# 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 | k210_nmű | German | TUE:10:15-12:00 |

BMEGT61A051 German for Engineers B2 - Recommended entrance level: B2 - The course focuses on developing competencies required for effective general and technical/specialist communication in German. There is an equal emphasis on both written and spoken German. In the course students are introduced to distinctive uses of technical texts, with particular emphasis on their lexical and syntactic characteristics. Students acquire an essential collection of technical terminology in all fields of engineering. - By the end of the course, students are able to understand complex technical texts. Moreover, they are able to create simple technical scripts bearing the basics of the technical register in mind. They are able to formulate their opinions concerning specialist topics. They recognize and use terminology related to their own fields of interest and outside their profession's scope. They are able to elaborate on: technical inventions, innovations, appliances, devices, mechanisms, materials technology, properties of materials, basic geometrical shapes, primary mathematical concepts, proper names of tools, the principles of energy technology, and the basic questions of sustainability. - Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | k112_nkk | German | MON:12:15-14:00 |

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 |
|---|---|---|---|
| BMEGT61A081 | Manager Communication - German - B2 | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | k114_nmaco | German | MON:14:15-16:00 |

BMEGT61A081 Business German - Manager Communication - German - B2 - Recommended entrance level: B2 - The aim of the course is to make students participate in business communication in German, to master business German vocabulary and to understand business processes. The course is aimed at students pursuing economics and engineering studies, which can provide them with the opportunities to understand and accept the similarities and differences in economic and engineering approaches. - After completing the course, students will understand not only professional texts but also texts and videos intended for a wider audience, and they will be able to write texts related to managerial work (e.g., summary, reminder, official letter). As a result of the structured development of economic vocabulary, students are able to participate in workplace communication, can comment on economic events, and gather, organize, and share information about companies. - Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| 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 |
|---|---|---|---|
| BMEGT61MNPD | German in Company Contexts | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | k416_nDAF | German | THU:16:15-18:00 |

BMEGT61MNPD Deutsch im Unternehmen B2- Recommended entrance level: B2 - The subject develops communication skills required for taking a job at level B2. The main focus is on oral and written communication though it aims at developing all the skills steadily making students familiar with professional language. - By the end of the course the student will be able to discuss typical topics related to economy and company life, like different types of work, he/she knows the special vocabulary of the stock market, how to introduce a new product. Also the student takes part in project work during which he/she presents companies operating in German-speaking countries. - 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 |
|---|---|---|---|
| BMEGT62AF81 | Manager Communication - French - B2 | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | k314_fmen | French | WED:14:15-16:00 |

Subject name Manager communication - French Subject code(s) BMEGT62AF81 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.nyi.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 linguistic skills and knowledge of language functions at B2 level which will allow him/her to communicate in commercial contexts and carry out the language related tasks necessary in technical management. Competences Oral comprehension/ Speaking skills: Students will be able to communicate effectively in typical conversational situations in the studentsrsquo; field, taking into consideration intercultural factors. Written comprehension/Written composition: Students will be able to understand texts and to produce grammatically accurate and professionally appropriate texts and to convey information related to the studentrsquo;s professional field. Topics covered Types of businesses (organisational structures) Business description Labour market (EU) Job advertisements (job descriptions) Job interviews, exchange of information (job seeking) Business cultures in different countries, intercultural factors Communication in the workplace: Making contact, telephone, email Communication in the workplace: negotiations, meetings Speaking about diagrams, graphs and tables Product presentations, trade fairs Requirements for

participation in the lessons ldquo;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.rdquo; Code of Studies and Exams, Article 14 (3) Subject requirements 1/3 - the studentrsquo;s performance during the semester (including assembling a semester file) 1/3 - presentation: to be given during term time; on a subject of the studentrsquo;s choice from the material covered during the lessons; may be done in groups 1/3 - 90-minute end of term written test (based on the material taught) and an optional mid-term test

| 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 |
|---|---|---|---|
| BMEGT62AS81 | Manager Communication - Spanish - B2 | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | k408_spmen | Spanish | THU:08:15-10:00 |

Subject name Manager communication - Spanish Subject code(s) BMEGT62AS81 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 linguistic skills and knowledge of language functions at B2 level which will allow him/her to communicate in commercial contexts and carry out the language related tasks necessary in technical management. Competences Oral comprehension/ Speaking skills: Students will be able to communicate effectively in typical conversational situations in the students' field, taking into consideration intercultural factors. Written comprehension/Written composition: Students will be able to understand texts and to produce grammatically accurate and professionally appropriate texts and to convey information related to the student's professional field. Topics covered Types of businesses (organisational structures) Business description Labour market (EU) Job advertisements (job descriptions) Job interviews, exchange of information (job seeking) Business cultures in different countries, intercultural factors Communication in the workplace: Making contact, telephone, email Communication in the workplace: negotiations, meetings Speaking about diagrams, graphs and tables Product presentations, trade fairs 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 (including assembling a semester file) 1/3 - presentation: to be given during term time; on a subject of the student's choice from the material covered during the lessons; may be done in groups 1/3 - 90-minute end of term written test (based on the material taught) and an optional mid-term test

| 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 | k116_amű | English | MON:16:15-18:00 |
| Practice | k509_amű | English | FRI:09:15-11:00 |
| Practice | k408_amű | English | THU:08:15-10:00 |

BMEGT63A051 English for Engineers B2 - Recommended entrance level: B2 - The course focuses on developing competencies required for effective general and technical/specialist communication in English. There is an equal emphasis on both written and spoken English. In the course students are introduced to distinctive uses of technical texts, with particular emphasis on their lexical and syntactic characteristics. Students acquire an essential collection of technical terminology in all fields of engineering. - By the end of the course, students are able to understand complex technical texts. Moreover, they are able to create simple technical scripts bearing the basics of the technical register in mind. They are able to formulate their opinions concerning specialist topics. They recognize and use terminology related to their own fields of interest and outside their profession's scope. They are able to elaborate on: technical inventions, innovations, appliances, devices, mechanisms, materials technology, properties of materials, basic geometrical shapes, primary mathematical concepts, proper names of tools, the principles of energy technology, and the basic questions of sustainability. - Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| 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 | k509_axc | English | FRI:09:15-11:00 |

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 | k508_AC | English | FRI:08:15-10:00 |

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 |
|---|---|---|---|
| BMEGT658361 | Hungarian Culture | Exam | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | k208 | English | TUE:08:15-10:00 |

BMEGT658361 Magyar kultúra - Hungarian Culture - B2 - - Recommended entrance level:: B2 - The series of lectures is designed to engage students in learning about Hungarian people, the land, history, cultural traditions and geography. The lecture focuses on Hungary's history and culture in considerable depth from the arrival of the Magyars in the Carpathian basin in 896 to the present day, which creates a better understanding of today's Hungarian conditions. - After completing the course, participants will be able to identify important historic events and their impact on today's social, political and economic situation. Also, students will become familiar with the main geographical areas and their architectural heritage from Roman ruins and medieval townhouses to Baroque churches, Neoclassical public buildings and Art Nouveau bathhouses and schools. Getting acquainted with Hungary's rich folk traditions, like wonderful embroidery, porcelain, wooden artefacts and music, students will have a better understanding of the Hungarian soul and symbols. - Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

# 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 |
|---|---|---|---|
| Laboratory | 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 |
|---|---|---|---|
| Laboratory | 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 |
|---|---|---|---|
| Laboratory | 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 |
|---|---|---|---|
| BMEEPAGA501 | Architectural Informatics 3 - CAD for Architects | Mid-semester mark | 3 |

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

Use of state-of-the-art CAAD software to develop professional architectural solutions. Extensive use of 3-D computer model development. Architectural documentation with computers. Computer animation and fly-throught pictures for architectural space analysis.

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

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

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

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

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

One dimensional steady state heat transfer of composit slabsThermal condition for a room, balance temperature of a nonheated space, energy conservation approaches. Conduction: Fourier’s equation, Concept of thermal conductivity, Range of thermal conductance of building materials, One-dimensional steady state conduction through a plane slab. Convection. Steady state heat transfer of composite slabs, overall heat transfer coefficient, temperature gradient. Modified conduction of insulations. Air gaps. Reverse tasks: Maximizing inner temperature different. fulfilling new U-

value requirement for existing wall. Examples.Linear heat transmissionIntroduction to Thermal Bridges, Definition of Self-Scale Temperature, two applications of SST, Definition of Apparent Thickness, Generalized model of wall corner, generalized model of wall corner temperature, Example: estimation of wall corner temperature. Moisture transfer Definition of Moist air, Dalton‘s Law, Moisture content, Saturation vapour pressure, Relative humidity, dew point, dry and wet bulb temperatures, Specific Enthalpy, Moisture balance, Mechanism of vapour transfer, Scope of calculation, Vapour conductivity and resistance, Overall vapour resistance of multilayer wall, Overall vapour transfer, Design consideration, example. Introduction to Solar Architecture Indirect Solar collecting walls. Mass walls: principles, surface, shading, energetic operation, delaying, losses, operation in summer, irradiated solar energy, examples, simplified thermal model. Example: calculation of thermal balance of a mass wallSolar Design Strategies Sustainable future (global impact of buildings, energy crises, the 2030 challenge, sustainable future). Energy Conscious Design (historical overview - traditional and modern architecture, international style, energy conscious architecture and refurbishment). Energy Conscious Refurbishment. Building Energy Standards (building energy regulation, certifications, standards). Energy Consumption of Buildings (Low and Passive and "zero" energy buildings). Autonom buildings. Energy Conscious Architecture, Passive Solar Systems (smart conceptual design, building volumes, thermal mass, mass wall, Trombe wall, transparent insulation, sun space, green roofs). Active Solar Systems (pv-panesl, solar collectors, heat pump, wind turbine)

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

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | 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 |
|---|---|---|---|
| BMEEPEKA501 | CM1 - Basics of Construction | Mid-semester mark | 2 |

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

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | TUE:12:15-14:00(K389); TUE:12:15-14:00(K389) |
| Practice | EN1 | English | WED:08:15-10:00(K389) |

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

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

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | TUE:08:15-10:00(KM79); TUE:08:15-10:00(KM79) |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPEKS901 | Special construction projects | Mid-semester mark | 2 |

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

The coursersquo;s aim is to give up-to-date information on different special fields of construction in three blocks. In the first block the construction technologies of special, sub- and superstructures are shown, involving topics like metro tunnels, metro stations, special slurry walls, special reinforced concrete superstructures and formwork systems. In the second block traditional and modern materials and technologies are presented regarding to eco- and green architecture, like construction technologies of the passive buildings, or green facades. In the third block students get information on the application of traditional construction technologies, restoration methods and the maintenance of monuments and historic buildings. Besides the theoretical lecturers many site visits are organized to present the practical aspects of the subject as well.

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

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

The subject History of Theory of Architecture I. follows the structure of preliminary architectural history courses focusing on the determinant theories of architecture of different periods. The exploration of the most important tendencies and notions of theory of architecture is based on the preliminary history of architecture studies in an essentially chronological structure, evaluating them in critical analysis and searching their role in the history of ideas. Lecture topics include: Categories and concepts of theory in the history of architecture from antiquity to the raise of modernism in the beginning of the 20th century. Vitruvius and his interpretations. Architectural theory in the Middle Ages from early Christianity to late Gothic period. Humanism and the revival of antique architecture in the 15th. The column orders and commentaries on Vitruvius; the theory of the ideal city. Baroque in the reform of the catholic

church. Academic movement in France and Classicism in Italy in the 17th . Theory of architecture in France in the 18th century. Enlightenment and revolutionary architecture. 19th century theories in England, France and Germany; the interpretation of medieval and classical heritage. The dilemma of eclecticism. Pioneers of modernism and their manifests. The pluralism in the interpretation of architectural space; architecture and philosophy.

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

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

Similarly to the international practice, the course aims research activity in architecture and its documentation primarily. The research topics' possible horizon is determined by the course lists of the departments and the students' interest. Besides the architectural topics, the course will appreciate interdisciplinary and special fields in the international environment. The project work will demonstrate generic and specific skills and understanding of the research's open and synthetic character. The objective of this course is to hone the skills of analysis and abstraction in order to develop a framework for research. The student should be able to draw from precedent in the art, architecture, and engineering in the development of this framework, which will act as scaffolding for the theoretical, experimental, and creative decisions. This course will consist of a series of consultations with the teachers, but the essay should write by the student. The available topics are given by the Departments of the Faculty. The student can also propose a special topic for research during the course, but the teacher must be agreeing with the proposal. The available topics are listed on the department's homepage: http://www.eptort.bme.hu/

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

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

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

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

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

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

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

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPETM101 | History of Contemporary Architecture M | Exam | 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 |
|---|---|---|---|
| BMEEPETO901 | History of Architecture in Hungary 2 | Mid-semester mark | 2 |

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

The course gives an overview of Hungarian architecture from the end of the 18th century up to now. While following the timeline, the classes concentrate on the main problems of the investigated periods, like the question of historicism, international and national sources between the 2 Wars, socialist realism in the 1950s, technology and high-rise in the 1960s, built environment in the 1970s, post-modernism in the 1980s. As the problem of identity (national or regional architecture) is a recurrent theme through the whole period, the course pays a special attention to it.

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

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPETT721 | History of Art | Exam | 2 |

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

Beginnings of the art: the pictures of the cavemen. ndash; Ancient art of the East: Egypt. ndash; Classical art of the Antiquity: Greek and Roman art. ndash; Early Christian and Medieval art. ndash; Renaissance and Baroque art. ndash; The art at the age of Enlightenment: Gothic revival, Classical revival, Classicism. ndash; Romanticism, Realism, Impressionism, Postimpressionism. Bibliography: Ernst H. Gombrich: The Story of Art, Phaidon, 1995;

Michael Levey: A History of Western Art; and other (selected) books of WORLD OF ART series: Thames and Hudson, Oxford University Press; etc.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPRAG111 | Design Skills 1 | Mid-semester mark | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | EN1 | English | TUE:16:15-18:00(K3R1); TUE:16:15-18:00(K3R1) |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPRAG121 | Freehand Drawing for civil engineers | Mid-semester mark | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | EN1 | English | TUE:18:15-20:00(K3R1); TUE:18:15-20:00(K3R1) |

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

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

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

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

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

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

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

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPSTA101 | Introduction to structural design | Exam | 2 |

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

The most important methods of analysis and design of engineering structures are presented, together with their modelling, and the applied approximations. It is shown how high school statics (and math) can be applied to engineering structures. The understanding of the behaviour of structures is emphasized.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPSTA301 | Strength of Materials 1 | Exam | 4 |

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

Basic concepts of strength of materials. Behavior of solid bodies. Material laws, constitutive equations: elasticity and plasticity. Central tension and compression. Design criterion. Pure shear. Steel and carpenter joints. Pure bending.

Second moment of inertia. Bending in elastic stress state. Symmetric bending and skew bending. Eccentric tension and compression. Core of section. Materials not having tensile strength. Bending in plastic stress state. Bending combined with shear. Calculation of shear stresses. Design for bending. Normal force – moment interaction curve. Torsion. Plane stress state. Possible failure conditions: rupture and yield. Elastic energy.

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

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPSTM101 | 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 |
|---|---|---|---|
| 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 |
|---|---|---|---|
| BMEEPTCEP01 | Interdisciplinary, Project based Design F | Mid-semester mark | 16 |

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPUI0423 | Hungarian Settlements | Exam | 2 |

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

The aim of the subject is to familiarize with the characteristics of Hungarian cities and urban development processes. The subject intends to combine the benefits of lectures and lessons; providing the opportunity for active involvement. With the participation of invited speakers, you can hear about the most important periods of Hungarian city history and urban planning features, especially in the context of today's processes. In the remaining classes we deal with the morphological (graphical) analysis of the selected Hungarian settlements. Morphology not only provides an excellent approach to understanding the history of urban development, but it is also worth exploring and learning from a methodological point of view.

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

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEPUI0901 | Urban housing | Mid-semester mark | 2 |

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

see moodle: https://edu.epitesz.bme.hu/course/view.php?id=702 The seminar is related to the Urban Housing LAB of the BME Department of Urban Planning and Design: http://urb.bme.hu/urbanhousing/ The objectives of this course are to introduce you to think critically about contemporary mass housing issues and solutions, to have an international comparison about the urban housing situation, and to make understand the complexity of mass housing development. As students arrive from different countries, the seminar uses the opportunity to learn from each other, to discover and compare several case studies. The five 4x45minute-long occasions are differentiated by geopolitical position and key topics: Introduction / urban housing terminology / comparative research method Post-Socialist Central European Countries / large housing estates Western European Countries / contemporary alternative housing solutions Post-Soviet Countries / homeownership USA / affordable housing

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | EN1-ER | English | |
| Practice | EN2-ER | English | |
| Practice | EN5-ER | English | |

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

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

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

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

# Faculty of Chemical Technology and Biotechnology

IMPORTANT NOTES

If for one subject you can find several different types (lecture, practice, laboratory) of courses then please choose one and only one course from each type in order to be able to perform the subject's requirements successfully.Civil Engineering courses are on the website seperately. Courses chosen from the offer of Faculty of Civil Engineering will be checked and arranged individually by the departmental coordinator.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVEBEA301 | Biochemistry | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A9 | English | MON:15:15-18:00(ONLINE) |

Principles of bioenergetics. Enzymes. Energy sources and main metabolic pathways of living organisms. Carbohydrate metabolism. Lipid metabolism. Protein and amino acid metabolism. Metabolism of nucleotides. Integration of metabolism. Generation and storage of metabolic energy. Citric acid cycle. Genetic information (storage, transmission and expression). The central dogma of molecular biology. Alcohol and drug metabolism. The regulation of metabolic pathways.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | laboratory-ER | English | FRI:13:15-17:00(HF4) |
| Lecture | theory-ER | English | MON:12:15-14:00(ONLINE) |

Definitions, classes of plastics, most important properties. Radical polymerization. Polycondensation, cross-linked polymers. Models of polymer physics. Polymer solutions. Phases and physical states. Behaviour of solid polymers, rubber elasticity. Uniaxial deformation, tensile testing, necking. Fracture, brittle and ductile failure. Relationship of molecular and macroscopic structure. Crystalline polymers. Melting, crystallization, polymorphism. Correlation between crystalline structure and properties. Structure of amorphous polymers. Polymer blends and composites. Physical states and processing modes. Machining. Application of plastics. Type and cause of degradation. Types of additives. Plastics and the environment. Plastics based on natural resources. Biodegradable polymers. Lab practice demonstrating the most important processing technologies and quality control methods.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A6-ER | English | FRI:08:15-10:00(KM34) |
| Practice | A7-ER | English | FRI:08:15-10:00(KM34) |

Reaction kinetics: Homogeneous reactions. First order and second order reactions. Equilibrium reactions. Consecutive and parallel reactions. Temperature dependence of reaction rates. Kinetics of heterogeneous reactions. Transport processes: Thermodynamic driving forces. Laws of diffusion. Heat conductance. Viscosity. Electrochemistry: Equilibrium in electrolytes. Thermodynamics of galvanic cells. Electrode potentials. Conductivity of electrolytes. Kinetics of electrode processes.

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

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

i) Equilibrium states: One componenet liquid-vapor phase equilibrium. Apparent heat of evaporation; Two component liquid-liquid phase equilibrium. Critical temperature of miscibility; Electrochemical equilibrium and electromotive force of a galvanic cell. Nernstian operation; Calorimetry. Heat of an acid-base reaction. Specific heat of an organic liquid. ii) Reaction kinetics: Rate constant of iodination of acetone; Order of a component in kinetics of decomposition of hydrogen peroxide iii) Measurements in transport phenomena: Electrolyte conductivity. Molar conductivity. Dissociation constant of a weak electrolyte; Rheology. Viscosity of a Newtonian liquid. Flow curve of a thixotropic slurry. Literature:

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVEFAM201 | Physical chemistry and structural chemistry | Exam | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A0-ER | English | TUE:08:15-10:00(ONLINE); WED:14:15-17:00(ONLINE) |

Interactions of atoms and molecules with particules and external fields: Interactions with particles, electric field, magnetic field, elementary magnets, diamagnetism, precession of magnetic moment, paramagnetism, interaction with electromagnetic waves, the electromagnetic spectrum. Structure and properties of atoms: The hydrogen atom, the structure of the hydrogen atom, angular and magnetic moments of the hydrogen atom, angular and magnetic moments of the hydrogen atom, the electronic spectrum of the hydrogen atom. Many-electron atoms: hydrogenic atoms, other many-electron atoms interactions with external magnetic field, with external electric field interpretation of other many-electron atoms, measurement of atomic spectra. Ions. Ionization, interactions of ions Structure and properties of molecules Molecular symmetry: symmetry elements, operations, point groups, representations. The electronic structure of molecules: construction of molecular orbitals, localized orbitals. The covalent bond: characteristics of the covalent bond, he structure of two-atomic molecules, hybridization, delocalized systems, complex compounds of transition elements. Rotation of molecules: diatomic molecules, polyatomic and their rotational spectra. Vibration of molecules: vibrational motion and spectra of diatomic molecules, vibrational motion and spectra of polyatomic molecules. Non-linear spectroscopy: other vibrational spectroscopic methods; large amplitude motions. Electronic transitions in molecules: excitation of electrons, types of electronic transitions, excited state and its decay, excitation spectrum and substituent effect, measurement and application of excitation spectra, ultraviolet photoelectron spectroscopy. Dispersion of light: dispersion and refractive index, electron excitation with polarized light. Mass spectroscopy: principle and instrumentation, applications. Paramagnetic resonance: paramagnetic molecules, electron spin resonance. Nuclear magnetic resonance: the resonance, spin-spin interactions, 13C-NMR spectroscopy, recording NMR data, the Overhauser effect, relaxation processes, measurement of relaxation processes, two-dimensional NMR spectroscopy. Diffraction methods and molecular structure: diffraction methods, scattering on isolated molecules, electron diffraction in gas phase, character of measured and calculated geoemetric parameters. The structure of atomic and molecular ensembles Intermolecular interactions: theoretical descriptions, types of interactions. Structure of molecular ensembles: liquid state models, the structure of liquids, the solid crystalline state, conductors, semiconductors and insulators in solid atate. Diffraction methods: in structure investigation of ordered systems, methods: X-ray diffraction, electron diffraction, neutron diffraction. Spectroscopic methods: X-ray photoelectron spectroscopy, Auger electron spectroscopy, secondary ion emission mass spectroscopy, Mouml;ssbauer spectroscopy, vibrational spectroscopy in condensed phases.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVEFAM212 | Biopolymers | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | laboratory-ER | English | |
| Lecture | theory-ER | English | THU:08:15-10:00(CHA10) |

Biopolymers are polymers arising in living organisms (e.g. microorganisms or higher order plants and animals) or synthesized from bio-based building blocks (e.g. acids, amino acids, carbohydrates, natural triglycerides) in a chemical process. The course introduces the students to the most significant biopolymers, their chemical structure, properties and the most important application areas

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A0 | English | THU:12:15-14:00(KF38) |

In the modern materials science the main goal is designing materials to accomplish multiple properties in a single system. Usually these materials can respond to environmental stimuli by exhibiting particular changes in some of their properties. The aim of this course is to provide theoretical and practical knowledge in the chapters of modern materials science based on the colloids science (“the world of nano”), surface chemistry and physical chemistry of polymers.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVEFKAKM1 | Physical Chemistry and Radiochemistry | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | A1-ER | English | WED:16:15-19:00(F11FK) |
| Lecture | A0-ER | English | THU:08:15-10:00 |

The course covers the laws of thermodynamics and their application to the properties of gases, liquids, and solids, and to homogeneous and heterogeneous equilibria; chemical kinetics. Nature, production and applications of radioactivity. Topics will include: radioactive decay processes, types of radioactive decay, atomic nuclei, interactions with matter; radiochemical instrumentation; nuclear reactions.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | eng_th | English | THU:13:15-16:00(F11Schay) |
| Practice | eng | English | THU:13:15-16:00(F11Schay) |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVEKFMBR1 | Environmentally Benign and Catalytic Processes | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | eng_ER | English | FRI:08:15-11:00(CH201) |

National and international activities with respect to environmental programs. quot;Cleanquot; technologies. EU directives, tendencies, regulations. Clean air projects, activities, processes. Classification of air pollutants, intervention places, exhaust reduction. Water quality control, physico-chemical treatment of waste waters, WAO, stripping with air or steam. Clean technologies, supercritical solvents and processes. Membrane processes, case studies. Catalytic processes, working mode of catalysts, kinetics, catalyst preparation, testing, modification, catalyst poisons, catalytic reactors, economics of catalytic processes. Catalytic processes in environmental technologies, automotive catalysis, fuel-cells, hydrogen and methanol economy. At the practices the students get individual tasks, get acquainted with the chosen topic, carry out measurements, evaluate them and finally report about their results in written and oral form.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A21-ER | English | MON:13:15-15:00(ONLINE); THU:10:30-12:00(ONLINE) |

The subject of chemistry. Material, the structure of the material, mixtures, energy and mass conservation. Atoms, molecules, elements compounds, ions, mol. Chemical formula, stoichiometry, concentration and its measurement. Chemical reactions and their types. Redox reactions, oxidation number acid-base reactions, acid-base theories, pH. Characterisation of the gaseous state, gas laws. The liquid and the solid states. Phase transitions and their characterisation by phase diagramms. Crystallization, sublimation and distillation. Thermochemistry. Chemical equlibria. The Le Chatellier principle. Homogenous and heterogenous mixtures. Specific chemical equlibria, pH equlibria, solubility product constant. Basics of electrochemistry. Electrolysis, Faradayrsquo;s law. Electrode potential, redox electrodes, metal electrodes, gas electrodes. Ionic conductivity. Galvanic cell and redox equilibria. Chemical kinetics, reaction rate, rate constant, activation barrier, Arrheniusrsquo; law. Thermodynamics and kinetics for a reaction. Basics of colloids, definitions. Atoms electrons, atomic structure. Atomic orbitals, the hydrogen atom. Multielectron atoms, the Aufbau principle. The periodic table of the elements. The chemical bond in H2. Covalent, ionic and dative bonds. Diatomic molecules the sigma and the pi-bond. Delocalization. Hybridization and molecular structure. VSEPR theory. Metals. Molecular movements, rotation, vibration.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | A10-ER | English | FRI:08:15-11:00(ONLINE) |

Expression for the composition of solutions and their applications. Operations with solutions, crystallization, recrystallization. Gases. Properties of gases. Equation of state for ideal gas, and its versions. Boylersquo;s law, Charlesrsquo; laws. Gay-Lussacrsquo; law. Mixtures of gases, compositions. Partial pressure, and volume. Daltonrsquo;s rule and Amagatrsquo;s rule. Vapor pressure. Colligative properties of dilute solutions. Vapor pressure lowering, boiling-point elevation, and freezing-point depression, osmosis. Balancing equations. Oxidation numbers, redox equations. Stoichiometry and its applications. Yield. Avogadrorsquo;s law. Calculation of titration. Basic terms in thermochemistry. Energy, heat and enthalpy. Heat capacity, molar heat capacity. The heat of reactions and Hess's law. General description of chemical equilibria. Various forms of equilibrium constants and their connections. Application of LeChatelier's principle. The shift in the equilibrium composition by the change in the amount of reactants, in the pressure, and in the temperature. Heterogeneous equilibria. Acid-base equilibria, pH of solutions; Electrochemisty;

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A10 eng | English | TUE:14:15-16:00(ONLINE); WED:15:15-17:00(ONLINE) |

Fundamentals of chemical analysis: sampling and sample preparation, separation techniques, and error calculations. Evaluation of analytical data. Gravimetric methods of analysis. Titrimetric methods of analysis: precipitation, acid-base, complex formation, and oxidation-reduction titrations. Theory and applications of

instrumental analytical methods: potentiometry, voltammetry, conductometry, thermal analysis, liquid and gas chromatography, flame photometry, atomic absorption spectrometry, ultraviolet, visible and infrared molecular spectroscopy.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVESAM202 | Material Science Analysis Methods | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AL eng | English | TUE:10:15-14:00(CHFAA) |
| Lecture | AE eng | English | THU:13:15-15:00(ONLINE) |

The course will give a broad overview on the measurement methods used in materials science involving nanotechnology, inorganic chemistry, polymers, biomaterials, organic materials. During the laboratory practices the students will get both theoretical knowledge and practical experience about a large number of analytical methods and instruments

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A19-ER | English | MON:10:15-12:00(CHFMAX); TUE:10:15-12:00(CHFMAX) |
| Practice | A20-ER | English | MON:10:15-12:00(CHFMAX); TUE:10:15-12:00(CHFMAX) |

Structures of molecules; Stereochemistry, configuration, conformation; Theory of reactions, theories of acid and bases, HSAB and FMO theories; Theory of redox and radical reactions, chemistry of paraffins. Reactivity of olefines and acetylenes, electrophilic addition, oxidation and polymerization; Reactivity of monocyclic aromatic compounds, electrophilic substitution; The theory of substitution and elimination; The chemistry of halogen compounds, alcohols, phenols and ethers; The chemistry of nitro compounds and amines; Reduction and oxidation of alcohols, oxo compounds and carboxylic acid derivatives; Reactivity of oxo compounds, carboxylic acids and carboxylic acid derivatives; Oxo-enol tautomerism; Chemistry of carboxylic acids; Chemistry of carboxylic acid derivatives;

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 11-ER | English | TUE:15:15-17:00(ONLINE) |

The subject gives an overview on biocatalysis and biotransformation with special emphasis on stereoselective methods for chemical engineers and bioengineers for chemical and bioindustries (pharma, fine chemicals, food and cosmetics industries). The interdiscliplinary subject aims to improve probem solving capabilities related to stereochemical as well as biotechnology issues such as protein structure, enzyme immobilization and molecular genetics tools for biocatalysts development. General features of biotransformations and biocatalysis - Enzyme and cell immobilization - Development of novel biocatalysts by traditional and molecular genetics methods - Stereochemical questions related to biotransformations - Selectivity types in biotransformations - Biotransformations with isolated enzymes (hydrolases, oxido-reductases, liases, transferases) - Biotransformations with multienzyme systems - Synthetic whole-cell biotransformations with traditional and recombinant microbes - Industrial biotransformations: examples of biotransformations on industrial scale.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | Eng1-ER | English | THU:16:15-19:00(ONLINE) |
| Practice | Eng2-ER | English | THU:16:15-19:00(ONLINE) |

Random variable, density and distribution function, expected value, variance. Continuous distributions, normal distribution, standard normal distribution, #61539;2, t and F distribution. Central limit theorem. Population and sample. Parameter estimation. Hypothesis testing, parametric tests. Mutual distribution of several random variables, correlation. Principles of regression, linear regression. Checking adequacy, weighted regression, parameter estimation, partition of SSQ, confidence intervals. Design of experiments. 2p full factorial: the design, orthogonality and rotatability, estimation of parameters, significance tests. 2p-r fractional factorials.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVEVMA709 | Computer Process Control | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | eng_lab-ER | English | TUE:10:15-13:00(ONLINE) |
| Lecture | english-ER | English | TUE:10:15-13:00(ONLINE) |

Hardware and software of computer control, on-line data collection, supervisory control, direct digital control, sampled data system, theory of sampled data systems, bdquo;Zrdquo; transformation, relations between Laplace and Z-transformations, stability in Z plane, examples for samled data systems.

# Faculty of Civil Engineering

IMPORTANT NOTES

If for one subject you can find several different types (lecture, practice, laboratory) of courses then please choose one and only one course from each type in order to be able to perform the subject's requirements successfully.Civil Engineering courses are on the website seperately. Courses chosen from the offer of Faculty of Civil Engineering will be checked and arranged individually by the departmental coordinator.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOAFAS42 | Field Course of Structural Geodesy | Mid-semester mark | 1 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | EN2 | English | WED:14:15-18:00(KF27l) |
| Practice | EN1 | English | WED:14:15-18:00(KF27l) |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOAFAT41 | Surveying I. | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | MON:12:15-14:00(KF88) |
| Practice | EN2 | English | THU:08:15-10:00(KF27k); THU:08:15-10:00(KF27k) |
| Practice | EN6 | English | THU:10:15-12:00(KF27b); THU:10:15-12:00(KF27b) |
| Practice | EN1 | English | THU:08:15-10:00(KF27m); THU:08:15-10:00(KF27m) |
| Practice | EN3 | English | WED:08:15-10:00(KF27k); WED:08:15-10:00(KF27k) |
| Practice | EN4 | English | FRI:14:15-16:00(KF27k); FRI:14:15-16:00(KF27k) |
| Practice | EN7 | English | FRI:10:15-12:00(KF27k); FRI:10:15-12:00(KF27k) |
| Practice | EN5 | English | FRI:10:15-12:00(KF27b); FRI:10:15-12:00(KF27b) |

Surveying and Geodesy. Height systems. Optical levelling, the surveyors' level. Line levelling (procedure, field observations and processing). Systematic error sources of levelling, the two-peg-test. Line levelling, detail point levelling. Height observations for horizontal layouts.Horizontal positioning observations. Angular observations and the theodolite. Calibration procedure of the theodolite. Measuring with the theodolites: set up, sighting, horizontal and vertical angular observations, systematic error sources. The computation of the mean direction and the zenith angle. Centring excentric observations. Trigonometric heighting.Distance observations: corrections, reductions. Physical methods of distance measurements. Electrooptical Distance Meters. Processing distance observations. Plane surveying. Computation of horizontal coordinates on the projection grid. Orientation of the horizontal circle. Intersections.

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEODHAOFO | University Experience | Signature | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | EN1 | English | WED:13:15-14:00(KM30); WED:13:15-14:00(KM30) |

| 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 | WED:10:15-12:00(KF12); WED:10:15-12:00(KF12) | |

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 |
|---|---|---|---|---|
| BMEEOEMA301 | Building Materials 1 | | Mid-semester mark | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Laboratory | EN2 | English | WED:08:15-10:00(MMFL2); WED:08:15-10:00(MMFL2) | |
| Laboratory | EN3 | English | WED:08:15-10:00(MMFL3); WED:08:15-10:00(MMFL3) | |
| Laboratory | EN1 | English | WED:08:15-10:00(MMFL4); WED:08:15-10:00(MMFL4) | |
| Laboratory | EN4 | English | WED:08:15-10:00(MMFP); WED:08:15-10:00(MMFP) | |
| Lecture | EN0 | English | FRI:12:15-14:00; FRI:12:15-14:00 | |

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

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOEMA-A1 | Building Construction Methodology | | Exam | 2 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | THU:08:15-09:00(K183); THU:08:15-09:00(K183) | |
| Practice | EN1 | English | THU:09:15-10:00(K183); THU:09:15-10:00(K183) | |

During the semester methodology of planning, methods of design of building constructions are presented. Listing of requirements depend on function of building (building physical, acoustical point of views and fire protection).

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | EN1 | English | THU:12:15-14:00(MMFL2); THU:12:15-14:00(MMFL2) |
| Laboratory | EN2 | English | THU:12:15-14:00(MMFL3); THU:12:15-14:00(MMFL3) |
| Laboratory | EN3 | English | THU:12:15-14:00(MMFL4); THU:12:15-14:00(MMFL4) |
| Lecture | EN0 | English | WED:08:15-10:00(MMFP) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | WED:16:15-18:00(KF12) |
| Practice | EN2 | English | MON:16:15-18:00(K375); MON:16:15-18:00(K375) |
| Practice | EN1 | English | MON:16:15-18:00(K183); MON:16:15-18:00(K183) |

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(KM78) |
| Practice | EN1 | English | WED:10:15-12:00(K374); WED:10:15-12:00(K374) |

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

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

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

The importance and necessity of chemistry in civil engineering. The structure of atoms, the electron shell structure, the structure of molecules and chemical bonding models. States of materials - explanation by intermolecular forces. Ideal and real laws of gases. Fluid systems properties. The structure of crystalline solids (ionic, atomic, molecular and metallic lattice crystal structure and properties). Difference between ideal and realistic structure, macroscopic properties of crystalline materials, lattice defects. Structure and properties of non-crystalline (amorphous or glassy) solids. Macromolecular substances and its chemical properties. Homogeneous and heterogeneous systems. Gibbs law. interfacial phenomena. The types of chemical reactions, speed of chemical reactions. Activation energy and reaction heat. Hess's law. Chemical equilibrium. Acids, bases and salts. The pH concept. Hydrolysis of salts. Electrochemistry. Redox processes, redox potentials. Production of metals, corrosion of metals. Binding materials and binding mechanism. Cement chemistry. Chemical and mineralogical composition of cements. Hydration products, CSH, CAH, CH, primary and secondary ettringite. Application of theoretical knowledge in engineering practice.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | MON:18:15-20:00(KF88); MON:18:15-20:00(KF88) |
| Practice | EN2 | English | MON:10:15-12:00(K376); MON:10:15-12:00(K376) |
| Practice | EN1 | English | MON:10:15-12:00(K374); MON:10:15-12:00(K374) |
| Practice | EN3 | English | MON:10:15-12:00; MON:10:15-12:00 |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | WED:12:15-13:00(K363); WED:12:15-13:00(K363) |
| Practice | EN1 | English | WED:13:15-15:00(K363); WED:13:15-15:00(K363) |

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 |
|---|---|---|---|
| BMEEOEMPRE2 | Technical Drawing | Mid-semester mark | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | EN0 | English | WED:08:15-10:00(K375); WED:08:15-10:00(K375); THU:12:15-14:00(K375); THU:12:15-14:00(K375) |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | EN2 | English | THU:12:15-14:00(K142b) |
| Laboratory | EN1 | English | THU:12:15-14:00(K142b) |
| Laboratory | EN3 | English | TUE:16:15-18:00(K142a) |
| Lecture | EN0 | English | MON:14:15-16:00(KM30); MON:14:15-16:00(KM30) |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOFTAV32 | C/C++ Programming | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | EN1 | English | FRI:12:15-14:00(K142a); FRI:12:15-14:00(K142a) |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN | English | THU:08:15-10:00; THU:08:15-10:00(K142a) |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | TUE:10:15-13:00; TUE:10:15-12:00(K142a) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | EN4 | English | WED:16:15-18:00(K142a); WED:16:15-18:00(K142a); FRI:14:15-16:00(K142b) |
| Laboratory | EN2 | English | TUE:08:15-10:00(KF27c); TUE:08:15-10:00(KF27c); TUE:12:15-14:00(KF27c) |
| Laboratory | EN1 | English | MON:12:15-14:00(K142b); THU:08:15-10:00(K142b); THU:08:15-10:00(K142b) |
| Laboratory | EN3 | English | MON:14:15-16:00(KF27l); THU:12:15-14:00(K142a); THU:12:15-14:00(K142a) |
| Laboratory | EN5 | English | WED:10:15-12:00(K142b); WED:10:15-12:00(K142b); FRI:14:15-16:00(K142b) |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | LAB | English | WED:10:15-12:00(K389); WED:10:15-12:00(K389) |
| Laboratory | SH_LAB | English | WED:10:15-12:00(K389); WED:10:15-12:00(K389) |
| Lecture | EA | English | WED:08:15-10:00(K389); WED:08:15-10:00(K389) |
| Lecture | SH_EA | English | WED:08:15-10:00(K389); WED:08:15-10:00(K389) |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOFTMV32 | C/C++ Programming | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | EN1 | English | FRI:12:15-14:00(K142a); FRI:12:15-14:00(K142a) |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOFTPRE1 | Basic Informatics | Mid-semester mark | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | EN2 | English | MON:16:15-18:00(K142a); MON:16:15-18:00(K142a); WED:18:15-20:00(K142a); WED:18:15-20:00(K142a) |
| Laboratory | EN1 | English | MON:10:15-12:00(KF30a); MON:10:15-12:00(KF30a); THU:08:15-10:00(KF30a); THU:08:15-10:00(KF30a) |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOGMAT41 | Geology | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | EN1 | English | TUE:10:15-12:00(K136); TUE:10:15-12:00(K136) |
| Laboratory | EN4 | English | THU:14:15-16:00(K136); THU:14:15-16:00(K136) |
| Laboratory | EN3 | English | THU:12:15-14:00(K136); THU:12:15-14:00(K136) |

| | | | |
|---|---|---|---|
| Laboratory | EN2 | English | TUE:12:15-14:00(K136); TUE:12:15-14:00(K136) |
| Lecture | EN0 | English | MON:12:15-14:00(KF88) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | THU:10:15-12:00(KF10); THU:10:15-12:00(KF10) |
| Practice | EN2 | English | THU:14:15-16:00(K376); THU:14:15-16:00(K376) |
| Practice | EN1 | English | THU:14:15-16:00(KM21); THU:14:15-16:00(KM21) |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOGMAT43 | Earthworks | Exam | 3 |

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

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

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOGMK701 | Soil Mechanics and Foundation Engineering | Exam | 3 |

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

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

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

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | WED:08:15-10:00(KF88); WED:08:15-10:00(KF88); WED:14:15-16:00(KM79) |
| Practice | EN1 | English | WED:14:15-16:00(KM79) |

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | THU:08:15-10:00(KF88); THU:08:15-10:00(KF88) |

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 |
|---|---|---|---|
| BMEEOHSAS47 | Steel and Composite Structures | Mid-semester mark | 4 |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | FRI:10:15-12:00(KF12); FRI:10:15-12:00(KF12) |
| Lecture | Consultation | English | FRI:14:15-16:00(KF12); FRI:14:15-16:00(KF12) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | THU:14:15-17:00(KF12); THU:14:15-17:00(KF12) |

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

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

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | TUE:10:15-11:00(K389); TUE:10:15-11:00(K389) |
| Practice | EN1 | English | TUE:11:15-12:00(K389); TUE:11:15-12:00(K389) |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | MON:14:15-16:00(KF88); THU:16:15-18:00(KF88); THU:16:15-18:00(KF88) |
| Practice | EN1 | English | TUE:12:15-14:00(KF88) |

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | WED:12:15-14:00(K376); WED:12:15-14:00(K376) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | WED:12:15-14:00(KF12); WED:12:15-14:00(KF12); THU:10:15-12:00(KM21) |
| Practice | EN1 | English | THU:10:15-12:00(KM21) |

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

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

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | EN2 | English | MON:14:15-16:00(KF10); MON:14:15-16:00(KF10); WED:10:15-13:00(KF10); WED:10:15-13:00(KF10) |

| | | | |
|---|---|---|---|
| Practice | EN1 | English | MON:14:15-16:00(KM78); MON:14:15-16:00(KM78); WED:10:15-13:00(KM78); WED:10:15-13:00(KM78) |
| Practice | EN3 | English | MON:14:15-16:00(K375); MON:14:15-16:00(K375); WED:10:15-13:00(K375); WED:10:15-13:00(K375) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | EN1 | English | TUE:15:15-18:00(KM78); TUE:15:15-18:00(KM78); FRI:08:15-10:00(K375); FRI:08:15-10:00(K375) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | MON:08:15-10:00(KF99); MON:08:15-10:00(KF99); TUE:10:15-12:00(K144); TUE:10:15-12:00(K144) |

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-2 | Nonlinear Mechanics | Exam | 4 |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | WED:12:15-14:00(KF88); WED:12:15-14:00(KF88) |
| Practice | EN1 | English | THU:14:15-16:00(KF88); THU:14:15-16:00(KF88) |

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

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

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

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | MON:14:15-16:00(KF99); MON:14:15-16:00(KF99) |

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

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

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEEOUVAT44 | Theory of Administration, Real Estate Registration | Mid-semester mark | 3 |

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

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0 | English | THU:14:15-16:00(KF99); THU:14:15-16:00(KF99) |
| Practice | EN1 | English | THU:16:15-17:00(KF99); THU:16:15-17:00(KF99) |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOUVMU-4 | Project Management in Transportation | | Mid-semester mark | 2 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | WED:14:15-16:00(KF99); WED:14:15-16:00(KF99) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOUVMU61 | Modelling Transport | | Mid-semester mark | 2 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | WED:10:15-12:00(KF99); WED:10:15-12:00(KF99) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOUVMU62 | Operation of Railway Systems | | Mid-semester mark | 2 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | WED:08:15-10:00(KF99); WED:08:15-10:00(KF99) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOUVMU64 | Railway Structures | | Exam | 5 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | TUE:08:15-10:00(K144); TUE:08:15-10:00(K144); WED:12:15-14:00(KF99); WED:12:15-14:00(KF99) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOUVMU66 | Computer Aided Transportation Design | | Mid-semester mark | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | THU:11:15-14:00(KF99); THU:11:15-14:00(KF99) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVKAT41 | Basics of Environmental Engineering | | Mid-semester mark | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | MON:10:15-12:00(K389); MON:10:15-12:00(K389) | |

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

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVKAT42 | Public Works I. | | Exam | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | MON:12:15-14:00(K389); MON:12:15-14:00(K389) | |
| Practice | EN2 | English | TUE:08:15-10:00(KM31) | |
| Practice | EN1 | English | TUE:08:15-10:00(KM31) | |

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

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVKMI51 | Environmental system | | Exam | 4 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | WED:16:15-19:00(KM31); WED:16:15-19:00(KM31) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVKMI52 | Ecology | | Mid-semester mark | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | TUE:10:15-12:00(KM30); TUE:10:15-12:00(KM30) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVKMV-1 | Drinking water and wastewater treatment II. | | Exam | 4 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | THU:13:15-16:00(KM31); THU:13:15-16:00(KM31) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVKMV-2 | Monitoring of aquatic environment | | Mid-semester mark | 2 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | THU:11:15-13:00(KM31); THU:11:15-13:00(KM31) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVKMV64 | Public water network reconstruction | | Mid-semester mark | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | WED:14:15-16:00(KM31); WED:14:15-16:00(KM31) | |

| 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 | THU:08:15-10:00(KF10); THU:08:15-10:00(KF10) | |
| Practice | EN1 | English | TUE:08:15-10:00(KF10) | |
| Practice | EN2 | English | TUE:08:15-10:00(KF10) | |

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

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVVAT42 | Hydraulics I. | | Exam | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | MON:12:15-14:00(K373); MON:12:15-14:00(K373) | |
| Practice | EN2 | English | MON:08:15-10:00(KF10) | |
| Practice | EN1 | English | MON:08:15-10:00(KF10) | |

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 |
|---|---|---|---|---|
| BMEEOVVMV-1 | Modelling of Hydrosystem | | Exam | 4 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | WED:08:15-10:00(KF15 (Klimm)); WED:08:15-10:00(KF15 (Klimm)) | |
| Practice | EN1 | English | WED:10:15-11:00(KF15 (Klimm)); WED:10:15-11:00(KF15 (Klimm)) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVVMV62 | Desing of Water Darmage Prevention Structures | | Mid-semester mark | 4 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | WED:11:15-13:00(KF15 (Klimm)); WED:11:15-13:00(KF15 (Klimm)) | |
| Practice | EN1 | English | WED:13:15-14:00(KF15 (Klimm)); WED:13:15-14:00(KF15 (Klimm)) | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEEOVVMX61 | Integrated Water Management | | Mid-semester mark | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EN0 | English | THU:16:15-18:00(KF15 (Klimm)); THU:16:15-18:00(KF15 (Klimm)) | |
| Practice | EN1 | English | THU:18:15-19:00(KF15 (Klimm)); THU:18:15-19:00(KF15 (Klimm)) | |

# 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 | EEN03BM | English | MON:08:15-10:00; WED:14:15-16:00 |

https://edu.gtk.bme.hu/ The course introduces the essentials of management as they apply within the contemporary work environment and gives a conceptual understanding of the role of management in the decision making process. Particular attention is paid to management theories: principles of management, marketing management, quality management, production and project management. For problem formulation, both the managerial interpretation and the mathematical techniques are applied. Budapest University of Technology and Economics Faculty of Economic and Social Sciences Course Syllabus and Requirements Management and Business Economics 2. Course code Semester Hours per week (Theory/Practice) ECTS credits Language of Instruction Level (BSc/BA/MSc/MA) BMEGT20A001 fall/spring 4/0 4 Hungarian BSc/BA 3. Course supervisor (name, title, department): János Kövesi, dr. Habil, Professor, Department of Management and Business Economics 4. Lecturers: Name: Position: Department/Institute/availability(Room, e-mail address): Szilvia Bíró-Szigeti, PhD 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 | EEN03BM | English | |

https://edu.gtk.bme.hu/ Learning outcomes: After completing the course, the students will be able to understand the role of marketing in an organization. Students will become familiar with marketing tasks, tools and strategies. Through practical work students will be able to elaborate certain marketing topics using the knowledge acquired during lectures. Content: Introduction to marketing. Creating customer value. Analyzing the marketing environment. Company and marketing strategy. Marketing information and customer insights. Market segmentation and targeting. Positioning. Creating competitive advantage. Consumer markets and buyer behavior. Business markets and business buyer behavior. Products and services. New product development. Designing pricing strategies. Marketing channels. Integrated marketing communication. Budapest University of Technology and Economics Faculty of

Economic and Social Sciences Course Syllabus and requirements Marketing 2. Course code Semester Hours per week (Theory/Practice) ECTS credits Language of Instruction Level (BSc/BA/MSc/MA) BMEGT20A048 fall 3/1/0 5 English BSc/BA 3. Course supervisor (name, title, department): Zsuzsanna Szalkai, PhD, Associate Professor, Department of Management and Business Economics 4. Lecturers: Name: Position: Department/Institute/availability (Room, e-mail address): Zsuzsanna Szalkai, PhD Associate Professor Department of Management and Business Economics, szakaizs@mvt.bme.hu, Room QB304 5. Preliminary knowledge required: - 6. Academic prerequisites: - 7. Objectives and description of the course: After the course the students understand the role of marketing in an organization. Students get familiar with the marketing tasks, tools and strategies. Through the practical work the student is able to elaborate certain marketing topic using the knowledge acquired on lectures. 8. Teaching methods: Lectures and seminars 9. Requirements and assessment: Team project: 20% Presentation: 10% Exercises on Seminars: 10% Team project has two parts: written report and presentation. Students will work in a maximum of 5-member group on a selected market and company. 10. Exams, make-up duties and make-up exams: Exam: 60% Final exam in the exam period. Exam can be repeated in the exam period. Overall assessment: 87-100%:excellent 75-86%: good 63-74%: satisfactory 50-62%: passed 0-49%: failed 11. Office hours: Wednesday 10.00-12.00 Bld. Q Room B 304 12. Course material, compulsory and recommended readings: Ph. Kotler, G. Armstrong, J. (2016): Principles of Marketing. 16th Ed. Pearson Lecture slides Handouts 13. Workload and detailed class schedule: Topics to be discussed, readings required for the class, other assignments Week 1 Introduction to Marketing. Creating Customer Value Week 2 Analyzing the Marketing Environment. Marketing strategy Week 3 Marketing Information and Customer Insight Week 4 Market Segmentation, Targeting and Positioning. Competitive Advantage Week 5 Consumer Markets and Buyer Behavior Week 6 Business Markets and Business Buyer Behavior Week 7 Product Strategy and New Product Development Week 8 Marketing services Week 9 Marketing Channels: Delivering Customer Value Week 10 Understanding and Capturing Customer Value. Pricing Strategies Week 11 Integrated marketing communication part I: advertising, sales promotion Week 12 Integrated marketing communication part II: PR, direct marketing and personal selling. Week 13 Team presentations Week 14 Team presentations

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN32GE-jel. | English | THU:14:15-18:00; THU:14:15-16:00 |

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 | EEN06GT | English | WED:14:15-16:00 |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN04GT | English | WED:16:15-18:00 |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN27BM | 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 |
|---|---|---|---|
| BMEGT42M104 | Sustainable Environmental and Natural Resource Management | Exam | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN13GT | English | MON:12:15-16:00 |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN06GT | English | WED:10:15-14:00 |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN06EO | English | MON:14:15-16:00(KM30); MON:14:15-16:00(KM30) |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN13BM | English | THU:14:15-16:00 |

| 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(E205) |

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(E205) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN01ER | English | THU:08:15-10:00(E302) |
| Practice | GEN01ER | English | THU:10:15-12:00(E302) |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN01ER | English | WED:16:15-18:00(E504) |
| Practice | GEN01ER | English | WED:18:15-20:00(E504) |

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 |
|---|---|---|---|
| BMEGT43A232 | International Communication | Exam | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN01ER | English | TUE:12:15-16:00(E302) |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGT43M410 | Introduction to Cultural Studies | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN01ER | English | WED:14:15-16:00(E205) |

Cultural studies developed at the intersection of a number of different disciplines and theoretical standpoints. The objective of the course is to introduce these theoretical roots and the current approaches, which have developed within the framework of cultural studies. One of the most important elements of the development of approaches within cultural studies is the critical reassessment of the positivist epistemological tradition according to which reality can be experienced and understood in a relatively unproblematic fashion. Another defining element of a large portion of work within cultural studies is its conceptualisation of culture as always political. According to this approach all texts are inherently political as they inevitably bear the marks of structures of power and are at the centre of struggles over meaning and signification. The problematization of knowledge structures and meaning has contributed to opening up the analysis of reading and consumption towards a sensitivity for the possible independent readings and interpretations created by readers, viewers and consumers based on their own social experience, acknowledging the fact that these readers, viewers and consumers are capable of resisting the dominant readings of different texts and can even construct counter-interpretations opposing the dominant ideology from within the very texts aimed at supporting those dominant positions.

| 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 |
|---|---|---|---|
| BMEGT55A001 | Business Law | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN07ER | English | |

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

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|---|
| economics. Organisations and enterprises as the subjects of law: conceptional questions. International models of company law. The development of the Hungarian company law. General rules of the Hungarian Company Act. Internal organisation of companies. The law of company registration, the registration proceedings and the company registry. Companies with a partnership profile. Companies limited by shares. Concept and types of securities. Competition law. EU directives and regulations on companies and competition: their execution in the Hungarian law. |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN03ER | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EEN03KO_SH | English | |

# 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 |
|---|---|---|---|
| BMEVIEEJV14 | Optoelectronics | Exam | 4 |

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

The subject discusses a relatively broad range of optoelectronic devices in depth; including operating characteristics, structure, typical application areas in optical communications and in measurements. The subject is presented only in English language, primarily for foreign students, but Hungarian students may also elect it. Synopsis: Week 1 Optoelectronic semiconductor materials and their technology. Energetic interactions of light and material. The wave equation and its solution. Plane wave, phase velocity, refractive index. Refraction. Generation and recombination in semiconductors and their relationship to the light sensing and light emission. Week 2 Macroscopic solids, heterostructures, optical properties of nanometer-thick layers. Passive devices: transmission properties of optical waveguides and direction couplers. Week 3 Optical fibers in practice. Dispersion. Multipath dispersion, abrupt and gradual change of refractive index type multimode optical fibers. Material dispersion, Waveguide dispersion, single-mode fibers. Week 4 Absorption, attenuation, atomic and electron resonance, the minimum absorption wavelength. Light spillage of the optical fiber, the scattering mechanisms. Week 5 Resonators and optical sensors. Controlled passive devices: optical deflectors, modulators, switches. Week 6 Optical amplifiers. Light amplifier mechanisms in optical fibers. Rahman and Brillouin scattering. Stimulated scattering. Light-doped optical fiber amplifier. Semiconductor light amplifiers. Week 7 Photodetectors. Light Detection using pn junction. The PIN photodiode. Avalanche photodiode. Heterojunction photodiode. The detectors for optical and electrical characteristics. Week 8 Image converter, storage and dissector devices. MOS and CCD video recorders. CCD operation basics. Various CCD arrangements. Realization of the high speed shutter. Week 9 ERROR Week 10 Stimulated emission. Structure, types, and optical modulation properties of laser diodes. Cut-off frequency, transient operation modes. Week 11 ERROR Week 12 Display devices. LCD, plasma, photoluminescent displays. Week 13 Organic semiconductors, OLED light sources and displays. Week 14 Optical digital information recording. Holographic information recording, DVD-ROMs, flash EPROMs.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHIAB00 | Coding Technology | Exam | 4 |

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

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEVIHIAB01 | Communication Networks I. | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | LA | English | TUE:14:15-18:00 |
| Lecture | EA | English | WED:14:15-16:00 |

https://portal.vik.bme.hu/kepzes/targyak/VIHIAB01/en/

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEVIHIAV06 | Introduction to Quantum Computing and Communication | | Mid-semester mark | 2 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | EA | English | | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEVIHIAV35 | Privacy-Preserving Technologies | | Mid-semester mark | 2 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | E | English | | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEVIHIAV39 | Administrating Computer Networks in Practice I. | | Mid-semester mark | 2 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Laboratory | LA1 | English | | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEVIHIAV43 | Cybersecurity Operations Fundamentals | | Mid-semester mark | 4 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Laboratory | LA | English | | |

| 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/

# 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 |
|---|---|---|---|---|---|
| BMEGEÁTA4SD | BSc Final Project | | | Mid-semester mark | 15 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | | |
| Practice | A-2021o-G | English | | | |
| http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATA4SDhttps://gpk.bme.hu/en/content/42 | | | | | |
| Subject code | Subject name | | | Requirement | ECTS credit |
| BMEGEÁTBG11 | Fluid Mechanics | | | Mid-semester mark | 6 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | | |
| Laboratory | A-2021o-L1prs | English | | | |
| Laboratory | A-2021o-L2prs | English | | | |
| Lecture | A-2021o-E | English | | | |
| Practice | A-2021o-G1 | English | | | |
| Practice | A-2021o-G2 | English | | | |
| http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG11https://gpk.bme.hu/en/content/42 | | | | | |
| Subject code | Subject name | | | Requirement | ECTS credit |
| BMEGEÁTBKSD | Final Project | | | Mid-semester mark | 15 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | | |
| Practice | A-2021o-G | English | | | |
| http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBKSDhttps://gpk.bme.hu/en/content/42 | | | | | |
| Subject code | Subject name | | | Requirement | ECTS credit |
| BMEGEÁTMWDB | Final Project B | | | Mid-semester mark | 15 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | | |
| Practice | A-2021o-G | English | | | |
| https://gpk.bme.hu/en/content/42 | | | | | |
| Subject code | Subject name | | | Requirement | ECTS credit |
| BMEGEÁTNKDA | Master Thesis Project A | | | Mid-semester mark | 15 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | | |
| Practice | A-2021o-G | English | | | |
| | | | | | |
| Subject code | Subject name | | | Requirement | ECTS credit |
| BMEGEÁTNKDB | Master Thesis Project B | | | Mid-semester mark | 15 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | | |
| Practice | A-2021o-G | English | | | |
| | | | | | |
| Subject code | Subject name | | | Requirement | ECTS credit |
| BMEGEÁTNKPR | Teamwork Project | | | Mid-semester mark | 6 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | | |
| Laboratory | A-2021o-L | English | | | |
| | | | | | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEÁTNW02 | Computational Fluid Dynamics | Mid-semester mark | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A-2021o-E | English | |
| Practice | A-2021o-G1 | English | |
| Practice | A-2021o-G5 | English | |
| Practice | A-2021o-G2 | English | |
| Practice | A-2021o-G3 | English | |
| Practice | A-2021o-G4 | English | |

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW02https://gpk.bme.hu/en/content/42

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | A-2021o-Lprs | English | |
| Lecture | A-2021o-E | English | |

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW08https://gpk.bme.hu/en/content/42

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | A-2021o-Lprs | English | |
| Lecture | A-2021o-E | English | |

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW10https://gpk.bme.hu/en/content/42

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | A-2021o-L | English | |
| Lecture | A-2021o-E | English | |

http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW19https://gpk.bme.hu/en/content/42

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEÁTOF01 | Individual Project | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | A-2021o-L | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | 22-1-ENG-LAB | English | |
| Lecture | 22-1-ENG-E | English | |

Subject for BSC students, MSC students bpease choose Energy Conversion (BMEGEENNWEC ) subject Energy Processes and Equipment Aims and objectives and description of the course: The course gives a general overview of energy production and energy generation systems functioning and operation, importance of energy management. Opportunities and challenges are also discussed. Learning outcomes: General overview of energy production and energy generation systems function and operation. Course description: The Detailed topics are: basic processes of energy conversion fossil, and renewable energy sources. Steam and gas turbine, IC engines, fuel-cells, solar collectors, power stations: gas, steam, nuclear, and combined heat and power generation. Energy saves consumer equipments. Methodology to be used: Three hour lectures and two laboratory test per week. The presentations are oral presentations, with computer projection, and notes on the blackboard. URL: ftp://ftp.energia.bme.hu/pub/TAD/SDS_BMEGEENAG71_Energy_Processes_and_Equipments.pdf

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | 22-1-ENG-LAB | English | |
| Practice | 22-1-ENG-G | English | |

Measurement at Energy and Environment Protection Aims and objectives and description of the course: middot; Fundamentals of measurement theory and basic metrological concepts. middot; Measurement procedures and data processing techniques. middot; The measuring system components and characteristics. middot; Basics of emissions, temperature, energetic and heat engines measurements. Learning outcomes: The main outcomes are the general overview of measurements of energetic systems, different temperature and emission measuring systems. The students has practice to use this elements. Course descriptiption: The role of measurements in maintaining and controlling the energy conversation processes. Hardware and software tools of the control and measurement systems. Laboratory tests of different engines and equipments. Simultaneous determination of system variables (flow rates, pressures, temperatures, etc.). Methods of determination of performance, efficiency, exhaust gas composition. Methodology to be used: Three hour lectures and laboratory test per week. The presentations are oral presentations, with computer projection, and notes on the blackboard. Presentation of the theoretical background and lab tests. URL: ftp://ftp.energia.bme.hu/pub/TAD/SDS_BMEGEENAG51_Measurement_at_Energ_and_Environment_Protection.pdf

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEENBGHK | Heat Transfer G | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 22-1-ENG-E | English | |
| Practice | 22-1-ENG-G2 | English | |
| Practice | 22-1-ENG-G1 | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 22-1-DEU-E | German | |
| Practice | 22-1-DEU-G | German | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | 22-1-ENG-G | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEENBMHO | Thermal engineering | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 22-1-ENG-E | English | |
| Practice | 22-1-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 | 22-1-ENG-LAB | English | |
| Lecture | 22-1-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 | 22-1-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 | 22-1-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 |
|---|---|---|---|
| BMEGEENNKDA | Master Thesis Project A | Mid-semester mark | 15 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | 22-1-ENG-G | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEENNKDB | Master Thesis Project B | Mid-semester mark | 15 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | 22-1-ENG-G | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEENNKSG | Intenrship M | Signature | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | 22-1-ENG-G | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEENNWEC | Energy Conversion | Mid-semester mark | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 22-1-ENG-E | English | |
| Practice | 22-1-ENG-G | English | |

ONLY FOR MSc STUDENTS!BSc students should choose BMEGEENBGEB, bdquo;Energy processes and equipments" subject.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEENNWME | Measurement in Energy Engineering | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | 22-1-ENG-LAB | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | 22-1-ENG-LAB | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 22-1-ENG-E | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 22-1-ENG-E | English | |
| Practice | 22-1-ENG-G | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 22-1-ENG-E | English | |
| Practice | 22-1-ENG-G | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A23 | English | |
| Practice | A24 | English | |

Air-Conditioning BMEGEÉPAG62 Main aims and objectives, learning outcomes of the subject: The objective is the introduction to the fundamentals of air-conditioning systems in buildings providing a comprehensive knowledge on the theory and practice of system design and dimensioning with particular attention to the most recent technologies. By the end of this course you will: - Have knowledge about the aims of air-conditioning: providing comfort - both thermal and good indoor air quality, reduce energy consumption, increase energy performance, etc. - Be able to apply appropriate mathematical and computer-based methods for the calculation of buildings' heat loads and cooling loads, sizing of air-conditioning elements. - Be able to apply knowledge of techniques, codes and standards of practice to the design of cooling components and systems. Method of education: The theoretical background will be interpreted via lectures, the calculations and tools will be presented during the seminars. Calculation problems/examples will require active participation. Detailed thematic description of the subject (by topic, min. 800 character): Date of class Topics to be discussed, readings required for the class Week 1 Introduction, AC systems, types Heat transfer Week 2 Thermal comfort Heat load calculation Week 3 Thermal comfort, examples Indoor Air Quality Week 4 Cooling load calculation h-x diagram, psychrometric chart Week 5 Elements, heat exchangers, hum. Volume flow rate calculation Week 6 Elements, heat exch. cooling, hum Injection Week 7 Test 1, HW out Injection Week 8 Pressure diagram Air Inlets, SCHAKO Week 9 Elements, heat recovery Week 10 Elements, filters Week 11 Air handling processes Duct network, sizing Week 12 Air handling processes Week 13 Air handling unit, calc. example Week 14 Test 2 HW in Requirements and grading a) in term-period Knowledge, understanding and skills are assessed through a combination of written tests and homework throughout the semester. Homework will be distributed during the semester and will have to be turned in by the end of the course, before the exam period. Later submission is allowed but a fee has to be paid and homework will have to be turned in by the 3rd week of the exam period. Homework will not be graded but is compulsory in order to receive a grade. b) in examination period The course ends with an exam in the exam period. Student will be allowed to take the exam if both mid-term and end-term tests are passed. c) Disciplinary Measures Against the Application of Unauthorized Means at Mid-Terms, Term-End Exams and Homework URL: https://epget.bme.hu/subjects.php?lepes=2amp;tid=216

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEGIBGG1 | Machine elements 1. | Exam | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AL2 | English | |
| Laboratory | AL1 | English | |
| Lecture | AE | English | |
| Practice | AG1 | English | |
| Practice | AG2 | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEGIBXGA | Fundamentals of Mechanical Engineering Drawing | Mid-semester mark | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A_EA | English | |
| Practice | A_Gy1 | English | |
| Practice | A_Gy2 | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEGTAG93 | CAD/CAM application | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | 2 | English | |
| Lecture | 1 | English | |

https://manuf.bme.hu/?page_id=1797amp;lang=en#mmme

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | 2 | English | |
| Lecture | 1 | English | |

https://manuf.bme.hu/?page_id=1797amp;lang=en#mmme

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 1 | English | |
| Practice | 2 | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | 1 | English | |
| Practice | 2 | English | |

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | NE | German | |
| Lecture | LEC | English | |
| Practice | SEM1 | English | |
| Practice | NG | German | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEMMBXM3 | Dynamics | Exam | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | LEC | English | |
| Lecture | NE | German | |
| Practice | NG | German | |
| Practice | SEM | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEPTAGE2 | Injection molding | Mid-semester mark | 3 |

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

http://www.pt.bme.hu/targyalapadat/88_BMEGEPTAGE2_targyleiras.pdf Objectives: theoretical and practical understanding of the injection molding technology. Knowledge of production engineering and design aspects of modern plastic products. Understanding of the most advanced design and simulation procedures. Topics: detailed description of the injection molding technology. Analysis of the process cycle diagram. Construction and operation of injection molding machines. Design for injection molding. Materials for injection molding, and fiber reinforced materials. Methods for the identification and elimination of molding defects. Injection mold design and injection molding simulation. /* 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: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;} @font-face {font-family:"Palatino Linotype"; panose-1:2 4 5 2 5 5 5 3 3 4; mso-font-charset:238; mso-generic-font-family:roman; mso-font-pitch:variable; mso-font-signature:-536870265 1073741843 0 0 415 0;} /* Style Definitions */ p.MsoNormal, li.MsoNormal, div.MsoNormal {mso-style-unhide:no; mso-style-qformat:yes; mso-style-parent:""; margin-top:0cm; margin-right:0cm; margin-bottom:8.0pt; margin-left:0cm; line-height:107%; 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;} .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;} .MsoPapDefault {mso-style-type:export-only; margin-bottom:8.0pt; line-height:107%;} @page WordSection1 {size:595.3pt 841.9pt; 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-top:0cm; mso-para-margin-right:0cm; mso-para-margin-bottom:8.0pt; mso-para-margin-left:0cm; line-height:107%; mso-pagination:widow-orphan; font-size:11.0pt; font-family:"Calibri",sans-serif; mso-ascii-font-family:Calibri; mso-ascii-theme-font:minor-

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEPTAGE3 | Polymer processing | Mid-semester mark | 3 |

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

http://www.pt.bme.hu/targyalapadat/90_BMEGEPTAGE3_targyleiras.pdf The aims of this subject is at familiarizing the students with the polymer processing technologies in details: preliminary techniques, extrusion, blow molding, thermoforming, rotational molding, polymeric foams and elastomers technology. Topics: classification of polymer processing technologies. Basic rheological aspects of polymers. Preliminary techniques of polymer processing (material conveying, drying, mixing, dosing etc.). Calendering. Extrusion. Extruder constructions, single and twin screw extruders. Compounding wit extruder. Extrusion dies (film blowing, flat film-, pipe, sheet, profile extrusion; extrusion blow molding; extrusion coating). Thermoforming: vacuum and pressure forming. Rotational molding. Foams technology: thermoplastic and thermoset foams. Elastomer technologies. Finishing and decoration. Joining technologies: welding and adhesive bonding. /* 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: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;} @font-face {font-family:"Palatino Linotype"; panose-1:2 4 5 2 5 5 5 3 3 4; mso-font-charset:238; mso-generic-font-family:roman; mso-font-pitch:variable; mso-font-signature:-536870265 1073741843 0 0 415 0;} /* Style Definitions */ p.MsoNormal, li.MsoNormal, div.MsoNormal {mso-style-unhide:no; mso-style-qformat:yes; mso-style-parent:""; margin-top:0cm; margin-right:0cm; margin-bottom:8.0pt; margin-left:0cm; line-height:107%; mso-pagination:widow-orphan;

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| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVÉAG02 | Diffusion Processes | Exam | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A44 | English | |
| Practice | A45 | English | |

Diffusion Processes Aim of the subject: To teach to the students the theory of the mass transfer operations and the methods and equipment of one of the most important diffusion process (distillation). Topics of the subject: 1st week: Applications of mass transfer, more important diffusion processes. Batch and continuous operation. Continuous and stagewise contact. Equilibrium stage. Phase rule of Gibbs. Vapour-liquid equilibrium of a binary mixture. 2nd week: Steady state and transient diffusion. Theory of diffusion, Fick's 1-st law. Analogy with momentum and heat transfer. 3rd week: Relation between the diffusivities DA,B and DB,A. Equimolar counter diffusion. One way (unimolar) diffusion. 4th week: Prediction of diffusivities for gases, influence of pressure and temperature. Diffusion in small pores (Knudsen diffusion, in pores of intermediate size). Diffusion in liquids. Dilute aqueous solutions. 5th week: Schmidt number. Turbulent diffusion. Transient diffusion. Mass transfer coefficients. 6th week: Theory of film. Two film theory. The rate of mass transfer. Relation between the overall (Ky) and film transfer coefficients (kx, ky). 7th week: Determination of mass transfer coefficients. Measurements: wetted wall column. Correlations, Sherwood-number. 8th week: Vapour-liquid equilibrium conditions. Basic notions and laws. Vapour-liquid equilibrium of ideal mixtures. Temperature-composition (T-x,y) and y-x equilibrium diagrams of ideal and azeotropic (minimum and maximum boiling point) mixtures. Optimal feed plate location. 9th week: Distillation methods. Flashing and its calculation. 10th week: Rectification. Determination of the number of theoretical plates. Heat condition of feed (q). Intersection of the operating lines (q-line). 11th week: Heat balance of the column. Total reflux, minimum number of plates. Minimum reflux ratio. Optimal reflux ratio. 12th week: Rectification calculations. 13th week: Differential distillation, calculations. Batch rectification under constant reflux ratio and constant distillate composition. 14th week: Plate efficiencies. Different types of plates. URL: https://epget.bme.hu/subjects.php?lepes=2amp;tid=103

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVÉAG04 | Measurement Techniques for Chemical and Environmental Processes | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | A26 | English | |
| Practice | A25 | English | |

BMEGEVÉAG04 Measurement for Chemical and Environmental Processes (0/1/2/f/3) Aim of the subject: Basic measurement techniques and their application possibilities in chemical industry and environmental protection. Topics of the subject: 1-6. week : Classroom / Dep. of Building Services and Proc.Engin./ 5x3 lessons. - Basic concepts for process plant instrumentation. Instrument selection. ( Temperature, flow rate, pressure, level and weight measurement methods.). - Mixing autoclave. Mixing performance is calculated. Torque measurement. Data processing. -Instrumentation and control of dryers.Measurement of heat- and mass transfer coefficients. Air humidity measurement. - Instrumentation and control of evaporators. Measurement of heat- and mass transfer coefficients. Composition Measurement. - Water quality monitoring. pH, conductivity, turbidity measurements. 6-7week: Lab. Exercises / Dep. of Building Service and Proc.Engin./ 2x3 lessons LAB1. Measurement of a convective dryer. LAB2. Measurement of a single effect evaporator. 8-9. week: Lab. Exercises / Department of Fluid Mechanics/ 2x3 lessons. LAB3. Investigation on capture hood of hot flue gas LAB4. Wind tunnel investigation on pollutant transport 10-11. week: Lab. Exercises / Department of Energy Engineering/ 2x3 lessons. LAB5. Reduction in emissions with Catalytic Converters LAB6. Determination of the Three-way Catalyst Conversion Efficiency 12-13. week: Lab. Exercises / Department of Hydrodynamic Systems/ 2x3 lessons. LAB7. Measurement of fluidization LAB8. Measurement of cyclone 14. week: /Dep. of Building Services and Proc.Engin. TEST practices material URL: https://epget.bme.hu/subjects.php?lepes=2amp;tid=331

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | AnGy_a | English | |

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

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | AnE-Vegy | English | THU:08:15-10:00(ONLINE) |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVGAV04 | Chemical Engineering Practice | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AnL-Vegy | English | WED:08:15-10:00(L-HIDROLAB) |
| Practice | AnGy-Vegy | English | WED:08:15-10:00(D327) |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVGBG01 | Introduction to mechanical engineering | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AnL2 | English | |
| Laboratory | AnL1 | English | |
| Laboratory | AnL3 | English | |
| Lecture | AnE | English | |
| Practice | AnGy2 | English | |
| Practice | AnGy3 | English | |
| Practice | AnGy1 | English | |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVGBG03 | Measurement Technique of Processes | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AnL | English | |
| Lecture | AnE | English | |

Main objectives of the subject: The aim of this subject is to present the fundamental devices and methods of measurement techniques of processes. The course presents the mathematical methods of the measuring techniques and the signal processing; shows the practical usage of them; and points out the achievable results. Detailed thematic description of the subject: Lectures: 7*2h Reviewing the basic concepts of probability theory and mathematical statistics; Error Estimation for indirect measurements; estimating systematic errors Estimating systematic (accuracy class) and random errors ensemble for indirect measurement results; Calibration The fundamentals of measuring time variant signals: Sampling and Quantization Theorems; Theoremrsquo;s analysis; Consequences in measuring techniques Fourier series and transformation, and their role in signal processing; The Spectrum and itrsquo;s applications; Recognizing periodic and noise processes Application of spectrum and cepstrum analysis for investigation operating machines The real measurement result; Noise, as the characterization of stochastic processes; Amplitude density function; Autocorrelation and Cross correlation functions Application of Autocorrelation and Cross correlation technique for analyzing periodic and transient signals Laboratory practices: 4*3,5h Pressure transducerrsquo;s response to step function Pressure transducerrsquo;s response to harmonic excitation Measuring transmission characteristics of an impulse line Investigating the effects of sampling parameters

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVGBG06 | Individual project 1. | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AnL-HDR | English | |
| Laboratory | AnL-EGR | English | |
| Laboratory | AnL-ÉPGET | English | |
| Laboratory | AnL-ARA | 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 |
|---|---|---|---|
| BMEGEVGBG13 | Fluid Flow Systems | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AnL | English | |
| Lecture | AnE | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVGBG16 | Positive Displacement Pumps and Compressors | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | AnL | English | |
| Lecture | AnE | English | |

| 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 |
|---|---|---|---|
| BMEGEVGBKSZ | Summer Internship | Signature | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | AnGy | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVGMWDA | Final Project A | Mid-semester mark | 15 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | AnGy_m | English | |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEGEVGMWDB | Final Project B | Mid-semester mark | 15 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | AnGy_m | English | |

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

| 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 |
|---|---|---|---|
| BMEGEVGNKSG | Internship M | Signature | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | AnGy | English | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEGEVGNWPR | Teamwork Project | | Mid-semester mark | 6 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Laboratory | AnL | English | | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEGEVGNX26 | Hemodynamics | | Mid-semester mark | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | AnE | English | | |

| Subject code | Subject name | | Requirement | ECTS credit |
|---|---|---|---|---|
| BMEGEVGNX27 | Flow Stability | | Mid-semester mark | 3 |
| **Course type** | **Course code** | **Course language** | **Timetable information** | |
| Lecture | AnE | 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 |
|---|---|---|---|
| BMETE11AF05 | Introduction to Solid State Physics | Exam | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | E0 | English | |

Symmetries of crystals, crystal structures, Bravais lattices. Theory of diffraction, structural factor, atomic scattering factor. X-Ray, electron and neutron scattering experiments. Lattice vibrations in harmonic approximation, dynamical matrix, normal coordinates, dispersion relation, density of states. Quantum description of lattice vibrations, energy and momentum of phonons, experimental measurement of the dispersion relation. Bose-Einstein statistics, heat capacity of solid bodies, Debye approximation. Drude model of electrons, transport and optical properties. Fermi-Driac statistics, Sommerfeld expansion, heat capacity, magnetic susceptibility of an electron gas. Electrons in the periodic potential of a crystal, Bloch electrons. Band structure in the nearly free and tight binding approximation, effective mass.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11AF39 | Measurement Control Project Work in LabVIEW Environment | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | T1 | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11AF40 | Group Theory for Physicists | Exam | 5 |

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

The aim of the course is to introduce the principles of group theory to physics students: we learn how the symmetries of a system can be used to describe it, and how the symmetries of nature manifest themselves in laws of physics. We apply the concepts of group and representation theory to practical problems. Theory: Symmetries in nature and physics. Definition and basic properties of groups. Some special groups. Homomorphism, isomorphism. Subgroups, cosets, Lagrange's theorem. Normal subgroup, quotient group, first isomorphism theorem. Conjugate, conjugacy classes, centralizer. Group action, orbit, stabilizer. Representations and their properties, equivalent representations, irreducible representations. Schur's lemma. Character of representations, propertires of characters, character tables. Direct sum of representations and their reduction. Product representations. Lie groups, infinitesimal generators, Lie algebras. Topological properties, universal covering group. Rotation group and its representations. Lorentz group and other matrix groups. Calculation: Description of normal modes, crystals, and quantum mechanical wave functions using group theory. Selection rules. – H.F. Jones: Groups, Representations and Physics (IOP Publishing, 1998)– R.L. Liboff: Primer for Point and Space Groups (Springer, 2003).– M.S. Dresselhaus, G. Dresselhaus, A. Jorio: Group Theory - Application to the Physics of Condensed Matter (Springer, 2008).

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11AF41 | Computer Solution of Technical and Physical Problems | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | T1 | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11AX13 | Physics for Civil Engineers | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | En0 | English | TUE:16:15-18:00(KF88); TUE:16:15-18:00(KF88) |

Basics of mechanics: the essence of physics, modeling, basic concept of measurement, experiments, standard of units, kinematics, curvilinear motion, circular motion, basic laws of dynamics, Newton’s laws, the problem of weight,

special forces, the universality of gravity, planetary motion; friction and air-resistance, work, energy, power, energy conservation and work-energy theorem, linear momentum, impulse, collisions, ballistic pendulum, extended objects, rigid bodies, rotation, angular momentum, moment of inertia. Basics of thermodynamics: pressure, Pascal's law, atmospheric pressure, Archimed's law, buoyancy, flow of gases and liquids, Bernoulli's equation, temperature, thermal equilibrium, absolute scale, thermal expansion, phase-transitions, concept of ideal gases, state-equation of an ideal gas, Joule experiment, work done on/bye the gas, heat exchange, internal energy, equipartition theorem, special processes (isobar, isochor, isotherm, adiabatic), 1st law of thermodynamics.Required knowledge: Basics of undergraduate mathematics (analysis, ordinary differential equations, integration).

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11AX21 | Physics 1 | Exam | 4 |

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

Mechanics: Measurements, units, models in physics. Space, time, different frames of references. Motion of a particle in 3D. Newton's laws. Work, kinetic energy, potential energy. Work-energy theorem. Conservation laws in mechanics. Motion in accelerated frames, inertial forces. Newton's law of gravitation. Basics of the theory of special relativity. System of particles, conservation laws. Kinematics and dynamics of a rigid body. Oscillatory motion, resonance. Wave propagation, wave equation, dispersion, the Doppler effect. Thermodynamics: Heat and temperature. Heat propagation. Kinetic theory of gases. Laws of thermodynamics. Reversible and irreversible processes, phase transitions. Entropy, microscopic interpretation of entropy. Elements of statistical physics. Static electric and magnetic fields: Electric charge. Electric field, electric flux, electric potential. Basic equations of electrostatics. Applications of Gauss's law. Capacitors, energy of the static electric field. Dielectrics, boundary conditions. Electric current. Magnetic field. Current carrying wire in magnetic field. Magnetic field produced by an electric current, the Biot-Savart law.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11AX23 | Physics 1i | Exam | 4 |

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

KINEMATICS: Motion in one dimension. Motion in two dimensions. Position vector. Average velocity, instantaneous velocity. Average acceleration, instantaneous acceleration. Position, velocity and acceleration in Cartesian and polar coordinates. Projectile motion. Circular motion. Curvilinear motion, tangential and radial accelerations. THE LAWS OF MOTION: Inertial frames. Newton's laws. Force, mass. Normal force, tension, spring force, gravitational force, static and kinetic friction. Free body diagrams. The 1st cosmic speed. WORK AND ENERGY: Work of a varying force. Kinetic energy and the work-energy theorem. Power. POTENTIAL ENERGY: Work done by a spring. Work done by gravity. Work done by kinetic friction. Conservative and nonconservative forces. Potential energy. Conservation of mechanical energy. Changes in mechanical energy in the presence of nonconservative forces. Energy diagrams and the equilibrium of a system. The 2nd cosmic speed. LINEAR MOMENTUM AND COLLISIONS: Linear momentum. Conservation of momentum. Elastic and inelastic collisions in 1D, 2D and 3D. Center of mass. Rocket propulsion. ROTATION OF A RIGID OBJECT ABOUT A FIXED AXIS: Angular velocity vector, angular acceleration vector. Rotational kinetic energy. Moment of inertia. The parallel axis theorem. Torque. Work, power, energy. ANGULAR MOMENTUM: Angular momentum of a particle and a system of particles. Conservation of angular momentum. Gyroscopes. Analogy between translational and rotation motion. KEPLER'S LAWS OF PLANETARY MOTION. STATIC EQUILIBRIUM: Conditions of equilibrium for a rigid object. ACCELERATING FRAMES: Inertia forces: the translational inertia force, the centrifugal force, the Coriolis force, the Euler force. Discussion of motion in the rotating frame of the Earth. OSCILLATORY MOTION: Simple harmonic motion, amplitude, phase constant, angular frequency. Mass attached to a spring. Energy of a simple harmonic oscillator. The simple pendulum. The physical pendulum. The torsional pendulum. Damped oscillations. Forced oscillations. Resonance. WAVES: Transverse and longitudinal waves. Travelling waves in 1D. Reflection and transmission of waves. Sinusoidal waves, wavelength, period, wave number, angular frequency. The linear wave equation in 1D and in 3D. Spherical waves, plane waves. The Doppler effect, discussion using a spacetime diagram. Shock waves. Superposition and interference of sinusoidal waves. Standing waves: strings, air columns, membranes. Beats. SPECIAL RELATIVITY, KINEMATICS: The concept of events and observers. The Galilean transformation. The isotropy of the speed of light in any inertial frame. Einstein's postulates. The synchronization of clocks. Spacetime intervals: timelike, lightlike and spacelike intervals. Minkowski diagrams and worldlines of particles and light. The

relativity of simultaneity. Length contraction and proper length. Time dilation and proper time. Causality. The twins paradox, the rod-barn paradox, the two spaceships paradox. The paradox of the identically accelerated twins. The acoustic Doppler effect vs. the electromagnetic Doppler effect. Velocity transformation. SPECIAL RELATIVITY, DYNAMICS: Linear momentum. Newton's 2nd law in its correct form. Kinetic energy. Connection between mass and energy. Relativistic formulas for elastic and inelastic collisions. Relation between the energy and the momentum of a particle. Acceleration due to a constant force. TEMPERATURE: Thermal equilibrium, thermal contact. The 0th law of thermodynamics. Temperature scales. Thermal expansion of solids and liquids. The ideal gas. Extensive and intensive state variables: volume, mass, pressure, temperature. HEAT AND THE 1ST LAW OF THERMODYNAMICS: Internal energy. Heat. Heat capacity, specific heat, molar specific heat. Latent heat. Work done on an ideal gas. The 1st law of thermodynamics. Adiabatic, isobaric, isovolumetric, isothermal processes. THE KINETIC THEORY OF GASES: Relationship between microscopic and macroscopic quantities. Average molecular kinetic energy, pressure, temperature. Degrees of freedom. The equipartition of energy. Specific heat at constant volume and at constant pressure. The adiabatic process on a P-V diagram. Specific heat of solids: the Dulong-Petit law. The distribution of atmospheric density at constant temperature: the Boltzmann distribution. Distribution of molecular speeds in an ideal gas: the Maxwell-Boltzmann distribution. Collision frequency and mean free path. HEAT ENGINES, ENTROPY AND THE 2ND LAW OF THERMODYNAMICS: Heat engines. Thermal efficiency. The 2nd law (Kelvin-Planck formulation). Refrigerators and heat pumps. The coefficient of performance. The 2nd law (Clausius). Reversible and irreversible processes. The Carnot engine. Reduced heat. Entropy. The 2nd law (in terms of entropy change). Change in entropy for an ideal gas and reversible processes. Adiabatic free expansion. Irreversible heat transfer. Macrostates, microstates, thermodynamic probability. Connection between entropy and probability.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11BG05 | Physics for Engineers | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | GN0 | German | |
| Lecture | GE0 | English | |

1. Laws of mechanics (basic concepts of kinematics, Newton's laws of motion, force laws).2. Physical conservation laws (momentum, angular momentum). Work, power, kinetic energy. Conservation of mechanical energy.3. Harmonic vibrations and és wave phenomena.4. Electrostatics (Coulomb force, electric field strength and potential, capacity, capacitors).5. Electric current, electric resistance; laws of electric circuits.6. Lorentz force acting on a moving charged particle and electric current in magnetic field; torque for a current carrying loop in magnetic field; magnetic dipole monetum.7. Magnetic field produced by moving charged particles and current carrying wires; magnetic field of solenoids, toroids.8. Faraday's law of induction, inductance., Lenz's law.9. Alternate current, RL, RC, RLC circuits.10. Basic concepts of electromagnetic waves.11. Fundamental phenomena of geometric and wave optics.12. Applications and demonstration experiment for the above chapters of the study.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF02 | Physics Laboratory RP | Mid-semester mark | 6 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | T1 | English | |

Laboratory topics for students selecting the Research for Physics majors: Superconductivity (Critical Magnetic Field, Persistent Current, Josephson Effect); Infrared and Raman spectroscopy (Drude spectrum of metals, Fan resonance, C60 molecular excitation); Nanophysics (quantum-Hall phenomenon, conductivity quantization, measurement of atomic transmissions); Charge density waves (nonlinear phenomena, dielectric relaxation); Magneto-optic Kerr effect (magnetics of semiconductors).

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF03 | Seminar RP1 | 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 |
|---|---|---|---|
| BMETE11MF05 | Seminar RP3 | 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 |
|---|---|---|---|
| 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 |
|---|---|---|---|
| BMETE11MF09 | Professional Practice RP | Signature | 0 |

| 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 RP1. The student performs research tasks related to the diploma work topic for 3 weeks, anytime during the summer holiday, under the guidance of the thesis advisor. The signature indicating completion of this course will be entered to Neptun by the responsible teacher, based on the suggestion of the thesis advisor.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF14 | Theory of Magnetism 2 | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

The basic concepts and results from the first part of the course are assumed to be familiar. The following topics are discussed: spontaneous breaking of symmetry in the Heisenberg model, crystal field theory, symmetries and degeneracies, transition metal atoms in cubic crystal field, further symmetry breakings and symmetries, itinerant ferromagnetism, correlated metals, heavy fermions.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF24 | Transport in Complex Nanostructures | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

The course overviews the complex physical phenomena in various hybrid nanostructures with a special emphasis on the following topics of superconductiong nanostructures and spintronics: Introduction to mesoscopic superconductivity. Andreev reflections, BTK theory and mesoscopic proximity effects. Multiple Andreev Reflections. Advanced applications of the Josephson effect. Investigation of Andreev Bound states and the current-phase relation. Andreev Qubits. Superconducting islands, Andreev states in quantum dots. Majorana fermions. Basic concepts of spintronics. Magnetization measurements: magnetic force microscopy, scanning NV center methods, X-ray magnetic circular dichroism, etc. Magnetoresistance phenomena (AMR, GMR, TMR). Spin injection, non-local measurements. Semiconductor spintronics, Rashba effect, spin relaxation, weak anti-localization. Spintronics in quantum dots. Optical spin injection, electron spin resonance. Spin Hall phenomena. Exotic spin structures, multi ferroic materials, skyrmions. Antiferromagnetic spintronics. Spin transfer torque, spin pumping.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF26 | Physics of Semiconductors | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

Introduction: importance of semiconductor physics, modern applications, the limitations of electronics. Charge carriers in semiconductors: band structure, envelope function, lattice distortions, impurities, localized states, shallow and deep levels. Band structure of semiconductors: spin-orbit interaction, kp model. Transport phenomena: quasiclassical dynamics, Boltzmann equation, conductivity, Hall-effect, magnetoresistance, thermoelectric and thermomagnetic phenomena. Diffusive phenomena in semiconductors: inhomogeneous semiconductors, diffusion, diffúzió, Einstein-relation, conduction, Gunn-diode, p-n junction, Zener-diode, tunnel diode, bipolar transistors, JFET. Characterization and engineering of semiconductors: traditional and epitaxial growth, characterization techniques, lattice matching, band-engineering, heterostructures, superlattices, highe electron mobility 2DEG and its high frequency applications, fabrication of semiconductor nanostructures. Field effect and its applications: surface density of states, remote doping, Schottky barrier, Schottky diode, ohmic contacts, MOS-structures, High-k dielectrics, flash memories, solar cells, CCD devices, the fundamentals of CMOS technológy. Optical properties of semiconductors: interaction with light, photoconduction, absorpion of free charge carriers, recombination mechanisms, the principles and applications of light emitting diodes and semiconductor lasers.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF28 | Seminar on Nanophysics 2 | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | T1 | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF30 | Interacting Spin Systems in Real Materials | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

The lecture aims at the understanding of the magnetic properties of various Mott insulators, comparing theoretical understanding with experimental measurements. It builds on the "Theory of magnetism II" course (but it can also be followed on its own). Topics: The origin of spin exchanges in materials. Neutron and optical spectra. Excitations in S=1/2 and S=1 spin chains, AKLT state. Spin ladders in a magnetic field. Spin waves in LaCu2O4 and other antiferromagnets, comparing calculated spectra with neutron experiments. Magnetization plateaus in SrCu2(BO3)2 and in frustrated systems, the role of quantum fluctuations and lattice distortions. Ground state degeneration and magnetic monopoles in spin ice. Nematic and multipolar ordering in frustrated systems. Magnetoelectric coupling in multiferroic materials. Realization of the Kitaev model in two and three-dimensional iridium oxides, the role of strong spin-orbit coupling. Magnetic excitations with finite Chern number.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF32 | Independent Laboratory RP2 | Mid-semester mark | 13 |

| 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 |
|---|---|---|---|
| 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 |
|---|---|---|---|
| BMETE11MF34 | Topological Insulators | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

An important finding of the previous decade is that even the (non-interacting) band theory of electrons in solids can provide fundamental novelties. Topological insulators are crystalline band-insulator materials accomodating conducting – occasionally perfectly conducting – surface states. In this lecture series we use simple models to introduce the topological invariants that are important in band theory, we provide theoretical tools to calculate those, and show how topology protects the surface states from certain perturbations. We provide insight into the general theory of topological insulators, and review a few related experimental arrangements and results.Topics: One-dimensional crystals with chiral symmetry: the Su-Schrieffer-Heeger model. Adiabatic dynamics in quantum mechanics, Berry phase, Chern number. Adiabatic charge pumping in a one-dimensional crystal. Quantum Anomalous Hall effect: the Qi-Wu-Zhang model. Two-dimensional time-reversal-invariant topological insulators: the Bernevig-Hughes-Zhang model. Quantized conductance of two-dimensional topological insulators.Literature: J. Asbóth, L. Oroszlány, A. Pályi: A Short Course on Topological Insulators, (Springer, 2016)Prerequisites: quantum mechanics, band theory of crystalline solids (tight-binding models).

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF38 | Chemistry in Nanotechnology | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

The course presents recent developments in nanotechnology and nanoscience using chemical methods. We will overview measurement techniques for nanosclae building blocks, namely transmission electron microscopy (TEM), scanning electron microscopy (SEM), dynamic light scattering (DLS). Synthesis of nanoparticles: chemical, physical and biological methods and chemical stabilization of nanoparticles. Purification and size and shape-selective purification of nanoparticles. The stability of nanoparticles and interactions existing at nanoscale and using them for the self-assembly of nanoscopic components: nanostuctured materials. Usage of nanoparticles in chemistry, medicine and chemical robotics. Targeted drug delivery applications.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF45 | Superconductivity | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

Phenomenology of superconductors. Meissner effect, London equations, electrodynamics of superconductors. Bardeen-Cooper-Schrieffer theory: ground state, thermodynamic and transport properties. Ginzburg-Landau theory: free energy, GL equations and their solution, Abrikosov vortices, magnetic properties of Type II superconductors. Josephson effect and its applications. High-temperature superconductors. Prerequisites: Modern Solid State Physics.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF46 | Physics Laboratory NA | Mid-semester mark | 6 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | T1 | English | |

In the laboratory, students carry out complex measurement tasks close to the state-of-the-art research results; Measurements are performed using modern measuring instruments used in research laboratories, they learn the computer programming of these measuring instruments and make their own measurement control programs. The measurement protocols follow the style of scientific publications. Planned measurement tasks: Basic skills in computer aided measurement control. Lock-in amplifier programming, quartz sensor testing. Programming of digital oscilloscope, investigation of atomic size nano-wires. Temperature controller and digital multimeter programming, phase transition measurement of high temperature superconductor. Electrochemical layer separation. Surface analytical measurements by SIMS and XPS methods. Assembling and testing a scanning tunnel-microscope. ESR / NMR spectroscopy, investigation of modern magnetic materials by measuring the magneto-optic Kerr effect.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF47 | Seminar NA1 | 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 |
|---|---|---|---|
| BMETE11MF49 | Seminar NA3 | 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 |
|---|---|---|---|
| BMETE11MF55 | Modern Solid State Physics | Exam | 7 |

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

This course describes the behavior of interacting many body systems (mainly electron systems) building on solid state physics and statistical physics knowledge gained while earning a BSC degree in Physics. The following topics are discussed: identical particles, second quantization, interacting electron systems in Bloch and Wannier representation, itinerant ferromagnetism, linear response theory, susceptibility of metals, spin density waves, Bose liquid.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE11MF58 | Nanotechnology and Materials Science | Exam | 5 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

This course gives an introduction to the main trends in nanotechnology and material science. We cover advanced fabrication and measurement techniques by giving examples from state-of-the-art research and development results. The course addresses the following topics: Novel concepts and modern material systems in nanotechnology. Advanced imaging methods from electron microscopy to atomic resolution scanning probe techniques. Top-down nanofabrication techniques: photo and electron beam litography, deposition and special patterning techniques. Bottom-up approaches and self-organizing nanostructures. Semiconductor technology and novel concepts in information technologies. Investigation of electronic and vibrational properties by optical spectroscopy. Advanced surface analysis techniques.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15AF36 | Quantum Mechanics 2 | Exam | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

Subject: Based on the undergraduate learning of Quantum Mechanics this course provides advanced knowledge in Quantum Mechanics according to the following topics: Identical particles, He-atom, Hartree- and Hartree-Fock approximation. Scattering theory, scattering amplitude and cross section, Green functions, Lippmann-Schwinger equation, Born series, method of partial waves. Motion in electromagnetic field, Aharonov-Bohm effect, Landau levels. Time evolution and pictures in Quantum Mechanics (Schrödinger, Heisenberg and Dirac pictures). Adiabatic motion and Berry phase. Relativistic Quantum Mechanics: Klein-Gordon equation, Dirac equation, continuity equation, Lorentz invariance, spin and total angular momentum, free electron and positron, non-relativistic limit, spin-orbit interaction. Necessary background: basic knowledge in Quantum Mechanics, Electrodynamics and Relativistic Mechanics Literature: – Franz Schwabl: Quantummechanics, Springer 1990 – Albert Messiah: Quantummechanics, Vol. 1-2, North Holland, 1986

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15AF43 | Practical Course in Quantum Mechanics 2 | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Practice | T1 | English | |

Subject: Problem solving course related to the lecture in Advanced Quantum Mechanics (Quantum Mechanics 2). The following topics are covered: Identical particles, He-atom, Hartree- and Hartree-Fock approximation. Scattering theory, scattering amplitude and cross section, Green functions, Lippmann-Schwinger equation, Born series, method of partial waves. Motion in electromagnetic field, Aharonov-Bohm effect, Landau levels. Time evolution and pictures in Quantum Mechanics (Schrödinger, Heisenberg and Dirac pictures). Adiabatic motion and Berry phase. Relativistic Quantum Mechanics: Klein-Gordon equation, Dirac equation, continuity equation, Lorentz invariance, spin and total angular momentum, free electron and positron, non-relativistic limit, spin-orbit interaction. Necessary background: basic knowledge in Quantum Mechanics, Electrodynamics and Relativistic Mechanics Literature: – Franz Schwabl: Quantummechanics, Springer 1990 – Albert Messiah: Quantummechanics, Vol. 1-2, North Holland, 1986

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15AX03 | Physics A3 | Exam | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | GA | English | |

Topics:1. Units, definitions. Speed of light.2. Special relativity. Time dilation, length contraction.3. Relativistic mass, energy. Fission and fusion of atoms.4. Boltzmann distribution. Statistical temperature. Entropy.5. Atomic physics. Blackbody radiation. Photoelectric effect. Franck-Hertz experiment.6. 1D Schrödinger equation.7. Solution of 1D problems, (stepwise pot. tunneling, harmonic osc.)8.-9. H atom.10. Stern–Gerlach experiment, Pauli Exclusion Principle.11. Periodic table. Molecules.12. Band structure, conductivity.13. Semiconductor physics.14. Application.Necesssary background: sound knowledge in Mechanics and Electromagnetism, as well as in Mathematics (Analysis and Linear Algebra) at undergraduate level.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15MF51 | Electronic Structure of Solid Matter | Exam | 4 |

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

Building on the quantum mechanics and solid state physics studies of the Physics BSC education, this course aims to discuss modern theories and methods for the electronic structure of solid matter. The following topics will be outlined: Foundations of the static density functional theory. Variational and pseudopotential methods. Ab initio methods for correlated systems (LDA+U, self-interaction correction, DMFT). Group theory and time reversal in band structure. Surface states, the Rashba-Bycskov effect. Alloy theory, the coherent potential approximation. Metallic (itinerant) magnetism, method of the disordered local moments. Jenő Sólyom: Fundamentals of the Physics of Solids II, Electronic properties (Springer-Verlag Berlin Heidelberg 2009)

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15MF53 | The Physics of Disordered Systems | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

Goal: Disorder is present everywhere around us, and it leads to fascinating phenomena. This course is supposed to cover some of these subjects, including Anderson's localization theory, Coulomb glasses and spin glasses, hysteresis or percolation, Griffith phases, just to name a few. Prerequisites: Quantum mechanics, intermediate level solid state physics, statistical physics. Subjects to be covered: Structural disorder: Polimers, fractals, liquids,

glasses, quasicrystals, amorphous metals, granular materials. Percolation. Disordered magnetic systems: Hysteresis, memory effects, and Preisach model. Domain wall motion: mean field theory, Barkhausen noise. Disordered ferromagnets and Griffith phase. Frustrated spin systems and spin glasses: phenomenology, Sherrington -Kirkpatrick model, TAP equations. Replicas, and replica symmetry breaking. Droplet theory. Localization theory: Disordered semiconductors and impurity bands. Localization transition and Anderson's theory. The scaling theory of localization. The Coulomb glass. Critical wave function and multifractal properties. Quantum Hall effect. Quantum glasses: The Bose glass. Fisher scaling and the strong disorder fixed point.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15MF71 | Advanced Quantum Field Theory | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

This course builds upon Quantum Field Theory (BMETE15MF65, cf. https://physics.bme.hu/BMETE15MF65_kov?language=en) and discusses advanced topics such as(i) renormalization group and scaling;(ii) role of symmetries and their breaking,(iii) advanced functional techniques, non-perturbative methods and their applications,(iv) effective action, effective potential and(v) instantons and quantum tunneling. – M.E. Peskin, D.V. Schroeder: An Introduction to Quantum Field Theory (1995, Addison-Wesley)– C. Itzykson, J-B. Zuber: Quantum Field Theory (2006, Dover Publications)– S. Weinberg: The Quantum Theory of Fields I-III (1995, 1996, 2000, Cambridge University Press)

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15MF72 | Particle Physics | Exam | 5 |

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

The course aims to survey the fundamental phenomena, models and experimental methods of particle physics. Topics covered: – Discovery of particles, their properties and classification.– Locality, relativistic fields. Dirac equation. Electromagnetic interaction, gauge invariance.– Strong interaction. Isospin symmetry. Fundamentals of SU (3) quark model of hadrons. Discovery of colour, basics of quantum chromodynamics.– Weak interactions. Neutrinos. Parity and CP violation, CPT invariance. Basics of Fermi theory. FCNC problem, GIM mechanism. The W and Z intermediate bosons and the Higgs particle.– Particle accelerators. Principles of particle detection.– Open problems and perspectives in particle physics. Necessary background: – Advanced mechanics (material of course BMETE15AF32)– Quantum mechanics (material of course BMETE15AF49) Recommended background:– Advanced quantum mechanics (material of course BMETE15AF36)– Group theory (material of course BMETE11AF40) Literature: Lecture notes available online at https://physics.bme.hu/BMETE15MF72_kov?language=en

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15MF73 | Statistical Physics 2 | Exam | 5 |

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

Subject:1. Ferromagnetic phase transition: The Ginzburg-Landau theory. Conditional free energy, Ginzburg-Landau functional. 2. Correlation functions and their scaling properties. Universal scaling collapse, and connection between various critical exponents. Classical linear response. 3. Basic ideas of renormalization group. 4. Superfluidity: basic phenomena, the two-fluid model, the Gross-Pitaevskii functional and the time independent Gross-Pitaevskii equations, vortices and healing length. 5. Basic properties of density matrix and density operators, mixed states and pure states. 6. Neumann equation. Spin in an external magnetic field, spin relaxation. 7. The equilibrium structure of the density operator. Neumann entropy and the principle of maximal entropy. 8. Linear response theory. Energy dissipation and generalized susceptibilities, the Kubo formula.9. Kubo formula, classical and quantum noise, and the fluctuation-dissipation theorem. 10. Classical limit of the fluctuation-dissipation theorem, Onsager’s regression hypothesis, and Nyquist-Johnson noise. 11. Markov processes. H-theorem for closed and open systems. 12. Detailed balance, Monte-Carlo simulations, simulated annealing. 13. Langevin equation and Brownian motion. Drift, diffusion, and Eistein relation. 14. Fokker-Planck equations, velocity relaxation of a particle, and diffusion equation. Prerequisite: sound knowledge in Statistical Physics at undergraduate level

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15MF75 | Artificial Intelligence in Data Science | Mid-semester mark | 5 |

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

Aim: Introduction to machine learning from a physicist's perspective, with the aim to understand how it works and less emphasis on tricks or parameter optimization.Subjects: Regression. Image segmentation. Decision tree. Deep learning (from scratch in numpy). Higher level implementations (tensorflow, sklearn, keras). Convolutional neural

networks. Pre-trained models. Data augmentation. Textual data. Sequential data. Game models.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE15MF77 | Quantum World | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

This course is aimed at students who wish to explore the strange world of the quantum, building upon the usual quantum mechanics course for physics students. Its central question is: what is the world described by the laws of quantum physics like?The main topics are the following: – Paradoxes of quantum theory and their implications;– Quantum probabilities and consistent histories;– Decoherence and the origin of classical behaviour.These issues are approached primarily from a physicist's perspective, nevertheless they are also central to our understanding and interpretation of quantum theory from a philosophical perspective as well.Required knowledge: undergraduate quantum mechanics (material of BMETE15AF49 and BMETE15AF36 courses)Literature:– R. Omnés: The Interpretation of Quantum Mechanics, 1994. Princeton University Press– R.B. Griffiths: Consistent Quantum Theory, 2002. Cambridge University Press.– M. Schlosshauer: Decoherence and the Quantum-To-Classical Transition, 2007. Springer-Verlag Berlin Heidelberg– W.H. Zurek: Decoherence, einselection, and the quantum origins of the classical, Rev. Mod. Phys. 75: 715, 2003. quant-ph/0105127

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE80AX23 | Nonlinear Dynamics | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | T0 | English | |

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

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

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 |
|---|---|---|---|
| BMETE80MFAI | Fusion Devices | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | T1 | English | |
| Lecture | T0 | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE80MX00 | Nuclear and Reactor Physics Fundamentals | Exam | 5 |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE80NE02 | Fusion Devices | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Laboratory | T1-JEL | English | |
| Lecture | T0-JEL | English | |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE90AX00 | Mathematics A1a - Calculus | Exam | 6 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN-VIK-0 | English | MON:12:15-14:00; TUE:12:15-14:00 |
| Lecture | EN-VBK-0 | English | WED:16:15-19:00(KF51 (AUD.MAX)); THU:16:15-17:00(KF51 (AUD.MAX)) |
| Lecture | EN-EMK-0 | English | TUE:14:15-16:00(KF88); TUE:14:15-16:00(KF88); WED:16:15-18:00(KF88); WED:16:15-18:00(KF88) |
| Practice | EN-VIK-1 | English | WED:10:15-12:00 |
| Practice | EN-EMK-1 | English | MON:16:15-18:00(K373); MON:16:15-18:00(K373) |
| Practice | EN-EMK-3 | English | THU:16:15-18:00(K374); THU:16:15-18:00(K374) |
| Practice | EN-VBK-1 | English | THU:17:15-19:00(KF51 (AUD.MAX)) |

BUDAPEST UNIVERSITY OF TECHNOLOGY AND ECONOMICS BME FACULTY OF ECONOMIC AND SOCIAL SCIENCES (GTK)Analysis Mathematics A1a (BMETE90AX00) Course desciption: obligatory course-unit (6 contact hours) Real functions, Combining Functions, Trigonometric Functions, Exponential Functions, Inverse Functions and Logarithms, Inverse Trigonometric Functions, Limit of a Function and Limit Laws, One-Sided Limits, Continuity of Functions, Differentiation, Tangents and the Derivative at a Point, The Derivative as a Function, Differentiation Rules, The Chain Rule, Linearization, Applications of Derivatives, Extreme Values of Functions, The Mean Value Theorem, Monotonic Functions and the First Derivative Test, Concavity, Asymptotes of Graphs, Curve Sketching, Indeterminate Forms and L'Hôspital's Rule, Optimization, Antiderivatives, Indefinite Integrals, Techniques of Integration: Using Basic Integration Formulas, Integration by Parts, Substitution Method, Trigonometric Integrals, Trigonometric Substitutions, Integration of Rational Functions (by Partial Fractions and Other Methods), The Definite Integral, The Fundamental Theorem of Calculus, Applications of Definite Integrals: Area Between Curves, Volumes, Areas of Surfaces of Revolution, Arc Length.

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

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0-EA0 | English | WED:08:15-10:00(K373); WED:08:15-10:00(K373) |
| Practice | EN0-EA1 | English | WED:10:15-12:00(K373); WED:10:15-12:00(K373) |

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 |
|---|---|---|---|
| BMETE90AX09 | Mathematics A3 for Electrical Engineers | Exam | 4 |

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

Differential geometry of curves and surfaces. Tangent and normal vector, curvature. Length of curves. Tangent plane, surface measure. Scalar and vector fields. Differentiation of vector fields, divergence and curl. Line and surface integrals. Potential theory. Conservative fields, potential. Independence of line integrals of the path. Theorems of Gauss and Stokes, the Green formulae. Examples and applications. Complex functions. Elementary functions, limit and continuity. Differentiation of complex functions, Cauchy-Riemann equations, harmonic functions. Complex line integrals. The fundamental theorem of function theory. Regular functions, independence of line integrals of the path. Cauchy's formulae, Liouville's theorem. Complex power series. Analytic functions, Taylor expansion. Classification of singularities, meromorphic functions, Laurent series. Residual calculation of selected integrals. Laplace transform. Definition and elementary rules. The Laplace transform of derivatives. Transforms of elementary functions. The inversion formula. Transfer function. Classification of differential equations. Existence and uniqueness of solutions. The homogeneous linear equation of first order. Problems leading to ordinary differential equations. Electrical networks, reduction of higher order equations and systems to first order systems.The linear equation of second order. Harmonic oscillators. Damped and forced oscillations. Variation of constants, the in-

homogeneous equation. General solution via convolution, the method of Laplace transform. Nonlinear differential equations. Autonomous equations, separation of variables. Nonlinear vibrations, solution by expansion. Numerical solution. Linear differential equations. Solving linear systems with constant coefficients in the case of different eigenvalues. The inhomogeneous problem, Laplace transform. Stability.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE90AX18 | Mathematics A3 for Chemical Engineers and Bioengineers | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN-CA0 | English | WED:10:15-12:00(ONLINE) |
| Practice | EN-CA1 | English | THU:10:15-12:00(ONLINE) |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE90AX21 | Calculus 1 for Informaticians | Exam | 6 |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE90AX33 | Mathematics EP1 | Exam | 4 |

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

This course covers the elements of single variable calculus and linear algebra. Special emphasis is put on the concepts of linear algebra which are later used by architects in structural design. These are the systems of linear equations, matrices and determinants with their properties. From the elements of calculus, the limit of sequences, the differentiation, the integration and applications belong to the course material.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE90MX33 | Mathematics MSc for Civil Engineers | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN0-EA0 | English | MON:10:15-12:00(KF88); MON:10:15-12:00(KF88) |
| Practice | EN0-EA1 | English | MON:12:15-14:00(KF88) |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE91AM35 | Basics of Mathematics | Exam | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A0 | English | |

Notations, formal languages, formalism in mathematics. Mathematics and the deductive systems. – Propositional logic. The language of propositional logic. Logical operations, tautologies, logical equivalences. A calculus in propositional logic. Completeness and its importance. – First order logic. Language of first order logic: terms, formulas, quantifiers, equality. Structure, model, algebra. Valuation in a model. The concept of logical consequence. Axioms and theorems. Standard and non-standard models. Calculus, deductive and refutation systems. Completeness. Direct and indirect proofs. On the concepts induction and recursion. – The real numbers as ordered field with suprema. The construction of the real numbers. Non-standard real numbers, infinitesimals. – Set theory. Ordered pairs, relations, functions. Equivalence- and ordering relations. Equivalence of sets. Countable and non-countable cardinalities. Cantor's diagonalization procedure. Continuum hypothesis. Classes, Russel paradoxon. Well -ordering. The axiom of choice and its importance.– R.G. Exner: An Accompaniment to Higher Mathematics, Springer, 1996

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE91AM36 | Introduction to Algebra 1 | Exam | 9 |

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

Elementary number theory: integers, divisibility, division with remainders, greatest comon divisor, Euclidean algorithm, irreducible numbers and prime numbers,Fundamental Theorem of Arithmetic. Linear Diophantine equations, modular arithmetic, complete and reduced remainder systems, solution of linear congruences. Complex numbers, algebraic and trigonometric forms, Binomial Theorem. Relation between the complex numbers and the

geometry of the plane. Roots of unity, primitive roots of unity. Polynomials with one variable, operations, Horner-scheme, rational root test, Fundamental Theorem of Algebra. Irreducibility of polinomials, Schönemann-Eisenstein criterion. Multivariate polynomials, complete and elementary symmetric polynomials, Viete formulas, roots of cubic polynomials. Systems of linear equations in two and three variables, Gaussian and Gauss-Jordan elimination. R^n and its subspaces. Linear combinations, linear independence, spanned subspace, basis, dimension. Coordinate systems, row space, column space, nullspace of a matrix. Subspace of solutions, solutions in the row space. Matrix operations, inverse matrix, base change matrix. Operations with special matrices, PLU decomposition. Solution of systems of equations with the help of PLU decomposition. Determinant as the volume of the parallelepiped. Basic properties, determinant of a matrix. The notion of permutations, transpositions, cycles, expansion of the determinant. Laplace Expansion Theorem, Mutiplication Theorem of Matrices, formula for the inverse of a matrix, Cramer's Rule. Basic properties of matrix rank. Linear maps and their matrices: the matirx of a projection to a subspace. Similar matrices. Optimal solution of inconsistent systems of linear equations, normal equation, solution in the row space and its minimality. Moore-Penrose generalized inverse.– W. Sierpinski: Elementary theory of numbers, North Holland, 1987.– P. Halmos: Finite dimensional vector spaces, Springer, 1967.– V.V. Prasolov, Problems and Theorems in Linear Algebra, AMS, 1994.– P. Halmos C.D. Meyer: Matrix analysis and applied linear algebra (online textbook)– J. Hefferon: Linear Algebra, free online book– K.H. Rosen: Elementary Number Theory and Its Application, 6th Edition, Pearson, 2010.– C.D. Meyer: Matrix Analysis and Applied Linear Algebra, SIAM, 2000.– K.H. Rosen: Elementary Number Theory, Pearson (2011) (online textbook)

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE91AM38 | Algebra 1 | Exam | 7 |

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

Groups, semigroups. Basic properties of groups, group homomorphism, subgroups, cosets. Langrange's Theorem. Examples: diherdral groups, quaternion group, symmetric groups, alternating groups. Decomposition of permutations into disjoint cycles, transpositions. Permutation groups, group actions, transitivity, Cayley's Theorem. Cyclic groups, order of a group element. Cauchy's Theorem. Direct product of groups. Normal subgroups, factor group, Homomorphism Theorem, Noether's Isomorphism Theorems. Important subgroups: derived subgroup, centre, class equation. Subgroup chains, Sylow's Theorems, description of the structure of groups of small size. Nilpotent groups. Fundamental Theorem of Finite Abelian Groups. Free groups. Free algebras over rings, ideals, maximal and prime ideals. Description of the polynomial ring R[x]. Principal ideal domains. Noether rings, unique factorization domains (UFD). Factor rings, field extensions, construction of finite fields. Modules over rings, submodules, module homomorphisms. Semisimple modules and rings. The structure of matrix algebras over division rings. Vector space and module constructions: factor module, direct product, direct sum, tensor product. Linear fuction and the dual space. – P.J. Cameron: Introduction to Algebra, Oxford Science Publications, 1998.– Atiyah-Macdonald: Introduction to commutative algebra, online textbook

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE91AM39 | Algebra 2 | Exam | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | A0 | English | |

Field extensions, construction and uniqueness of simple algebraic extensions, finite and algebraic extensions. Normal extensions, splitting field, separable extension, finite fields, Wedderburn's theorem, Galois group, irreducibility of the cyclotomic polynomials, Galois groups of radical extensions, Galois correspondence, Fundamental theorem of Galois theory. Applications of Galois theory: Fundamental theorem of algebra, ruler and compass constructions, solvability of equations by radicals, Abel–Ruffini theorem. Existence and uniqueness of algebraic closure, transcendental extensions, transcendence of e, Gelfand-Schneider theorem. - Review of the basic concepts of number theory, Euler ? function. Linear congruences and systems of congruences, binomial congruences of higher degree, discrete logarithm, congruences of prime power moduli. Quadratic congruences, Legendre and Jacobi symbol, quadratic reciprocity. Prime numbers: Euclid's theorem, gaps between primes, Chebyshev's theorem, harmonic series of primes, Dirichlet's theorem for (nk + 1). Arithmetic functions: d(n), ?(n), ?(n). Multiplicativity, convolution, Möbius function, the Möbius inversion formula. Prime number theorem, magnitude of the nth prime, prime tests, Rabin–Miller test, RSA function. Diophantine equations: linear diophantine equations, Pythagorean triples, Fermat's two squares theorem, Gaussian integers. – I. Stewart: Galois Theory, CRC Press, 2003– Niven, Zuckerman, Montgomery: An Introduction to the Theory of Numbers, John Wiley amp; Sons, 1960– M.B. Nathanson: Elementary Methods in Number Theory, Springer, 2000

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE93BG01 | Mathematics G1 | Exam | 6 |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETE93BG03 | Mathematics G3 | Mid-semester mark | 4 |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETETOP101 | Mechanics | Exam | 0 |

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

Principles and concepts of classical physics. Vector and scalar quantities. Motion in one and two dimensions. Projectiles. Newton’s laws. Conservative and dissipative forces. Equilibrium of rigid bodies. Levers, pulleys. Torque, circular motion, angular acceleration, moment of inertia. Linear and angular momentum. Work and energy. Energy of rotational motion, work of spring. Laws of conservation. 2 hours of lectures with demonstrational experiments and problem solving practice 4 hours/week.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETETOP102 | Electricity | Exam | 0 |

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

Fundamental phenomena of electrostatics. Electric charge, field strength. Electric potential and voltage. Electric polarization. Capacitors. Energy of the electric field. Electric current. Electric power. Electric circuits. Magnetic field produced by current. Electromagnetic induction. Self induction. Transformers. Alternating current. Electrical oscillations. Electromagnetic waves. 2 hours of lectures with demonstrational experiments and problem solving practice 4 hours /week.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMETETOP117 | Engineering Sciences | Mid-semester mark | 0 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | EN1 | English | TUE:10:15-12:00(K221); TUE:10:15-12:00(K221); WED:10:15-12:00(K221); WED:10:15-12:00(K221) |

# Faculty of Transportation Engineering and Vehicle Engineering

IMPORTANT NOTES

If for one subject you can find several different types (lecture, practice, laboratory) of courses then please choose one and only one course from each type in order to be able to perform the subject's requirements successfully.Civil Engineering courses are on the website seperately. Courses chosen from the offer of Faculty of Civil Engineering will be checked and arranged individually by the departmental coordinator.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEKOKAM103 | Electronics - electronic measuring systems | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | ERA_Ea | English | TUE:12:15-14:00 |
| Practice | ERA_gy | English | TUE:10:15-12:00 |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEKOKAM104 | Information and communication technology | Mid-semester mark | 3 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | ERA_ea | English | WED:14:15-16:00 |
| Practice | ERA_gyak | English | WED:16:15-18:00 |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEKOKAM202 | Transport Automation | Mid-semester mark | 4 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | ERA_L | English | WED:14:15-16:00 |
| Practice | ERA_P | English | MON:12:15-14:00 |

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEKOKGA226 | Airtransport Management I. | Mid-semester mark | 2 |

| Course type | Course code | Course language | Timetable information |
|---|---|---|---|
| Lecture | ERA_L | English | THU:12:15-14:00 |
| Practice | ERA_P | English | THU:12:15-14:00 |

Market of air transport. Strategy. Marketing. Controlling. Charges. Airlines and airports.

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEKOKKM227 | Smart City | Mid-semester mark | 3 |

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

| Subject code | Subject name | Requirement | ECTS credit |
|---|---|---|---|
| BMEKOKUM206 | Transport Operation Technology | Exam | 5 |

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