code	Course language	Timetable information
Lecture	T0	English	
Practice	T1	English	

The course is a general introduction to relativistic quantum field theory.Canonical quantisation. Quantised Klein-Gordon and Dirac fields. Spin-statistics theorem.Interacting fields. CPT theorem. Scattering theory and the S-matrix. Unitarity and microcausality. Perturbation theory, Feynman rules for correlation functions.Asymptotic states. Feynman rules for the S matrix. Cross sections and decay rates.Quantisation of the electromagnetic field. Gauge invariance.Kallen-Lehmann representation, sum rules. LSZ reduction formulae.Feynman path integral in Hamiltonian and Lagrangian formalism.Functional formalism. Generator functionals. Free fields, Wick theorem.Grassmann variables and path integrals for fermions. Renormalisation theory. Classification of divergences, counter term formalism. Symmetries and Ward identities. Spontaneous symmetry breaking.Renormalisation group, Callan-Symanzik equation. Connection with theory of critical phenomena.M.E. Peskin and D.V. Schroeder: An Introduction to Quantum Field Theory (Addison-Wesley)C. Itzykson and J-B. Zuber: Quantum Field Theory (Dover Publications) S. Weinberg: The Quantum Theory of Fields I-III (Cambridge University Press)

Subject code	Subject name	Requirement	ECTS credit
BMETE15MF66	Theoretical Nanophysics	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	TUE:16:15-18:00
Practice	T1	English	TUE:18:15-19:00

Nanosystems and mesoscopic systems represent the most intensively studied areas of modern solid-state physics: modern lithographic procedures enable us to create semiconducting devices and metallic grains, where electrons

move coherently. Today, we can contact individual grains, atoms and molecules, and place them into micro-resonators.The goal of the course is to cover novel phenomena occurring in such devices. I Knowledge of quantum mechanics solid-state physics and statistical physics is assumed. The course covers the following subjects: description of small grains (Coulomb interaction, coherence, single particle levels); fundamentals of random matrix theory (university classes, level repulsion); Coulomb blockade and spectroscopy (master equation, co-tunneling and Kondo effect); conductance and noise of point contacts; molecular transport; superconducting grains, Josephson junctions, and quantum bits;Nano wires, edge states, and hybrid structures. The course is accompanied by a series of problem sets, which the students are supposed to prepare and hand in by the end of the semester.E. Akkermans, G. Montambaux, J.-L. Pichard, and J. Zinn-Justin: Mesoscopic Quantum Physics, North Holland, 1996.

Subject code	Subject name	Requirement	ECTS credit
BMETE15MF74	Computer Simulation in Physics	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	THU:16:15-18:00(F3213)
Practice	T1	English	THU:18:15-19:00(F3213)

Subject code	Subject name	Requirement	ECTS credit
BMETE80MD00	Nuclear Physics	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	WED:08:15-11:00
Practice	T1	English	WED:11:15-12:00

Required prior knowledge: Basics of classical physics and of electrodynamics, basic concepts of quantum mechanics and statistical physics.Syllabus:1. Manipulating electrically charges particles. Thomson and Millikan experiment. Mass spectroscopy and atomic mass unit (mass-doublet method). Spatial resolution, de Broglie formula. Electrostatic accelerators: Cockroft-Walton, Van de Graaf, Tandem Van de Graaf. Resonance accelerators: linear accelerator, cyclotron, synchrotron. LHC.2. Size of the nucleus, Rutherford's experiment. Hofstädter experiments. Discovery of the neutron and the composition of the nucleus. Angular momentum and parity.3. Stability of the nucleus, nuclear mass, mass defect. Weizsäcker's semi-empirical binding energy formula. Types and main characteristics of radioactive decays. Exponential decay law, decay chains. (Radioactive dating.)4. Basic theory of beta decays. Fermi's Golden Rule, Fermi theory of beta-decay, allowed and forbidden transitions. Fermi and Gamow -Teller transitions. Parity non-conservation.5. Anti-neutrino and neutrino detection (Reines Cowan, and Davis experiments). Solar neutrino puzzle and the neutrino oscillation.6. Basic theory of alpha decays. Transition coefficients and alpha spectroscopy factor. Basic theory of gamma-decays. Classification of decay modes: „electric" and „magnetic" transitions. Selection rules.7. Probabilities of gamma-transitions and Weisskopf-units. Sum rules. Measurements of decay probabilities.8. Nuclear models: Fermi-gas, Shell-model.9. Basics of collective model. Rainwater approximation. Vibrations and rotations.10. Nuclear forces. Learning from the deuteron. Basic ideas of Yukawa theory. Charge independency and isospin.11. Nuclear reactions. Kinematics. Elastic scattering (of neutrons). Microscopic and macroscopic cross sections and their two additivities. Differential cross-sections. Excitation functions.12. Partial-wave approximation, Born approximation, Distorted Wave Born Approximation.13. Mechanism and characteristics of nuclear fission. Nuclear chain reaction and some safety considerations.14. Nuclear fusion and the working principles of fusion devices. JET and ITER.

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX02	Mathematics A2a - Vector Functions	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	EN0-EMK	English	MON:16:15-18:00(ONLINE); MON:16:15-18:00(ONLINE); TUE:16:15-18:00(ONLINE); TUE:16:15-18:00(ONLINE)
Practice	EN2-EMK	English	WED:16:15-18:00(ONLINE); WED:16:15-18:00(ONLINE)
Practice	EN1-EMK	English	WED:16:15-18:00(ONLINE); WED:16:15-18:00(ONLINE)

Solving systems of linear equations: elementary row operations, Gauss-Jordan- and Gaussian elimination. Homogeneous systems of linear equations. Arithmetic and rank of matrices. Determinant: geometric interpretation, expansion of determinants. Cramer's rule, interpolation, Vandermonde determinant. Linear space, subspace, generating system, basis, orthogonal and orthonormal basis. Linear maps, linear transformations and their matrices. Kernel, image, dimension theorem. Linear transformations and systems of linear equations. Eigenvalues, eigenvectors, similarity, diagonalizability. Infinite series: convergence, divergence, absolute convergence. Sewuences and series of functions, convergence criteria, power series, Taylor series. Fourier series: axpansion, odd and even functions. Functions in several variables: continuity, differential and integral calculus, partial derivatives, Young's theorem. Local and global maxima / minima. Vector-vector functions, their derivatives, Jacobi matrix. Integrals: area and volume integrals.

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX07	Mathematics A3 for Civil Engineers	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA0	English	TUE:16:15-18:00(ONLINE); TUE:16:15-18:00(ONLINE)
Practice	EA1	English	FRI:15:15-17:00(ONLINE); FRI:15:15-17:00(ONLINE)

Differential geometry of curves and surfaces. Scalar and vector fields. Potential theory. Classification of differential equations. Linear differential equation of the second order. Nonlinear differential equations. Systems of linear differential equations. The concept of probability. Discrete random variables an their distributions. Random variables of continuous distribution. Two-dimensional distributions, correlation and regression. Basic notions of mathematical statistics.

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX17	Mathematics A2c	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	EN0-CA0	English	TUE:16:15-19:00; WED:16:15-19:00
Practice	EN0-CA1	English	TUE:16:15-19:00; WED:16:15-19:00

Differential calculus of functions of several variables: partial derivatives, differentiability, tangent plane. Derivatives of composite functions. Local and global maxima / minima. Inverse function, implicit function. Double and triple integrals. (5 weeks) Numerical series, power series, Taylor series. (2 weeks) Laplace and Fourier transform. (1 week) Linear algebra. Vectors, applications in geometry. Systems of linear equations. (3 weeks). Differential equations (separable differential equations, first order linear differential equations, second order linear differential equations with constant coefficients). (3 weeks)

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX22	Calculus 2 for Informaticians	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Lecture	EN0-EB0	English	MON:10:15-12:00; TUE:10:15-12:00
Practice	EN1-EB1	English	THU:14:15-16:00

Differential equations: Separable d.e., first order linear d.e., higher order linear d.e. of constant coefficients. Series: Tests for convergence of numerical series, power series, Taylor series. Functions of several variables: Limits, continuity. Differentiability, directional derivatives, chain rule. Higher partial derivatives and higher differentials. Extreme value problems. Calculation of double and triple integrals. Transformations of integrals, Jacobi matrix. Analysis of complex functions: Continuity, regularity, Cauchy - Riemann partial differential equations. Elementary functions of complex variable, computation of their values. Complex contour integral. Cauchy - Goursat basic theorem of integrals and its consequences. Integral representation of regular functions and their higher derivatives (Cauchy integral formulae).

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX26	Mathematics A2f - Vector Functions	Mid-semester mark	6

Course type	Course code	Course language	Timetable information
Lecture	EN0-VIK	English	MON:10:15-12:00; WED:08:15-10:00
Practice	EN1-VIK	English	WED:10:15-12:00

Solving systems of linear equations: elementary row operations, Gauss-Jordan- and Gaussian elimination. Homogeneous systems of linear equations. Arithmetic and rank of matrices. Determinant: geometric interpretation, expansion of determinants. Cramer's rule, interpolation, Vandermonde determinant. Linear space, subspace, generating system, basis, orthogonal and orthonormal basis. Linear maps, linear transformations and their matrices. Kernel, image, dimension theorem. Linear transformations and systems of linear equations. Eigenvalues, eigenvectors, similarity, diagonalizability. Infinite series: convergence, divergence, absolute convergence. Sewuences and series of functions, convergence criteria, power series, Taylor series. Fourier series: axpansion, odd and even functions. Functions in several variables: continuity, differential and integral calculus, partial derivatives, Young's theorem. Local and global maxima / minima. Vector-vector functions, their derivatives, Jacobi matrix. Integrals: area and volume integrals.

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX34	Mathematics EP2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	EN1	English	

Limit, continuity, partial derivatives and differentiability of functions of multiple variables. Equation of the tangent plane. Local extrema of functions of two variables. Gradient and directional derivative. Divergence, rotation. Double and triple integrals and their applications. Polar coordinates. Substitution theorem for double integrals. Curves in the 3D space, tangent line, arc length. Line integral. 3D surfaces. Separable differential equations, first order linear differential equations. Algebraic form of complex numbers. Second order linear differential equations with constant

coefficients. Taylor polynomial of exp(x), sin(x), cos(x). Eigenvalues and eigenvectors of matrices.

Subject code	Subject name	Requirement	ECTS credit
BMETE90AX51	Mathematics A4 - Probability Theory	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-A0	English	
Practice	EN1-A1	English	

Notion of probability. Conditional probability. Independence of events. Discrete random variables and their distributions (discrete uniform distribution, classical problems, combinatorial methods, indicator distribution, binomial distribution, sampling with/without replacement, hypergeometrical distribution, Poisson distribution as limit of binomial distributions, geometric distribution as model of a discrete memoryless waiting time). Continuous random variables and their distributions (uniform distribution on an interval, exponential distribution as model of a continuous memoryless waiting time, standard normal distribution). Parameters of distributions (expected value, median, mode, moments, variance, standard deviation). Two-dimensional distributions. Conditional distributions, independent random variables. Covariance, correlation coefficient. Regression. Transformations of distributions. One- and two-dimensional normal distributions. Laws of large numbers, DeMoivre-Laplace limit theorem, central limit theorem. Some statistical notions. Computer simulation, applications.

Subject code	Subject name	Requirement	ECTS credit
BMETE90MX44	Mathematics M1c - Differential Equations	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN-CA0	English	WED:08:15-10:00
Practice	EN-CA1	English	WED:10:15-12:00

Preliminaries: one- and multivariate calculus, elements of linear algebra. Explicit first order ordinary differential equations and it solution. Simple types. Linear systems. Higher order equations. Laplace transform, properties and applications. Elements of the qualitative theory. On partial differential equations. Elements of variational calculus.

Subject code	Subject name	Requirement	ECTS credit
BMETE93BG02	Mathematics G2	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	EN0-GPK	English	
Practice	EN1-GPK	English	

Solving systems of linear equations: elementary row operations, Gauss-Jordan- and Gaussian elimination. Homogeneous systems of linear equations. Arithmetic and rank of matrices. Determinant: geometric interpretation, expansion of determinants. Cramer's rule, interpolation, Vandermonde determinant. Linear space, subspace, generating system, basis, orthogonal and orthonormal basis. Linear maps, linear transformations and their matrices. Kernel, image, dimension theorem. Linear transformations and systems of linear equations. Eigenvalues, eigenvectors, similarity, diagonalizability. Infinite series: convergence, divergence, absolute convergence. Sequences and series of functions, convergence criteria, power series, Taylor series. Fourier series: axpansion, odd and even functions. Functions in several variables: continuity, differential and integral calculus, partial derivatives, Young's theorem. Local and global maxima / minima. Vector-vector functions, their derivatives, Jacobi matrix. Integrals: area and volume integrals.

Subject code	Subject name	Requirement	ECTS credit
BMETE95AM30	Probability Theory 2	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	T0	English	MON:10:15-12:00
Practice	T1	English	TUE:10:15-12:00

Subject code	Subject name	Requirement	ECTS credit
BMETE95AM31	Mathematical Statistics 1	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	
Practice	EN1	English	

Statistical sample, descriptive statistics, empirical distributions. Most frequently used probabilictic models, likelihood function, sufficiency, maximum likelihood principle. Theory of point estimation: unbiased and asymptotically unbiased estimators, efficiency, consistency. Methods of point estimation: maximum likelihood, method of moments, Bayes principle. Interval estimation, confidence intervals. Theory of hypothesis testing, likelihood ratios. Parametric inference: u, t, F tests, comparing two treatments. Two-way classified data, contingency tables, chi-square test. Nonparametric inference: Wilcoxon and sign tests, Spearman correlation. Regression analysis. Linear regression, method of least squares, Pearson correlation. Multivariate regression, multiple correlation. Linear models, analysis of

variance for one- and two-way classified data. Practical considerations: selecting the sample size, test for normality, resampling methods. – R. A. Johnson, G. K. Bhattacharyya, Statistics. Principles and methods. Wiley, New York, 1992.– G. K. Bhattacharyya, R. A. Johnson: Statistics – Principles and Methods, Wiley, 2014.

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM07	Markov Processes and Martingales	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	
Practice	T1	English	

1. Martingales:Review (conditional expectations and tower rule, types of probabilistic convergences and their connections, martingales, stopped martingales, Doob decomposition, quadratic variation, maximal inequalities, martingale convergence theorems, optional stopping theorem, local martingales). Sets of convergence of martingales, the quadratic integrable case. Applications (e.g. Gambler's ruin, urn models, gambling, Wald identities, exponential martingales). Martingale CLT. Azuma-Houml;ffding inequality and applications (e.g. travelling salesman problem)2. Markov chains:Review (definitions, characterization of states, stationary distribution, reversibility, transience-(null-)recurrence). Absorbtion probabilites. Applications of martingales, Markov chain CLT. Markov chains and dynamical systems; ergodic theorems for Markov chains. Random walks and electric networks 3. Renewal processes:Laplace transform, convolution. Renewal processes, renewal equation. Renewal theorems, regenerative processes. Stationary renewal processes, renewal paradox. Examples: Poisson process, applications in queueing4. Point processes:Definition of point processes. The Poisson point process in one and more dimensions. Transformations of the Poisson point process (marking and thinning, transforming by a function, applications). Point processes derived from the Poisson point process. 5. Discrete state Markov processes:Review (infinitesimal generator, connection to Markov chains, Kolmogorov forward and backward equations, characterization of states, transience-(null-)recurrence, stationary distribution). Reversibility, MCMC. Absorption probabilities and hitting times. Applications of martingales (e.g. compensators of jump processes). Markov processes and dynamical systems; ergodic theorems for Markov processes. Markov chains with locally discrete state space: infinitesimal generator on test functions References:Karlin, S.; Taylor, H. M.: Sztochasztikus folyamatok. Gondolat Kiadoacute;, Budapest, 1985Lindvall, T.: Lectures on the Coupling Method. Dover Publications, Inc., Mineola, NY, 2002Norris, J. R.: Markov chains. Cambridge University Press, Cambridge, 1998 Resnick, S.: Adventures in Stochastic Processes. Birkhauml;user Boston, 1992 Rosenblatt, M.: Markov processes. Structure and Asymptotic Behavior. Springer-Verlag, New York-Heidelberg, 1971 Williams, D.: Probability with Martingales. Cambridge University Press, 1991

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM11	Stochastic Models	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	T0	English	

Coupling methods (stochastic dominance, coupling random variables and stochastic processes, examples: connectivity using dual graphs, optimization problems, combinatorial probability problems)Percolation (definitions, correlation inequalities, duality, contour methods)Strongly dependent percolation: Winkler percolation, compatible 0-1 sequencesBasics of statistical physics (Gibbs measure, a few basic models)Card shuffling (completely shuffled deck, how many times should one shuffle?)Random graph models (Erdősndash;Reacute;nyi, Barabaacute;sindash;Albert; basic phenomena)Variants of random walks: scenery reconstruction, self-avoiding eacute;s self-repelling walks, loop -erased walks, random walk in random environment)Queueing models and basic behavior; stationary distribution and reversibility, Burke Theorem; systems of queuesInteracting particle systems (simple exclusion on the torus and on the infinite lattice, stationary distribution, Palm distributions, couplings, other models)Graphical construction of continuous time Markov processes (Yule model, Hammersley's process, particle systems)Self organized criticality: sandpile models (questions of construction, commutative dynamics, stationary distribution in finite volume, power law decay of correlations)Linear theory of stationary processes: strongly and weakly stationary processes, spectral properties, autoregressive and moving average processes. Analysis of time series, long memory processes.Models of risk processes. References: (Selected chapters from the following ndash; and other ndash; works.) Grimmett, G.: Percolation. Springer-Verlag, Berlin, 1999. Liggett, T.: Interacting Particle Systems. Springer-Verlag, Berlin, 2005. Lindvall, T.: Lectures on the Coupling Method. Dover Publications, Inc., Mineola, NY, 2002. Thorisson, H.: Coupling, Stationarity, and Regeneration. Springer-Verlag, New York, 2000. Walrand, J.: An Introduction to Queueing Networks. Prentice Hall 1988Werner, W.: Lectures on Two-dimensional Critical Percolation, http://arxiv.org/abs/0710.0856Werner, W.: Random Planar Curves and Schrammndash;Loewner Evolutions, http://arxiv.org/abs/math/0303354Zeitouni, O.: Lecture Notes on Random Walks in Random Environment, XXXI summer school in probability, St Flour, France, Volume 1837 of Springer's Lecture notes in Mathematics

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM12	Advanced Theory of Dynamical Systems	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	T0	English	

Subadditive and multiplicative ergodic theorems. Lyapunov exponents. Spectral properties of measure preserving transformations. Shadowing lemma. Markov partitions and their construction for uniformly hyperbolic systems.

Perron-Frobenius operator and its spectrum. Doeblin-Fortet inequality.Stochastic properties of hyperbolic dynamical systems. Kolmogorov-Sinai entropy. Ornstein's isomorphy theorem (without proof).M. Pollicott: Lectures on Ergodic theory and Pesin Theory on compact manifolds, CUP, 1993.R. Bowen: Equilibrium states and the ergodic theory of Anosov diffeomorphisms, Springer LNM 470, 1975. M. Brin, G. Stuck: Introduction to Dynamical Systems, CUP, 2002.

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM34	Markov Decision Processes and Reinforcement Learning	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	T0	English	

General theory of MDPs:Basic concepts of Markov Decision Processes (MDPs), main types such, as stochastic shortest path, total discounted and average (ergodic) cost problems. Control policies, value functions, Bellman operators and their core properties, monotonicity, contraction, optimality equations, greedy policies and approximation possibilities. Existence and properties of optimal control policies.Standard RL methods for MDPs:Main solution directions of MDPs: iterative approximations of value functions (e.g., value iteration, Q-learning, SARSA); direct search in the space of policies (e.g., policy iteration, policy gradient); linear programming formulation, complexity. Generalizations: unbounded costs, partial observability.Temporal difference (TD) learning based policy evaluations: Monte Carlo methods, eligibility traces, TD(0), TD(1) and TD(lambda): online, offline, first-visit, every-visit variants, convergence theorems, optimistic policy improvements. Examples, like Q-learning for SSPs. Off-policy policy evaluations.Small-sample theory for RL:Multi-armed bandit problems, exploration-vs-exploitation, regret, Hannan consistency, canonical bandit model, subgaussian bandits, explore-then-commit algorithm, upper confidence bound (UCB) algorithm, the optimism principle, regret bounds for UCB, asymptotic optimality of UCB, contextual bandits, stochastic linear bandits, confidence regions for bandit problems, online confidence sets.Large-sample theory for RL:General adaptive algorithms and stochastic approximation (SA), fixed point and root finding problems. Examples of classical SA algorithms with analogous methods in RL: Robbins-Monro (e.g., Q-learning), Kiefer-Wolfowitz (e.g., policy gradient), SPSA (simultaneous perturbation stochastic approximation), stochastic gradient descent (SGD) and its acceleration methods (e.g., momentum).Asymptotic analysis of general adaptive algorithms assuming martingale difference noise sequences. Convergence results based on Lyapunov (potential) functions. Applications to classical examples: SGD with Lipschitz continuous gradient and Euclidean norm pseudo-contractions. Convergence analysis based on contraction and monotonicity properties, and their illustration through RL examples.Recommended literature:Bertsekas D. P. amp; Tsitsiklis J. N.: Neuro-Dynamic Programming, Athena Scientific, 1996.Lattimore, T. amp; Szepesvári, Cs.: Bandit Algorithms, Cambridge University Press, 2018.Feinberg, A. E. amp; Shwartz, A. (eds.): Handbook of Markov Decision Processes, Kluwer Academic Publishers, 2002.Kushner, H. amp; Yin, G.: Stochastic Approximation and Recursive Algorithms and Applications, 2nd edition, Springer, 2003.Sutton, R. S. amp; Barto, A. G: Reinforcement Learning: An Introduction, 2nd edition, MIT Press, 2018.

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM41	Stochastic Analysis	Exam	8

Course type	Course code	Course language	Timetable information
Lecture	T0	English	
Practice	T1	English	

1) Martingales, discrete stochastic integral, optional stopping theorem, discrete Doob decomposition.2) Multivariate normal distribution, Gaussian process, Paul Lévy's construction of Brownian motion.3) Martingales derived from Brownian motion, properties of Brownian motion, B.M. is nowhere differentiable.4) Stieltjes integral, quadratic variation (e.g. of Brownian motion), mutual variation.5) Strong Markov property, reflection principle for Brownian motion.6) Definition of Ito integral (w.r.t. Brownian motion), case of deterministic integrand (Gaussian process), martingale property of Ito integral, quadratic variation of Ito integral.7) Def of Ito process, Ito formula (in the case when we integrate w.r.t. B.M.)8) Stochastic integral w.r.t. Ito process, Ito formula for Ito processes.9) Stochastic integration by parts, time-dependent Ito formula, multivariate Ito formula.10) Harmonic functions and martingales.11) Paul Lévy's characterization of B.M.12) Martingale representation theorem.13) Existence and uniqueness of strong solution of stochastic differential equation.14) Famous stochastic differential equations (SDEs): O-U process, Geometric Brownian motion, Brownian bridge.15) Equivalent definitions and properties of Besssel process, relation of squared Bessel process and branching processes.16) Stochastic exponential and stochastic logarithm.17) General linear SDE, stochastic logistic equation, CIR process.18) Infinitesimal generator of diffusion process, Dynkin's formula.19) Weak solution of SDE, Tanaka's counterexample, Tanaka's formula.20) Diffusions and related elliptic PDE's (Laplace, Poisson, Helmholtz).21) Diffusions and related parabolic PDE's (heat equation, Kolmogorov forward/backward, Feynman-Kac formula).22) Stationary distribution of 1-dimensional diffusion process.23) Change of measure, Girsanov's formula.– H-H. Kuo, Introduction to Stochastic Integration, Springer, 2008.– F.C. Klebaner, Introduction to stochastic calculus with applications, (Third edition) Imperial College Press, 2012.– Durrett, Richard. Stochastic calculus: a practical introduction. Vol. 6. CRC press, 1996.

Subject code	Subject name	Requirement	ECTS credit
BMETETOP201	Vibration, Waves and Thermodynamics	Exam	0

Course type	Course code	Course language	Timetable information
Lecture	T0	English	
Practice	T1	English	
Practice	T2	English	

Subject code	Subject name	Requirement	ECTS credit
BMETETOP202	Optics and Atomic Physics	Exam	0

Course type	Course code	Course language	Timetable information
Lecture	A0	English	
Practice	A3	English	
Practice	A1	English	
Practice	A2	English	

Subject code	Subject name	Requirement	ECTS credit
BMETETOP203	Algebra 2	Exam	0

Course type	Course code	Course language	Timetable information
Lecture	A1	English	

Subject code	Subject name	Requirement	ECTS credit
BMETETOP204	Geometry 2	Exam	0

Course type	Course code	Course language	Timetable information
Lecture	A1	English	

Subject code	Subject name	Requirement	ECTS credit
BMETETOP205	Computing	Exam	0

Course type	Course code	Course language	Timetable information
Lecture	A0	English	

Subject code	Subject name	Requirement	ECTS credit
BMETETOP208	Advanced Algebra	Exam	0

Course type	Course code	Course language	Timetable information
Lecture	A0	English	

Subject code	Subject name	Requirement	ECTS credit
BMETETOP209	Computer Algebra	Exam	0

Course type	Course code	Course language	Timetable information
Lecture	A1	English	

Subject code	Subject name	Requirement	ECTS credit
BMETETOPB22	Basic Mathematics 1	Mid-semester mark	0

Course type	Course code	Course language	Timetable information
Lecture	EN0-A0	English	WED:17:15-19:00(ONLINE); WED:17:15-19:00(ONLINE); THU:17:15-19:00(ONLINE); THU:17:15-19:00(ONLINE)

Algebra part. Integers, rational, real numbers. Arithmetic operations and their properties. Prime factorization. Powers. Working with arithmetic expressions. Equations of first degree and second degree. Equations with radicals. Factoring polynomials. Notion of sets. Set operations and their properties. Inequalities. Word problems. Geometry part. Basic notions: lines, angles. Triangles (equilateral, isosceles, right triangles, bisector, altitude, etc. in triangles). Circles. Circumscribed and inscribed circles of triangles. Tangents to circles, angles of circumference. Angles in radian. Perimeter and area of planar figures. Sine, cosine, tangent of angles in right triangles and in triangles with obtuse angle. Sine theorem, Cosine theorem. Parallelograms. Sphere, tetrahedron, prism, cylinder, pyramid, cone,

parallelepiped. Surface area and volume. Cartesian coordinate system. Area and volume of similar figures.

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
BMEKOALM244	City logistics	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	ERA_EA	English	THU:14:15-16:00
Practice	ERA_GYAK	English	THU:12:15-14:00

Subject code	Subject name	Requirement	ECTS credit
BMEKOALM323	Planning of warehousing systems	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	ERA_EA	English	THU:10:15-12:00
Practice	ERA_GYAK	English	THU:12:15-14:00

Subject code	Subject name	Requirement	ECTS credit
BMEKOALM337	Planning of extra-logistics networks	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	ERA_EA	English	WED:10:15-12:00
Practice	ERA_GYAK	English	WED:08:15-10:00

Subject code	Subject name	Requirement	ECTS credit
BMEKOKAM703	Safety and reliability in vehicle industry	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	ERA ea	English	THU:08:15-10:00

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
BMEKOKKM222	Road Safety	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	ERA_L	English	WED:10:15-12:00
Practice	ERA_P	English	WED:08:15-10:00

Subject code	Subject name	Requirement	ECTS credit
BMEKOKKM230	Environmental effects of transport	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	ERA_L	English	WED:10:15-12:00
Practice	ERA_p	English	WED:08:15-10:00