Centre of Modern Languages

IMPORTANT NOTES

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

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W60A	Communication Skills - English - B2	Mid-semester mark	2

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

.cs34CA72B{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;text-decoration: none;} .cs95B300B{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs1F994FB{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:transparent;text-decoration: underline;font-style:normal;font-weight:normal;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs7AB323B{font-size:12pt;font-weight:bold;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;}

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

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

Course type	Course code	Course language	Timetable information
Practice	K12_nkk	German	TUE:12:15-14:00

.cs34CA72B{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;text-decoration: none;} .cs95B300B{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs1F994FB{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:transparent;text-decoration: underline;font-style:normal;font-weight:normal;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs7AB323B{font-size:12pt;font-weight:bold;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;}

Detailed description: hhttps://edu.gtk.bme.hu/local/tad/tad.php?id=973Recommended entrance level: B2- The course is aimed to prepare

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

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

Course type	Course code	Course language	Timetable information
Practice	Sz14_axc	English	WED:14:15-16:00
Practice	Cs14_axc	English	THU:14:15-16:00

.csC176A7B{font-size:12pt;font-weight:bold;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;}
.cs7CFEB6B{font-size:12pt;font-weight:bold;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;text-decoration: none;}
.cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;}
.cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt}
.cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;}
.cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;}
.cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt}
.cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt}
.csC162C0B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;}
.csD80DFDB{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:#FFFFFF;text-decoration: underline;font-style:normal;font-weight:bold;}

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

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

Course type	Course code	Course language	Timetable information
Practice	Cs14_nxc	German	THU:14:15-16:00

.csC176A7B{font-size:12pt;font-weight:bold;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;}
.cs7CFEB6B{font-size:12pt;font-weight:bold;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;text-decoration: none;}
.cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;}
.cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt}
.cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;}
.cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;}
.cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt}
.cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt}
.csC162C0B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;}
.csD80DFDB{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:#FFFFFF;text-decoration: underline;font-style:normal;font-weight:bold;}

Detailed description:
https://edu.gtk.bme.hu/local/tad/tad.php?id=979 Recommended entrance level: B2- The course is aimed to develop communication skills through the topic of cultural differences and prepare participants for managing intercultural situations they might face in their academic and/or professional career in a globalised world. The focus is on oral skills development, though reading and listening comprehension, as well as writing skills are included.- Upon

completing the course participants will be able to talk about the background of cultural differences, manage intercultural differences with raised awareness and open up to groups from other cultures. Students can identify and analyse the values underlying cultural differences, as well as manage multicultural workplace or scientific and business situations which involve conflict management, discussing, planning and implementing ideas. The course not only develops analytical skills required to gauge and solve intercultural situations, but also emotional intelligence. - Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W62S	Cross-cultural Communication - Spanish - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	Sz14_sxc	Spanish	WED:14:15-16:00

.cs34CA72B{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;text-decoration: none;} .cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs1F994FB{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:transparent;text-decoration: underline;font-style:normal;font-weight:normal;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs5CC07D4 {margin:12pt 0pt 12pt 0pt;text-align:left;text-indent:0pt} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .csC162C0B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;} .cs7AB323B{font-size:12pt;font-weight:bold;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;}

Detailed description: https://edu.gtk.bme.hu/local/tad/tad.php?id=981 Recommended entrance level: B2- The course is aimed to develop communication skills through the topic of cultural differences and prepare participants for managing intercultural situations they might face in their academic and/or professional career in a globalised world. The focus is on oral skills development, though reading and listening comprehension, as well as writing skills are included.- Upon completing the course participants will be able to talk about the background of cultural differences, manage intercultural differences with raised awareness and open up to groups from other cultures. Students can identify and analyse the values underlying cultural differences, as well as manage multicultural workplace or scientific and business situations which involve conflict management, discussing, planning and implementing ideas. The course not only develops analytical skills required to gauge and solve intercultural situations, but also emotional intelligence.- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

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

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

.cs34CA72B{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;text-decoration: none;} .cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs1F994FB{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:transparent;text-decoration: underline;font-style:normal;font-weight:normal;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs5CC07D4 {margin:12pt 0pt 12pt 0pt;text-align:left;text-indent:0pt} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs7AB323B{font-size:12pt;font-weight:bold;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;}

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

the wonderful embroidery, porcelain, wooden artefacts and music, students will have a better understanding of the Hungarian soul and symbols.- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

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

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

.cs34CA72B{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;text-decoration: none;} .cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs1F994FB{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:transparent;text-decoration: underline;font-style:normal;font-weight:normal;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs7AB323B{font-size:12pt;font-weight:bold;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} Detailed description: https://edu.gtk.bme.hu/local/tad/tad.php?id=984 Recommended entrance level: B2- The course is aimed to develop competencies required for effective general and technical/specialist communication in English. There is an equal emphasis on both written and spoken English. In the course students are introduced to distinctive uses of technical texts, with particular emphasis on their lexical and syntactic characteristics. Students acquire the basic technical terminology in all fields of engineering.- By the end of the course students are able to understand more complex technical texts. Moreover, they are able to create simple technical scripts bearing the basics of the technical register in mind. They are able to formulate their opinions concerning specialist topics. They recognise and use terminology related to their own fields of interest and outside their profession's scope. They are able to elaborate on: technical inventions, innovations, appliances, devices, mechanisms, materials technology, properties of materials, basic geometrical shapes, primary mathematical concepts, proper names of tools, the principles of energy technology and the basic questions of sustainability.- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

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

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

.cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .csF86573B{font-size:12pt;font-weight:bold;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;text-decoration: none;} .csF59EFB{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:transparent;text-decoration: underline;font-style:normal;font-weight:bold;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs7AB323B{font-size:12pt;font-weight:bold;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} Detailed description: https://edu.gtk.bme.hu/local/tad/tad.php?id=985Recommended entrance level: B2- The course is aimed to develop competencies required for effective general and technical/specialist communication in English. There is an equal emphasis on both written and spoken English. In the course students are introduced to distinctive uses of technical texts, with particular emphasis on their lexical and syntactic characteristics. Students acquire the basic technical terminology in all fields of engineering.- By the end of the course students are able to understand more complex technical texts. Moreover, they are able to create simple technical scripts bearing the basics of the technical register in mind. They are able to formulate their opinions concerning specialist topics. They recognise and use terminology related to their own fields of interest and outside their profession's scope. They are able to elaborate on: technical inventions, innovations, appliances, devices, mechanisms, materials technology, properties of materials, basic geometrical shapes, primary mathematical concepts, proper names of tools, the principles of energy technology and the basic questions of sustainability.- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W65A	Business English - B2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	Cs14_abl	English	THU:14:15-16:00

.csC176A7B{font-size:12pt;font-weight:bold;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;} .cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs13FD22B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;text-decoration: none;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .csC162C0B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;} .csCBAB87B{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:#FFFFFF;text-decoration: underline;font-style:normal;font-weight:normal;}

Detailed description:
https://edu.gtk.bme.hu/local/tad/tad.php?id=986 Recommended entrance level: B2- The course is aimed to engage students in business communication in the target language, to master business English vocabulary and to understand business processes. The course is aimed at students pursuing economics and engineering studies, providing them with the opportunities to understand and accept the similarities and differences in economic and engineering approaches.- After completing the course, students will understand not only professional texts but also texts and videos intended for a wider audience, and they will be able to write texts related to managerial work (e.g., summary, reminder, official letter). As a result of the structured development of economic vocabulary, students are able to participate in workplace communication, can comment on economic events, and gather, organise, and share information about companies.- Completion requirement: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

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

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

.csC176A7B{font-size:12pt;font-weight:bold;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;} .cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs13FD22B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;text-decoration: none;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .csC162C0B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;} .csCBAB87B{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:#FFFFFF;text-decoration: underline;font-style:normal;font-weight:normal;}

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

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

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

.csC176A7B{font-size:12pt;font-weight:bold;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;} .cs95B2DFB{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs13FD22B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;text-decoration: none;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .csC162C0B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;} .csCBAB87B{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:#FFFFFF;text-decoration: underline;font-style:normal;font-weight:normal;} .csFB35A1B{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times Roman;}

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

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

Course type	Course code	Course language	Timetable information
Practice	Sz10_aUN	English	WED:10:15-12:00

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

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

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

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color:transparent;font-style:normal;font-family:Calibri;} .cs1D21654{text-align:left;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .cs13FD22B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;text-decoration: none;} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .cs9880FCB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Times New Roman;} .cs3270F94{margin:0pt 0pt 0pt 0pt;text-align:left;text-indent:0pt} .cs27B0404{text-align:justify;margin:0pt 0pt 1pt 0pt;line-height:1.07;text-indent:0pt} .csC162C0B{font-size:12pt;font-weight:normal;color:#000000;background-color:#FFFFFF;font-style:normal;font-family:Calibri;} .csCBAB87B{font-size:12pt;font-family:Calibri;color:#0000FF;background-color:#FFFFFF;text-decoration: underline;font-style:normal;font-weight:normal;}

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

Subject code	Subject name	Requirement	ECTS credit
BMEGT60W71A	Professional writing - English C1	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	H10_aProf	English	MON:10:15-12:00

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Detailed description:
https://edu.gtk.bme.hu/local/tad/tad.php?id=996Recommended entrance level: B2+/ C1- The course is aimed to develop the students' writing skills. The course focuses on creating opportunities for students to write high-quality texts in a work environment and in the academic field. While developing the students' writing skills in these two contexts, equal emphasis will be placed on grammatical accuracy, expressiveness and organisation. - By the end of the course students will be able to create texts in the appropriate register according to the genre requirements of a work environment (e.g. memos, reports, summaries). They will be able to produce texts in writing, taking into account the structural and linguistic requirements of academic prose. Students will be able to express the finer shades of meaning in logically structured written texts both in a work environment and in the academic field.- Completion requirements: active participation in classes (maximum 30% absence allowed) and completion of assignments and / or progress tests issued during the semester.

Faculty of Architecture

IMPORTANT NOTES

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

Subject code	Subject name	Requirement	ECTS credit
BMEEPAG0236	Applied Building Information Modelling B (Archicad advanced)	Mid-semester mark	3

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

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

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

Course type	Course code	Course language	Timetable information
Laboratory	EN1-ER	English	WED:16:15-18:00(K218)

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

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

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEEPAGA501	Architectural Informatics 3 - CAD for Architects	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN1-ER	English	THU:11:15-13:00(K216)
Lecture	EN0-ER	English	THU:10:15-11:00(K216)

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	WED:10:15-12:00(K344)

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

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

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

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

Water supply The physical and chemical properties of water. Obtaining of water from the nature. Mechanical, chemical and biological treatment of water. Water treatment process of swimming pools. Transport of water. Characteristics of water pumps. Fresh water demand and production, hydrofors and hydroglobes. Cold water distribution network in a building. Metering of water consumption. Pipe materials and appliancies: valves and taps, safety equipments. Fire protection networks. Domestic hot water demand and production. Domestic hot water networks in a building. Boiler types. Circulation. Appliancies: toilets, baths, showers, washing machines, etc. Legionella. Waste water systems Requirements of waste water networks. Traps and syphons. Sanitary rooms for disabled people. Waste water networks. Rain water networks. Pipe materials and fittings. Gas supply Physical properties of natural and PB gas. Dangers of gas supply. Safety requirements. Gas supply networks outside and inside the building. Gas meters. Materials and fittings of gas networks. Gas appliancies: boilers, stoves, ovens. Categorisation and safety requirements of appliancies. Chimneys: types and requirements. Parameters of drought. Drought diverter. Artificial lighting Visual environment and its components. Characteristics of the human vision. Essential ideas of lighting technique: luminous flux, luminous intensity, illuminance, luminance. Characterisation of surfaces: reflection and transmission, spreading of light, colour. Requirements concerning the lighting. Average illuminance and its uniformity. Colour rendering. Modelling 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	TUE:12:15-14:00(K221)

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

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

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

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEEPEKM2I1	Real-Estate development and building rehabilitation	Mid-semester mark	2

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:10:15-12:00(K350)
Practice	EN1-ER	English	TUE:12:15-13:00(K350)

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

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	THU:08:15-10:00(K285)
Practice	EN1-ER	English	THU:08:15-10:00(K285)

This subject introduces all major building construction components (walls, foundations, floors, roofs, skeleton frames, stairs, ramps, doors and windows) and primary building engineering service systems. During lectures, the building is considered as a composition of spaces with different functions, separated by special surfaces. The course aims to introduce and explain the grammar of architectural design through practical tasks, such as the survey of onersquo;s own flat. Concurrently, the basic dependant factors of the creative design process are described. Students are acquanted with technical terminology as well as the role and use of various construction solutions including their classifications. The above shall assist students with both starting independent design exercise work and the continuing of building construction studies in greater detail.

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

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	MON:08:15-10:00(K285)
Practice	EN1-ER	English	FRI:08:15-10:00(K351)

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

Subject code	Subject name	Requirement	ECTS credit
BMEEPESA501	Building Construction 4	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:12:15-14:00(K352)

Practice	EN1-ER	English	THU:08:15-10:00(K352)

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN1-ER	English	THU:13:15-15:00(K350)

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

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

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:10:15-12:00(K285)
Practice	EN1-ER	English	TUE:12:15-13:00(K285)

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:12:15-14:00(K392)
Practice	EN1-ER	English	TUE:14:15-15:00(K392)

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	FRI:10:15-12:00(K221)
Practice	EN1-ER	English	FRI:12:15-13:00(K221)

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
BMEEPETO901	History of Architecture in Hungary 2	Mid-semester mark	2

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

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 Achitectural Design	Exam	2

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	WED:10:15-12:00(K345)

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
BMEEPKO0995	Architectural Research for Exchange Students - KO	Mid-semester mark	6

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

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

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

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	MON:10:15-14:00(K3R5)

Subject code	Subject name	Requirement	ECTS credit
BMEEPRAA501	Drawing and Composition 5	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	TUE:14:15-16:00(K3R7)

In this semester students apply their previously acquired skills in the most complex architectural representation: in drawing affter imagination. After practising the representation of reality and preparing creative perspective drawings (with the help of the real view, which could not be drawn from real points of view), students in this course prepare fully detailed, external and internal perspective views of buildings of various size, based on plans (e.g. ground plans, sections, elevations), using their experience and creative imagination, applying conventional graphic techniques. Students have to accomplish a modelling task during the semester, which improves creative thinking.

Subject code	Subject name	Requirement	ECTS credit
BMEEPRAO702	Drawing 7.	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	TUE:16:15-18:00(K3R6)

The course examines the relationship between colour and colour, colours and humans, and between colours and the built environment. Technical introduction of pigments, behaviour of colours when mixing pigments, the basic techniques of painting. The role of colours in the creative character and in the thoughtfully built environment. Presentation of the exterior architectural colour design, colour preferences and theories in the different historical periods. The concept and conditions of colour harmonies, guide to the effective use of the different harmony-theories. The use of colour design in everyday projects (authentic colouration in historic renovation, aesthetic urban rehabilitation, etc.) Students learn the architectural use of colour design through a series of projects, from the manual techniques of painting to digital colouration.

Subject code	Subject name	Requirement	ECTS credit
BMEEPRAT701	Department's Design 2.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Practice	EN1-ER	English	WED:14:15-17:00(K3R1)

This subject based on interior design. The design process focuses on abstract formal approach. Students create different 3D possibilities in the first half of the semester, then they analyse them. The project becomes in this way interior design. The design project based on the fundamental decisions and 3D modelling, which are completed by manual works.

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

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

The subject is suggested for student on MSc course to refresh the structural studies of the different BSc courses. The typical structural problems are presented: beams, slabs, columns, walls, trusses and bracings. All the typical structural materials are presented too: reinforced concrete, steel, timber and brick. The structural analysis is on the

focus: loads, the hierarchy of structural elements, equilibrium, internal forces, stresses. The resistance of the structural elements is the other topic: elastic and plastic resistance, buckling resistance. The Eurocode is the base of the resistance calculations, but the subject tries to be 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	WED:14:15-16:00(K364)

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

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

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEEPSTA105	Statics	Exam	4

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:10:15-12:00(K364)
Practice	EN1	English	WED:14:15-16:00(K352)

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	MON:12:15-14:00(K363); WED:10:15-12:00(K363)
Practice	EN1	English	FRI:08:15-10:00(K352)

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

Subject code	Subject name	Requirement	ECTS credit
BMEEPSTQ702	Sustainable conceptual design of structures	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-11:00(K343)
Practice	EN1	English	MON:11:15-13:00(K343)

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	TUE:12:15-14:00(K344)
Practice	EN1	English	FRI:12:15-14:00(K344)

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	MON:08:15-16:00(K222); WED:08:15-16:00(K222)
Practice	EN2-ER	English	TUE:08:15-16:00(K222); THU:08:15-16:00(K222)

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

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

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

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
BMEEPUI0995	Architectural Research for Exchange Students - UI	Mid-semester mark	6

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	TUE:08:15-10:00(K285)

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0-ER	English	FRI:12:15-14:15(K350)

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:15:15-16:00(K397)
Practice	EN1	English	THU:16:15-17:00(K397)

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

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	A11	English	MON:15:15-18:00(CHA11)

The subject (biochemistry) does not aim at giving comprehensive biochemistry knowledge. Instead it would like to give a short overview of the biochemical pathways and their connections. The first part gives basic knowledge from the field of basic cell biology. The second part focuses to the basic principles of enzymology and bioenergetics. This part gives background to the metabolic processes discussed in the third block. The energy producing processes such as the oxidative phosphorylation and the photosynthesis is embedded into this metabolic part. This metabolic part is followed by the forth, last part which discuss the basics of molecular biology.#160;

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

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

Introduction. Position and development of the plastics industry, the role of plastics in the economy. Definition: macromolecule, polymer, plastic, additives, other ingredients. Types of plastics: linear and cross-linked polymers, elastomer, engineering plastics. Properties of polymers and their modification. Outline of the subject, key questions (chemistry, physics, processing, application, environmental issues).2.#160;#160; Polymerization. Radical polymerization. Basic reactions: initiation, chain propagation, chain transfer, termination. Polymerization technologies: gas phase, emulsion, suspension, bulk. Copolymerization, relative reactivity. Ionic polymerization. Stereospecific polymerization.3. Polycondensation, cross-linked polymers. Functionality, average functionality. Molecular mass and functionality, criterion of cross-linking and the production of cross-linked polymers. Materials, short introduction to the most frequently used polymers. Thermoplastics: PE, PP, PVC, PS and its copolymers. Engineering plastics: PC, PET, PA. Thermoset resins: pheno- and aminoplasts, epoxy resins, polyesters, polyurethanes. Elastomers and rubbers. 4#160;#160;#160; Polymer physics. Conformation, the freely-jointed chain model, factors hindering conformational changes. Radius of gyration, chain-end distance, entanglements. Polymer solutions, phase diagram, solubility. Several methods to determine molecular weight. The behavior of solid polymers, rubber elasticity.5.#160;#160; Deformation and fracture. Gas, liquid and solid state. Physical states. Crystalline and amorphous materials. Themomechanical traces, transitions. Melt rheology, flow, viscosity, shear dependence. Phenomenological models, viscoelastic deformation. Unidirectional deformation, stress vs. strain traces, necking. Fracture, brittle and plastic fracture, stiffness-impact resistance correlations.6.#160;#160; Correlation of structure and properties. Relationship of the molecular and macroscopic structure of plastics, characteristic temperatures, properties. Plasticization. Semi-crystalline polymers. Crystallization, melting, polymorphism. Nucleation. Correlation between crystalline structure and properties. Structure of amorphous polymers. 7.#160;#160; Modified polymers. Polymer blends, miscibility, compatibility. Particulate filled polymers, correlation between component characteristics and composite properties. Reinforcing with short and long fibers. Micromechanical deformation processes. Structure and properties. Influence of interfacial interactions.8.#160;#160; Processing of thermoplastics. Physical states and processing technologies. Melt processing, the role of viscoelasticity. Extrusion, injection molding, blow-molding, calendaring. Processing in the rubber elastic state: thermoforming. Machining.9.#160;#160; Other processing methods and products. Fiber spinning, foams, membrane technology. Reactive injection molding. Processing of cross-linkable resins. Molding epoxy resins, impregnation, polyester resins reinforced with glass fibers and mats. Phenoplast and aminoplast boards. Rubber technology, tires. Lacquers, adhesives.10. Application of plastics. Types of plastics used as packaging materials, the corresponding processing technologies, products. The most important characteristics of plastic packaging materials (mechanical properties, aesthetics, permeability, additives, lifetime, etc.). Aspects used in the selection of plastic packaging materials (properties, economy, regulations). Packaging of food and drugs. Legal aspects of using plastic packaging materials. Automotive industry. Body and body parts, bumpers. Suspension, vibration and sound insulation. Under hood parts. Lights and other electric parts. Instrument panel, seats, floor, trunk. Electronics, informatics. Insulators and conducting plastics. Non-linear optical plastics. Light sensitive, piezoelectric and liquid crystal polymers. Household equipment, bowls, plates, utensils. Chemical industry, pipes, pumps, heat exchangers. Agriculture: green houses, irrigation systems, artificial insemination, animal

identification plates. Healthcare: disposable products, catheters, etc. Building industry: pipes, wall paper, profiles, electrical parts, etc. 11. Degradation, stabilization, additives. Reasons of degradation: heat, light, oxidation, irradiation. Mechanism of degradation, chain scission, elimination, depolymerization. Type of additives: additives maintaining (stabilizers, lubricants) or modifying properties (plasticizers, fillers, colorants, blowing agents, impact modifiers, etc.). Role and mechanism of additives.12. Plastics and the environment. Plastic waste. Life cycle analysis. Methods of waste disposal: incineration, chemical decomposition, reprocessing, dumping. Technical and financial questions of reprocessing. Natural polymers and components: starch, cellulose, wood flour. Biodegradable polymers: properties and economy. Legal issues related to the handling of plastic waste. #160;Laboratory practice1.#160;#160; Introduction. Presentation of the goals and method of lab practice. Instructions for the preparation of the reports and information about individual questions. Aspects of the evaluation of the work done in the lab and of the report. Information about the prevention of accidents and fire in the lab.2.#160;#160; Identification of plastics. Application of rapid methods for the identification of unknown plastics. Identification based on visual inspection and the burning test (way of burning, odor of burning material, pH, dripping). Identification of heteroatoms, solubility and density. 3.#160;#160; Thermal analysis of polymers. Application of differential scanning calorimetry (DSC), polarization optical microscopy, thermo-optical methods for the study of plastic products. Differences between crystalline and amorphous polymers, analysis of correlations between structure and application properties. 4.#160;#160; Mechanical properties of plastics. Tensile testing of amorphous and crystalline polymers and copolymers, evaluation and interpretation of tensile characteristics. Application of dynamic mechanical thermal analysis (DMTA) for the determination of the relaxation transition of polymers (demonstration). 5.#160;#160; Extrusion of thermoplastics. Introduction to the construction and operation of the extruder. Processes taking place in the extruder and the factors determining them. Similarities and differences in industrial and laboratory extrusion. Correlations between the technological parameters of the extrusion and the properties of the product. 6.#160;#160; Injection molding of thermoplastics. Parts, construction and operation of injection molding machines. Detailed presentation of processes taking place during injection molding. Structure and properties of injection molded parts. Effect of injection molding technology on the properties of injection molded parts.7.#160;#160; Plastic foams. Production of foams with physical and chemical blowing agents. Preparation of foamed polystyrene blocks. Production of soft and rigid polyurethane foams. Characterization of the structure of the foam. #160;

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

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

Kinetics: rates of chemical reactions#160;#160; #160;–#160;#160; #160;Definitions: molecularity, order of reactions, rate of reaction. Zero-order reactions, first-order reactions, second-order reactions.–#160;#160; #160;Equilibrium reactions. Consecutive and parallel reactions.–#160;#160; #160;Homogeneous catalytic reactions, autocatalysis, enzyme kinetics, oscillating reaction.–#160;#160; #160;Temperature dependence, collision theory, transition-state theory.–#160;#160; #160;Determining the order and rate constant of a reaction.–#160;#160; #160;Kinetics of heterogeneous reactions.–#160;#160; #160;Kinetic salt effects.Electrochemistry#160;#160; #160;–#160;#160; #160;Chemical potentials and activities in electrolyte.–#160;#160; #160;The electrochemical potential.–#160;#160; #160;Electrochemical cells.–#160;#160; #160;Thermodynamics of Galvanic cells, the Nernst equation.–#160;#160; #160;Electrode potentials.–#160;#160; #160;Types of electrodes.–#160;#160; #160;Membrane potentials, glass electrodes.–#160;#160; #160;Conductivity of electrolytes.–#160;#160; #160;Electrode kinetics and polarization.–#160;#160; #160;Corrosion, Protecting against corrosion.Transport phenomena–#160;#160; #160;Definitions, thermodynamic driving forces.–#160;#160; #160;Laws of diffusion: Fick laws, statistical view, steady state diffusion.–#160;#160; #160;Heat conduction.–#160;#160; #160;Viscosity, newtonian and non-newtonian fluids.Physical Chemistry Calculations in kinetics and electrochemistry#160;

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

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

Introductory lecture: students are introduced with the basics of experimental procedures in determination of physicochemical properties of materials, types of experimental errors, calculation and characterization of errors and presentation of experimental results. Mathematical statistics (probability, deviation) will be discussed shortly.The practical part of the subject consists of 8-10 practices in small groups (6 students in one group) which will be chosen from the following practices at the beginning of each semester. Each practice aims to improve the skills of students in individual work, arranging of experimental setups and critical evaluation of results. The knowledge covers various fields in thermodynamic and kinetics as it follows.1. Determination of apparent heat of evaporation in a one-component system. Various organic solvents will be characterized by using the Clausius-Clapeyron-equation and several possible experimental errors will be considered during the measurement. The method of linear least squares regression is used for evaluation.2. Phase equilibrium in liquid-liquid two-component systems. Two-component systems displaying either LCST or UCST will be investigated and the composition-temperature phase diagram will be constructed. Component balance equation will be discussed and used to determine the volume ratio of phases.3. Adsorption. Two different experiments will be introduced: nitrogen gas adsorption and adsorption of diluted solutions

on the carbon surfaces. Theoretical background and limits of the methods will be discussed and results of the methods will be compared with a critical viewpoint.4. Determination of the molecular weight of a linear macromolecule using viscosimetry. The terms dynamic, relative, specific and intrinsic viscosity will be introduced and discussed. The molecular weight of a chosen neutral polymer will be determined by the measurement of its relative viscosity by a capillary viscosimeter. Experimental error and its effect on the molecular weight will be characterized.5. Rheology.#160; Flow and viscosity curves will be discussed and classified. Newtonian and thixotropic fluids will be investigated by using an Ostwald and a rotational viscosimeter. 6. Calorimetry. Various calorimetric methods will be introduced. Heat of an acid-base reaction will be determined by an adiabatic calorimeter while specific heat capacity of an organic liquid will be determined by a heat transfer calorimeter. Experimental results will be compared with literature data. 7. Conductivity of electrolyte solutions. The basics of conductometry will be introduced and the terms conductivity, specific and molar conductivity will be discussed. The degree of dissociation of a chosen electrolyte will be determined by the measurement of conductivity and thermodynamic functions for the dissociation (enthalpy, Gibbs free energy and entropy) will be calculated.8. Rate constant of iodination of acetone. Basics of reaction kinetics (order, rate constants) will be discussed and the reaction rate constant of a simple chemical reaction will be determined by concentration measurements as a function of time with titration. The rate-limiting reaction step will be determined by linear plot.9. Order of a component in kinetics of decomposition of hydrogen peroxide.#160; Reaction rate of the peroxide will be calculated from the flow rate of the product (oxygen gas) in a continuous reactor. Order of the kinetics will be determined.#160; #160;10.Kinetics of reaction between ions. Basic of reaction kinetics and the effect of inert ions on reaction rate will be discussed. A simple ion reaction will be investigated and reaction time will be determined by using a colour indicator of reaction end. Reaction rate constant will be determined and the effect of experimental errors will be analysed. 11. Electrochemistry. Both electrochemical equilibrium and kinetics of an electrochemical reaction will be investigated. A simple galvanic cell will be constructed and the validity of the Nernst-equation will be analysed in a wide concentration range of components. Polarization of an other cell will be characterized by recording the polarization curve and the Tafel plot of an electrochemically active organic compound.#160;

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	WED:14:15-17:00; THU:11:15-13:00(CH306)

The subject deals with the theoretical foundations of chemistry and the experimental and calculation methods that present information about the structure and properties of molecules and molecule ensembles.1.#160;#160;#160;#160; Interactions of atoms and molecules with particles and external fields#160;1.1.#160;#160; Research and its application#160;1.2.#160;#160; Interactions with particles#160;1.3.#160;#160; Interactions with electric field#160;1.4.#160;#160; Interactions with magnetic field#160;1.4.1. Elementary magnets#160;1.4.2. Diamagnetism#160;1.4.3#160; Precession#160; magnetic moment#160;1.4.4. Paramagnetism#160;1.5.#160;#160; Interactions with magnetic waves#160;1.6.#160;#160; The electromagnetic spectrum#160;#160;2.#160;Structure and properties of atoms#160;2.1.#160;#160; Introduction#160;2.2.#160;#160; The hydrogen atom#160;2.2.1. The structure of the hydrogen atom#160;2.2.2. Angular and magnetic moments of the hydrogen atom#160;2.2.3. Selection rules of the hydrogen atom#160;2.2.4. The electronic spectrum of the hydrogen atom#160;2.3.#160;#160; Many-electron atoms#160;2.3.1. Hydrogen-like atoms#160;2.3.2. Other many-electron atoms#160;2.3.3. Interaction with external magnetic field#160;2.3.4. Interaction with external electric field#160;2.3.5. Interpretation of the electronic spectra#160;2.3.6#160; The measurement of the atomic spectra#160;2.4.#160;#160; Ions#160;2.4.1. Ionization#160;2.4.2. Interactions of ions#160;#160;3.#160;Structure and properties of molecules#160;3.1.#160;#160; Molecular symmetry#160;3.1.1. Symmetry elements and symmetry operations#160;3.1.2. Point groups#160;3.1.3#160; Representations of point groups#160;3.2.#160;#160; The electronic structure of molecules#160;3.2.1. Construction of molecular orbitals#160;3.2.2. The symmetry of molecular orbitals#160;3.2.3. Localized molecular orbitals#160;3.3.#160;#160; The covalent bond#160;3.3.1. The characteristics of the covalent bond#160;3.3.2. The structure of two-atomic molecules#160;3.3.3. Hybridization#160;3.3.4. Delocalized systems#160;3.3.5. Complex compounds of the transition metals#160;3.4.#160;#160; The rotation of the molecules#160;3.4.1. Introduction#160;3.4.2. Rotational motion of diatomic molecules#160;3.4.3. The rotational spectra of the diatomic molecules#160;3.4.4#160; The rotational spectra of polyatomic molecules#160;3.5.#160;#160; The vibration of molecules#160;3.5.1. Vibrational motion of diatomic molecules#160;3.5.2. Vibrational spectra of diatomic molecules#160;3.5.3. Vibrations of polyatomic molecules#160;3.5.4. Vibrational spectra of polyatomic molecule#160;3.5.5. Non-linear spectroscopy#160;3.5.6. Other vibrational spectroscopic methods#160;3.5.7. Large amplitude motion#160;3.6.#160;#160; Electronic transitions in molecules#160;3.6.1. The excitation of the electrons#160;3.6.2. The types of electronic transitions#160;3.6.3. The excited state and its decay#160;3.6.4. The electron excitation spectrum and the substituent effect#160;3.6.5. Measurement and application of electron excitation spectra#160;3.6.6. Ultraviolet photoelectron spectroscopy (UPS)#160;3.7.#160;#160; The dispersion of light#160;3.7.1. The dispersion of the refractive index#160;3.7.2. Electron excitation with polarized light#160;3.8.#160;#160; Mass spectroscopy (MS)#160;3.8.1. The principle and instrumentation of mass spectroscopy#160;3.8.2. Applications of the mass spectroscopy#160;3.9.#160;#160; Paramagnetic properties of molecules#160;3.9.1. Paramagnetic molecules#160;3.9.2. Electron spin resonance#160;3.10. #160;Nuclear magnetic resonance (NMR)#160;3.10.1.#160;#160; The nuclear magnetic resonance#160;3.10.2.#160;#160;#160; Spin-spin interactions#160;3.10.3.#160;#160;#160; 13C-NMR spectroscopy#160;3.10.4.#160;#160;#160;#160;

Recording NMR spectra#160;3.10.5.#160;#160;#160;#160; The Overhauser effect (NOE) #160;3.10.6.#160;#160;#160;#160;#160; Relaxation processes#160;3.10.7.#160;#160;#160;#160;#160; Measurement of the relaxation processes#160;3.10.8.#160;#160;#160;#160;#160; Two-dimensional NMR spectroscopy#160;3.11.#160;#160;#160;#160;#160;#160;#160;#160; Diffraction methods in the molecular structure elucidation#160;3.11.1#160;#160;#160;#160;#160;#160; Introduction to the diffraction methods#160;3.11.2#160;#160;#160;#160;#160;#160; Scatterings on isolated molecules#160;3.11.3#160;#160;#160;#160;#160;#160; Electron diffraction in gas phase#160;3.11.4#160;#160;#160;#160;#160;#160; The character of the measured and calculated geometric parameters#160;#160;4.#160;The structure of atomic and moleclar ensembles#160;4.1.#160;#160; Intermolecular interactions#160;4.1.1.#160; The theoretical description of the intermolecular interactions#160;4.1.2#160; The types of intermolecular interactions#160;4.2.#160;#160;#160; The structure of molecular ensembles#160;4.2.1.#160; Liquid state models#160;4.2.2#160;#160; The structure of liquids#160;4.2.3.#160; The solid crystalline phase#160;4.2.4#160;#160; Conductors, semiconductors and insulators in solid state#160;4.3.#160;#160;#160;#160; Diffraction methods#160;4.3.1.#160; Diffraction methods in the structure investigation of ordered systems#160;4.3.2.#160;#160;#160; Methods of X-ray diffraction#160;4.3.3.#160;#160;#160; Methods of electron diffraction in solid state#160;4.4.#160;#160; Spectroscopic methods #160;4.4.1.#160;#160;#160;#160; X-ray photoelectron spectroscopy (XPS) #160;4.4.2.#160;#160;#160;#160; Auger-electron spectroscopy (AES)#160;4.4.3#160;#160;#160;#160;#160; Secondary ion emission mass spectrometry (SIMS)#160;4.4.4.#160;#160;#160;#160; Mössbauer spectroscopy#160;4.4.5.#160;#160;#160;#160; Vibrational spectroscopy in condensed phases#160;#160;

Subject code	Subject name	Requirement	ECTS credit
BMEVEFAM212	Biopolymers	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	lab-ENG	English	
Lecture	theory-ENG	English	TUE:14:15-16:00(HF2)

Biopolymers are polymers arising in living organisms (e.g. microorganisms or higher order plants and animals) or synthesized from bio-based building blocks (e.g. acids, amino acids, carbohydrates, natural triglycerides) in a chemical process. The course introduces the students to the most significant biopolymers, their chemical structure, properties and the most important applications. #160;

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

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

In the modern materials science the main goal is designing materials to accomplish multiple properties in a single system. Usually these materials can respond to environmental stimuli by exhibiting particular changes in some of their properties. The aim of this course is to provide theoretical and practical knowledge in the chapters of modern materials science based on the colloids science (“the world of nano”), surface chemistry and physical chemistry of polymers. #160;1. Introduction:History and definitions.2. Nonconventional hard materials:Metal foams: preparation and application. Shape memory: shape memory alloys, shape memory polymers. Their response to the envi-ronmental stimuli. Structure-property correlations. Application.Special technical ceramics: Piezoelectric and magnetostrictive materials, structure-property correlations. Application.3. Complex fluids:Different types of magnetic behavior. Preparation, structure and properties of ferrofluids, magneto- and electrorheological fluids. Biomedical and industrial applications. 4. Soft materials, polymer gels:Classification, synthesis and characterization of polymer (hydro)gels. Tough hydrogels. Re-sponsive polymer gels. Applications of the responsive polymer gels, focused on the biomedical applications.5. Self-assemblySelf-assembly as a universal process. Molecules and particles capable of self-assembly. Clas-sification of self-assembly processes. Practical importance of self-assembly: Coatings and thin films made with self-assembly. LBL-techniques (layer-by-layer). Langmuir- and Langmuir-Blodgett thin films. 6. Nanoparticles, nanocoatingsFunctional nanoparticles and nanocoatings, their synthesis using wet colloid chemical meth-ods. Properties of nanoparticles, quantum size effects. Core-shell and hollow nanoparticles. Biomedical applications of nanoparticles. The sol-gel method. Characterization of nanocoat-ings – optical methods (optical spectroscopy, scanning angle reflectometry, ellipsometry.)7. Applications of nanocoatings Morphology and water-repellent properties: superhydrophobicity. Wetting models. Self-cleaning, self-healing coatings. Adhesive nanostructured coatings. Coatings and thin films in solar cells. Biomedical applications of nanocoatings.8. Porous nonconventional materials:Classification and characterization (rigid and flexible pores, independent pores vs. pore net-works, composites, possible applications). Brief description of characterization methods and their complementarity.9. Use of templates for porous materials:Soft and hard templates; synthesis, (MCM, zeolites, MIP): Synthesis; new properties related to porosity. 10. Nanotubes (carbon, boron, noble metal, etc); carbon allotropes:Synthesis, physical and chemical properties, present and perspective applications11. Organic and inorganic aerogels:Synthesis; new properties introduced by porosity (thermal and electric conductivity, etc.). 12. Metal organic frameworks (MOFs):3D self-assembly of multivalent metal ions and organic ligands; stiff and flexible porosity; their potential in gas storage, sensing, etc.#160;

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:12:15-15:00(CH307)
Practice	eng	English	THU:12:15-15:00(CH307)

Characterization and calculation of liquid-liquid and gasliquid-liquid equilibria. Equilibrium ratio, vapor tension, Antoine equation, Raoult-Dalton equation, relative volatility, bubble-point calculations, phase distribution calculations.Use of binary phase plots and equlibrium plots, use of ternary phase plots. Single stage equilibrium distillation and flash. Simple distillation. Rayleigh equation, vapor consumption.Steam distillation. Continuous multistage distillation. Reflux ratio. MESH equations. CMO. Upper and lower operating lines. Q-line. Graphical determination of the theoretical number of stages. Graphical determination of the minimum numberof theoretical stages. Fenske equation. Minimum reflux#160; ratio, graphical construction. Relations between number of stages, reflux ratio, and product purity. Plates and packings. Stage efficiency, HTU, NTU, HETP. Column capacity. Batch rectification with constant reflux ratio and with constant purity. Azeotropic and extractive distillation methods. Pressure swing distillation. Absorption. Kremser-Souders-Brown equation.Liquid extraction. Equilibrium ratio, distribution ratio, and phase ratio. Simple extraction. Repeated extraction. Perkolation. Continuous countercurrent multistage extraction.Counter-solvent extraction. Devices. Computation with constant equilibrium ratio, graphical constraction with constant phase ratio and with non-constant phase ratio.#160;

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	WED:10:15-13:00

National and international activities with respect to environmental programs. "Clean" 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. #160;

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

Course type	Course code	Course language	Timetable information
Laboratory	A12	English	TUE:10:15-12:00(CH301)
Lecture	A11	English	TUE:10:15-12:00(CH301)

Environmental toxicology as part of the risk-based environmental management plays an increasingly important role. The main aim of the subject is to give an overview on the effect-based tools of the modern environmental risk management. The course covers both the theoretical background and the detailed practical aspects of environmental toxicology together with its applications in the risk assessment, risk management and in the environmental decision making. TheoryThe role of environmental toxicology, environmental toxicology in risk-based environmental management, the basics of environmental toxicology, the effects of toxic substances and the measurement of the effects.Classification of environmental toxicity methods: generally applicable methods to water, soil, sediment, methods suitable to pure chemical substances, test organisms, measurement and study endpoints for measurement of the effects and chemical substances and contaminated environmental elements.Studying of the interaction between chemical substances and the environment, measurement of the actual toxicity of chemical substances, selection of test methods suitable for the environmental problem, test battery for integrated monitoring. #160;Detailed description of ecotoxicity test methods applied to water, sediment and soil. Single species ecotoxicity tests with bacterial, plant, animal test organisms. Multispecies environmental toxicity methods: microcosm, mesocosm tests, field studies. Genotoxicity and mutagenicity studies. Innovative and alternative environmental toxicity test methods replacing animal testing.Evaluation, interpretation and utilisation of environmental toxicity results in the integrated assessment of contaminated sites, in integrated environmental monitoring, in the general risk assessment of chemical substances, in the derivation of environmental quality criteria and#160; limit values, in the local and site specific risk assessment of contaminated sites and generally in environmental management.The concept and methodology of environmental and human health risk assessment of chemical substances. Environmental risk assessment of contaminated sites: methods, examples, case studies. Laboratory practice The students will learn about five various topics within the laboratory practice of this main subject.1. Environmental toxicity test methods with aquatic test organisms. We may test the adverse effects of chemical substances on the water ecosystem with test organisms from various trophic levels. #160;The most common test methods include: alga test, single cell animal (pl. Tetrahymena pyriformis) test, plant test (ex. tiny duckweed), animal test (ex. fresh water shell-covered crustacean (Ostracoda), water flea).2. Respiration measurement of soil microflora in a dynamic and a static system. The activity of soil microflora can be studied by measurement of the amount of CO2 produced by soil microbes in a dynamic (ventilated) and static (closed bottle test) system. The methods are suitable for monitoring of

bioremediation.3. Microbiological studies of soil hygiene. Soil microorganisms are involved in numerous essential processes. There are various techniques for their quantitative and qualitative study.#160;4.#160;#160;Aliivibrio fischeri bioluminescence inhibition test. Aliivibrio fischeri is a marine bacterium, which emits light under favourable conditions. Light emission is inhibited in the presence of toxic substances, which can be detected by luminometer5. Plant germination and Collembola mortality test. Terrestrial plants represent one of the most important trophic level, the producers. They can be used for ecotoxicity testing of both waters and soils polluted with toxic substances. Folsomia candia (Collembola), the ancient springtails insect can be used for testing of soils polluted with organic contaminants.#160;

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

Course type	Course code	Course language	Timetable information
Lecture	A23-ER	English	MON:12:15-14:00(CHA10); THU:10:15-12:00(CH201)

The basics of chemistry. The structure of the materials. Mixtures and compounds. The concept of equilibra. Conservation principles. The concept of mol. Chemical changes and chemical equations. Stochiometry. Oxiadation and reduction, redox processes. The oxidation number, and its use in balancing chemical equations. #160;(6 hours) Characterization of the gasous states. Macroscopic description and microscopic understanding. Laws governing the gaseous state, boundary conditions, the ideal gas law. Characterization of the liquid and solid states. Lattice types. Phase diagram of pure materials. Laws for phase equlibra. Vapour tension. The phenomena of boiling and melting. Non-equlibrium processes. Laws of mixtures of materials. Mixtures of gases, liquids and solids. Phase diagrams of binary mixtures. Distillation, rectification, crystallization as purification processes. Freezing point depression, boiling point elevation, laws of the osmotic pressure. Determination of the molecular weigth. Limitations. #160;(6 hours)The basics of the thermodynamics:Extensive and intensive measures. The concept of energy. Chemical equlibra and its relation to the energy. Thermochemistry, Heat. Definitions: heat of formation, heat of combustion, reaction energy. Hess's law. Chemical systems and chemical equlibria. Equlibrium constant. Gaseous equlibria, Equlibria in the liquid phase. Heterogenous equlibria. Equlibria of electrolytes. The concept of pH. pH equlibria. Weak acids and bases, acidity and basicity strength. Hydrolyzing salts of weak acids and bases. Water as a specific case. Buffer solutions. Titration of weak acids. Acid-base indicators. The Solubility product constant. Coupled equlibria. (16 hours)#160;Acid base theories. Acid-base theory of Arrhenius, wateric solutions. The Bronsted acid base theory. Acidity as a relative measure, weak and strong acids. The Lewis acid-base theory, relation to complex formation and to the Bronsted theory, superacids. (2 hours)Basics of electrochemistry. Electric energy: potential and charge. Faraday's law, the conservation of the charge. Conductivity. The additivity of the specific conductivities in dilute solutions. The electrode potential, concept, measurement, the hydrogen electrode, relatio to pH. Nernst's equation. The relation of the elecrode potential to the redox properties. Galvanic cells, batteries. #160; #160;(12 hours).The kinetics of chemical reactions. Definitions: reaction rate, rate constant, concentration dependence. Reaction order and molecularity. Reaction mechanisms. Activation barrier and the law of Arrhenius. The principle of catalysis. Remarks on the thermodynamics and kinetics.#160;(2 hours)The structure of matter.#160; #160;The experimental reasults leading to the quantum mechanics, quantized physical properties (atomic spectra, photoelectric effect, Rutherford's experiment). The electronic structure of the hydrogen atom: orbitals, energies, electron density, (quantum numbers). Heavier atoms. The Aufbau principle, occupation rules (Hund's rule, Pauli principle, electron spin). Realtion to the periodic system, ionization energy, electron affinity, electronegativity. The concept of the covalent bonding, qualitative understanding by quantum mechanics. Polarized covalent and ionic bonding, dative bond formation. Bonding and formation of hydrides, valence rules (octet rule) in the periodic table. Molecular structure and simple models (the concept of hybridization and the VSEPR model). Electronic structure of diatomic molecules, the case of oxygen. The concept of electron delocalization.(12 h)#160;

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	A12-ER	English	FRI:08:15-11:00

Expression for the composition of solutions and their applications. Operations with solutions, crystallization, recrystallization.Gases. Properties of gases. Equation of state for ideal gas, and its versions. Boyle's law, Charles' laws. Gay-Lussac's law.Mixtures of gases, their compositions. Partial pressure, and volume. Dalton's rule and Amagat's rule. Vapor pressure.Colligative properties of dilute solutions. Vapor pressure lowering, boiling-point elevation, and freezing-point depression, osmosis.Balancing equations. Oxidation numbers, redox equations. Stoichiometry and its applications. Yield. Avogadro's law. Calculation of titration.Basic terms in thermochemistry. Energy, heat and enthalpy. Heat capacity, molar heat capacity. The heat of reactions and Hess' law.General description of chemical equilibria. Various forms of equilibrium constants and their connections.#160;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:-#160;#160; Strong acids and bases;-#160;#160; Weak acids and bases;-#160;#160;#160; Hydrolysis of salts;-#160;#160;#160; Buffers and buffer capacitiesSolubility equilibria: solubility product and its applications, common ion effect; speciation effect; temperature effect.Electrochemisty:-#160;#160;#160; Electrolyte solutions. Electrical resistance and conductivity of dilute solutions;-#160;#160;#160; Electrolysis;-#160;#160;#160; Electrode potentials: standard hydrogen electrode, simple metal electrodes, redox electrodes,#160; metal-insoluble salt electrodes, gas electrodes-#160;#160;

Composition dependence of electrode potentials in various electrode types: Nernst equation.-#160;#160; Electrochemical cells, cell diagrams, cell reactions, half-cell reactions. Electromotive force.-#160;#160;#160; Basic terms in electrochemistry, direction of electrochemical processes.#160;

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

Course type	**Course code**	**Course language**	**Timetable information**
Lecture	A-24	English	TUE:14:15-16:00(CH307); WED:14:15-16:00

To provide thorough understanding of the fundamental principles, main methods and applications of chemical analysis (volumetric, gravimetric and instrumental analysis), as well as their tools of trade. The subject aims to provide a sound bases for later subjects including the Analytical Chemistry Laboratory and other advanced analytical chemistry subjects within Analytical and Structural Chemistry Specialization. #160;

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

Course type	**Course code**	**Course language**	**Timetable information**
Lecture	AE-17	English	MON:12:15-15:00(CH306)

IntroductionThe strategy of structure determination of the organic compounds. Basic conceptions of organic structures (configuration, conformation, isomerism, tautomerism, rate processes). Organic microanalysis. Methods to determine the carbon, hydrogen and nitrogen content of the samples. Determination of the sulphur and halogen content. Qualitative and quantitative analysis of some important functional groups.UV spectroscopyElectronic structure of the molecules, atomic and molecular orbitals, orbital symmetry, Electronic transitions, and selection rules. Band structures. Chromophores and auxochromic groups. Discussion of some simple chromophores. Conjugation, the Woodward-Fieser rules.Substituent, solvent and steric effects, Polyenes, aromatic and heteroaromatic structures.IR spectroscopyMolecular vibrations, the vibrational and vibrational-rotational spectrum. The two-atomic model, the harmonic and nonharmonic vibrations. Characteristic vibrational frequencies. The correlation between the IR and Raman spectroscopy. Stretching and bending frequencies.The impact of the structural effects modifying the vibrational frequencies: inductive and mesomeric effects, hyperconjugation, ring strain, steric and isotope effects. Characteristic frequencies of carbonyl compounds, alcohols, amines, nitro compounds, etc. The measurement of the infrared spectra. Sample preparation. The Fourier-transform infrared spectrophotometer.Mass spectroscopyThe mass spectrometer. Ionization methods (EI, CI, APCI, ESI, MALDI). Isotopes. Ion separation and detection methods. The coupling of the mass spectrometer (GC-MS, HPLC-MS, MS/MS). The importance of the molecule and base peak. Ion chemistry: fragmentation and rearrangement. The most important processes: alpha cleavage, onium reaction, allyl and benzyl-cleavage, McLafferty rearrangement, retro Diels-Alder reaction. Typical fragmentations and rearrangements of organic molecules. Application of isotope abundance determination: halogen compounds.Nuclear magnetic resonance (NMR) spectroscopyThe nuclear spin. Nuclear spins in magnetic field: the Bloch equations. The measurement of the NMR spectra: CW and PFT. Spectral aquisition. 1H and 13C-NMR spectroscopy. The basic NMR parameters: the chemical shift, the coupling constant. 1H-NMR: Multiplicity and intensity of the signals. The inductive effect, diamagnetic anisotropy, ring currents. Empirical calculation of the chemical shift. The Karplus-curve. 13C-NMR: broadband decoupling, gated decupling. Spectral editing methods: the DEPT and the APT experiments.#160;

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-19	English	TUE:10:15-14:00(CHFAA)
Lecture	AE-19	English	THU:13:15-15:00(CH306)

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.Laboratory practices: 9x4 hours- XPS, SIMS (X-ray photoelectron spectroscopy, Secunder ion mass spectrometry)#160;#160;#160;#160;#160;#160;#160;#160; 4 h- FTIR (Infrared spectrocopy)
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 4 h- Raman
spectroscopy#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#
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160;#160;#160;#160;#160; 4 h- XRD (X-ray diffraction)
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 4 h- SEM-EDX (Scanning electron microscopy, Energy dispersive X-ray spectroscopy)#160;#160;#160;#160;#160;#160;#160; 4 h- AFM (Atomic force miscoscopy)
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160; 4 h- High resolution optical microscopy
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4 h- Particle size analysis#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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60;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 4 h- Thermal analysis (TG/DTA-MS: Simultanous thermogravimetry and differential thermal analysis with on-line coupled mass spectrometry)
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 4 hTest:1x2 h1. test: From the laboratory practice curriculum#160;

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

Course type	Course code	Course language	Timetable information
Lecture	A26-ER	English	MON:10:15-12:00(CH304); WED:12:15-14:00
Practice	A27-ER	English	MON:10:15-12:00(CH304); WED:12:15-14:00

Part I. Basic of organic chemistry, structure and chemistry of hydrocarbons6.1. Basics of organic chemistry, structures of carbon compoundsDevelopment of organic chemistry. Structure of molecules: theory of covalent bonding, rationalization of chemical bonds.#160; #160; #160; #160; #160; #160; #160; #160; #160; #160; #160; #160; #160;#160; #160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160; 3 hClassification of organic compounds. Nomencalture of basic hydrocarbons. Nomenclature of aliphatic and aromatic hydrocarbons. #160;2 h6.2. Configuration,#160; stereochemistry, conformation Constitutional isomerisms. Stereoisomerism: E/Z isomerism, chirality, enantiomers and diastereomers. Inversion, retention and recemization. Conformation of aliphatic and alicyclic hydrocarbons.
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160;#160;#160;#160;#160;#160; 3 hSubstitutional and groupfunctional nomenclature. The main functional groups. #160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 2 h6.3. Theory of reactions, theories of acid-base, HSAB and FMO theories Types of organic reactions: substitutions, additions, eliminations and rearrangements. Nature of the reactions: multistep and concerted, ionic and radical reactions. The energy profile of reactions: transition state, parameters for activation, intermediates, concept of#160; kinetic and thermodynamic control. Acid-base equilibria. The concept of electrophilicity and nucleophilicity.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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60;#160;#160; #160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 3 hExercise for nomenclature of organic compounds. #160; 2 h6.4. Theory of redox and radical reactions, chemistry of paraffins Rationalizing the oxidation number. Preparation of paraffins and cycloparaffins by reduction, methods for forming carbon-carbon single bonds. Physical properties, radical reactions and oxidation of paraffins and cycloparaffins.
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160; 3 hExercise for the CIP-system.#160;#160;#160;#160; 2 h6.5. Reactivity of olefines and acetylenes, electrophilic addition, oxidation and polymerization#160;Electrophilic addition and radical reactions of olefines. Reactions of 1,3-dienes. Electrophilic addition and radical reaction of acetylene derivatives. Substitution and adddition reactions of conjugate bases of acetylene
derivatives.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160; #160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 3 hPreparation of paraffins and cycloparaffins. Exercise for oxidation number. Reactions of paraffins. Conformation of paraffins and cycloparaffins.
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160; 2 h6.6. Reactivity of monocyclic aromatic compounds, electrophilic substitutionThe structure of benzene, aromaticity and aromatic character. The mechanism of electrophilic substitution, halogenation, nitration and sulphonation, Friedel-Crafts alkylation and acylation. Orientation rules.#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 3 hPreparation and reactions of olefines. E/Z nomenclature of olefines. Elimination reactions. Preaparation and reactions of
acetylenes.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 2 h Part II. Compound containing carbon-heteroatom single bonds8.7. The theory of substitution and eliminationThe mechanisms of aliphatic nucleophilic substitutions and eliminations, their regio- and stereochemistry. Factors influencing these reactions. Ambident nucleophiles. Aromatic nucleophilic substitution.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 3 hTest 1.: Nomenclature. Preparation, reactions, conformation and configuration of aliphatic and cyclic paraffins. Preparation and reactions of olefines. Regio- and stereoselectivity. Preparation and reactions of acetylenes. #160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
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#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160;#160;#160;#160;#160;#160;#160; 2 h 8.8. The chemistry of halogen compounds, alcohols, phenols and ethers The physical properties of halogen compounds, alcohols, phenols and ethers. Acidity and basicity of these compounds. Reactions of halogen compounds with metals. Preparation and reactions of alcohols, phenols and
ethers.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#
160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#16
0;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#
160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#16
0; 3 hPreparation and reactions of aromatic compounds. Exercises for SEAr and SNAr reactions. #160;#160; 2 h8.9. The chemistry of nitro compounds and amines Preparation and reduction of nitro compounds. The structure, physical and basical properties of amines. Preparation and reactions of amines.
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160; 3 hPreparation and reactions of halogen compounds, alcohols, phenols and ethers. Exercises for substitution and elimination reactions. #160; 2 hPart III. Compound containing carbon-heteroatom multiple bonds8.10. Reduction and oxidation of alcohols, carbonyl compounds and carboxylic acid derivativesPreparation of carbonyl compounds and carboxylic acids by oxidation. Preparation of alcohols and carbonyl compounds by reduction. Using Grignard and related reactions for the preparation of alcohols and carbonyl compounds. Using Friedel-Crafts and related reactions for the preparation of aromatic carbonyl compounds. #160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#1
60;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160; #160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 3 hPreparation and reactions of nitro compounds. Exercises regarding pKa.
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 2 h8.11. Reactivity of carbonyl compounds, carboxylic

acids and carboxylic acid derivativesComparison of the reactivities of aliphatic and aromatic carbonyl compounds, carboxylic acids and carboxylic acid derivatives - nucleophilic addition and nucleophilic addition-elimination reactions. Preparation and reactions of ?,ß-unsaturated carbonyl compounds and carboxylic acids. Inverse reactions.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 3 hTest 2.: Preparation and reactions of aromatic compounds.#160; Orientation rules. Preparation and reactions of halogen compounds. Mechanism, regio- and stereoselectivity of substitution and elimination reactions. Preparation and reactions of alcohols, phenols, ethers, nitro compounds and amines.
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 2 h 6.12. Oxo-enol tautomerism, carboxylic acids Oxo-enol tautomerism. Comparison of the reactivities of oxo-enol tautomers. Reactions taking place with the conjugate bases of carbonyl compounds and carboxylic acid derivatives (at ?-position). The chemistry of dicarbonyl and related compounds.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; #160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 3 hSupplementary test 1.
or#160; 2 h6.13. Chemistry of carboxylic acids and carboxylic acid derivativesPhysical and chemical properties of carboxylic acids. Preparation and reactions of dicarboxylic acids - decarboxylation reactions. Carboxylic acid derivatives: preparation and reactions of ketene, acyl halides, acid anhydrides, azides, esters, amides, nitriles, imid acid esters - nucleophilic addition and nucleophilic addition-elimination reactions.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 3 hPreparation and reactions of carbonyl compounds. Preparation of carboxylic acids. Reactions of carbonyl compound and carboxylic acids.#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; 2 hExtra supplementary test 1. or 2.#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;
#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160;#160; #160;2 h7. Method of education:#160;

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

Course type	Course code	Course language	Timetable information
Lecture	13-ER	English	TUE:15:15-17:00(CH301)

The aim of the subject is to provide high-level scientific and practical knowledge to the future chemical and bioengineers of chemical and biological industries (pharmaceutical, agro- and fine chemical, cosmetic and food industries) with special focus on the development of problem solving skills related to chemical problems by using the tools of biotechnology.#160;Biotransformations and biocatalysisCharacteristic advantages and disadvantages of processes – Enzyme classification and nomenclature – Coenzymes – Enzyme kinetics – Protein structure and basics of enzyme action – Effect of conditions on enzyme activity – Characteristics of microbial transformations – Enzyme- and cell immobilizationDevelopment of novel biocatalystsGenetic engineering tools – Production of biocatalysts by recombinant organisms – Novel methods of modifications of enzyme properties by genetic methods: site directed mutagenesis, gene shuffling, directed evolution, metabolic engineering, random DNA cloning – Catalytic antibodies – High throughput test methodsStereochemical issues related to biocatalytic processesBasic terms of stereochemistry – Methods to determine enantiomeric composition – Classification of selective transformationsTypes

of selectivities for biocatalytic processesMild conditions – Chemoselectivity – Regioselectivity – Diastereomer selectivity – Diastereotopic selectivity – Enantiomer selectivity – Enantiotopic selectivity – Parallel manifestation of multiple selectivitiesHydrolasesGeneral features of processes performed by hydrolasesCharacteristics of hydrolases used for preparative purposes – General features of transformations by hydrolases: hydrolytic processes in aqueous media – non-hydrolytic processes in organic solventsPreparative application of hydrolases: types of the applicable selectivitiesBiotransformations under mild conditions – Substrate specificity, chemoselectivity – Regioselective transformations – Diastereomer and diastereotopic selective processes – Enantiomer selective biotransformations: general considerations, transformations of amino acids and their derivatives, selective transformations of racemic acids (ester hydrolysis, alcoholysis, transesterification), selective transformations of racemic alcohols (ester hydrolysis, acylation, transesterification), racemic lactones, amines, epoxides and other compounds – Enantiotopic selective biotransformations: general considerations, transformations of compounds with a single prochiral center, reactions of meso compounds, enantiotopic and diastereotopic face distinctions by hydrolasesOxidoreductasesGeneral features of processes by oxidoreductasesFeatures of oxidoreductases applied for preparative purposes – Processes by oxidoreductases acting without external cofactor – General features of oxidoreductases acting with externally added cofactors – Cofactor regeneration methods by using oxidoreductasesPreparative use of oxidoreductases: types of useful selectivitiesReduction of racemic aldehydes – Oxidation of racemic alcohols – Reduction of achiral carbonyl compounds – Oxidation of prochiral and meso alcohols – Simultaneous manifestation of multiple selectivities in processes with oxidoreductases – Enzymatic Baeyer-Villiger-type oxidationsBaker's yeast as whole-cell system for preparative useGeneral considerations – Reduction of ketones: achiral ketones, racemic ketones, 1,2-dioxo compounds, 1,3-dioxo compounds, other dioxo compounds – Reduction of oxocarboxylic acid derivatives: 2-oxocarboylic acid derivatives, 3-oxocarboylic acid derivatives, 2-substituted-3-oxocarboylic acid derivatives, oxocarboxylic acid derivatives with carbonyl function at 4 or more distant position – Reduction of carbon-carbon double bond – Other reductions – Hydrolysis – Lyase activity – CyclizationsOther preparative application of enzymes and microorganismsOther enzymes: transferases (glycosidases, aminotransferases, phosphorylases) – Lyases (aldolases, oxynitrilases) – Selected examples of whole-cell biotransformationsIndustrial applications of biotransformationEnzyme and cell immobilization – Bioreactors – Stereoselective biotransformations carried out on an industrial scale#160;

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(CH308)
Practice	Eng2-ER	English	THU:16:15-19:00(CH308)

To teach the basics and methods of mathematical statistical treatment of measurement data.To teach the design and analysis of the most basic full factorial experimental designs.Random variable, density and distribution function, expected value, variance. Continuous distributions, normal distribution, standard normal distribution, ?2, t and F distribution. Central limit theorem. Population and sample. Parameter estimation. Hypothesis testing, parametric tests. Mutual distribution of several random variables, correlation. Principles of regression, linear regression. Checking adequacy, weighted regression, parameter estimation, partition of SSQ, confidence intervals. Design of experiments. 2p full factorial: the design, orthogonality and rotatability, estimation of parameters, significance tests. 2p-r#160;fractional factorials. #160;

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(F211)
Lecture	english-ER	English	TUE:10:15-13:00(F211)

The process control gives funded knowledge about the control theory and practice. Currently, everywhere the computer is used, also for control. The compter helps, however, not only for the control but also for the design of the control sturctur. It enables the engineer to calculate controllability features and also modelling both steady state and dynamic.#160;Single input single output (SISO) processes, control of SISO systemsMultiple Input Multiple Output processes (MIMO), control of MIMO systemsState-space modelling, state-space modelsDetermination of gain arrayDesing of control structure for MIMO systems, Controlability indexes, Niederlinski index, Interconnection of control loops, measurement of the interconnection among control loops, relative gain array, condition number, singular valueMorari resiliency indexComplex steps of control sturcture design for MIMO systems.Uncertanity in the controler tuning, Skogestad-Morari methodDoyle-Stein criteriumAlternatives of the computer application for control and operation.On-line data collection, supervisory control, direct digital controlHardware toolsSampling theory, mathematical modeling, Time function, Laplace transormation, Frequency function„Z”-transformation, characters of the Z-transformationApplication of the Z – transformation, Sampling theory, Dead time in the Z domain,Stability in the Z-domainInternal Model Control,Model Based ControlSmith predictor#160;

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
BMEEOAFAT41	Surveying I.	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Laboratory	EN3	English	WED:08:15-10:00(KF27k); WED:08:15-10:00(KF27k)
Laboratory	EN2	English	THU:08:15-10:00(KF27k); THU:08:15-10:00(KF27k)
Laboratory	EN7	English	FRI:08:15-10:00(KF27k); FRI:08:15-10:00(KF27k)
Laboratory	EN4	English	FRI:14:15-16:00(KF27b); FRI:14:15-16:00(KF27b)
Laboratory	EN6	English	THU:10:15-12:00(KF27b); THU:10:15-12:00(KF27b)
Laboratory	EN5	English	FRI:08:15-10:00(KF27b); FRI:08:15-10:00(KF27b)
Laboratory	EN1	English	THU:08:15-10:00(KF27b); THU:08:15-10:00(KF27b)
Lecture	EN0	English	MON:12:15-14:00(KM30)

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(KF27a); TUE:12:15-14:00(KF27a)

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
BMEEODHMG-D	Diploma Project Structural Engineering MSc Program	Mid-semester mark	20

Course type	Course code	Course language	Timetable information
Practice	ENG	English	

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

Course type	Course code	Course language	Timetable information
Practice	ENN	English	

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

Course type	Course code	Course language	Timetable information
Practice	ENT	English	

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

Course type	Course code	Course language	Timetable information
Practice	ENU	English	

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

Course type	Course code	Course language	Timetable information
Practice	ENVVV	English	
Practice	ENVVK	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(MMFL3); WED:08:15-10:00(MMFL3)
Laboratory	EN4	English	WED:08:15-10:00(MMFP); WED:08:15-10:00(MMFP)
Laboratory	EN1	English	WED:08:15-10:00(MMFL2); WED:08:15-10:00(MMFL2)
Laboratory	EN3	English	WED:08:15-10:00(MMFL4); WED:08:15-10:00(MMFL4)
Lecture	EN0	English	FRI:12:15-14:00(K389); FRI:12:15-14:00(K389)

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(KM30); THU:08:15-09:00(KM30)
Practice	EN1	English	THU:09:15-10:00(KM30); THU:09:15-10:00(KM30)

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	EN2	English	THU:10:15-12:00(MMFP); THU:10:15-12:00(MMFP)
Laboratory	EN3	English	THU:10:15-12:00(MMFL3); THU:10:15-12:00(MMFL3)

Laboratory	EN1	English	THU:10:15-12:00(MMFL4); THU:10:15-12:00(MMFL4)
Lecture	EN0	English	THU:12:15-14:00(KM79)

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(K371)
Practice	EN1	English	MON:16:15-18:00(K183); MON:16:15-18:00(K183)
Practice	EN2	English	MON:16:15-18:00(K375); MON:16:15-18:00(K375)

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(KF12)
Practice	EN1	English	WED:16:15-18:00(KF12); WED:16:15-18:00(KF12)

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	WED:08:15-10:00(KM30); WED:08:15-10:00(KM30)

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:16:15-18:00(KF10); THU:16:15-18:00(KF10)
Practice	EN2	English	MON:10:15-12:00(K371); MON:10:15-12:00(K371)
Practice	EN1	English	TUE:08:15-10:00(K374); TUE:08:15-10:00(K374)

3 main parts of the subject: 1. Descriptive geometry 2. Engineering drawing 3. Freehand drawing. 1. Basics of descriptive geometry course modules: Students gain knowledge and skills in regularities and techniques of descriptive geometry, developing spacial reasoning. Topics: basic constructions in planes of projections, transformations, tasks of intersections, intersections and interpenetrations of plane and curved solids, cast shadows,

construction in scale, special revolution solids and skew surfaces. Additional representation systems: dimensioned representations, orthogonal axonometry, perspective projection. 2. Engineering drawing course modules: Students gain knowledge and skills in engineering drawing, specific notations, proportions and scale, magnification, minification, construction of ground plans and sections. 3. Engineering free-hand representation course modules: develop free-hand drawing in scale.

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:10:15-12:00(K183)
Practice	EN1	English	WED:12:15-14:00(KF12); WED:12:15-14:00(KF12)

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
BMEEOGMAT41	Geology	Exam	3

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:10:15-12:00(KM21); THU:10:15-12:00(KM21)
Practice	EN1	English	THU:12:15-14:00(K371); THU:12:15-14:00(K371)
Practice	EN2	English	THU:12:15-14:00(K372); THU:12:15-14:00(K372)

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOGMAT43	Earthworks	Exam	3

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

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

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

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

Subject code	Subject name			Requirement	ECTS credit
BMEEOGMMG-2	Environmental Geology			Mid-semester mark	4
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	FRI:10:15-12:00(KM21); FRI:10:15-12:00(KM21)		
Practice	EN1	English	FRI:12:15-13:00(KM21); FRI:12:15-13:00(KM21)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOGMMG63	Numerical Methods in Geotechnics			Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**		
Laboratory	EN1	English	FRI:09:15-10:00(KM21); FRI:09:15-10:00(KM21)		
Lecture	EN0	English	FRI:08:15-09:00(KM21); FRI:08:15-09:00(KM21)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOGMMS52	Soil-structure interaction			Mid-semester mark	5
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	WED:08:15-10:00(K389); WED:08:15-10:00(K389); WED:14:15-16:00(K389)		
Practice	EN1	English	WED:14:15-16:00(K389)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOHSA-A1	Steel Buildings			Exam	5
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	TUE:08:15-10:00(EL111); TUE:08:15-10:00(EL111); THU:10:15-12:00(EL111)		
Practice	EN1	English	THU:10:15-12:00(EL111)		

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

Subject code	Subject name			Requirement	ECTS credit
BMEEOHSA-A2	Reinforced Concrete Buildings			Exam	5
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	MON:08:15-10:00(KF12); MON:08:15-10:00(KF12); TUE:10:15-12:00(EL111)		
Practice	EN1	English	TUE:10:15-12:00(EL111)		

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

Subject code	Subject name			Requirement	ECTS credit
BMEEOHSA-B3	Engineering Works			Exam	3
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	WED:08:15-10:00(K374); WED:08:15-10:00(K374)		

Subject code	Subject name			Requirement	ECTS credit
BMEEOHSAS42	RC and Masonry Structures			Mid-semester mark	4
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	TUE:08:15-10:00(KF12); TUE:08:15-10:00(KF12)		
Practice	EN1	English	TUE:10:15-12:00(KF12)		

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

characteristics of masonry. Design principles of unreinforced masonry walls according to EC6. Reinforced masonry walls.

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

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

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

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

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

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

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	THU:14:15-17:00(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(KF88); TUE:10:15-11:00(KF88)
Practice	EN1	English	TUE:11:15-12:00(KF88); TUE:11:15-12:00(KF88)

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:14:15-16:00(KF88); THU:14:15-16:00(KF88)
Practice	EN1	English	MON:14:15-16:00(KF88)

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

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

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

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

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

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

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

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

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(K374); MON:14:15-16:00(K374); WED:10:15-13:00(K372); WED:10:15-13:00(K372)
Practice	EN1	English	MON:14:15-16:00(K376); MON:14:15-16:00(K376); WED:10:15-13:00(K376); WED:10:15-13:00(K376)
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(K376); TUE:15:15-18:00(K376); WED:15:15-17:00(KM78); WED:15:15-17:00(KM78)

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

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

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

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

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(K389); WED:12:15-14:00(K389)
Practice	EN1	English	THU:16:15-18:00(KF88); THU:16:15-18:00(KF88)

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

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

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

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

Subject code	Subject name	Requirement	ECTS credit
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(K371); MON:14:15-16:00(K371)

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

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

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

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

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

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

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

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

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

Subject code	Subject name			Requirement	ECTS credit
BMEEOUVMU-4	Project Management in Transportation			Mid-semester mark	2
Course type	**Course code**	**Course language**	**Timetable information**		
Lecture	EN0	English	TUE:08:15-10:00(KF99); TUE:08:15-10:00(KF99)		

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

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

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

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

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

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

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

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

The aim of the course is to provide basic scientific and engineering background for further studies in environmental engineering by giving introduction to the following subjects: basics of ecology, the natural cycle of ecologically important elements and substances, the environmental effects of human activities, the ecological footprint, energy consumption patterns and energy production technologies, renewable energy sources. Selected environmental

problems associated with civil engineering activities (water, air and soil pollution), with focus on the urban environment. Tools and methods for conducting environmental impact assessment.

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	MON:12:15-14:00(K389); MON:12:15-14:00(K389)
Practice	EN1	English	TUE:08:15-10:00(KM30)
Practice	EN2	English	TUE:08:15-10:00(KM30)

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(KM30); WED:16:15-19:00(KM30)

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

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

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

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

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(KM31); WED:12:15-14:00(KM31)

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEEOVVAI42	Hydraulics 2	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	FRI:09:15-11:00(KF15 (Klimm)); FRI:09:15-11:00(KF15 (Klimm))
Practice	EN1	English	FRI:11:15-12:00(KF15 (Klimm)); FRI:11:15-12:00(KF15 (Klimm))

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)
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	EN1	English	THU:14:15-16:00(KF10)
Practice	EN2	English	THU:14:15-16:00(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	THU:10:15-12:00(KF10); THU:10:15-12:00(KF10)
Practice	EN1	English	THU:12:15-13:00(KF10); THU:12:15-13:00(KF10)

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

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

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

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

Faculty of Economic and Social Sciences

IMPORTANT NOTES

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

Subject code	Subject name	Requirement	ECTS credit
BMEGT20A001	Management and Business Economics	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Lecture	EEN07BM	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	EEN07BM	English	
Practice	GEN07BM	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
BMEGT20M011	Quantitative Methods	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	EEN04BM	English	
Practice	GEN04BM	English	

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

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

Course type	Course code	Course language	Timetable information
Lecture	EEN04BM	English	

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

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

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	EEN41BM	English	TUE:14:15-16:00(K221)

The aim is to allow students to understand todayrsquo;s economic environment. After having finished the course, students should understand the key concepts of macroeconomics (e.g. national income, unemployment, inflation,

budget balance, exchange rates and the balance of payments), master a basic set of tools of economic analysis and demonstrate the ability to apply them to simple practical problems.

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

Course type	Course code	Course language	Timetable information
Lecture	EEN40BM	English	MON:08:15-10:00; MON:10:15-12:00

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

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

Course type	Course code	Course language	Timetable information
Lecture	EEN38GT	English	

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

Course type	Course code	Course language	Timetable information
Lecture	EEN08GT	English	

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

Course type	Course code	Course language	Timetable information
Lecture	EEN33BM	English	

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

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

Course type	Course code	Course language	Timetable information
Lecture	EEN06GE	English	

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	EEN19GT	English	

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	EEN12GT	English	

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	EEN19BM	English	

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(E201)

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:08:15-12:00(E505)

The main focus of the course is culture, what kind of effect it has on the development of civilizations, societies and economies of past and present. There will be three major topics, such as „FOOD 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
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(E505)

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
BMEGT55A001	Business Law	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	EEN13ER	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 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	EEN05ER	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	EEN05KO_SH	English	

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

Course type	Course code	Course language	Timetable information
Lecture	EEN07ER	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
BMEVIAUAC01	Data-driven Systems	Exam	4

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

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

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

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

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

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

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIEEAB01	Microelectronics	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	AL01	English	MON:16:15-18:00
Laboratory	AL02	English	TUE:16:15-18:00
Lecture	AE	English	WED:10:15-12:00

Subject code	Subject name	Requirement	ECTS credit
BMEVIETAA00	Basics of Electrical and Electronic Systems	Exam	3

Course type	Course code	Course language	Timetable information
Laboratory	2_LA	English	FRI:14:15-18:00
Lecture	2_EA	English	MON:14:15-16:00

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

Course type	Course code	Course language	Timetable information
Laboratory	1_LA	English	THU:14:15-18:00
Lecture	1_M	English	TUE:12:15-14:00

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

Course type	Course code	Course language	Timetable information
Lecture	1	English	WED:08:15-10:00; WED:08:15-10:00; THU:08:15-10:00

Practice	1_Gy	English	

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAB04	Coding Technology	Exam	4

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAC00	Mobile Communication Networks	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	TUE:10:15-12:00
Practice	GA	English	WED:16:15-18:00

https://portal.vik.bme.hu/kepzes/targyak/VIHIAC00/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVIHIAC04	Mobile Communication Systems	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	EA	English	TUE:10:15-12:00
Practice	GA	English	WED:16:15-18:00

https://portal.vik.bme.hu/kepzes/targyak/VIHIAC04/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	

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

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

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

https://portal.vik.bme.hu/kepzes/targyak/VIHIAV35/en/ This course provides an introduction into the practical problems of data protection and privacy. Students can develop skills of understanding and assessing privacy threats and designing countermeasures. The course focuses on the problem of unwanted personal and sensitive data leakage from different information sources (e.g., large datasets, web-tracking, encrypted traffic, source/binary code, machine learning models), and its detection as well as mitigations using Privacy Enhancing Technologies (PETS). The objective of the course is to provide skills needed by Data Protection Officers (DPO) and also required by the European General Data Protection Regulation (GDPR).

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

Course type	Course code	Course language	Timetable information
Laboratory	LA2	English	WED:16:15-18:00

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

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

Course type	Course code	Course language	Timetable information
Laboratory	LA	English	THU:12:15-16:00

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIHVAC03	Introduction to Electromagnetic Fields	Exam	4

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

The course teaches the fundamentals of classical electrodynamics in an engineering approach. Besides the main principles, the most important fields of engineering applications as well as some analysis methods are discussed. The lectures are complemented with classroom practices. Synopsis: Part I. Fundamental laws Measurable global quantities of electromagnetism Scalar and vector fields of electromagnetism The system of Maxwell's equations Electromagnetic fields in materials Interface conditions Energy balance of the electromagnetic field Forces in the electromagnetic field Uniqueness of the solution of Maxwell's equations Classification of problems Part II. Static fields Scalar potential and Laplace-Poisson equation of electrostatics Electrodes, capacitances Field of the electric dipole Method of images The finite difference method Current flow problems and the electrostatics analogy Grounding, step voltage Static magnetic fields, Biot-Savart law Self and mutual inductance Induction phenomena Lumped circuits Part III. Transmission lines Telegraph equations Helmholtz-equation and its general solution Voltage and current distribution for specific loads (matched load, open end, etc.) Standing waves, transmission line as resonant circuit Circuit equivalents of the transmission line Part IV. Wave phenomena Wave equations (homogeneous and inhomogeneous) Helmholtz equation for plane waves, the transmission line analogy Reflection and refraction, polarised waves Plane waves in ideal dielectrics Plane waves in conductors, the skin effect Elementary electric dipole antenna Rectangular waveguides

Subject code	Subject name	Requirement	ECTS credit
BMEVIIIAA04	Digital Design 1	Exam	6

Course type	Course code	Course language	Timetable information
Laboratory	AL	English	MON:10:15-14:00(QBP)
Lecture	AE	English	THU:12:15-14:00; THU:12:15-14:00; THU:14:15-16:00
Practice	AG	English	THU:14:15-16:00

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

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

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

https://portal.vik.bme.hu/kepzes/targyak/VIIIAC03/en/The course presents the technologies used to realize industrial control systems. Sensing principles and sensor devices for the measurement of temperature, pressure, force, torque, displacement and flow of fluids are studied together with generally used transducers. The course also presents signal interfacing techniques, issues related to proper grounding and to reject external disturbances (conductive, electromagnetic) and the most widely used actuator devices. The special characteristics of the architecture of process control computers are analyzed together with the related software requirements, programming models and human machine interface solutions. The hardware architecture of programmable logic controllers (PLC) are introduced with the most widely used programming techniques (ladder, text based, function blocks, etc.) according to the IEC-61131 standard. The course also deals with distributed control system principles, control networks (ASI, CAN, MODBUS, POROFIBUS) and supervisory control and data acquisition (SCADA) systems.

Subject code	Subject name	Requirement	ECTS credit
BMEVIMIAB03	Operating Systems	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	LA	English	TUE:14:15-16:00
Lecture	EA	English	MON:10:15-12:00; MON:10:15-12:00; TUE:14:15-16:00

Subject code	Subject name	Requirement	ECTS credit
BMEVIMIAD00	Embedded Information Systems	Mid-semester mark	3

Course type	Course code	Course language	Timetable information
Lecture	EA	English	TUE:14:15-16:00
Practice	GA	English	TUE:16:15-17:00

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIMIAV10	Bioinformatics	Exam	4

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

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

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

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

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

Course type	Course code	Course language	Timetable information
Lecture	TA0	English	MON:12:15-14:00
Practice	TA1	English	WED:12:15-14:00

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

Subject code	Subject name	Requirement	ECTS credit
BMEVISZAA06	Introduction to the Theory of Computing 1	Exam	6

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

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http://cs.bme.hu/itc1/

Subject code	Subject name	Requirement	ECTS credit
BMEVISZAA07	Foundation of Computer Science	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	A0	English	TUE:08:15-10:00; WED:12:15-14:00; WED:12:15-14:00
Practice	A1	English	TUE:10:15-12:00
Practice	A2	English	WED:14:15-16:00

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https://portal.vik.bme.hu/kepzes/targyak/VISZAA07/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVISZAB04	Probability Theory and Statistics	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	A0	English	MON:12:15-14:00; TUE:10:15-12:00
Practice	A1	English	THU:08:15-10:00
Practice	A2	English	FRI:08:15-10:00

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https://portal.vik.bme.hu/kepzes/targyak/VISZAB04/en/

Subject code	Subject name	Requirement	ECTS credit
BMEVISZMA11	Mathematical Statistics	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	A1	English	TUE:08:15-10:00
Lecture	A0	English	TUE:08:15-10:00; TUE:10:15-12:00; TUE:10:15-12:00

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https://portal.vik.bme.hu/kepzes/targyak/VISZMA11/en/

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

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEVIVEAB02	Electrotechnics	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	2324_1_VIVEAB02_lab_angol	English	FRI:09:15-12:00
Lecture	2324_1_VIVEAB02_elm_angol	English	MON:10:15-12:00; MON:10:15-12:00; TUE:08:15-10:00

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

Course type	Course code	Course language	Timetable information
Lecture	2324_1_VIVEAC00_elm_angol	English	TUE:10:15-12:00

Practice	2324_1_VIVEAC00_gyak_angol	English	WED:16:15-18:00

https://portal.vik.bme.hu/kepzes/targyak/VIVEAC00/en/ The course is intended to provide theoretical knowledge and practical skills in the following fields: structure of the power system, network transformations, process of power transmission and distribution, network elements used for transmission and distribution tasks - interpretation and determination of parameters of transmission network elements used for calculations, representation of the elements - power line and transformer operations - power and voltage conditions of steady state operation, power losses - application of symmetrical components - fundamental effects of short-circuits and switches, calculation - Principles of star point earthing, related phemomena - Substation and busbar topologies - Basics of short-circuit protection Synopsis: 2. Impedances and capacitances of overhead lines. 4-wire model. Self and mutual impedances and capacitances. Symmetrical impedances and capacitances. Line asymmetries, symmetrisation. Calculation of series impedances and capacitances of overhead lines. Tower constructions of overhead lines. Calculation of inductances of overhead lines. Role of the protective wire. Double circuits, coupling in zero order. 3. Cables. Structure, electric parameters. Warming of cables. Operation of HV transmission lines. Distributed model, line parameters. Charging power, surge impedance power. Characteristic electric parameters. Concentrated T and Pi model, U-I phasor diagrams, approximate calculation of Q-flows. Evaluation of HV line operations: (1) open circuit, voltage profile, (2) active power flows, phase angle difference. Power losses of transmission networks: interpretation and components. 4. Limits of power transmission. Current loading, voltage stability, synchronous stability. Increasing transmission capabilities, FACTS devices. Cross-border capacities: interpretation and definitions. HVDC transmission. HVDC converter stations. Power transmission in HV AC and DC systems. Structure and application of HVDC. Advantages and disadvantages of HVDC. Operation and control of HVDC converter stations. 5. Control with HV transformers. Switching of shunt reactors. Effects of lengthwise and widthwise control of HV transformers in looped networks. Phase shift transformer. 6. MV and LV networks, voltage control, power losses. Roles in distribution network. Typical transformers, line cross sections, electric parameters. Structure of MV and LV networks, voltage profiles, regulations, voltage drops. Voltage control. MV and LV power losses. 7. Calculation of looped HV networks. Calculation models, basic relationships. Interpretation and application of I=Y*U and U=Z*I nodal equations. Determination and measurement of Y and Z. Equivalent models based on Z. Network reduction. 8. Load-flow calculations on looped HV networks. Nonlinear nature of the task, theorem of iteration solutions. Data, parameters, nodal models. Basic equations, solutions. Representation of the results. 9. Representation and calculation of short-circuits and switches with symmetrical components. Comparison of short-circuits. Principles of short-circuit current limitation. Calculation of simultaneous faults. Asymmetrical loading of 0.4 kV networks. Solutions using phase quantities and symmetrical components. Interpretation, analysis. Terminal short-circuit of transformers. Currents, effect of Yd and Dy windings. Earthing transformer, structure, role. Currents and voltages of short-circuits on power lines. Currents and voltages using 4-wire model. Phasor diagrams, symmetrical components. 10. Earthing methods. Effect of star point earthing in case of single-phase-to-ground faults, current-voltage phasor diagrams. 11. Voltage sag, loss of phases on 120/MV/0.4 kV radial networks. Phase-to-ground faults, voltage distortion effect of single-phase switch openings, spread of the effects, role of Yd and Dy transformers. Operation under faulty conditions. Three-phase short-circuit current, short-circuit power, voltage sag. 12. Busbar and substation topologies, principles. Busbars, feeders, devices, current and voltage transformers. Double busbar system, breaker-and-half system, other topologies. 13. Protection devices in the power system. Basic definitions. Role and requirements of protection. Structure and role of protection. Detection methods. Protection of MV busbar and feeders. Protection of radial networks. Coordination of current thresholds. Delayed overcurrent protection. Breaker failure protection. Busbar protection. Distance-time characteristic of protection schemes. 14. Network development. Design standards (ENTSO-E, Operating Rules, Distribution grid codes), methods, calculations. The European power system. Basic characteristics. Maps, differences between the European and the Hungarian network. Grid connection. Prerequisites, contracts, fees. Power supply of electric traction. Circuits, voltage levels feeding stations used in traction.

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

Course type	Course code	Course language	Timetable information
Lecture	2324_1_VIVEAC01_elm_angol	English	WED:08:15-10:00
Practice	2324_1_VIVEAC01_gyak_angol	English	THU:08:15-10:00

https://portal.vik.bme.hu/kepzes/targyak/VIVEAC01/en/ Transformers Single-phase and 3-phase transformers. Steady-state and transient operation. Unbalanced load of the 3-phase transformers. Special transformers. Windings of the rotation machines, torque development Concentrated and distributed winding (slots). The induced voltage, the developed air-gap filed, the stray field. Force and torque development and calculation. Induction machines Equivalent circuit and torque development. Deep-slot and double-slot rotors. Effect of the spatial harmonics. Starting and speed modification methods. Asymmetric operation, stator and rotor asymmetry. Single-phase and auxiliary-phase machines. Synchronous machines Cylindrical rotor case: Equivalent circuit and torque development. Motor and generator operation. Stability. Effect of the salient-pole. Reluctance machines. Permanent-magnet machines. Synchronous and induction linear machines. DC machines Armature windings. The role of the auxiliary and compensating windings. Separate, parallel and mixed excitation, characteristics. Starting and speed modification.

Modern calculation methods Finite element method (FEM). Poisson equation. Lagrange interpolation polynom. Dirichlet and Neumann conditions. Simple 2D promlem. Presentation of the QuickField, Flux2D and Motorpro, MotorCad software. Applications of electrical machines Household electrical machines. Electrical machines in consumer electronics. Electrical machines in vehicles. Magnetically levitated trains. Superconducting generators and motors. Servo motors. Kinetics of electrical drives Reduction of torques and masses to common shaft. Motion equation of the electrical drives. Stability criterion of drives. Definition of time constants. Design of electrical drive Protection levels. Operation condition of electrical motors. Thermal conditions. Selection of electrical motors. Applications of electrical drives Speed modification and braking methods of DC urban electrical vehicles. Voltage source inverter-fed induction machine driven trolley-bus. Semiconductor-based DC drive driven trains. Inverter-fed trains. Wind generators. The practices: · Calculation of electromagnetic forces · Single-phase transformers · Parallel operation of transformers · Connections of transformers · 3-phase transformers · AC windings · Calculation of the induced voltage · Steady-state operation of induction machines · Starting of induction machines · Steady-state operation of synchronous machines

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

Course type	Course code	Course language	Timetable information
Lecture	2324_1_VIVEAC02_elm_angol	English	MON:14:15-16:00
Practice	2324_1_VIVEAC02_gyak_angol	English	THU:08:15-10:00

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

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

Course type	Course code	Course language	Timetable information
Lecture	2324_1_VIVEMA04_elm_angol	English	MON:16:15-18:00
Practice	2324_1_VIVEMA04_gyak_angol	English	FRI:08:15-10:00

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

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

Course type	Course code	Course language	Timetable information
Lecture	2324_1_VIVEMA05_elm_angol	English	WED:14:15-16:00

Practice	2324_1_VIVEMA05_gyak_angol	English	WED:16:15-18:00
https://portal.vik.bme.hu/kepzes/targyak/VIVEMA05/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
BMEGEÁTBG04	Air Pollution Control, Wastewater and Solid Wastes Management		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	A-2023o-E	English	TUE:08:15-11:00(AE_MERLEG-T)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TBG04#160;http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG04https://gpk.bme.hu/en/content/42#160;#160;				
Subject code	Subject name		Requirement	ECTS credit
BMEGEÁTBG11	Fluid Mechanics		Mid-semester mark	6
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	A-2023o-L1prs	English		
Lecture	A-2023o-E	English		
Practice	A-2023o-G1	English		
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TBG11#160;http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATBG11https://gpk.bme.hu/en/content/42#160;				
Subject code	Subject name		Requirement	ECTS credit
BMEGEÁTNKPR	Teamwork Project		Mid-semester mark	6
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	A-2023o-L	English		
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNKPR#160;http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNKPRhttps://gpk.bme.hu/en/content/42#160;#160;				
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-2023o-E	English	MON:14:15-16:00(KF82)	
Practice	A-2023o-G3	English	THU:10:15-12:00(AE_CFDLAB)	
Practice	A-2023o-G4	English	THU:12:15-14:00(AE_CFDLAB)	
Practice	A-2023o-G1	English	WED:12:15-14:00(AE_CFDLAB)	
Practice	A-2023o-G5	English	THU:16:15-18:00(AE_CFDLAB)	
Practice	A-2023o-G2	English	THU:08:15-10:00(AE_CFDLAB)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNW02http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW02https://gpk.bme.hu/en/content/42#160;				
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-2023o-Lprs	English	WED:10:15-12:00(AE_NAGYLAB)	
Lecture	A-2023o-E	English	WED:08:15-10:00(AE_MERLEG-T)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNW08http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW08https://gpk.bme.hu/en/content/42#160;				

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-2023o-Lprs	English	THU:12:15-14:00(AE_NAGYLAB)	
Lecture	A-2023o-E	English	MON:10:15-12:00(AE_MERLEG-T)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNW10http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW10https://gpk.bme.hu/en/content/42#160;				
Subject code	Subject name		Requirement	ECTS credit
BMEGEÁTNW19	Vehicle Aerodynamics		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	A-2023o-L	English	WED:16:15-18:00(AE_NAGYLAB)	
Lecture	A-2023o-E	English	WED:14:15-16:00(KM34)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%81TNW19#160;http://www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATNW19https://gpk.bme.hu/en/content/42#160;				
Subject code	Subject name		Requirement	ECTS credit
BMEGEÉEBG51	Transfer processes		Exam	4
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	A6	English	TUE:14:15-17:00	
Lecture	A4	English	WED:13:15-15:00(D102)	
Practice	A5	English	WED:15:15-16:00(D102)	
URL: https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGE%C3%89EBG51				
Subject code	Subject name		Requirement	ECTS credit
BMEGEENBGEB	Energy Processes and Equipment		Mid-semester mark	5
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	24-1-ENG-LAB	English	TUE:12:15-14:00(DCS1)	
Lecture	24-1-ENG-E	English	MON:13:15-16:00(D224)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBGEB#160;				
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	24-1-ENG-LAB	English		
Practice	24-1-ENG-G	English		
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBGEK#160;				
Subject code	Subject name		Requirement	ECTS credit
BMEGEENBGHG	Heat Engines G		Exam	4
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	24-1-ENG-E	English	MON:16:15-18:00(D224)	
Practice	24-1-ENG-G2	English		
Practice	24-1-ENG-G1	English	FRI:14:15-16:00(D318)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBGEK##160;				
Subject code	Subject name		Requirement	ECTS credit
BMEGEENBGTD	Engineering Thermodynamics G		Mid-semester mark	4
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	24-1-ENG-E	English	TUE:10:15-12:00(D224)	
Lecture	24-1-DEU-E	German		
Practice	24-1-ENG-G	English	TUE:12:15-14:00(D224)	
Practice	24-1-DEU-G	German		
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBGTD#160;				

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

Course type	Course code	Course language	Timetable information
Practice	24-1-ENG-G	English	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBKSD#160;

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

Course type	Course code	Course language	Timetable information
Lecture	24-1-ENG-E	English	
Practice	24-1-ENG-G1	English	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENBMHO#160;

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	24-1-ENG-LAB	English	
Lecture	24-1-ENG-E	English	

AimThe course aims to study the environmental impact of energy production systems. Students learn the basic concepts, standards, most commonly used types and areas of application of life cycle assessment (LCA). In their semester project assignment, students determine the environmental impact of an energy system of their choice using life cycle assessment methodology. Within the framework of their project task, they learn to use the software required for modern life cycle analysis (e.g. openLCA, GaBi, EASETECH).Learning outcomesCompetences that can be acquired by completing the courseKnowledgeThe student is aware of the principles and importance of a life cycle approach. Knows the basic concepts of life cycle assessment (LCA), the most commonly used types and standards. Has comprehensive knowledge of life cycle assessment methodology. The student is informed about the environmental quantities typical of energy production and user (production) facilities. Knows the databases, models and software that can be used during life cycle assessment. Understands the dangers of shifting impacts between different environmental impact categories. The student is aware of the basic environmental mechanisms of different environmental impact categories. Understands the application areas of life cycle assessment and the specifics of each area for LCA. The student is informed about the range, types, and availability of primary and secondary data that can be used in a life cycle assessment. Understands the process of critically reviewing the results of life cycle assessment and the methods of assessing data quality.AbilityDescribes real technology systems with life cycle models. The student is able to assess environmental impacts in multiple ways. The student can identify complex environmental problems, explore, formulate and (using learned practical application) the theoretical and practical background needed to analyze them. The student solves complex, computationally intensive tasks using IT skills. The student can express his or her thoughts orally and in writing. Interprets the results of a life cycle assessment (LCA). Creates the conceptual life cycle model using the appropriate target software. Selects secondary data sources and databases for the life cycle model. Defines the life cycle boundaries of energy systems. Use the life cycle assessment results in the application areas that meet the set goals.AttitudeThe student constantly monitors his or her work, results and conclusions. The student expands his or her knowledge of energy management and sustainability through continuous learning. Open to the use of information technology tools. The student seeks to learn about and routinely use environmental tools needed to solve energy management problems. The student develops the ability to provide accurate and error-free problem solving, engineering precision and accuracy. The student applies energy efficiency, sustainability and environmental awareness in solving life cycle assessment tasks. The student monitors changes in legislation. The student publishes his or her results under professional rules. The student publishes his or her opinions and views without offending others.General rulesLearning outcomes are assessed based on two mid-year has written performance measures (one partial and one summative academic performance assessment). Summarizing academic performance evaluation: a complex, written way of evaluating the competence-type competence elements of the subject and knowledge in a closed examination, the dissertation asks for the necessary lexical knowledge during the performance evaluation. The available working time is 30 minutes. Partial performance evaluation (project task): a complex way of evaluating the knowledge, ability, attitude, and independence and responsibility type competence elements of the subject, which is the individual homework.Assessment methodsDetailed description of mid-term assessmentsMid-term assessment No. 1Type:diagnostic assessmentNumber:1Purpose, description:Checking knowledge-type competencies in writing (level assessment) is necessary to complete the subject successfully. The evaluation will take place in electronic form at the lecture, with a maximum duration of 30 minutes and 30 points. The summative assessment can be improved/replaced during the replacement period. ---------- ----------.Mid-term assessment No. 2Type:formative assessment, project-based, complexNumber:1Purpose, description:The basic aim of the partial performance assessment is to examine the existence of application skills and learning outcomes belonging to the attitude, autonomy and responsibility competence group. The way to do this is to create a life cycle model in 2-3 groups and then present the results to the laboratory practice group. The topic of the tasks is chosen

individually, but it is also possible to choose from a predefined list. The chosen topics must be finalized by the third week of education. The requirements and evaluation principles of the prepared model are included in terms of reference. The students can get up to 70 points with this task.Detailed description of assessments performed during the examination periodThe subject does not include assessment during the examination period.The weight of mid-term assessments in signing or in final gradingIDProportionMid-term assessment No. 130 %Mid-term assessment No. 270 %The weight of partial exams in gradeThere is no exam belongs to the subject.Determination of the gradeGradeECTSThe grade expressed in percentsvery good (5)Excellent [A]above 90 %very good (5)Very Good [B] 85 % - 90 %good (4)Good [C]72 % - 85 %satisfactory (3)Satisfactory [D]65 % - 72 %sufficient (2)Pass [E]50 % - 65 %insufficient (1)Fail [F]below 50 %The lower limit specified for each grade already belongs to that grade.Attendance and participation requirementsThe lack of the value means that there is no attendance requirement.At least#160;70% of#160;laboratory practices (rounded down) must be actively attended.#160;#160;

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	24-1-ENG-G	English	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNKDA#160;

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	24-1-ENG-G	English	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNKDB#160;

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

Course type	Course code	Course language	Timetable information
Practice	24-1-ENG-G	English	

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

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

Course type	Course code	Course language	Timetable information
Lecture	24-1-ENG-E	English	WED:10:15-12:00(D224)
Practice	24-1-ENG-G	English	THU:16:15-18:00(D216,D224)

ONLY FOR MSc STUDENTS!BSc students should choose BMEGEENBGEB,#160;„Energy processes and equipments"#160;subject.#160;https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNWEC#160;

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	24-1-ENG-LAB	English	FRI:14:15-16:00(D218)

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

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

Course type	Course code	Course language	Timetable information
Laboratory	24-1-ENG-LAB	English	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENNWPR#160;

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	24-1-ENG-E	English	MON:16:15-18:00(D216)

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

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

Course type	Course code	Course language	Timetable information
Lecture	24-1-ENG-E	English	MON:08:15-10:00(KF82)
Practice	24-1-ENG-G	English	MON:10:15-12:00(KF82)

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

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

Course type	Course code	Course language	Timetable information
Lecture	24-1-ENG-E	English	
Practice	24-1-ENG-G	English	

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEENUVHT#160;

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

Course type	Course code	Course language	Timetable information
Lecture	A27	English	
Practice	A28	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
BMEGEGIBXGA	Fundamentals of Mechanical Engineering Drawing	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	A_EA	English	TUE:10:15-13:00(R113)
Practice	A_ERAS	English	TUE:16:15-18:00(R110,R109)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEGIBXGA#160;

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

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

https://oktatas.gpk.bme.hu/tad/tantargy/BMEGEGINWDT#160;

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

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

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEGTAG94#160;

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

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

https://oktatas.gpk.bme.hu/tad/en/tantargyak/BMEGEGTBG65#160;#160;

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

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

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEGTNWNC#160;

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

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

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEGTNWPP#160;

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

Course type	Course code	Course language	Timetable information
Laboratory	J1	English	THU:12:15-14:00(G115); FRI:12:15-14:00(G115)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEGTNWPR#160;

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

Course type	Course code	Course language	Timetable information
Lecture	23o_A_E	English	WED:10:15-12:00(D401); THU:08:15-10:00(D401); THU:08:15-10:00(D401)
Practice	23o_A_G	English	WED:10:15-12:00(D401)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEMIBXIT#160;

Subject code	Subject name	Requirement	ECTS credit
BMEGEMINWAC	Advanced Control and Informatics	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	23o_A_E	English	WED:08:15-10:00(K150)
Practice	23o_A_G	English	MON:16:15-18:00(KF82)

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEMINWAC#160;

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

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

https://oktatas.gpk.bme.hu/tad/tantargy/BMEGEMMBXM1#160;

Subject code	Subject name		Requirement	ECTS credit
BMEGEMMBXM3	Dynamics		Exam	5
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	LEC	English	WED:10:15-12:00(KF87)	
Practice	SEM	English	WED:16:15-18:00(KF87)	
https://oktatas.gpk.bme.hu/tad/tantargy/BMEGEMMBXM3#160;				

Subject code	Subject name		Requirement	ECTS credit
BMEGEMMBXVE	Fundametals of the finite element method		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	AL1	English	THU:12:15-14:00(KF82)	
Lecture	AE	English	THU:10:15-12:00(KF82)	

Subject code	Subject name		Requirement	ECTS credit
BMEGEMMNWCM	Continuum Mechanics		Mid-semester mark	5
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	E	English	TUE:12:15-14:00(KF81)	
Practice	G1	English	THU:14:15-16:00(KF81)	
https://oktatas.gpk.bme.hu/tad/tantargy/BMEGEMMNWCM#160;				

Subject code	Subject name		Requirement	ECTS credit
BMEGEMMNWMO	Modal Analysis of Mechanical Systems		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	E	English	MON:18:15-20:00(MM_I29)	

Subject code	Subject name		Requirement	ECTS credit
BMEGEMMNWRO	Dynamics of Robots		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	E	English	MON:12:15-14:00(D316A)	

Subject code	Subject name		Requirement	ECTS credit
BMEGEMTAGE1	Metal forming		Mid-semester mark	4
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	L1	English	THU:16:15-18:00	
Laboratory	L2	English	THU:16:15-18:00	
Lecture	Ea	English	THU:14:15-16:00(G120)	
BME GPK TAD#160;				

Subject code	Subject name		Requirement	ECTS credit
BMEGEMTAGE2	Nondestructive testing of materials		Exam	3
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	Ea	English	THU:14:15-16:00(MT103)	

Subject code	Subject name		Requirement	ECTS credit
BMEGEMTBGF1	Materials engineering		Exam	4
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	L2B	English	WED:12:15-14:00	
Laboratory	L2A	English	WED:12:15-14:00	
Laboratory	L1B	English	MON:16:15-18:00	
Laboratory	L1A	English	MON:16:15-18:00	
Lecture	AEa	English	MON:10:15-12:00(G120)	
BME GPK TAD#160;				

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

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

BME GPK TAD#160;

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

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

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEPTBGE2Objectives: 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.#160;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
BMEGEPTBGE3	Polymer processing	Mid-semester mark	3

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

.cs1D2C654{text-align:left;margin:0pt 0pt 8pt 0pt;line-height:1.07;text-indent:0pt} .cs5CC07D4{margin:12pt 0pt 12pt 0pt;text-align:left;text-indent:0pt} .cs73E18CB{font-size:10pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Verdana;} .csB71C49B{font-size:12pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Palatino Linotype;} .csAA1C4AB{font-size:11pt;font-weight:normal;color:#000000;background-color:transparent;font-style:normal;font-family:Palatino Linotype;}

https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEPTBGE3 The aims of this subject is at familiarizing the students with the polymer processing technologies in details: preliminary techniques, extrusion, blow molding, thermoforming, rotational molding, polymeric foams and elastomers technology. Topics: classification of polymer processing technologies. Basic rheological aspects of polymers. Preliminary techniques of polymer processing

(material conveying, drying, mixing, dosing etc.). Calendering. Extrusion. Extruder constructions, single and twin screw extruders. Compounding wit extruder. Extrusion dies (film blowing, flat film-, pipe, sheet, profile extrusion; extrusion blow molding; extrusion coating). Thermoforming: vacuum and pressure forming. Rotational molding. Foams technology: thermoplastic and thermoset foams. Elastomer technologies. Finishing and decoration. Joining technologies: welding and adhesive bonding.

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

Course type	Course code	Course language	Timetable information
Lecture	AnE_a	English	
Practice	AnGy_a	English	

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

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

Course type	Course code	Course language	Timetable information
Lecture	AnE_a	English	MON:14:15-16:00(R108)
Practice	AnGy_a	English	THU:16:15-18:00

http://www.hds.bme.hu/oktatas.php?sm=1amp;lang=EN 6. Main aims and objectives, learning outcomes of the subject: Processing and analysis of technical data is often part of engineering tasks. The data can originate from measurements of economical processes and results or from some technological tests but the main methods of the analysis are basically independent from the data source. Utilizing these methods the valuable information can be extracted from complex data sets through measurements of possible correlations, hypothesis testing and quality assurance tests. 7. Method of education: Lectures: 2hrs/week Seminar: 1hr/week To be able to practice the course material usage of computers is necessary. 8. Detailed thematic description of the subject (by topic, min. 800 character): 1. Probability theory basic review: relative frequency, probability, probability density and distribution, expected value, standard deviation. 2. Basic definition in statistics: average, empirical variance, empirical ddensity and distribution functions. Application: quality control, histogram, Pareto-Lorenz diagram. 3. Data acquisition with sampling: sampling techniques. Sampling in quality control. Application: calculation of the required dataset sizes for analysis. 4 Operation characteristics curve: product acceptance using statistical sampling. Application: calculation of economically justifiable fallout rate. 5. Quality and reliability. Upper- and lower control bounds. Control capability index. Application: Machine settings verification. 6. Data acquisition with measurement: measurement principles (comparability, equality, disparity). Direct and indirect measurements. Propagation of measurement errors. Application: evaluation of acceptance measurements, error bounds. 7. Point and interval estimation: poperties of the estimations. Confidence interval for expected value and variance. Application: Analysis of technical and economic data with the help of confidence interval. 8. Correlation coefficient, empirical correlation coefficient. Main properties. Application: correlation diagram, use of correlation in quality control. 9. Regression analysis based on generalization of Gauss-Markov theorem. Application: linear and polynomial regression between the variables of the data of technical processes. 10. Regression models: Estimation of degree-index. Coefficient of determination. Forecasting economic trends with moving average and exponential smoothing. Application: prognosis of capacities, production and utilization. 11. Statistical tests: parametric and non-parametric test. Detailed discussion of the U-test. Critical domain. First and second type errors. Application: verification of change in consumption trends. 12. Parametric tests: T-test, F-test, etc. Application: Quality and production control with parametric tests. 13. Non-parametric tests: c2 and Wilcoxon tests. Application: verification of fittings in production and quality control. 14. Introduction to variance analysis: hypothesis testing with F-test, ANOVA test. Application: analysis of production quality.

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

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

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	AnL_BG01	English	THU:14:15-16:00(L-HIDROLAB)	
Lecture	AnE_BG01	English	THU:08:15-10:00(K150)	
Practice	AnGy_BG01	English	WED:10:15-12:00(D327)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBG01#160;				

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	AnL2	English	MON:12:15-14:00(L-HIDROLAB)	
Laboratory	AnL1	English	MON:12:15-14:00(L-HIDROLAB)	
Lecture	AnE	English	MON:12:15-14:00(D327)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBG03#160;#160;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; Theorem's analysis; Consequences in measuring techniques Fourier series and transformation, and their role in signal processing; The Spectrum and it's applications; Recognizing periodic and noise processes#160; Application of spectrum and cepstrum analysis for investigation operating machines#160; The real measurement result; Noise, as the characterization of stochastic processes; Amplitude density function; Autocorrelation and Cross correlation functions#160; Application of Autocorrelation and Cross correlation technique for analyzing periodic and transient signals#160; Laboratory practices: 4*3,5h Pressure transducer's response to step function Pressure transducer'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-ÉPGET	English		
Laboratory	AnL-EGR	English		
Laboratory	AnL-ARA	English		
Laboratory	AnL-HDR	English		
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBG06#160;Independent Study 1 BMEGEVGBG06 One-semester long individual project work. 4 hours/4 credits.				

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGBG10	Introduction to mechanical engineering		Exam	5
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	AnL2	English	THU:14:15-16:00(L-HIDROLAB)	
Laboratory	AnL1	English	THU:14:15-16:00(L-HIDROLAB)	
Lecture	AnE	English	THU:08:15-10:00(K150)	
Practice	AnGy2	English	MON:16:15-18:00(KF84)	
Practice	AnGy1	English	WED:10:15-12:00(D327)	

Subject code	Subject name		Requirement	ECTS credit
BMEGEVGBG13	Fluid Flow Systems		Mid-semester mark	4
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	AnL1	English	WED:16:15-18:00(L-HIDROLAB)	
Laboratory	AnL2	English	WED:16:15-18:00(L-HIDROLAB)	
Lecture	AnE	English	THU:14:15-16:00(KF83)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBG13#160;				
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	THU:11:15-12:00(L-HIDROLAB)	
Lecture	AnE	English	THU:12:15-14:00(D327)	
Subject code	Subject name		Requirement	ECTS credit
BMEGEVGBX14	Analysis of technical and economical data		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	AnL2	English	THU:16:15-18:00	
Laboratory	AnL1	English	THU:16:15-18:00	
Lecture	AnE	English	MON:14:15-16:00(R108)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGBX14#160;				
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		
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGNWPR#160;				
Subject code	Subject name		Requirement	ECTS credit
BMEGEVGNX26	Hemodynamics		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Lecture	AnE	English	THU:12:15-14:00(R108)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGNX26#160;				
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	THU:10:15-12:00(D327)	
https://oktatas.gpk.bme.hu/tad/en/tantargy/BMEGEVGNX27#160;				
Subject code	Subject name		Requirement	ECTS credit
BMEGEVGNXPB	Project Work B		Mid-semester mark	3
Course type	**Course code**	**Course language**	**Timetable information**	
Laboratory	AnL	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
BMETE11AX13	Physics for Civil Engineers	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	E0	English	

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
BMETE13AM16	Physics 1 for Mathematicians	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Lecture	E0	English	

Review of the physics we learned in secondary school: Newton's laws, Conservation laws. Inertial frame of reference, general transformation between two Inertial frame of reference. Galilei transformation, Lorentz transformation. Introduction to special relativity: Lorentz contraction, time dilation, proper time, invariant quantities. Four vectors. Accelerated Reference Frames, Fictitious force: Coriolis force, Foucault pendulum, centrifugal force. Demonstration experiments. Primer to geometrical optics, Fermat's principle, Euler-Lagrange equation. Hamilton's principle, Lagrange function, equation of motion. Relation between the symmetry of the Lagrangian and the conservation laws, Noether's theorem. Application of the law of conservation, motion in central field. Kepler problem.

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	TA0	English	THU:16:15-17:00
Practice	TA1	English	THU:17:15-19:00

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
BMETE80MX00	Nuclear and Reactor Physics Fundamentals	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	TUE:14:15-17:00; TUE:14:15-17:00
Practice	T1	English	TUE:17:15-18:00; TUE:17:15-18:00

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

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

The course starts with two introductory lectures: the first one summarizes the physics basis needed to understand the criteria for fusion energy producing devices, while the second reviews the main elements of fusion technology

and their functions. This is followed by two lectures of introduction to stellarator technology through the German stellarator program, and three leactures dealing with the past, present and future of tokamaks. Spherical tokamaks are discussed in a separate lecture followed by lectures introducing the most important milestones of German, US and Japanese fusion programs. The last lecture presents the rapidly expanding Far-East fusion programs in the context of the history of superconducting tokamaks.#160;

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

Course type	Course code	Course language	Timetable information
Lecture	EN-VBK-0	English	WED:16:15-19:00(CH304); THU:16:15-17:00(CH302)
Lecture	EN-VIK-0	English	TUE:12:15-14:00; WED:10:15-12:00
Lecture	EN-EMK-0	English	TUE:14:15-16:00(K372); TUE:14:15-16:00(K372); WED:16:15-18:00(K372); WED:16:15-18:00(K372)
Practice	EN-VBK-1	English	THU:17:15-19:00(CH302)
Practice	EN-VIK-1	English	FRI:10:15-12:00
Practice	EN-EMK-1	English	MON:16:15-18:00(K373); MON:16:15-18:00(K373)

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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(K376); WED:08:15-10:00(K376)
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	TUE:10:15-12:00
Practice	EN1	English	MON: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	MON:12:15-14:00(CH304)

Practice	EN-CA1	English	THU:12:15-14:00(CH304)

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:12:15-14:00(K364)
Practice	EN1	English	FRI:08:15-10:00(K285)

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
BMETE90AX58	Mathematics A4 - Probability Theory	Mid-semester mark	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

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

Subject code	Subject name	Requirement	ECTS credit
BMETE90MX63	Construction Information Technology Mathematics	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)

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

Course type	Course code	Course language	Timetable information
Lecture	A0	English	TUE:10:15-12:00

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	MON:14:15-16:00(H405A); FRI:08:15-10:00(H405A)

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
BMETE91MM09	Algebraic Topology	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	A0	English	

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:16:15-19:00(KF82); THU:16:15-17:00(KF82)
Practice	EN1	English	THU:17:15-19:00(KF82)

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

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	TUE:08:15-10:00(R513)
Practice	EN1	English	WED:08:15-10:00(R513)

Subject code	Subject name	Requirement	ECTS credit
BMETE94AM20	Differential Geometry 2	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	E0	English	MON:16:15-18:00(H405A)
Practice	E1	English	TUE:08:15-10:00

Subject code	Subject name	Requirement	ECTS credit
BMETE94AM24	Geometry 1	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	E0	English	
Practice	E1	English	

Subject code	Subject name	Requirement	ECTS credit
BMETE94MM00	Differential Geometry and Topology	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	E0	English	
Practice	E1	English	

Smooth manifolds, differential forms, exterior derivation, Lie-derivation. Stokes' theorem, de Rham cohomology, Mayerndash;Vietoris exact sequence, Poincareacute;-duality. Riemannian manifolds, Levindash;Civitaacute; connection, curvature tensor, spaces of constant curvature. Geodesics, exponential map, geodesic completeness, the Hopfndash;Rinow theorem, Jacobi fields, the Cartanndash;Hadamard theorem, Bonnet's theorem. References:J. M. Lee: Riemannian Manifolds: an Introduction to Curvature, Graduate Texts in Mathematics 176, Springer Verlag P. Petersen: Riemannian Geometry, Graduate Texts in Mathematics 171, Springer Verlag J. Cheeger, D. Ebin: Comparison Theorems in Riemannian Geometry, North-Holland Publishing Company, Vol. 9, 1975Szőkefalvi-Nagy Gy., Geheacute;r L., Nagy P.: Differenciaacute;lgeometria, Műszaki Kouml;nyvkiadoacute;, Budapest, 1979

Subject code	Subject name	Requirement	ECTS credit
BMETE94MM02	Combinatorial and Discrete Geometry	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	E0	English	
Practice	E1	English	

Subject code	Subject name	Requirement	ECTS credit
BMETE94MM03	Non-Euclidean Geometry	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	E0	English	
Practice	E1	English	

Subject code	Subject name	Requirement	ECTS credit
BMETE95AM29	Probability Theory 1	Exam	6

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

Introduction: empirical background, sample space, events, probability as a set function. Enumeration problems, inclusion-exclusion formula, urn models, problems of geometric origin. – Conditional probability: basic concepts, multiplication rule, law of total probability, Bayes formula, applications. Independence. – Discrete random variables: probability mass function, Bernoulli, geometric, binomial, hypergeometric and negative binomial distributions. Poisson approximation of the binomial distribution, Poisson distribution, Poisson process, applications. – General theory of random variables: (cumulative) distribution function and its properties, singular continuous distributions, absolutely continuous distributions and probability density functions. Important continuous distributions: uniform, exponential, normal (Gauss), Cauchy. Distribution of a function of a random variable, transformation of probability densities. – Quantities associated to distributions: expected value, moments, median, variance and their properties. Computation for the important distributions. Steiner formula. Applications. – Joint distributions: joint distibution, mass and density functions, marginal and conditional distributions. Important joint distributions: polynomial, polyhypergoemetric, uniform and mutlidimensional normal distribution. Conditional distribution and density functions. Conditional expectation and prediction, conditional variance. Vector of expected values, Covariance matrix, Cauchy-Schwartz inequality, correlation. Indicator random variables. – Weak Law of Large Numbers: Bernoull Law of Large Numbers, Markov and Chebyshev inequality. Weak Law of Large numbers in full generality. Application: Weierstrass approximation theorem. – Normal approximation of binomial distribution: Stirling formula, de Moivre-Laplace theorem. Applications. Normal fluctuations. Central Limit Theorem. – Ross, Sheldon: A First Course in Probability, 8th Edition, Pearson Education International, 2010– William Feller: An Introduction to Probability Theory and its Applications

Subject code	Subject name	Requirement	ECTS credit
BMETE95AM33	Tools of Modern Probability Theory	Exam	4

Course type	Course code	Course language	Timetable information
Lecture	T0	English	WED:10:15-12:00; THU:12:15-14:00

The goal of the course is to teach the most important tools that modern probability theory uses from combinatorics, linear algebra, real analysis, measure theory, complex analysis, functional analysis and geometry. We demonstrate the use of these tools through examples, but the emphasis is on developing the tools. A part of the knowledge acquired will be utilised in the masters program. Combinatorics: method of generator functions. Stirling formula. Euler gamma function. Topology: convergence on metric spaces and topological spaces. Compactness. Product space, product topology. Tychonoff#39;s theorem. Linear algebra: inner product spaces. Cauchy-Schwartz inequality. Calculating powers of matrices, analytic matrix-calculus. (Application: Markov transition probabilities.) Transformations of functions: Laplace transform. Fourier expansion, Fourier transformation. Discrete Fourier tranformation. (Application: characteristic function.) Legendre transform. Measure theory: exchanging integral and derivative. Uniform convergence and continuity. (Application: differentiability of the characteristic function.) Jensen inequality. Absoulte continuity, Radon-Nikodym theorem. (Application: conditional expectation.) Push-forward of measures, integration by substitution. (Application: distribution of random variables, expectation of random variables.) Product space, product measure. Fubini#39;s theorem. (Application: independence.) Decomposition of measures, conditional measure, factor measure. Complex analysis: Residue theorem, Laurent expansion. (Application: calculating convolutions and characteristic functions.) Analytic extensin, Vitali#39;s theorem. Functional analysis: spectrum of bounded operators, resolvent, spectral radius. Hahn-Banach theorem. C^k spaces, Arsela-Ascoli theorem. Continuous linear functionals, Riesz-Markov theorem. Dual spaces, weak star topology, tightness. Fourier transform once again, Riesz-Fischer theorem. Suggested literature: Jaacute;rai Antal: Meacute;rteacute;k eacute;s integraacute;l (in Hungarian) Rudin: Functional Analysis

Subject code	Subject name	Requirement	ECTS credit
BMETE95AM41	Stochastic Processes	Exam	6

Course type	Course code	Course language	Timetable information
Lecture	T0	English	THU:08:15-10:00(H406); FRI:10:15-13:00(H406)

Descripton: Basic notions: finite dimensional marginals, Kolmogorov's fundamental theorem, strongly and weakly stationary processes, processes with stationary and/or independent increments. Discrete Markov chains: linear algebra of stochastic matrices, classification of states. Finite Markov chains: stationary measures and ergodic behaviour. Reversibility, random walk on graphs. Urn models. Countable Markov chains: transience, null-recurrence, positive-recurrence. Random walks on Zd: Polya's theorem. Random walks on countable graphs, branching processes, discrete time birth-and-death processes, queuing problems. Random walks on Z1: the reflection principle and limit distribution of the maximum, difference equations. Continuous time, discrete space Markov processes: the Poisson process, jump rates, exponential clocks. Stochastic semigroup: Kolmogorov-Chapman equations, infinitesimal generator. Complements of measure theory: filtrations, adapted processes, natural filtration. The general notion of conditional expectation (Kolmogorov's theorem), fundamental properties. Discrete time martingales: sub/super/martingales, stopping times, stopped martingales. Optional stopping theorem, Wald identity, martingale

convergence theorem, submartingale inequality, maximal inequality. Azuma-Hoffding inequality, applications. The Brownian motion: defining properties, covariances. Sketch of Paul Levy’s construction, basic analytic properties. Applications. Literature: – Essentials of Stochastic Processes (2nd edition), Springer, 2012. – R. Durrett: Probability Theory with Examples, 4th edition, Cambridge U. Press, 2010.

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM01	Mathematical Modelling Seminar 1	Mid-semester mark	1

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

The aim of the seminar to present case studies on results, methods and problems from applied mathematics for promoting(i) the spreading of knowledge and culture of applied mathematics;(ii) the development of the connections and cooperation of students and professors of the Mathematical Institute, on the one hand, and of personal, researchers of other departments of the university or of other firms, interested in the applications of mathematics.The speakers talk about problems arising in their work. They are either applied mathematicians or non-mathematicians, during whose work the mathematical problems arise.An additional aim of this course to make it possible for interested students to get involved in the works presented for also promoting their long-range carrier by building contacts that can lead for finding appropriate jobs after finishing the university.

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM02	Mathematical Modelling Seminar 2	Mid-semester mark	1

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

The aim of the seminar to present case studies on results, methods and problems from applied mathematics for promoting(i) the spreading of knowledge and culture of applied mathematics;(ii) the development of the connections and cooperation of students and professors of the Mathematical Institute, on the one hand, and of personal, researchers of other departments of the university or of other firms, interested in the applications of mathematics.The speakers talk about problems arising in their work. They are either applied mathematicians or non-mathematicians, during whose work the mathematical problems arise.An additional aim of this course to make it possible for interested students to get involved in the works presented for also promoting their long-range carrier by building contacts that can lead for finding appropriate jobs after finishing the university.

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM09	Statistical Program Packages 2	Mid-semester mark	2

Course type	Course code	Course language	Timetable information
Laboratory	EN1	English	FRI:08:15-10:00

The goal of the course is to provide an overview of contemporary computer-based methods of statistics with a review of the necessary theoretical background.1. How to use the SPSS (Statistical Package for Social Sciences) in program mode. Writing userrsquo;s macros. Interpretation of the output data and setting the parameter values accordingly. Definition and English nomenclature of the dispalyed statistics.2. Introduction to the S+ and R Program Packages and surveying the novel algorithmic models not available in the SPSS (bootstrap, jackknife, ACE).3. Practical application. Detailed analysis of a concrete data set in S+. References: Mardia, K. V., Kent, J. T., Bibby, M.: Multivariate analysis, Academic Press, New York, 1979Ketskemeacute;ty, L., Izsoacute;, L.: Introduction to the SPSS Program Package, in Hungarian, ELTE Publishers, Budapest, 2005S+ or R User's Guide (together with the program package)

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM15	Multivariate Statistics	Exam	5

Course type	Course code	Course language	Timetable information
Lecture	T0	English	MON:14:15-16:00
Practice	T1	English	MON:16:15-18:00

Multivariate central limit theorem and its applications. Density, spectra and asymptotic distribution of random matrices in multivariate statistics (Wishart-, Wigner-matrices). How to use separation theorems for eigenvalues and singular values in the principal component, factor, and correspondence analysis. Factor analysis as low rank representation, relatios between representations and metric clustering algorithms. Methods of classification: discriminatory analysis, hierarchical, k-means, and graph theoretical methods of cluster analysis. Spectra and testable parameters of graphs.Algorithmic models, statistical learning. EM algorithm, ACE algorithm, Kaplanndash;Meier estimates. Resampling methods: bootstrap and jackknife. Applications in data mining, randomized methods for large matrices. Mastering the multivariate statistical methods and their nomenclature by means of a program package (SPSS or S+), application oriented interpretation of the output data. References:Bolla, M., Kraacute;mli, A.: Theory of statistical inference (in Hungarian), Typotex, Budapest, 2005Mardia, K. V:, Kent, J. T., Bibby, J. M.: Multivariate Analysis, Academic Press, Elsevier Science, 1979, 2003

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM30	Macroeconomics and Finance for Mathmeaticians	Exam	3

Course type	Course code	Course language	Timetable information
Lecture	EN0	English	WED:16:15-18:00

1. Introduction to economic statistics. National accounts, GDP, GNI, LFS, CPI, monetary aggregates, stock vs. flow indicators.2. Introduction to finance and financial market: Fundamentals, DCF method, NPV, interest rates, loans, deposits, bonds.3. Basics of fixed income securities. Interest rates, compounding, term structure, pricing of bonds.4. Basics of interest rate risk management. Duration, convexity, risk management concepts.5. Interest rate models in continuous time: interest rates as stochastic processes, modelling the term structure.6. Introduction to economic modelling.7. Economic growth theory.8. Business cycles and monetary policy.9. Portfolio theory and risk metrics for capital markets.10. Introduction to credit risk modelling.11. Risk management and capital requirements in banking.12. Empirical remarks on course topics and revision. Wickens, Mike: Macroeconomic Theory. A Dynamic General Equilibrium Approach. Princetion University Press. 2008. Jorion, Philippe: Financial Risk Manager Handbook. Part I and II. Wiley. 2003

Subject code	Subject name	Requirement	ECTS credit
BMETE95MM37	Applied Statistics and Likelihood Methods (ASLM)	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Lecture	A0	English	TUE:08:15-10:00

Over the course of the 14-week semester, this course covers seven main topics (roughly two-weeks per topic), including: Linear (simple and multiple) regression Overview of experimental design Generalized linear models and applications Nonlinear modelling and applications Bioassay and synergy Mixed modelling and longitudinal data analysis Survival analysis methods and applications

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
BMEKOKAM326	Algorithm Design	Mid-semester mark	5

Course type	Course code	Course language	Timetable information
Laboratory	ERA_LAB	English	MON:16:15-18:00
Lecture	ERA-EA	English	WED:14:15-16:00

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

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

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

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEKOKKM228	Transport Infrastructure Management	Mid-semester mark	3

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

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

Subject code	Subject name	Requirement	ECTS credit
BMEKOVRM121	Numerical methods	Mid-semester mark	4

Course type	Course code	Course language	Timetable information
Laboratory	Lab_ERA	English	FRI:10:15-12:00
Lecture	EA_ERA	English	FRI:08:15-10:00

Subject code	Subject name	Requirement	ECTS credit
BMEKOVRM334	Numerical optimization	Exam	5

Course type	Course code	Course language	Timetable information
Laboratory	Lab_ERA	English	FRI:09:15-11:00
Lecture	EA_ERA	English	FRI:07:15-09:00; FRI:07:15-09:00; FRI:09:15-11:00

Subject code	Subject name	Requirement	ECTS credit
BMEKOVRM606	Computational fluid- and thermodynamics	Exam	4

Course type	Course code	Course language	Timetable information
Laboratory	Lab_ERA	English	MON:14:15-16:00
Lecture	EA_ERA	English	THU:10:15-12:00