2024

Bachelor of Science in Materials Engineering

UNIVERSITY OF DUNAÚJVÁROS

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Description of the degree study program

Bachelor of Science in Materials Engineering (Materials Engineering)	
Institution responsible for training	University of Dunaújváros
Institutional identification number	FI60345
Address	1/A, Tancsics Mihaly street, Dunaújváros, H-2400
Responsible manager	Dr. habil István András, Rector
Managers responsible for training	
Institute of Specialists	Technical Institute
Institute Director	Dr. habil Róbert Sánta, PhD
Responsible	Dr. Judit Pázmán, PhD
Main aspects of the study program	
Precondition of student application acceptance:	General Certificate of Education or a certificate of secondary school final exam, that certificate, which is required to start a higher educational study program in the home country of the student, the level of the required English language knowledge to start bachelor studies: IELTS 5.5
Training data	
Level of educational program	undergraduate
Level of qualification	bachelor (BSc)
Description of qualification in the diploma in Hungarian	Anyagmérnök
Description of qualification in the diploma in English	Materials Engineer
Scheme of Study	7 semesters
Credit points to be acquired	210

The objectives of the training and the professional competencies to be acquired	The aim of the course is to train materials engineers who are capable of understanding and managing the processes in metals, polymers and ceramics, as well as in advanced complex material systems, i.e. composites. They will also have the ability to modify material properties in different technologies, to investigate the structure and properties of materials, to manage and organise material production processes in a systems approach and to ensure the quality of materials produced by these technologies, and the theoretical knowledge to pursue the course at Master's (MSc) level.
Practical training	In the 7th (last) semester, at least 6 weeks of organized practice at a professional practice location
Conditions for issuing the Final certificate (diploma)	Nftv. § 108.47. paragraph 47: "The successful completion of the examinations prescribed in the curriculum and - with the exception of the preparation of the thesis (diploma thesis) - the fulfilment of other study requirements and the acquisition of the credits prescribed in the training and outcome requirements, which certifies that the student has fully met the study and examination requirements prescribed in the curriculum without grading and assessment." The University makes the award of the diploma (diploma) conditional on the completion of the foreign language requirement, which is the completion of a professional subject in a foreign language, as required by the institution responsible for the course.
Thesis	The thesis is a solution to a materials engineering problem or a research project in a specific field of study, which can be completed in one semester under the guidance of internal and industrial consultants, based on the knowledge acquired by the student during his/her studies, by studying additional literature. The candidate will demonstrate through the thesis that he/she has acquired sufficient competence in the practical application of the knowledge acquired, is able to carry out his/her tasks in materials engineering and is familiar with other literature beyond the course material and is able to apply it in a value-adding manner. Formal requirements: the thesis is 50-70 pages long.
Condition for passing the final examination	To be admitted to the final examination, you must have a final certificate (diploma) obtaining and having a thesis accepted for examination.
Final exam	The final examination is a test and assessment of the knowledge, skills and abilities required to obtain a diploma, during which the student must also demonstrate that he or she can apply the knowledge acquired. The final examination consists of the defence of a thesis and an oral examination in the subjects specified in the curriculum.
Final examination subjects	ZV1: DUEN-MUA-212 Mechanical Material Testing DUEN-MGT-116 Materials Science DUEN-MST-210 Industrial materials ZV2: DUEN-MUA-150 Production technologies of nuclear power plant devices DUEN-MST-111 Production technologies of space ceramics DUEN-MST-251 Life cycle of plastics
Diploma average	The average of the certificate should be calculated in the following way: (FE + D + SA)/3. (FE) The mathematical average of the marks of the final exam subject(s). (D) The mark given by the final exam committee to the thesis. (SA) the weighed average mark of subjects for the total number of credit points collected in the complete study time period – except the credit points of thesis writing.

Diploma qualification	Excellent 4,51 - 5,00; Good 3,51 - 4,50; Satisfactory 2,51 - 3,50; Pass 2,00 - 2,50
Conditions for the award of a diploma	Successful completion of the final examination is a prerequisite for the award of a diploma certifying the completion of higher education.
Language education	English
Physical education	Over 4 semesters, 2 hours per week
Work schedule	Full-time course

Required engineering competences

With a bachelor's degree, materials engineers are able to, taking into account the expected specialisations:

- quality control of the work phases and quality management of sub-tasks in materials technologies, to determine the properties of different products,
- to assess and reduce the environmental burden of materials production,
- to assess and rationalise energy use in materials production,
- to solve occupational safety and health problems,
- to apply the principle of equal access.

Knowledge:

- Knowledge of the basic physico-chemical processes in material systems, their (basic) mathematical description, with particular reference to the laws of thermodynamics and kinetics.
- You will have a broad knowledge of the atomic, micro- and macro-structure of solids, the basic methods and principles of operation of the basic tools needed to study the structure and the processes that lead to the formation of structures.
- Detailed knowledge of the principles of operation of machinery and equipment in materials production,
- know the basic technologies for the production and shaping (plastic forming and casting) of metals and their alloys.
- Knowledge of the basic technologies of heat treatment, surface treatment.
- Knowledge of basic technologies for the production of ceramics (including glass and binders) and composite materials.
- You know the basic technologies for the production and processing of polymers.
- He has a systematic knowledge of the energy characteristics of the technologies in his field, energy efficiency requirements and the possibilities of providing the necessary energy.
- He/she has a basic knowledge of the expectations and requirements of the occupational safety and fire protection, safety and environmental protection related to his/her field of expertise.
- Have a basic knowledge of the fundamentals, boundaries and requirements of environmental protection, quality assurance, information technology, law and economics, which are integrally related to the field.
- Knowledge of specific learning, knowledge acquisition and data collection methods, their ethical limitations and problem-solving techniques in materials engineering.

Ability:

- Ability to apply the related computational and modelling principles and methods of product and process design.
- The ability to interpret and characterise the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used.
- Apply the technical specifications related to the operation of manufacturing systems, the principles and the economic context of setting up and operating machinery and equipment,
- manages and controls specialised technological production processes, taking into account the elements of quality assurance and quality control.
- Ability to diagnose malfunctions, select remedial actions.
- Understands and applies the environmental, occupational health and safety and security requirements of the field, and is able to modify processes to meet expectations.
- Ability to comply with legislation and economic requirements in your field.
- Understand and use the online and print literature in their field in Hungarian and foreign languages.

Attitude:

- Strive to keep their self-education in materials engineering continuous and in line with their professional goals.
- It strives to solve its tasks and make management decisions by listening to the opinions of the colleagues it manages, preferably in cooperation.
- You have the stamina and monotony tolerance to carry out practical activities.
- It takes a creative approach to continuously improve the technologies and processes used.
- It strives to use environmentally sound technologies and to protect the built and natural environment.

It strives to use energy and material-saving processes and technologies.

Autonomy and responsibility:

- Directs the work of the personnel assigned to him/her, supervises the operation of machinery and equipment, based on the instructions of the workplace manager.
- It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks.
- Assesses the environmental pressures associated with production and seeks to reduce them.
- Assess and rationalise energy use in material production.
- Carry out occupational safety and health duties.
- Assesses the efficiency, effectiveness and safety of the work of subordinates.
- He or she is attentive to promoting the professional development of his or her subordinates, and to managing and assisting them in their efforts in this direction.
- Helping young staff to develop and progress in their careers.

Curriculum for Materials Engineering BSc programme

Materials Engineering BSc

Subject code	Subject name	Credit	Requirement	Semester - Classes per week																					Prerequisite
				1			2			3			4			5			6			7			
				T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-IMA-100	Tutorial mathematics	0	A	0	2	0																			-
DUEN-IMA-152	Engineering Mathematics 1.	5	E	0	3	0																			-
DUEN-ISF-010	Informatics	5	M	0	0	3																			-
DUEN-MGT-111	Engineering representation	5	M	1	2	0																			-
DUEN-MUG-152	Mechanics 1.	5	E	1	2	0																			-
DUEN-MUG-212	CAD	5	M	0	0	3																			-
DUEN-MUT-151	Engineering Physics	5	E	1	1	1																			-
DUEN-IMA-212	Engineering Mathematics 2.	5	M				0	0	3																-
DUEN-MST-210	Industrial materials	5	M				1	0	2																-
DUEN-MST-250	Thermodynamics	5	E				1	0	2																-
DUEN-MUG-222	Basics of machine design	5	M				2	1	0																DUEN-MGT-111 DUEN-MUG-212 DUEN-MUG-152
DUEN-MUG-257	Mechanics 2.	5	E				1	2	0																DUEN-MUG-152
DUEN-MUT-250	Heat and Fluid Dynamics	5	E				1	1	1																DUEN-MUT-151
DUEN-IMA-110	Mathematics 3.	5	M							0	3	0													DUEN-IMA-152
DUEN-MGT-116	Materials Science	5	M							1	0	2													-
DUEN-MST-150	Production technologies of nuclear power plant devices	5	E							1	0	2													-
DUEN-MUA-150	Materials Engineering	5	E							1	1	1													-
DUEN-MUA-252	Reaction kinetics	5	E							1	1	1													-
DUEN-MUA-255	Plastic physics	5	E							1	0	2													-
DUEN-MST-211	Up-to-date casting technologies	5	M										1	0	2										-
DUEN-MST-212	Instrumental analytical chemistry	5	M										1	0	2										-
DUEN-MST-251	Life cycle of plastics	5	E										1	0	2										-
DUEN-MST-252	Micro and nano structures	5	E										1	0	2										-
DUEN-MST-253	Space ceramics	5	E										2	0	1										-
DUEN-MUA-212	Mechanical Material Testing	5	M										1	0	2										-
-	Optional course - Materials Engineering	5	-													-	-	-							-
DUEN-MST-111	Production technologies of space ceramics	5	M													2	0	1							-
DUEN-MUA-113	Heat Treatment	5	M													1	0	2							-
DUEN-MUA-210	Welding	5	M													1	1	1							-
DUEN-MUA-215	Non-destructive testing of materials	5	M													1	0	2							-
DUEN-MUA-251	Forming of Metals	5	E													1	1	1							-
-	Optional course - Materials Engineering	5	-																-	-	-				-
-	Optional course	5	-																-	-	-				-
-	Optional course	5	-																-	-	-				-
DUEN-MGT-210	Environmental policy and protection against radioactivity	5	M																2	0	1				-
DUEN-MST-254	Coating Processes	5	E																1	0	2				-
DUEN-MUG-090	Thesis project 1.	0	S																2	0	0				-
DUEN-TVV-122	Entrepreneurship	5	M																1	2	0				-
-	Optional course	5	-																			-	-	-	-
DUEN-MUA-091	Research Thesis - ANYBSC	15	S																			0	12	0	-
DUEN-MUA-093	Professional Internship - ANYBSC	0	S																			0	0	0	-
DUEN-TVV-114	Management	5	M																			1	2	0	-
DUEN-TVV-118	Product Management and Value Analysis	5	M																			2	1	0	-
	Number of Theoretical/Practice/Lab classes per week			3	10	7	6	4	8	5	5	8	7	0	11	6	2	7	6	2	3	3	15	0	
	Total number of classes per week			**20**			**18**			**18**			**18**			**15**			**11**			**18**			
	Total credit points			**210**																					

Optional course - Materials Engineering

Subject code	Subject name	Credit	Requirement	Semester - Classes per week																					Prerequisite
				1			2			3			4			5			6			7			
				T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	T	P	L	
DUEN-MGT-117	Basics of nuclear safety	5	M													2	0	1							-
DUEN-MGT-118	Basics of Atomenergetics	5	M													2	1	0							-
DUEN-MGT-119	Ensuring the integrity of equipment	5	M													2	1	0							-
DUEN-MGT-152	Equipments of Nuclear Power Plants	5	E													2	1	0							-
DUEN-MGT-257	Basic Priciples of Hydrogen Technology	5	E													2	1	0							-
DUEN-MGT-112	Engineering construction	5	M																1	2	0				DUEN-MGT-111
DUEN-MGT-155	Hydrogenstorage technologies	5	E																2	0	1				-
DUEN-MGT-213	Industrial knowledge	5	M																2	0	1				-
DUEN-MGT-256	NPP measurements and NDT	5	E																2	1	0				-
DUEN-MUG-213	Metrology	5	M																2	0	1				DUEN-MUG-257
DUEN-MUG-252	Production Technology	5	E																2	1	0				DUEN-MUG-152
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	0	0	0	0	0	0	10	4	1	11	4	3	0	0	0	
	Total number of classes per week			0			0			0			0			**15**			**18**			0			
	Total credit points			**40**																					

Notation: **E**: Exam, **M**: Mid-year grade, **L**: Lecture, **T** Tutorial, **P** Practice, **Cr** Credit, **R** Requirement

Short description of the subjects

Tutorial mathematics

Name of the subject	in Hungarian	Matematika felzárkóztató	Level	BSc
	in English	Tutorial mathematics	Code	DUEN(L)-IMA-100

Responsible educational unit	
Name of compulsory prior learning DUEN(L)-	

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/26	per week	0	per week	2	per week	0		5	english
Part time	150/10	per term	0	per term	10	per term	0			
Teacher responsible for the subject				Name		Antal Joós, PhD			schedule	Associate professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Based on the preliminary knowledge assessment, this course is recommended for students studying in the bachelor courses in economics and management, materials engineering, mechanical engineering, business informatics, computer engineering, technical management, and in the higher vocational courses in engineering, economics, and management. The aim is to acquire basic mathematical knowledge, to raise students' mathematical knowledge, skills, and competences to a level appropriate for the preparation of higher education studies and for the completion of mathematics courses.	
Typical delivery methods	Presentation	
	Practice	Classroom exercises, student-prepared papers, presentations, case studies
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge**	
	Ability Ability to apply the mathematical knowledge and activities learned. Ability to apply the problem-solving methods and procedures learned. Ability to develop and defend their own solution plans in discussions (argumentative debating skills) in relation to the mathematical concepts learnt. Ability to organise his/her own learning process effectively, to find and use different learning resources (print, electronic).	
	Attitude Open to learning about and embracing mathematically based, applied mathematical developments and innovations related to your qualifications and area of expertise. Interested in new methods and tools related to the field.	
	Autonomy and responsibility Taking responsibility for your own work and the work of others.	
Short description of the subject content	The material for the intermediate mathematics exam. Operations with complex numbers. Set theory, the concept of a function. Number sequences, powers, roots, order of operations. Logarithm, solutions of linear and quadratic equations. Solving problems in text. Exercise problems from the numeracy exercise in Engineering Mathematics 1.	
Types of student activities	Task solving with guidance 60 %, Independent processing of tasks 40 %	
Required literature and contact details	• Lay, D. C.: Linear Algebra and its applications, 4th edition, Addison-Wesley, 2012. • Stewart, J.: Complex Numbers, Additional Topic to Essential Calculus, 2nd edition, 2013, pp. 1-11. • Smith, R. T., Minton, R. B.: Calculus: Early transcendental functions, 4th edition, McGraw Hill, New York, 2012.	
Recommended literature and contact details	• Electronic content and learning material in Moodle and/or in Neptun systems.	
Description of tasks to be submitted/measurement reports		
Description and timetable of the workshops	During the semester, full-time and correspondence students write 1 final examination in week 13. The final examination is assessed according to the Examination and Study Regulations	

Engineering Mathematics 1.

<table>
<tr><td rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="6">Mérnöki matematika 1.</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="6">Engineering Mathematics 1.</td><td>Code</td><td>DUEN(L)-IMA-152</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Information Technology, Department of Mathematics and Computer Science</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td></td><td>per week</td><td>3</td><td>per week</td><td></td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>0</td><td>per term</td><td>15</td><td>per term</td><td>0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Antal Joós, PhD</td><td>schedule</td><td>Associate Professor</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
To acquire the mathematical foundations necessary to master the subjects, and to broaden mathematical knowledge for the study of the literature.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6"></td></tr>
<tr><td>Practice</td><td colspan="6">Small tables, computational exercises.</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.</td></tr>
<tr><td colspan="7">Ability
Ability to plan, organise and carry out independent learning.</td></tr>
<tr><td colspan="7">Attitude
Open to learning about and embracing mathematically based, applied mathematical developments and innovations related to their qualifications and areas of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Taking responsibility for your own work and the work of others</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">Operations with complex numbers. Set theory, the concept of a function. Number sequences limit, convergence criteria. Basic properties of univariate real functions, limit, continuity. Interpretation of differential coefficient of univariate real functions, relation between differentiability and continuity, derivative function, differential of differentiable function. General differentiation rules, differentiation of elementary functions. Mean value theorems of differential calculus, higher order differential coefficients, L'Hospital's rule, function disjunction. Concept of Riemann integral, conditions for integrability, properties of definite integral, mean value theorem of integral calculus, Newton-Leibniz formula. The primitive function, the indefinite integral and some of its properties, basic integrals. Integration methods. Impropriu integral. Basic properties of multivariate real functions, differential calculus, calculation of extremal values.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Processing theoretical material with guidance 10%
Independent processing of theoretical material 30%
Task solving with guidance 30 %
Independent processing of tasks 30 %</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• · Kovács J. - Takács G. - Takács M.: Analysis. 16th edition. Takis, Analysis, 16th Edition, Budapest, National Textbook Publisher, 2004.</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• · P. Horváth: Multiple choice exercises for mathematics exercises. 2nd revised edition. Dunaújváros, Publishing Office of Dunaújváros College, 2008.</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Informatics

<table>
<tr><td rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="3">Informatika</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="3">Informatics</td><td>Code</td><td>DUEN(L)-ISF-010</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="5">Institute of Informatics, Department of Software Development and Applications</td></tr>
<tr><td colspan="3">Name of compulsory prior learning DUEN(L)-</td><td colspan="5"></td></tr>
<tr><td>Type</td><td colspan="2">Presentation</td><td>Practice</td><td>Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time 150/39</td><td>per week</td><td>0</td><td>per week 0</td><td>per week 3</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time 150/15</td><td>per term</td><td>0</td><td>per term 0</td><td>per term 15</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td>Name</td><td colspan="2">Nagy Bálint, PhD</td><td>schedule</td><td>Associate professor</td></tr>
</table>

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The students should be able to manage graphical operating system surely. The students should be able to browse the Internet and send emails. The students should be able to prepare documents with a word processing program and create spreadsheet by using spreadsheet program. The students should be able to prepare and manage simple databases. They should be able to prepare simple presentations as well.	
Typical delivery methods	Presentation	
	Practice	
	Laboratory	In classrooms with the use of projector and computer, students solve individual tasks on the computers, using programs, with teacher assistance. Computer based exercises, individual tasks.
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Students familiar with the general and specific mathematics, informatics principles, rules, relationships and procedures of the user programs in the field of information technology. They have adequate expertise in the IT field specialist knowledge of specific tools for selecting tools and to carry out its tasks.	
	Ability Students are able to perform partial activities independently during solving more complex system problems. They apply their studied problem solving methods and procedures efficiently in expertly tasks	
	Attitude Students are interested in new methods and tools related to IT section. Students consider their own professional competences and activities on reflective way. Open to understand and accommodate professional, technological development and innovation area.	
	Autonomy and responsibility Students strive for efficient and quality work. The responsible for the technical operations carried out independently.	
Short description of the subject content	Confident use of operating system: managing files and folders. Goal-oriented use of the Internet, knowledge of NETiquette. Targeted search on the Internet. Use of email programs. Word processing with MS Word word processor program: Basic text editing operations, creating tables, applying styles, creating a table of contents and other lists, and creating mail merges. Spreadsheet management with MS Excel spreadsheet program: Creating, uploading and formatting tables, using cell references, formulas, functions, charts as data visualization, applying simple database operations, managing and visualizing data. Making a presentation with MS PowerPoint or Prezi: basic slide editing and formatting operations, using the slide master, slide templates, applying styles, slideshow settings and presentation techniques. Independent, creative use of any kind of innovative IT tools and applications	
Types of student activities	Heard information processing by creating notes, systematization of information has led by tasks (40%) Self-processing (individual) tasks (60%)	
Required literature and contact details	• [1] WORD 2010 All-In-One for Dummies by Doug Lowe with Ryan Williams, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet) • [2] EXCEL 2010 All-In-One for Dummies by Greg Harvey, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet) • [3] ACCESS 2010 All-In-One for Dummies by Margaret Levine Young, Alison Barrows, and Joseph C. Stockman, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet) • [4] POWER POINT 2010 All-In-One for Dummies by Doug Lowe, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet) • [5] The Internet for Dummies 12th edition by John R. Levine – Margaret Levine Young, Wiley Publishing Inc, Indiana (free pdf on Internet)	

	• [6] OFFICE 2010 All-in-one for Dummies by Peter Weverka, Wiley Publishing, Inc. Indiana (free pdf on Internet)
Recommended literature and contact details	• Electronic literature in Moodle or in Neptun. Microsoft Office Tutorial and examples (Internet).
Description of tasks to be submitted/measurement reports	The student has the opportunity to solve a Word and Excel tasks on a topic of his or her own choice that match and are consistent with the learning materials of the semester. The extra point will be included in the final grade. It is necessary to discuss
Description and timetable of the workshops	At the end of each topic, students write closed papers, typically: - Week 5: Word processing computer-based test - Week 11: Spreadsheet management computer-based test In case of any computer-based tests, the opportunity for replacement and correction is

Engineering representation

Name of the subject	in Hungarian	Műszaki ábrázolás	Level	BSc
	in English	Engineering representation	Code	DUEN(L)-MGT-111

Responsible educational unit	Institute of Technology, Department of Mechanical Engineering and Energy
Name of compulsory prior learning DUEN(L)-	

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	2	per week		M	5	english
Part time	150/15	per term	5	per term	10	per term	0			

Teacher responsible for the subject	Name	Gábor Vizi, PhD	schedule	Associate Professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The student should be able to perform any variation of the basic constructions found in descriptive geometry. Recognise the elementary constructions needed to solve various complex problems and be able to determine their correct sequence. Be able to select the optimal solution for a given situation from a range of possible solutions. The student should be familiar with the theory and practice of technical drawing projections and sections. The student should be able to edit technical drawings of machine parts using conventional tools, to read technical drawings. The student should be able to construct dimensional drawings of machine parts.
Typical delivery methods	Presentation: All students in a large lecture, using lecture, Power Point and overhead projector Practice: Small group exercises for up to 25 people, sketching and editing Laboratory: Other:
Requirements (expressed in terms of learning outcomes)	**Knowledge** You know the terminology, key concepts and theories related to your field. You have a comprehensive knowledge of the main theories and problem-solving methods in your field. Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes. Comprehensive knowledge of the operating principles and structural units of the machines, power tools, mechanical equipment and tools used. Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used. **Ability** Performs the job according to his/her qualifications. Ability to plan, organise and carry out independent learning. Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background **Attitude** Open to learning about and embracing developments in machine design related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field. **Autonomy and responsibility** Taking responsibility for your own work and the work of others.
Short description of the subject content	Image plane, coordinate system, projection. Representation of a point, real line and point image. Law of projection and of change of view. Mutual positions of spatial elements. Projections dependent on the positions of a straight line, lines of deviation and intersection. Transversals, notable lines of a plane. True magnitude of the plane, constructions with rotation. Intersection of two planes, angles of inclination, distances. Solving problems with basic constructions. Basic standards of technical drawing design. Theoretical overview of projection systems in engineering practice. Application of views, views. Use of sections and sections. Dimensioning on engineering drawings. Grids of dimensions
Types of student activities	Theoretical processing with guidance 20 % Theoretical processing with guidance 20 % Problem solving with guidance 20 % Problem solving with guidance 40 % Laboratory measurements with guidance - Preparation of laboratory reports -
Required literature and contact details	• • Illustrative Geometry Basic Tasks (Guide and practical exercises, Tamás Zahola) • • László Tóth- Tamás Zahola: Mechanical Engineering. Zahra Zahola. Főiskolai Kiadó
Recommended literature and contact details	• • Károly Koffán: 15 lectures. 15 lectures. Főiskolai Kiadó. • • Koffán Károly: 15 exercises. College notes. College Publishing House.
Description of tasks to be submitted/measurement reports	

Description and timetable of the workshops	

Mechanics 1.

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Mechanika 1.</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="4">Mechanics 1.</td><td colspan="2">Code</td><td>DUEN(L)-MUG-152</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td>Type</td><td>Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time 150/39</td><td>per week 1</td><td>per week</td><td>2</td><td>per week</td><td>0</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time 150/15</td><td>per term 5</td><td>per term</td><td>10</td><td>per term</td><td>0</td></tr>
<tr><td colspan="2">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Béla Palotás, PhD</td><td>schedule</td><td></td></tr>
<tr><td colspan="2">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Students will learn the mechanical principles of designing simple engineering structures by applying the concepts and contexts presented in the lectures to exercises and home preparation. You will learn the concepts and practical relationships of statics and strength of materials.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">All students in a large lecture, using lecture, Power Point and overhead projector.</td></tr>
<tr><td>Practice</td><td colspan="6">Small table for up to 25 people, calculation exercises</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.
Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.
You know the terminology, key concepts and theories related to your field.
You have a comprehensive knowledge of the main theories and problem-solving methods in your field.</td></tr>
<tr><td colspan="7">Ability
Ability to plan, organise and carry out independent learning.
Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.
Ability to build basic models of technical systems and processes.</td></tr>
<tr><td colspan="7">Attitude
Open to learn about and embrace developments in mechanics related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Taking responsibility for your own work and the work of others.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="7">Statics of a material point: concept of vector, operations that can be performed on vectors. Force, force system, equilibrium. Statics of rigid bodies: concept of rigid body. Concept of momentum. Equivalence of force systems, reduction. Concept of force. Equilibrium of rigid body. Ideal constraints. Determination of force systems for spatial and planar force systems. Statics of supports: support elements, supports and constraints, concepts and principles of determination of internal forces and stresses, relationships between stresses. Fundamentals of strength of materials: basic concepts, subdivision, methods of strength of materials, purpose of strength tests, requirements for structural elements, the tensile diagram and mechanical properties that can be derived from it. Determination of mechanical stresses under simple loading conditions. Concept and definition of stress state. Evaluation of stress state, principal stresses, principal stress directions. Elements of strain state: specific strains and angular distortions. Evaluation of strain state. Relationship between strain and stress state elements. Equivalent stress concept, theories.</td></tr>
<tr><td colspan="2">Types of student activities</td><td colspan="7">Theoretical processing with guidance/independent: 15/35 %
Task completion with guidance/independent: 15/35 %</td></tr>
<tr><td colspan="2">Required literature and contact details</td><td colspan="7">• Dr. Sándor Vigh: Mechanics. College notes
• Engineering Mechanics I. Elementary Statics, Workbook, Departmental Working Group, Dunaújváros, ME DFK Publishing Office, 1994.
• Engineering Mechanics II/1. Elementary Strength, Workbook, Dunaújváros, DF Kiadó, 2000.
• Dr Vigh S. . Engineering Mechanics IV. Cross-sectional Characteristics. college note, Dunaújváros, DF Kiadó, Dunaújváros, 1998.Engineering Mechanics I. Exemplar: part 1, Dunaújváros, DF Kiadói Hivatal, 2000.
• Technical Mechanics II. Manual: II/A, , Dunaújváros , DF Publishing Office, 2000.</td></tr>
<tr><td colspan="2">Recommended literature and contact details</td><td colspan="7"></td></tr>
</table>

Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

CAD

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">CAD</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">CAD</td><td>Code</td><td>DUEN(L)-MUG-212</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td></td><td>per week</td><td></td><td>per week</td><td>3</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>0</td><td>per term</td><td>0</td><td>per term</td><td>15</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Gábor Vizi, PhD</td><td>schedule</td><td>Associate Professor</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The student should be familiar with the practice of computer geometric modelling. Be able to build parametric geometric models of parts that "survive" design changes and incorporate design intent. Be able to select the optimum modeling sequence and method for the task at hand from a variety of possible modeling sequences and methods. Be able to build an assembly from the parts created. Be able to produce technical drawings of components and assemblies that best meet the requirements of the applicable drawing standards.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6"></td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">Computer laboratory exercise</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Apply the related computational and modelling principles and methods of engineering product, process and technology design.</td></tr>
<tr><td colspan="7">Ability
Ability to plan, organise and carry out independent learning.
Ability to build basic models of technical systems and processes.</td></tr>
<tr><td colspan="7">Attitude
Open to learning about and embracing developments in CAD related to your qualifications and area of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Taking responsibility for your own work and the work of others.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">The student will learn the practice of computer geometric modelling through computer laboratory sessions using a modern parametric modelling system (SolidWorks). You will learn the use of commands to create machine parts. You will learn how to build assemblies. You will be able to create technical drawing documentation that best complies with current standards in your engineering work, based on the component and assembly models you have already built.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Processing theoretical material with guidance 20 %
Independent processing of theoretical material 20 %
Task solving with guidance 20 %
Independent processing of tasks 40 %
Laboratory measurements under supervision
Preparation of laboratory reports</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• • SolidWorks Online Help</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• • Specifications and documentation for the SolidWorks software system</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Engineering Physics

Name of the subject	in Hungarian	Mérnöki fizika	Level	BSc
	in English	Engineering Physics	Code	DUEN(L)-MUT-151
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Name of compulsory prior learning DUEN(L)-				

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	1	per week	1	E	5	english
Part time	150/15	per term	5	per term	5	per term	5			
Teacher responsible for the subject				Name		Miklós Horváth, PhD			schedule	College professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The aim of the course is to learn the mechanics of the material point, electrodynamics, the statics and dynamics of liquids and gases, thermodynamics, as well as the basics of optics, quantum mechanics and semiconductors and modern physics, the following subjects preparation for the subsequent modules.

Typical delivery methods		
	Presentation	Projector, ppt presentation
	Practice	Projector, ppt presentation
	Laboratory	Laboratory presentations and experiments
	Other	

Requirements (expressed in terms of learning outcomes)	**Knowledge** The student knows the most important theorems of the mechanics of the point of matter, including kinematics, dynamics, momentum, work, energy output, vibrations, damped vibrations and can solve problems related to these theorems at a proficiency level. You know the properties of ideal fluids and the most important laws of fluid statics and their application. He/she knows the laws of state changes of gases, the laws of thermal expansion and phase transitions, the first and second laws of thermodynamics. He/she knows the basics of electrostatics, DC networks, magnetism and induction, and AC networks, and can solve simple problems with these. You will know the most important concepts of geometry and physical optics, their applications and the basics of atomic physics and quantum mechanics.
	Ability The ability to recognise and understand physical phenomena in the areas listed in the theme, to draw conclusions and to understand and solve problems in technical practice
	Attitude Collaborate with classmates and the teacher to develop knowledge. Open to learning and applying modern investigative techniques. Strives for accuracy in both numerical and laboratory exercises.
	Autonomy and responsibility Solve tasks independently using the resources and materials provided. Independently set up and carry out measurements in laboratory exercises, can recognise measurement errors and estimate their consequences. Can independently process measurement results and calculate errors.
Short description of the subject content	Mechanics of material point, kinematics, dynamics. Uniformly accelerating motion, uniform and accelerating circular motion, momentum, work, energy, power, and related laws. Statics of ideal fluids, Pascal's law, Archimedes' law, buoyancy. Ideal gases, gas laws, 1st and 2nd laws of thermodynamics, entropy, thermal expansion, phase transitions. Electrostatics, DC networks, magnetism and electromagnetic induction. Calculation of alternating current networks. Geometric and physical optics, photometry. Fundamentals of atomic physics and quantum mechanics.
Types of student activities	Attending lectures, solving problems in numerical exercises, active participation in laboratory exercises, taking notes.
Required literature and contact details	• Endre Kiss: Text-based learning material based on the engineering physics textbook in Moodle • Physics working group; edited by Dr. Miklós Horváth: Exercises based on the physics textbook in the Moodle system • Kelemen A. :Measurement descriptions based on Physics Laboratory Exercises I in Moodle • Hartai J. Kiss E. Spissák L.: Measurement descriptions based on Physics Laboratory Exercises II in Moodle
Recommended literature and contact details	• Ágoston Budó: Experimental Physics 1., 2., 3. (National Book Publishing House, Budapest, 1997) • R. Feynmann: Modern Physics (Műszaki Könyvkiadó, Budapest, 1986)
Description of tasks to be submitted/measurement reports	Measurement reports from laboratory exercises

Description and timetable of the workshops	Examination papers in weeks 7 and 13: The papers contain 10 test questions, 2 theoretical questions to be explained and 2 problems to be solved, for which a total of 100 points can be awarded.

Engineering Mathematics 2.

<table>
<tr><td rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="4">Mérnöki matematika 2.</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="4">Engineering Mathematics 2.</td><td>Code</td><td>DUEN(L)-IMA-212</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="6">Institute of Information Technology, Department of Mathematics and Computer Science</td></tr>
<tr><td colspan="3">Name of compulsory prior learning DUEN(L)-</td><td colspan="6">IMA-152</td></tr>
<tr><td>Type</td><td colspan="2">Presentation</td><td>Practice</td><td>Laboratory</td><td colspan="2">Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time 150/39</td><td colspan="2">per week 0</td><td>per week 0</td><td>per week 3</td><td colspan="2" rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time 150/15</td><td colspan="2">per term 0</td><td>per term 0</td><td>per term 15</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td>Name</td><td colspan="3">László Bognár, PhD</td><td>schedule</td><td>College professor</td></tr>
<tr><td colspan="3">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="6">Goals, development objectives
The purpose of the course is to make the students familiar with analysing data using statistical methods and tools. Having covered this course students understand the objective of probability and statistics, they know the different ways of gathering data, analysing datasets with statistical software and they can make inferences for real world situations based on samples of data.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">These formal lectures mostly aim at transferring information. Students are expected to take personal notes in addition to the course text, slides or transparencies.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Laboratory</td><td colspan="5">Students are expected to be actively involved. Whether it is about exercises, feedback on an assignment or practicing statistical data analysis with software package personal input will always be expected.</td></tr>
<tr><td>Other</td><td colspan="5"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge
Students will have a solid foundation of analysing processes or phenomena described by quantitative data.
Students will demonstrate their ability to apply statistics in other fields at an appropriate level and demonstrate their ability to apply knowledge acquired from their major to real world models.
Students will demonstrate mastery of data analysis and statistical concepts by communicating critically reasoned analysis through written and oral presentations.
Students will acquire up-to-date skills and/or applications of computer use related to future career choices.</td></tr>
<tr><td colspan="6">Ability
Students will be able to read, interpret, and critically analyse journal articles in the related field.</td></tr>
<tr><td colspan="6">Attitude
Collaborate with classmates and the teacher to develop knowledge.
Open to learning and applying modern investigative techniques.
Strives for accuracy in both numerical and laboratory exercises.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
Taking responsibility for your own work and the work of others</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">During the course students will be engaged in the following topics: introduction, descriptive statistics, probability, random variable, method of estimation, test of hypotheses, simple linear regression</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="6">Frontal work 30%
Individual or group work 50%
Testing 20%</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="6">• • James T. McClave, P. George Benson, Terry Sincich : Statistics for Business and Economics. Ed 12th. Pearson Education, Inc. 2014.
• • Douglas C. Montgomery George C. Runger : Applied Statistics and
• Probability for Engineers. Ed 5th. John Wiley & Sons Inc. 2011.
• • Moodle textbook</td></tr>
<tr><td colspan="3">Recommended literature and contact details</td><td colspan="6">• • http://onlinestatbook.com/2/index.html
• • James T. McClave, P. George Benson, Statistics for business and economics, Twelfth edition, Info Tech, Inc., University of Florida.</td></tr>
<tr><td colspan="3">Description of tasks to be submitted/measurement reports</td><td colspan="6"></td></tr>
<tr><td colspan="3">Description and timetable of the workshops</td><td colspan="6"></td></tr>
</table>

Industrial materials

Name of the subject	in Hungarian	Műszaki anyagismeret	Level	BSc
	in English	Industrial materials	Code	DUEN(L)-MST-210
Responsible educational unit		Institute of Technology, Department of Structural Integrity		
Name of compulsory prior learning DUEN(L)-				

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	0	per week	2	M	5	english
Part time	150/15	per term	5	per term	0	per term	10			

Teacher responsible for the subject	Name	Zsolt Csepeli, PhD	schedule	College professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The aim of the course is to provide students with a basic knowledge of chemistry, through which they will become familiar with the structure of materials, the electron shell structure that determines material properties, the types of chemical bonds that determine macroscopic properties, and the microscopic structure and methods of analysis of different types of materials (metals, ceramics, polymers). Students will learn about the relationships between the structure and properties of materials, enabling them to select the most suitable materials for a given application in simple cases.	
Typical delivery methods	Presentation	Projector, ppt lectures, learning materials available in moodle.
	Practice	
	Laboratory	Laboratory measurements and calculations
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering. Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the field of engineering. Thorough knowledge of the materials used in the field of engineering, the methods of their manufacture and the conditions of their use.	
	Ability Ability to plan, organise and carry out independent learning.	
	Attitude Open to learning and absorbing knowledge related to chemistry and materials related to their qualifications and areas of expertise. Interested in new methods and tools related to the field.	
	Autonomy and responsibility It takes its decisions independently, in consultation with other disciplines, and takes responsibility for them.	
Short description of the subject content	Atomic structure. The structure of the periodic table. Electron configuration. Types and characteristics of chemical bonding. Electron affinity, electronegativity, oxidation number. Strong bonds. Weak bonds. General characterisation of metals, reactivity. Basic knowledge of organic chemistry. Grouping of carbon compounds, nomenclature. Isomerism. Main reactions of organic substances. Interconnection of macromolecules as a basis for polymer production. Basic knowledge of silicate chemistry. Basic knowledge of colloid chemistry. State change in solid phase processes. Polymorphic transformation. Types of engineering materials. Structure - processing - properties interaction. Crystal structure, crystal systems. Crystal, crystallite. Crystal lattice defects. Movement of atoms in matter, diffusion. Phases and constituents of metallic materials. Significance, definition of equilibrium phase diagrams. Rules for reading two and three component equilibrium phase diagrams. Basic types of two-element equilibrium phase diagrams.	
Types of student activities	Processing of heard text with annotation 50%. Conducting material tests 30%. Evaluation of measurements, preparation of report 20%..	
Required literature and contact details	• Balázs Verő, Éva Dénes, Zsolt Csepeli:Introduction to the Engineering Materials Science, Főiskolai Kiadó, Dunaújváros • Éva Dénes, Péter Farkas, Zsoltné Fülöp, Zoltán Szabó.	
Recommended literature and contact details	• Dr. Tamás Tóth: Mechanical properties of materials and methods of their investigation. Főiskolai Kiadó, Dunaújváros, Hungary	
Description of tasks to be submitted/measurement reports	The student shall draw up a measurement report on the measurements carried out.	
Description and timetable of the workshops	A final paper in weeks 6 and 12 from the lectures and laboratory classes.	

Thermodinamics

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Termodinamika</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Thermodinamics</td><td>Code</td><td>DUEN(L)-MST-250</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning
DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td></td><td>per week</td><td>2</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>0</td><td>per term</td><td>10</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Imre Kovács, PhD</td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The Thermodynamics curriculum covers the specific set of natural laws that provide materials engineers with the essential knowledge and foundation for a professional curriculum. After completing this module, students should be able to analyse processes in thermodynamics and perform energy calculations.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">A presentation for all students. Use of projector, overhead projector.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">Minden hallgatónak laboratóriumi gyakorlat.</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You will have theoretical and practical knowledge of the subject.</td></tr>
<tr><td colspan="7">Ability
Ability to carry out tasks related to the subject of the course.</td></tr>
<tr><td colspan="7">Attitude
Develops the necessary attitude to solve technical problems.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Taking responsibility for its work</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">The thermodynamic system. Main principles and basic concepts of thermodynamics. Thermodynamic functions and their applications. Enthalpy, entropy, free enthalpy. Phase equilibria. Phase transitions: evaporation, boiling, freezing in a single component system. Multicomponent systems: mixtures, blends, solutions, compounds. Gas behaviour and basic concepts of kinetic gas theory. Thermodynamic investigation of the end-to-end potential of chemical reactions using free enthalpy and normal free enthalpy. Thermodynamic study of combustion, roasting, reduction and oxidation processes.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Task solving with guidance 20 %</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• 1. P.W. Atkins : Physical Chemistry I., III. Nemzeti Tankönyvkiadó, Budapest, 2002. 2. Szegedi J.: Metallurgy of metallurgical processes.</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• György Diószegi: Mechanical Engineering Handbook. Technical Book Publishing House, Budapest, 1988.</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7">The formal requirements of the assignment must be completed in the form given by the teacher.The calculations must be presented in several steps, the results must be presented in a frame, with the unit of measurement clearly indicated. The formal requirem</td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7">Students are required to write 2 Final Exam papers during the semester. In the final examination, the student will answer questions and solve computational problems in an expository or test form.</td></tr>
</table>

Basics of machine design

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Géptervezés alapjai</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Basics of machine design</td><td>Code</td><td>DUEN(L)-MUG-222</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7">MUG-212
MUG-152
MGT-111</td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>2</td><td>per week</td><td>1</td><td>per week</td><td></td><td rowspan="2">M</td><td rowspan="2"></td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>5</td><td>per term</td><td>0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Szabó Attila, PhD</td><td>schedule</td><td>College associate professor</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The student should know the construction and operation of typical machine parts, components, assemblies and sub-assemblies used in engineering practice. Be able to select standard parts for such units, determine the main dimensions, and design the associated components. Be able to prepare drawing documentation of units using traditional and computer tools. The student will be able to apply the knowledge acquired in Mechanical Engineering I, CAD and Mechanics I to the construction of simple structures and assemblies.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">All students in a large lecture, using lecture, Power Point and overhead projector</td></tr>
<tr><td>Practice</td><td colspan="6">Small group of up to 25 people, sketching, drafting, calculation exercises</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.
You know the terminology, key concepts and theories related to your field.
You have a comprehensive knowledge of the main theories and problem-solving methods in your field.
Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes.
Comprehensive knowledge of the operating principles and structural units of the machines, power tools, mechanical equipment and tools used.
In-depth knowledge of learning, knowledge acquisition, data collection methods, their ethical limitations and problem-solving techniques in mechanical engineering.
Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used.
Apply the related computational and modelling principles and methods of engineering product, process and technology design.</td></tr>
<tr><td colspan="7">Ability
Performs the job according to his/her qualifications.
Ability to plan, organise and carry out independent learning.
Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.
Ability to build basic models of technical systems and processes.
Routinely identifies professional problems, explores and formulates the theoretical and practical background necessary to solve them, and solves them by applying standard operations in practice.</td></tr>
<tr><td colspan="7">Attitude
Open to learning and absorbing knowledge related to mechanical engineering related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Taking responsibility for your own work and the work of others</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">Repetitive parts or units of machinery performing the same function and having a similar design - machine components. Definition, grouping, description, description, representation, strength dimensioning, correct construction, operation and maintenance of machinery parts. The main machine components or groups to be discussed in detail are: drive and connecting screws, shafts, shaft couplings, couplings, bearings, belt drives, gears. In the discussion of the subjects, the emphasis is on the illustration and overview of the parts/assemblies.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Processing theoretical material with guidance 20 %</td></tr>
</table>

	Independent processing of theoretical material 20 % Task solving with guidance 20 % Independent processing of tasks 40 % Laboratory measurements under supervision Preparation of laboratory reports.
Required literature and contact details	• • László Tóth- Tamás Zahola: Mechanical Engineering. Zahra Zahola. Főiskolai Kiadó • • Dr. Péter Szendrő and co-authors, Mechanical Engineering BSc. textbook, 2007. Mezőgazda Kiadó, Budapest, 758 p.
Recommended literature and contact details	• • Dr. József Őze: Mechanical Elements I/2. I/3. I/4. I/5. I/6. I/7. I/8. manuscripts.1. • • Árpád Zsáry:Machine Elements II., Budapest, 1991. • • György Diószegi: Mechanical Engineering Handbook. Technical Book Publishing House, Budapest, 1988. • • István Majdán: Technical Pocketbook. Technical Book Publishing House, Budapest, 1995. • • Géza Nagy: Atlas of Mechanical Engineering. GTE ME Machine Elements Department, Budapest, 1991 • • 4000 SKF Bearing Master Catalogue
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Mechanics 2.

Name of the subject	in Hungarian	Mechanika 2.	Level	BSc
	in English	Mechanics 2.	Code	DUEN(L)-MUG-257
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Name of compulsory prior learning DUEN(L)-		MUG-152		

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	2	per week	0	E	5	english
Part time	150/15	per term	5	per term	10	per term	0			
Teacher responsible for the subject				Name		Béla Palotás, PhD			schedule	Professor emeritus

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The student will learn the mechanical principles of complex structure design by applying the concepts and contexts presented in the lectures to exercises and home preparation. You will learn about the statics of structures, limit states of use, the basics of the finite element method.

Typical delivery methods	Presentation	All students in a large lecture, using Power Point and overhead projector.
	Practice	Small table for up to 25 people, calculation exercises
	Laboratory	12-person laboratory exercise in solid mechanics and finite elements
	Other	

Requirements (expressed in terms of learning outcomes)	**Knowledge** Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering. Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field. You know the terminology, key concepts and theories related to your field. You have a comprehensive knowledge of the main theories and problem-solving methods in your field.
	Ability Ability to plan, organise and carry out independent learning. Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background. Ability to build basic models of technical systems and processes.
	Attitude Open to learn about and embrace developments in mechanics related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field
	Autonomy and responsibility Taking responsibility for your own work and the work of others.
Short description of the subject content	Statics of structures: classification of supporting structures. Articulated multi-girder, triple-jointed frame, truss and additional support structures - strength analysis, determination of support forces and loads. Rope structures. Friction, slip connections and their application in engineering. Applied strength of materials: working principles of strength of materials. Their application to the determination of displacements of rod structures. Approximate methods for determining displacements. Basic concepts of the finite element method. Solution of statically indeterminate structures by force method. Stability problems of flexible bodies: in-plane and spatial rod deflection, buckling. Flexible-ductile deformations, dimensioning of rod structures using ductile principles. Fatigue phenomenon, control. Phenomenon of ridge fracture, checking.
Types of student activities	Theoretical material processing with guidance/independently: 20/30% Task completion with guidance/independent: 10/20 % Laboratory work under supervision: 20 %
Required literature and contact details	• • Szőnyiné Passa Erzsébet - Dr. Koppány Imre: Mechanics - Supporting Structures I/A, Budapest, Nemzeti Tankönyvkiadó 1998. • • Dr. Vigh S. ed.: Technical mechanics II/B college notes, Dunaújváros, DF Kiadó, Dunaújváros, 2003.
Recommended literature and contact details	• • Departmental Working Group: Engineering Mechanics I. Elementary Statics, Workbook, Dunaújváros, ME DFK Publishing Office, 1994. • • Departmental Working Group: Engineering Mechanics II/2. Applied Strength, Workbook. DF Publishing House, Dunaújváros, 2002. • • Dr. Sándor Vigh - Béláné Szlávik - Dr. Gyula Izsák: Technical Mechanics I. Manual Part 2, Dunaújváros, DF Publishing Office, 2000. • • Dr. Vigh S.ed.: Engineering Mechanics II. Tutorial II/B, college notes. DF Kiadó, Dunaújváros, 1998.
Description of tasks to be submitted/measurement reports	

Description and timetable of the workshops	

Heat and Fluid Dynamics

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Hő- és áramlástan</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Heat and Fluid Dynamics</td><td>Code</td><td>DUEN(L)-MUT-250</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7">MUT-151</td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td>1</td><td>per week</td><td>1</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>5</td><td>per term</td><td>5</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Endre Kiss, PhD</td><td>schedule</td><td>College professor</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The study of the practical problems solutions in heat and fluid dynamics.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">For all students, using a large speaker, a board presentation, a projector or an overhead projector</td></tr>
<tr><td>Practice</td><td colspan="6">For every students, problem solving in small groups</td></tr>
<tr><td>Laboratory</td><td colspan="6">Measurements in pairs</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You are fully aware of the basic facts, directions and boundaries of the field of technical expertise. You are familiar with the general and specific rules, contexts and procedures necessary for the cultivation of the technical field. He knows the concept of his field, the most important contexts and theories. He is fully familiar with the main theories of his field of knowledge and problem solving Methods. At the employing level, he is familiar with the measurement procedures used in mechanical engineering, their tools, instruments and measuring equipment. It can interpret, characterize and model the structure, operation, design and relationship of the structural units and components of mechanical systems.</td></tr>
<tr><td colspan="7">Ability
It is capable of basic analysis of the disciplines that make up the technical field of knowledge, the synthetic formulation of correlations and the activity of evaluating the quality.
It is able to apply the most important terminology, theories and procedures of the technical field in which they are performed.
It is capable of planning, organising and performing independent learning.
It is able to identify routine professional problems, to solve them in principle and
to explore, formulate and provide practical background (standard operations
(e.g., the application of this problem).
It is able to understand and use the typical expertise, computer science and library resources of its field. The knowledge acquired is capable of carrying out tasks in its field
solution of the application.
It is capable of creating basic models of technical systems and processes.
It is able to communicate in your mother tongue in a professional, professional lyande manner, orally and in writing.</td></tr>
<tr><td colspan="7">Attitude
He accepts and authentically represents the social role of his profession, his fundamental relationship with the world.
It is open to the knowledge and acceptance and authentic transmission of professional, technological development and innovation in the field of technology.
It strives to resolve problems as much as possible in cooperation with others.
With sufficient endurance and monotony tolerance to carry out practical activities
Have.
Using his acquired technical knowledge, he strives to learn more about observable phenomena, to describe and explain his legalities.
In the course of its work, it complies with and enforces the relevant safety, health, environmental and quality assurance and control requirements.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Even in unexpected decision-making situations, it independently takes a look at the broad, underlying professional issues and developthem on the basis of specific sources.
In carrying out his professional duties, he also cooperates with qualified professionals in other fields (primarily technical, economic and legal).
Share your experiences with colleagues to help them grow.
It takes responsibility for the consequences of its technical analyses, its proposals and the decisions that are taken.With sufficient endurance and monotony tolerance to carry out practical activities
Have.</td></tr>
</table>

	Using his acquired technical knowledge, he strives to learn more about observable phenomena, to describe and explain his legalities. In the course of its work, it complies with and enforces the relevant safety, health, environmental and quality assurance and control requirements.
Short description of the subject content	The basics of fluid dynamics and thermodynamics. Euler and Bernoully equations, Haagen-Poiseuille equations, viscosity, laminar and turbulent flow, pressure drag in turbulent flow. Pressure drop in fittings. Impulse theorem. Similarity. Solid body in viscous substance. Intensive and extensive quantities. Uneversal and unified gas law. The mechanical work and the heat, and the firstlaw of thermodynamics. Isochoric, isobaric, isotherm and adiabatic processes. The politropic process. Cycles. Otto and Diesel cycles. Enthalpy, entropy, the second law of thermodynamics. Real gases. Thermal energy transport, conductance. convection and radiation. Heat pump and refrigerator.
Types of student activities	Lecture: Written text processing with note-taking 40%, theoretical material self-processing 20%, task solution 40%. Labor: Heard text processing with note-taking 10%, home preparation for measurement 20%, measurement 40%, minutes preparation 30%.
Required literature and contact details	• Kiss E. Heat and Fluid Dynamics Electronic notes (Moodle) • Kiss E. Heat and Fluid Dynamics Problem solving Electronic notes (Moodle) • Kiss E. Laboratory syllabuses Electronic notes (Moodle)
Recommended literature and contact details	•
Description of tasks to be submitted/measurement reports	Full time: 5 measurement reports Part time: 3 measurement reports
Description and timetable of the workshops	There are two tests during the semester. the first is in the 6th, and the second in the 13th week. The test is consisting of 10 freechoise questions (max. 30 points), two assay questions (max 20 points), and two problems tos olve for 50 points. If the res

Mathematics 3.

Name of the subject	in Hungarian	Matematika 3.	Level	BSc
	in English	Mathematics 3.	Code	DUEN(L)-IMA-110
Responsible educational unit		Institute of Information Technology, Department of Mathematics and Computer Science		
Name of compulsory prior learning DUEN(L)-		IMA-152		

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	0	per week	3	per week	0	M	5	english
Part time	150/15	per term	0	per term	15	per term	0			
Teacher responsible for the subject				Name		Nagy Bálint, PhD			schedule	Associate professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Azoknak a matematikai, függvénytani alapoknak a megszerzése, melyek a szaktárgyak elsajátításához nélkülözhetetlenek, valamint matematikai ismeretek bővítése a szakirodalom tanulmányozásához. Ismeri és érti a szakterület műveléséhez szükséges legfontosabb matematikai összefüggéseket és az ezeket felépítő fogalomrendszert. Rendelkezik az alkalmazott matematikai fogalmak elsajátítását segítő valamely számítógép-algebrai rendszer ismeretével a feladatok elvégzéséhez.	
Typical delivery methods	Presentation	
	Practice	Fogalmak, módszerek ismertetése nagy előadóban, táblás előadás.
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knows the methods and procedures required to solve mathematical tasks appropriate to the IT field. He has the knowledge and knowledge of the mathematical and functional education required for his field of expertise.	
	Ability Able to apply the learned mathematical knowledge and activity system. Uses learned problem-solving methods and procedures. Able to prepare own solution plan and to defend it in debates (argumentative debate skills) in relation to learned mathematical concepts. Able to effectively organize your own learning process, find and use a wide variety of learning resources (printed, electronic)	
	Attitude They are open to learning about and accepting mathematical development and innovation related to their qualification and field of expertise. Interested in new methods and tools related to the field.	
	Autonomy and responsibility They take responsibility for their own results, as well as those of their colleagues (working in the same project).	
Short description of the subject content	Special differentiation rules. Geometric application of derivatives. Area. Volumes and surfaces of revolution. Length of a curve. Centre of gravity. Multiple integration. Numerical integration. Solving nonlinear equations. Separable differential equations. Variable transformation: ax+by+c. Variable transformation: y/x. First order linear differential equations. Second order linear differential equations. Missing variable in second order differential equations.	
Types of student activities	Processing theoretical material with guidance. Independent processing of theoretical material. Task solution with control. Independent processing of tasks. Text interpretation. Processing of information individually and in groups. Conflicting opinions. Le	
Required literature and contact details	• Talata, I.: A Guide to Mathematical Analysis, Dunaújváros, 2007, pp. 1- 79. Electronic Study Guide	
Recommended literature and contact details	• Finney, R. L.; Thomas, G. B.: Calculus, Addison-Wesley, New York, 1990.	
Description of tasks to be submitted/measurement reports		
Description and timetable of the workshops	During the semester, there are two compulsory tests: one (maximum 50 points) on the 6th week in the practice session, the second (maximum 50 points) on the 12th week in the practice session. The tests consist of questions on theoretic and applied problems	

Materials Science

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Műszaki anyagtudomány</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Materials Science</td><td>Code</td><td>DUEN(L)-MGT-116</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td>0</td><td>per week</td><td>2</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>0</td><td>per term</td><td>10</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Zsolt Csepeli, PhD</td><td>schedule</td><td>College professor</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The aim of the course Technical Materials Science I is to familiarise students with the laws and principles governing the structure of solid materials used in technical practice. The aim is to enable students to apply the knowledge acquired about the structure and properties of materials in their future studies and work.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">Projector, ppt lectures, learning materials available in moodle.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">Laboratory measurements and calculations</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Ismeri az anyagi rendszerekben zajló alapvető fizikai-kémiai folyamatokat, azok (alapszintű) matematikai leírását, különös tekintettel a termodinamika és kinetika törvényszerűségeire. Széles körűen ismeri a szilárd anyagok atomi, mikro- és makroszerkezetét, a szerkezet vizsgálatához szükséges alapvető módszereket és az alapvető eszközök működési elvét, illetve a szerkezetek kialakulását előidéző folyamatokat.</td></tr>
<tr><td colspan="7">Ability
The ability to apply the knowledge acquired about the structure of materials and their structural features. Understands and applies the environmental, health and safety and accident prevention requirements specific to his/her field of specialisation, and is able to adapt processes to meet requirements. Ability to comply with the legislation and economic requirements in his/her field. Understands and uses the online and printed literature in Hungarian and foreign languages specific to his/her field of specialisation.</td></tr>
<tr><td colspan="7">Attitude
Strive to keep their self-education in materials engineering continuous and in line with their professional goals. He/she will endeavour to carry out his/her tasks and management decisions by seeking the opinion of his/her supervisors, preferably in cooperation. Have the stamina and tolerance of monotony required to carry out practical activities.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Directs the work of the personnel assigned to him/her, supervises the operation of machinery and equipment. Carries out safety and health duties. Assesses the efficiency, effectiveness and safety of the work of subordinates. He/she is responsible for promoting the professional development of his/her subordinates and for managing and assisting them in their efforts in this direction. Assists junior staff in their professional development and career progression.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">Engineering Materials Science I starts from the characteristics of the four states of matter and progresses to a discussion of homogeneous and heterogeneous polycrystalline materials. It discusses the nature of the interactions between the building blocks of solids and the structure of atoms, with particular reference to the quantum number system. It analyses the mechanism of formation of strong and weak bonds, the importance of the directional and non-directional nature of bonds and the scale of building blocks. It deals with the seven crystal systems and the 14 Bravais lattices, but also incorporates recent results beyond the classical categories. It discusses the lattice structure of pure metals, possible variations of phases in alloys, and types of ionic crystals. A significant part of the course is devoted to the thermodynamics essential for the description of equilibrium systems, the presentation of equilibrium phase diagrams of single- and multi-element systems, and the analysis of qualitative and quantitative information that can be extracted from such diagrams. As a counterpoint to the structure of the ideal crystal, ample space is devoted to the discussion of 0-, 1- and 2-dimensional lattice defects. The discussion of lattice defects is not limited to metallic materials, but also includes an analysis of lattice defects in ionic and covalently bonded crystals. The properties and structure of the grain boundaries and phase boundaries considered as lattice defects will be discussed in particular, since the structure of the array nanostructured materials, which represent one of the most important achievements of the last decade, can only be understood by understanding the structure of equilibrium and non-equilibrium grain boundaries. The</td></tr>
</table>

	course concludes with a discussion of diffusion, the transport process in solids. In the discussion of each material science phenomenon, a method based on the relevant body of knowledge or suitable for the study of the particular material science phenomenon is also described.
Types of student activities	Attending lectures and taking notes, solving computational problems in laboratory exercises and carrying out laboratory measurements.
Required literature and contact details	• Balázs Verő, Éva Dénes, Zsolt Csepeli: Introduction to engineering materials science. Dunaújváros College Publishing House, Dunaújváros, 2010. József Verő, Mihály Káldor. Metallurgy
Recommended literature and contact details	• Tamás Tóth: Materials science: the basics of engineering materials science, Dunaújváros College, Dunaújváros. DF Publishing House, Dunaunaztam University of Dunauntas, Dunauntas, Dunauntas, Dunauntas, Dunauntas, 2003. • József Verő, Mihály Káldor. • János Prohászka: Mechanical Properties of Metals and Alloys, Budapest University of Technology and Economics, Budapest University of Technology and Economics, 2003. • Mihály Káldor: Physical Metallurgy, Hungarian Iron and Steel Association, 1993.
Description of tasks to be submitted/measurement reports	The student shall draw up a measurement report on the measurements carried out.
Description and timetable of the workshops	A final paper in weeks 6 and 12 from the lectures and laboratory classes.

Reaction kinetics

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Reakciókinetika</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Reaction kinetics</td><td>Code</td><td>DUEN(L)-MGT-157</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td>1</td><td>per week</td><td>1</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>5</td><td>per term</td><td>5</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Imre Kovács, PhD</td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
After completing the module, students will know the basics of chemical equilibrium and chemical kinetics, be able to apply the basic concepts of reaction kinetics, and acquire the basic laws of homogeneous and heterogeneous reactive and non-reactive systems, and homogeneous and heterogeneous electrochemical systems.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">After learning the basic thermodynamic laws in the thermodynamics course, you will analyse the application of basic thermodynamic laws to specific/real chemical reactions.</td></tr>
<tr><td>Practice</td><td colspan="6">Blackboard presentation, use of projector.</td></tr>
<tr><td>Laboratory</td><td colspan="6">Blackboard calculation exercise</td></tr>
<tr><td>Other</td><td colspan="6">Student laboratory practice</td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You will have theoretical and practical knowledge of the subject.</td></tr>
<tr><td colspan="7">Ability
You will be able to design chemical reactions, select the apparatus, perform theoretical reaction kinetics and thermodynamic calculations.</td></tr>
<tr><td colspan="7">Attitude
Be able to identify technical problems and outline possible solutions</td></tr>
<tr><td colspan="7">Autonomy and responsibility
You will be able to assess the health and environmental hazards inherent in the occurrence and execution of chemical reactions, and to create the necessary safety preconditions.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">The direction of chemical processes and chemical equilibrium. Basics of chemical kinetics, experimental methods, empirical rate equation, mechanism of reactions. Activation, its types, catalysis, kinetics of homogeneous and heterogeneous and quasi-heterogeneous chemical reactions. Diffusion. Physical chemistry of aqueous solutions. Nernst equation. Fundamentals of electrochemistry. Corrosion. Crystallisation of metallic compounds.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Attending lectures and taking notes, solving calculation problems in exercises and completing laboratory work. Giving a short presentation on a topic related to the semester's curriculum</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• P.W. Atkins : Physical Chemistry I. Nemzeti Tankönyvkiadó, Budapest, 2002.
• P.W. Atkins : Physical Chemistry III. Nemzeti Tankönyvkiadó, Budapest, 2002.</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• Szegedi J.: Metallurgy of metallurgical processes. Dr. Endre Berecz. János Liszi: Physical Chemistry Veszprém, University Publishing House, 1993.</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7">Submission of a laboratory measurement report.</td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7">1 written final paper from the lectures given during the semester in the last class.</td></tr>
</table>

Production technologies of nuclear power plant devices

Name of the subject		in Hungarian		Atomerőműi berendezések gyártástechnológiája					Level	BSc
		in English		Production technologies of nuclear power plant devices					Code	DUEN(L)-MST-150
Responsible educational unit				Institute of Technology, Department of Structural Integrity						
Name of compulsory prior learning DUEN(L)-										
Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	0	per week	2	E	5	english
Part time	150/15	per term	5	per term	0	per term	10			
Teacher responsible for the subject				Name		Zsolt Csepeli, PhD			schedule	College professor
Training objective and justification of the course (content, output, location in the curriculum)				**Goals, development objectives** The aim of the course is to enable students to select the materials and production technologies best suited to the purpose. To this end, they will learn about the production, properties and applications of the most important metallic and non-metallic structural materials, as well as about the technologies for modifying (alloying, casting, plastic forming, heat treatment and surface treatment) and shaping (casting, plastic forming). They will learn about the fabrication technology of individual units in nuclear power plants, such as reactor vessel, steam generator, turbines, etc. Students will learn about the operation and application of the main bulk and pressure welding processes, with a focus on those used in nuclear power plants.						
Typical delivery methods				Presentation	Projector, ppt lectures, learning materials available in moodle.					
				Practice						
				Laboratory	Laboratory materials testing, heat treatment, plastic forming, plant visits.					
				Other						
Requirements (expressed in terms of learning outcomes)				**Knowledge** Detailed knowledge of the principles of operation of machinery and equipment for materials production, basic technologies for the production and shaping of metals and their alloys (plastic forming and casting). Knowledge of heat treatment and welding processes.						
				Ability Ability to select the right raw material and technology for the purpose. Ability to define the steps in the production of products.						
				Attitude Strive to keep their self-education in materials engineering continuous and in line with their professional goals. Have sufficient stamina and tolerance of monotony to carry out practical activities. A creative approach to the continuous improvement of applied technologies and processes. Strive to apply energy and material-saving processes and technologies.						
				Autonomy and responsibility It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks. Assesses and seeks to reduce the environmental impact of production. Assess and rationalise energy consumption related to the production of materials.						
Short description of the subject content				Metal production: pig iron production, steel production, continuous casting, aluminium production by electrolysis. Fe-Fe3C equilibrium phase diagram. Classification of steel and aluminium alloys, their characteristic properties. Germ formation and growth. Transformation diagrams for isothermal and continuous cooling. Formation of non-equilibrium tissue elements. Primary and secondary tissue structure. Fabric structure and mechanical properties of hot worked alloys. Forging, stamping, hot rolling, tube making processes. Metallurgical phenomena in cold forming. Fabric structure and mechanical properties of cold formed alloys. Plate forming technologies: straightening of base materials, material separation by thermal or shear stress, forming by bending, deep drawing, stretch forming. Full section heat treatments. Surface heat treatments. Operation and application of the main bulk and press welding processes. Process and machinery for reactor vessel, steam generator and turbine fabrication.						
Types of student activities				Processing of heard text by taking notes and recording the material using your own notes and those available electronically 40% Independent completion of laboratory exercises 20% Preparation of a mid-term assignment 20% Solving test problems 20%						
Required literature and contact details				• [1] Dr. József Verő - Dr. Mihály Káldor: Metallurgy. Textbook Publishing House, Budapest, 1977 [2] Dr. Éva Dénes, Dr. Péter Farkas, Zsoltné Fülöp and Dr. Zoltán Szabó. Nemzeti Tankönyvkiadó, Budapest. 2002. [4] TÁMOP e-learning courseware: moodle.duf.hu; (DUE library) [4] Dr. Elemér Köves: Aluminium Industry Handbook, Chapter 2, pp. 35-74; Chapter 4, pp. 173-196, Műszaki Könyvkiadó Budapest, 1984.						
Recommended literature and contact details				• Antal Óvári: Iron Metallurgy Handbook, Technical Book Publishing House, 1985. International Atomic Energy Agency, IAEA website www.iaea.org						

Description of tasks to be submitted/measurement reports	The student shall draw up a measurement report on the measurements carried out.
Description and timetable of the workshops	A final paper in weeks 6 and 12 from the lectures and laboratory classes.

Process Technology

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Fémtechnológia</td><td>Level</td><td colspan="2">BSc</td></tr>
<tr><td>in English</td><td colspan="4">Process Technology</td><td>Code</td><td colspan="2">DUEN(L)-MUA-150</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="3">Name of compulsory prior learning DUEN(L)-</td><td colspan="6"></td></tr>
<tr><td colspan="2">Type</td><td>Presentation</td><td colspan="2">Practice</td><td>Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week 1</td><td>per week</td><td>1</td><td>per week 1</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term 5</td><td>per term</td><td>5</td><td>per term 5</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="2">Andrea Szabó, PhD</td><td>schedule</td><td>Senior lecturer</td></tr>
<tr><td colspan="3">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="6">Goals, development objectives
The student will learn about the chemical and physical chemical processes used to produce pig iron and steel using ores and other auxiliary materials extracted from the earth. They will also learn the process of aluminium production from bauxite.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">ppt slide, porjektor használatával</td></tr>
<tr><td>Practice</td><td colspan="5">Számítási feladatok</td></tr>
<tr><td>Laboratory</td><td colspan="5">Egyetem laboratóriumaiban egyéni és csoportmunka keretében, üzemlátogatás</td></tr>
<tr><td>Other</td><td colspan="5"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge
A hallgatónak ismernie kell a vaskohászat alap- és segédanyagait, az olvasztó berendezéseket, az energiahordozókat, az olvasztás metallurgiai és üzemi sajátosságait, az oxigénes és elektroacélgyártás adagperiódusait, az üstmetallurgiai műveleteket, az acélok leöntési módjait. Az átolvasztási eljárásokat. A hallgatók elsajátítják a nyersvasgyártás és acélgyártás, továbbá a színfémek, főként az alumínium gyártásának folyamatait. Ismereteket szereznek a folyamatokhoz szükséges alapanyagok fizikai és kémiai tulajdonságairól, a folyamatok során végbemenő kémiai reakciókról és az egyes folyamatok optimalizálásáról, és gyakorlati ismereteket kapnak üzemlátogatások keretében.</td></tr>
<tr><td colspan="6">Ability
A kurzus végén a hallgatók képesek lesznek átlátni a nyersvas és acél gyártásának egyes részfolyamatait és így a teljes technológiát. Különböző acélok mikro-szerkezetét felismerik és a mikroszkópos vizsgálatokhoz szükséges mintaelőkészítést önállóan el tudják végezni.</td></tr>
<tr><td colspan="6">Attitude
Gyakorlati tevékenységek elvégzéséhez megfelelő kitartással és monotóniatűréssel rendelkeznek. Az hallgatók környezettudatos technológiák alkalmazását igyekeznek előtérbe helyezni az egyes színfémek és ötvözetek gyártásánál, így az épített és természeti környezet megóvását tartják szem előtt. Az energia és anyagtakarékos folyamatok, ill. technológiák kidolgozását és alkalmazását tűzik ki legfőbb céljuknak.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
A hallgató a technológiára jellemző munkafázisok minőségét ellenőrzi és elvégzi a részfeladatok minőségirányítását. Felméri és racionalizálja az anyaggyártással kapcsolatos energiafelhasználást. Felméri a gyártással kapcsolatos környezeti terhelést és törekszik annak csökkentésére.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">Az ércek jellemzése és értékelése. Nyersvasgyártás. Az eljárás alapanyagai, és metallurgiai folyamatai. A nyersvasgyártás termékei. Az acélgyártás célja. Az acélgyártás fizikai kémiai fázisai. Az oxigénes acélgyártás kifejlődése, alapanyagai. Az eljárás adagperiódusai. Irányítási modellek jellemzése. Az elektroacélgyártás alapanyagai és adagperiódusai. A frissítés és a kikészítés metallurgiai folyamatai, kéntelenítés, ötvözés. Az acél szennyezői. Az üstmetallurgia szerepe. Passzív és aktív üstmetallurgia. Gáztalanítás. Az acél kristályosodása és öntése. Hagyományos öntés, folyamatos öntés. Az acélok elektornsugaras és elektrosalakos átolvasztása.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="6">Előadásokon való részvétel és saját kézzel írott jegyzet készítése, ppt slideok használatával önálló felkészülés a zh dolgozatokra, laborgyakorlatokon és üzemlátogatáson való részvétellel a gyakorlati ismeretek elsajátítása</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="6">• [1] Óvári Antal: Vaskohászati kézikönyv. Budapest. Műszaki Könyvkiadó, 1985. DF könyvtár [2] Dr. Farkas Ottó. Nyersvaskohászattan II. Tankönyvkiadó Budapest, 1989. - DF Könyvtár [3] Károly Gyula, Józsa Róbert: Konverteres acélgyártás, Miskolci egyetem 2012-2013. [4] Károly Gyula, Kiss László, Harcsik Béla: Elektroacélgyártás, Miskolci Egyetem, 2013. Elérhetőség: DUE Moodle, pdf formátumban</td></tr>
<tr><td colspan="3">Recommended literature and contact details</td><td colspan="6">• [5] Szegedi J.- Szabó Z. Acélgyártás II. Tankönyvkiadó. Budapest, 1986. - DUE könyvtár. [6] Alumíniumipari kézikönyv. Műszaki Könyvkiadó, Budapest. 1980. DUE Könyvtár</td></tr>
</table>

Description of tasks to be submitted/measurement reports	Laborban végzett vizsgálatok jegyzőkönyvei.
Description and timetable of the workshops	A zh dolgozatok az egyes ppt-k végén lévő ellenőrző kérdésekből tevődnek össze. Témakörönként 2-3 kérdés. Kifejtős kérdések, melyekre lényegre törően kell válaszolni - Ábrák pontos felrajzolásával és rövid szövegekkel. Szorgalmi időszakban, utolsó előadás

Polimer Phisics

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Műanyag fizika</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Polimer Phisics</td><td>Code</td><td>DUEN(L)-MUA-255</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning
DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td></td><td>per week</td><td>2</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>0</td><td>per term</td><td>10</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Imre Kovács, PhD</td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The student will learn to apply plastics manufacturing technology in order to produce a plastic product suitable for a given application under economical conditions. He/she will know the final properties of polymers and be able to adapt them to the specific application. Learn and apply moulding, welding and refining techniques. Learn about waste management processes and recycling of used products back into production.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">projector, ppt lectures 1 hour per week, learning materials available in moodle</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">laboratory exercise, introduction to and use of Ansys Granta EDUPACK software</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You will learn about the structure of polymers, the types of chemical bonds between them and their role in polymerisation.
You will learn about polymerisation technologies and the properties of the resulting polymers.
You will learn about the production methods and properties of thermoplastic and thermosetting polymers.</td></tr>
<tr><td colspan="7">Ability
The ability to select the ideal polymer/plastic for a given application.
Ability to select the appropriate production technology for the polymer.
Ability to decide whether or not the polymer can be processed with the selected production technology</td></tr>
<tr><td colspan="7">Attitude
It takes a creative approach to continuously improve the technologies and processes used.
It strives to use environmentally sound technologies and to protect the built and natural environment.
strive to use energy and material-saving processes and technologies</td></tr>
<tr><td colspan="7">Autonomy and responsibility
It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks.
Assess and rationalise the energy consumption related to the production of materials.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">Classification of organic compounds. Major reactions of hydrocarbons. Polymerisation, polyaddition, polycondensation. Classification and structure of polymers. Physical and chemical properties of polymers. Physical chemical properties of polymer systems. Behaviour of polymer systems under mechanical stress. Stress and deformation. Rheological characterization of solid and liquid polymer systems. Thermal properties of polymers. Production and modification of properties of plastics. Preparation, properties and uses of the main thermoplastics and thermoplastics. Current research trends and recent advances in macromolecules.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Preparation of laboratory reports</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• [1] Dr. Endre Berecz: Kémiai műszakiaknak, Budapest, Nemzeti Tankönyvkiadó Kiadó, 1995 [2] BÉLA PUKÁNSZKY, JÁNOS MÓCZÓ: Plastics, Budapest University of Technology and Economics, Faculty of Chemical and Bioengineering, Department of Physical Chemistry and Materials Science, 2011.</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Up-to-date casting technologies

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Korszerű öntéstechnológiák</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Up-to-date casting technologies</td><td>Code</td><td>DUEN(L)-MST-211</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7">MUA-213
MUA-153</td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td>0</td><td>per week</td><td>2</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>0</td><td>per term</td><td>10</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Andrea Szabó, PhD</td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The student should have an encyclopaedic knowledge of casting technologies, be able to select the technology and moulding methods required to cast a given metal part, be familiar with moulding materials, production equipment and industrially important casting alloys.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">ppt slide, using a projector</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">laboratory exercise, factory visit</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knowledge of the basic technologies for the production of metals and their alloys, and detailed knowledge of the principles of operation of foundry machinery and equipment</td></tr>
<tr><td colspan="7">Ability
Apply the technical specifications related to the operation of manufacturing systems, the principles and the economic context of setting up and operating machinery and equipment.</td></tr>
<tr><td colspan="7">Attitude
You have the stamina and tolerance for monotony needed to carry out practical activities. He/she has a creative approach to the continuous improvement of the technologies and procedures used.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Directs the work of the staff assigned to him/her, supervises the operation of machinery and equipment, based on the instructions of the workplace manager. Determines the characteristics of the various products, checks the quality of the work phases specific to the technology and carries out quality management of the sub-tasks.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">The role of foundry in industry. Fundamental aspects of foundry (moulding materials, moulding methods, solidification of metals). Melting equipment and energy sources in foundry. Alloys in iron and steel casting, typical moulding methods, melting equipment. Light and non-ferrous metal casting alloys, forming techniques, melting equipment. Die casting. Modern casting technologies (squeeze casting, rapid prototyping). Cleaning of foundries. Role of powder metallurgy, raw materials, typical powder metallurgical products. Powder production. Pressing and sintering of metals. 3D metal printing, machines, technologies and finished products.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Attending lectures and taking notes, solving calculation problems in exercises and carrying out laboratory measurements.</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• Jenő Dúl: Die Casting (ebook), National Book Publisher Árpád Németh Árpád:Die Casting (manuscript) Dr. Pál Jónás: Light Metal Casting (ebook)</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• Dr. László Kovács. Foundry technology. Technical publishing house. Bpest, 1991. Departmental library Dr. F. Varga: Horticultural manual, Technical publishing house, Bp., 1985. Departmental library H. Reuter - P. Schneider. P. P. Reuter, P. Reuter, Technical Book Publisher, Bp. 1995. Departmental library R. Schneider: Kokilla foundry. Technical Publishing House, Bpest, 1982.</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Instrumental analytical chemistry

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Műszeres analitikai kémia</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Instrumental analytical chemistry</td><td>Code</td><td>DUEN(L)-MST-212</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td></td><td>per week</td><td>2</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>0</td><td>per term</td><td>10</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Imre Kovács, PhD</td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Materials engineers must be familiar with chemical laboratory operations and materials testing methods. At the end of the module, students are expected to know the methods of instrumental chemical analysis and to be able to perform analytical measurements independently. The student will be able to carry out analytical instrumental measurements on his/her own, building on the existing basic knowledge of chemistry.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">A presentation for all students. Use of projector, overhead projector</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">analytical measurements</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You will have theoretical and practical knowledge of the subject.</td></tr>
<tr><td colspan="7">Ability
Ability to perform tasks related to the subject of the course.</td></tr>
<tr><td colspan="7">Attitude
Develops the necessary attitude to solve technical problems.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Takes responsibility for its work</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">Concepts and steps of chemical analysis; Sampling and its characteristics; Sampling, Sampling design; Sample preparation methods Advanced exploration methods; Enrichment and separation methods; Classification of methods of material analysis; Analytical tests, Corrosion tests; Classical analytical methods: Gravimetry, Titrimetry Instrumental analytical methods Grouping of methods; Electroanalytical methods; Molecular spectroscopy; Atomic spectroscopy methods: Absorption methods; Emission methods, Spark excitation and inductively coupled plasma optical emission spectrometry.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Processing heard text by taking notes and recording the material using your own notes and those available electronically 40%</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• I] Dr. János Kristóf - Dr. Erzsébet Horváth: Chemical Analysis I. Veszprém University Publishing House, Veszprém, 2002.</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• Dr. János Inczédy:Basic Methods of Chemical Analysis,University note, Veszprém, 1992.</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Life cycle of plastics

<table>
<tr><td rowspan="2" colspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="4">Műanyagok életciklusa</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="4">Life cycle of plastics</td><td>Code</td><td>DUEN(L)-MST-251</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning
DUEN(L)-</td><td colspan="6"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td></td><td>per week</td><td>2</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>0</td><td>per term</td><td>10</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Imre Kovács, PhD</td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The student will learn to apply plastics manufacturing technology in order to produce a plastic product suitable for a given application under economical conditions. He/she will know the final properties of polymers and be able to adapt them to the specific application. Learn and apply moulding, welding and refining techniques. Learn about waste management processes and recycling of used products back into production.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">projector, ppt lectures 1 hour per week, learning materials available in moodle</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">laboratory exercise, introduction to and use of Ansys Granta EDUPACK software</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You will have theoretical and practical knowledge of the subject.</td></tr>
<tr><td colspan="7">Ability
Ability to perform tasks related to the subject of the course.</td></tr>
<tr><td colspan="7">Attitude
Develops the necessary attitude to solve technical problems.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Takes responsibility for its work</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">Moulding of plastics: moulding processes, dipping processes, rotational moulding, compression moulding, injection moulding, extrusion, heating of hollow bodies. Post treatment of injection moulded products, Plastic bonding by welding and adhesives, Biodegradable polymers, 3D printing and printed products, Waste processing, Separation technologies and recycling technologies in manufacturing technologies.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Processing heard text by taking notes and recording the material using your own notes and those available electronically 40%</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• W. Schaaf - A.Hahnemann: Processing of Plastics, Technical Publishing House, Budapest, 1974.</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Micro and nano structures

Name of the subject	in Hungarian	Mikro és nano struktúrák	Level	BSc
	in English	Micro and nano structures	Code	DUEN(L)-MST-252

Responsible educational unit	Institute of Technology, Department of Structural Integrity
Name of compulsory prior learning DUEN(L)-	

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week		per week	2	E	5	english
Part time	150/15	per term	5	per term	0	per term	10			

Teacher responsible for the subject	Name	Judit Pázmán, PhD	schedule	Associate Professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Materials engineers need to know the properties of different composite materials, how they are produced and their applications. The student should be able to select a suitable composite material for a given technical process. Optimal material selection based on the properties of micro and nano composites.	
Typical delivery methods	Presentation	projector, ppt lectures 1 hour per week, learning materials available in moodle
	Practice	
	Laboratory	'laboratory exercise, composite specimen fabrication and testing
	Other	Ansys Granta EDUPACK software familiarisation and application
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knowledge of the basic types of materials (metals, polymers and ceramics) and their production technologies, including composite materials. Knowledge of micro- and nanostructures used in electronics, their typical properties and manufacturing technologies.	
	Ability Ability to apply the related computational and modelling principles and methods of product and process design. Ability to select the optimum raw materials for a given application and to specify the appropriate manufacturing technology for the production of a composite product. Understand and use online and printed literature in Hungarian and foreign languages typical of his/her field of specialisation.	
	Attitude It takes a creative approach to continuously improve the technologies and processes used. It strives to use environmentally sound technologies and to protect the built and natural environment. Strive to use energy and material-saving processes and technologies.	
	Autonomy and responsibility It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks. Assess and rationalise the energy consumption related to the production of materials	
Short description of the subject content	Types of engineering materials (metals and alloys, ceramics, polymers, semiconductors). Fibre reinforced, fibre reinforced, layered composites, their manufacturing technologies, properties, applications and development potential. Sandwich structures, wood. Analysis of the properties of metals and other engineering materials and trends in their changes. Polymer matrix and ceramic matrix composite materials. Materials for micro and nano electronics. Coating technologies, electronic thin films (lithography, etching, chemical mechanical polishing). Scanning Probe Technologies. Fabrication of nanocomposites, fullerene, graphite and carbon nanotubes, ceramic nanotubes and particles. Logic Devices (MOSFETs, Ferroelectric Field Effect Transistors, Quantum Transport Devices, Single Electron Devices, Superconducting Digital Devices, Quantum Computing using Superconductors, Carbon Nanotubes for Data Processing, Molecular Electronics) Material selection problems.	
Types of student activities	Processing of heard text by taking notes and recording the material using your own notes and those available electronically 40% Independent performance of laboratory exercises 20% Completion of a mid-term assignment 20% Solving test problems 20%	
Required literature and contact details	• [1] Dr. Tamás Tóth: Composite materials, Főiskolai publisher, 2000. • [2] Zoltán Gácsi, Andrea Simon, Judit Pázmán. • [3] Imre Mojzes, Milán Molnár László: Nanotechnology, Műegyetemi Kiadó, 2007 • [4] Rainer Waser: Nanoelectronics and Information technology, Wiley-VCH, 2005. chapters II-III - pages 187-498.	

Recommended literature and contact details	•
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Space ceramics

Name of the subject	in Hungarian	Űripari kerámiák	Level	BSc
	in English	Space ceramics	Code	DUEN(L)-MST-253

Responsible educational unit	Institute of Technology, Department of Structural Integrity
Name of compulsory prior learning DUEN(L)-	

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	2	per week		per week	1	E	5	english
Part time	150/15	per term	10	per term	0	per term	5			
Teacher responsible for the subject				Name		Judit Pázmán, PhD		schedule	Associate Professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The aim of the course is to familiarise students with the raw materials needed for the production of ceramics, their sources and their possible uses. In the course of the subject, students will learn about silicate chemistry. The aim of the course is to provide prospective materials engineers with a knowledge of the physical, chemical and mechanical properties and applications of ceramics, with a focus on applications in the ceramics industry, which is essential for understanding the chemical composition-structure-material properties relationship.	
Typical delivery methods	Presentation	projector, ppt lectures 1 hour per week, learning materials available in moodle
	Practice	
	Laboratory	laboratory exercise
	Other	Ansys Granta EDUPACK software familiarisation and application
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knowledge of the structure of silicates, the formation of rocks. Knowledge of the physical, chemical and mechanical properties of ceramics and their uses. Knowledge of the main ceramics used in the ceramic industry, their main properties and the methods of testing materials for their classification.	
	Ability The ability to select the ideal ceramics for specific applications. Ability to select the appropriate production technology for the ceramic. Ability to decide whether or not a given ceramic can be processed with the selected production technology.	
	Attitude It takes a creative approach to continuously improve the technologies and processes used. It strives to use environmentally sound technologies and to protect the built and natural environment. Strive to use energy and material-saving processes and technologies.	
	Autonomy and responsibility It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks. Assess and rationalise the energy consumption related to the production of materials	
Short description of the subject content	Mineralogical overview. Basic concepts of crystallography. Crystalline chemistry of silicates. Raw materials for the silicate industry. Rocks, their formation, properties and applications. Basic knowledge of colloid chemistry. Physical and chemical properties of the structure of silicates. Main minerals of igneous rocks, characterisation, uses. Sedimentary rocks. Formation and types of sedimentary rocks. Main minerals of sedimentary rocks. Technological characteristics and uses: SiO2. Agglomerates, mineralogical and chemical properties. Materials used in the aerospace industry, ceramics. Ceramic matrix composites, grouping, structure, structure-property relationship, Ceramic components and stresses of spacecraft. Classification and applications of aerospace ceramics, their main properties, recyclability	
Types of student activities	Processing of heard text by taking notes and recording the material using your own notes and those available electronically 40% Independent performance of laboratory exercises 20% Completion of a mid-term assignment 20% Solving test problems 20%	
Required literature and contact details	• ASM Handkbook Volume 21 – Composites 39-64 old.; 1400-1442 old.;	
Recommended literature and contact details	•	
Description of tasks to be submitted/measurement reports		
Description and timetable of the workshops		

Material testing

Name of the subject	in Hungarian	Mechanikai anyagvizsgálat	Level	BSc
	in English	Material testing	Code	DUEN(L)-MUA-212
Responsible educational unit		Institute of Technology, Department of Structural Integrity		
Name of compulsory prior learning DUEN(L)-				

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	0	per week	2	M	5	english
Part time	150/15	per term	5	per term	0	per term	10			
Teacher responsible for the subject				Name		Zsolt Csepeli, PhD			schedule	College professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Students of materials engineering learn about the wide range of methods used to test metals, ceramics, polymers and composites, the testing instruments and the properties that can be determined by testing. By understanding the operation of the equipment, students will be able to carry out simple tests on their own and evaluate the results of the measurements. Students will also be able to select the appropriate test technique, design experiments and interpret results for more complex tests.

Typical delivery methods		
	Presentation	Projector, ppt lectures, learning materials available in moodle.
	Practice	
	Laboratory	Tabletop exercise and/or laboratory measurement. Use of projector.
	Other	

Requirements (expressed in terms of learning outcomes)	**Knowledge** Knowledge of the basic physico-chemical processes in material systems, their (basic) mathematical description, with particular reference to the laws of thermodynamics and kinetics. A broad knowledge of the atomic, micro- and macro-structure of solids, the basic methods for the study of structure and the principles of operation of basic devices and the processes that give rise to structures. He/she is familiar with the requirements and demands of the occupational health and safety, fire protection and safety areas related to his/her field of specialisation, and with the relevant environmental protection requirements.
	Ability Understands and applies the environmental, occupational health and safety and security requirements of the field, and is able to modify processes to meet expectations. Understands and uses online and printed literature in Hungarian and foreign languages.
	Attitude Strive to keep their self-training in materials engineering continuous and in line with their professional goals Have the stamina and monotony tolerance to carry out practical activities. Strive to use environmentally sound technologies and to protect the built and natural environment.
	Autonomy and responsibility Determine the characteristics of the different products, check the quality of the work phases specific to the technology and carry out quality management of the sub-tasks
Short description of the subject content	The subject covers the most common techniques for the testing of metals, ceramics, polymers and composites. Students will be introduced to creep and fatigue testing, the operation of electron microscopes, non-destructive testing and some special testing methods for non-metallic materials. By learning the standards for the different tests, students will gain knowledge that can be directly applied in practice. When introducing testing techniques, special attention will be paid to make students aware of the specificities of testing different types of materials.
Types of student activities	Processing of heard text with annotation 50%. Conducting material tests 30%. Evaluation of measurements, preparation of report 20%.
Required literature and contact details	• [1] Imre Pozsgai: Fundamentals of scanning electron microscopy and electron beam microanalysis Bp., 1995 [2] Zoltán Gácsi: Stereology and image analysis, Miskolc 2001 [3] Miklós Tisza: Material analysis, Miskolc University Publishing House, 2005 [4] Géza Bodor, László M. Vass: Polymer materials structure, University of Technology Publishing House, 2002
Recommended literature and contact details	• [5] Tamás Tóth: Mechanical properties of materials and methods of their investigation, Főiskolai Kiadó, Dunaújváros, 2004
Description of tasks to be submitted/measurement reports	The student shall draw up a measurement report on the measurements carried out.
Description and timetable of the workshops	A final paper in weeks 6 and 12 from the lectures and laboratory classes.

Production technologies of space ceramics

<table>
<tr><td rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="3">Űripari kerámiák gyártástechnológiája</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="3">Production technologies of space ceramics</td><td>Code</td><td>DUEN(L)-MST-111</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="5">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="3">Name of compulsory prior learning DUEN(L)-</td><td colspan="5"></td></tr>
<tr><td colspan="2">Type</td><td>Presentation</td><td>Practice</td><td>Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week 2</td><td>per week</td><td>per week 1</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term 10</td><td>per term 0</td><td>per term 5</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td>Name</td><td colspan="2">Judit Pázmán, PhD</td><td>schedule</td><td>Associate Professor</td></tr>
<tr><td colspan="3">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="5">Goals, development objectives
The aim of the course is to familiarise students with the different production technologies of ceramics for different applications. The aim of the course is to enable future materials engineers to master the grinding, pressing and sintering technologies of ceramics, as well as the specific manufacturing processes for special applications such as products for aerospace applications.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="4">projector, ppt lectures 1 hour per week, learning materials available in moodle</td></tr>
<tr><td>Practice</td><td colspan="4"></td></tr>
<tr><td>Laboratory</td><td colspan="4">laboratory exercise</td></tr>
<tr><td>Other</td><td colspan="4">Ansys Granta EDUPACK software familiarisation and application</td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="5">Knowledge
Knowledge of the main ceramics used in the ceramic industry, their main properties and the methods of material testing required for their qualification.
Knowledge of the different production technologies for ceramics, their various steps and the equipment required.
Knowledge of the production technologies of specialised ceramics for the aerospace industry, their equipment and their operating principles.
Translated with DeepL.com (free version)</td></tr>
<tr><td colspan="5">Ability
The ability to select the ideal production technology for a given application.
Ability to select the appropriate production technologies for specific applications.
Ability to decide whether or not ceramics with a given property and speciality can be processed with the selected production technology</td></tr>
<tr><td colspan="5">Attitude
It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks.
Assess and rationalise the energy consumption related to the production of materials</td></tr>
<tr><td colspan="5">Autonomy and responsibility
It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks.
Assess and rationalise the energy consumption related to the production of materials</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="5">Traditional and modern ceramic materials. Overview of the main properties and applications of modern technical ceramics. Technology of ceramic materials. Ceramic products: structure, properties and uses of classical ceramics, bricks and tiles, refractories. Relationship between chemical composition, microstructure and properties. Requirements for raw materials. Synthesis of ceramic raw materials by physical and chemical processes. Production of solid ceramic bodies. Moulding and heat treatment (sintering, sintering) processes. Sintering under special conditions (thermal plasma, blasting, etc.). Post-processing of solid ceramics, Manufacturing technologies for specific aerospace applications. Equipment for the production of space ceramics. Manufacturing processes, quality control.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="5">Processing of heard text by taking notes and recording the material using your own notes and those available electronically 40%
Independent performance of laboratory exercises 20%
Completion of a mid-term assignment 20%
Solving test problems 20%</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="5">• ASM Handkbook Volume 21 – Composites, CMC materials</td></tr>
<tr><td colspan="3">Recommended literature and contact details</td><td colspan="5"></td></tr>
<tr><td colspan="3">Description of tasks to be submitted/measurement reports</td><td colspan="5"></td></tr>
<tr><td colspan="3">Description and timetable of the workshops</td><td colspan="5"></td></tr>
</table>

Heat Treatment

Name of the subject	in Hungarian	Hőkezelés	Level	BSc
	in English	Heat Treatment	Code	DUEN(L)-MUA-113

Responsible educational unit	Institute of Technology, Department of Mechanical Engineering and Energy
Name of compulsory prior learning DUEN(L)-	MUA-213

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	0	per week	2	M	5	english
Part time	150/15	per term	5	per term	0	per term	10			
Teacher responsible for the subject				Name		Péter Bereczki, PhD			schedule	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The aim of the course is to familiarise students with the basic heat treatment and surface treatment processes used in industry, and to enable them to independently propose the heat treatment or surface treatment to achieve the desired properties.	
Typical delivery methods	Presentation	Projector, ppt presentation materials, whiteboard
	Practice	
	Laboratory	Laboratory practice, carrying out heat treatments and simple surface treatments, and structural testing of materials
	Other	

Requirements (expressed in terms of learning outcomes)	**Knowledge** The student will know the basic physical and chemical properties of metals and alloys and polymers/plastics, their behaviour in corrosive media and their structural changes under temperature. On the basis of this knowledge, students will learn heat treatments to improve the physical, chemical and mechanical properties of different types of materials (metals, polymers). They will thus be able to propose and apply appropriate heat treatment methods for a given application. The student will be familiar with the basic technologies of heat treatment and surface treatment.
	Ability Ability to apply the principles of heat treatment design to ensure that the technology is appropriate from the point of view of both structural and surface quality, integrity and economy. Ability to select the appropriate heat treatment technology taking into account the combination of properties to be achieved and to propose the type and characteristics of the heat treatment equipment.
	Attitude Strive to keep their self-training in materials engineering/heat treatment continuous and in line with their professional goals. Strive to apply environmentally sound technologies. Strive to apply energy and material saving processes and technologies.
	Autonomy and responsibility Define the heat treatment technology to ensure the properties of the different products, control the quality of the work phases specific to the technology and carry out quality management of the sub-tasks.
Short description of the subject content	Hőkezelési eljárások részletes bemutatása, a hozzájuk kapcsolódó technológia és tervezési elvek ismertetése : acélok ausztenitesítése, edzése, nemesítése; alumínium-ötvözetek homogenizálása, lágyítása, nemesítése. Felületi réteg kialakítása, karbonizálás, nitridálás, karbonitridálás, nitrocementálás
Types of student activities	Processing the lecture with notes (50%), carrying out material tests (30%), evaluating measurements and drawing up a report (20%)
Required literature and contact details	•
Recommended literature and contact details	•
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Welding

<table>
<tr><td rowspan="2" colspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="4">Hegesztés</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="4">Welding</td><td>Code</td><td>DUEN(L)-MUA-210</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="6">MUA-116</td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td>1</td><td>per week</td><td>1</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>5</td><td>per term</td><td>5</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Béla Palotás, PhD</td><td>schedule</td><td>Professor emeritus</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Students should be familiar with the basics of welding and related processes, welding parameters, their effects and the rules for their selection. Learn the basics of the welding procedure manual and welding plan, the basic welding tools and their selection principles. Know the weld defects, their effects and how to repair them, the basics of welding quality management, the basics of welding safety and environmental protection.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">All students in lecture, presentation on the blackboard. Use of a computer projector.</td></tr>
<tr><td>Practice</td><td colspan="6">For each student in lecture, example solution. Using a computer projector.</td></tr>
<tr><td>Laboratory</td><td colspan="6">(Workshop) lab exercise, use of projector.</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Know the variations of joining technologies, be able to apply welding procedures by knowing the rules for making flawless joints, be able to design the welding technology and prepare the manufacturer's welding instructions.</td></tr>
<tr><td colspan="7">Ability
Ability to perform the job according to your qualifications. Ability to plan, organise and carry out independent learning. Ability to manage and control the production process in the field of specialised technology, in accordance with the principles of quality management.</td></tr>
<tr><td colspan="7">Attitude
You have the stamina and monotony tolerance to carry out practical activities. A creative approach to the continuous improvement of the technologies and procedures used. He/she strives to use energy and material-saving processes and technologies.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Directs the work of the personnel assigned to him/her, supervises the operation of machinery and equipment. Determines the characteristics of the various products, checks the quality of the work phases specific to the technology and carries out quality management of the sub-tasks.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">The physical principles of welding.
The technology of the main bulk welding processes.
The technology of the main pressure welding processes.
Fundamentals of weldability.
Basics of welding quality management.
Welding technology documents and their preparation.
Welding safety at work; fire and environmental protection. Welding economics, environmentally friendly selection of welding processes and materials.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Active participation in lectures, classroom exercises and laboratory exercises.</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• [1] Downloadable lecture notes from www.duf.hu, [2] Welding pocket book I. (Welding procedures), Cokom Mérnökiroda Kft., Budapest 2023, [3] Welding pocket book II. (Welding production technology), Cokom Mérnökiroda Kft., Budapest 2023</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• [4] Welding and related technologies, GTE.- Budapest, 2007.</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7">Test 1. at Week 6: from the material of weeks 1 - 5, and
Test 2. at week 12: from week 7 - 11,
Test 3. (optional) in week 13, to make up or correct any failed and unwritten final exams.</td></tr>
</table>

Non-Destructive Material Testing

Name of the subject		in Hungarian		Roncsolásmentes anyagvizsgálat				Level	BSc	
		in English		Non-Destructive Material Testing				Code	DUEN(L)-MUA-215	
Responsible educational unit				Institute of Technology, Department of Structural Integrity						
Name of compulsory prior learning DUEN(L)-										
Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	0	per week	2	M	5	english
Part time	150/15	per term	5	per term	0	per term	10			
Teacher responsible for the subject				Name		Gábor Pór, PhD		schedule		
Training objective and justification of the course (content, output, location in the curriculum)				**Goals, development objectives** By mastering the course material, students will be able to simulate phenomena and processes of crucial importance for materials science, often very complex and increasingly complicated, from the atomic level to the mega-level approach of the virtual plant. The student will be able, using the tools of modelling and computer simulation, to discuss, simulate and manipulate processes to change the properties of materials and their production and to modify their parameters.						
Typical delivery methods				Presentation	A presentation for all students. Use of projector, overhead projector					
				Practice						
				Laboratory	laboratory exercise					
				Other						
Requirements (expressed in terms of learning outcomes)				**Knowledge** Students will have theoretical and practical knowledge of the subject.						
				Ability Ability to perform tasks related to the subject of the course.						
				Attitude Develops the necessary attitude to solve technical problems.						
				Autonomy and responsibility Takes responsibility for its work						
Short description of the subject content				As in other disciplines, modelling plays a crucial role in the process of cognition in materials science. With the rapid development of information technology, we now have the possibility of computer simulations of phenomena and processes of crucial importance for materials science, often very complex and increasingly sophisticated, from the atomic level approach to the mega-level approach of the virtual plant. The course covers the process of model building and the relationship of modelling to computer simulation. It will cover thermodynamic and kinetic models and simulation software for characterising equilibrium and non-equilibrium processes. It presents models and simulation software at different levels of approach (atomic, micro, meso, macro) and specific examples of their application. Describes the most common simulation techniques, with particular emphasis on finite element methods. In addition, it discusses the processes of material production and the processes of changing the properties of materials using modelling and computer simulation tools. In the context of the process modelling and process simulation in materials science, students will be introduced to VEM methods of thermal simulation and, in parallel, to the simulation of diffusion processes, which can be treated in a mathematically analogous way. In addition to heat and mass transport in the solid state, the course also includes a section on modelling and simulation of mass flow.						
Types of student activities				Working under supervision or performing independent computer tasks						
Required literature and contact details				•						
Recommended literature and contact details				•						
Description of tasks to be submitted/measurement reports										
Description and timetable of the workshops										

Forming of Metals

Name of the subject		in Hungarian		Fémek képlékenyalakítása				Level	BSc	
		in English		Forming of Metals				Code	DUEN(L)-MUA-251	
Responsible educational unit				Institute of Technology, Department of Structural Integrity						
Name of compulsory prior learning DUEN(L)-										
Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	1	per week	1	E	5	english
Part time	150/15	per term	5	per term	5	per term	5			
Teacher responsible for the subject				Name		Krisztián Wizner, PhD		schedule	Senior lecturer	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The student will learn the basic concepts of the plasticity of metals. Based on the knowledge of the basic concepts, the student is able to operate and design the actual forming technologies.	
Typical delivery methods	Presentation	For all students, in a large lecture, presentation on a whiteboard, projector or on-line using MS Teams, using a computer network.
	Practice	Group work presentations
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** You will know the theoretical and practical aspects of the plasticisation of metals and their alloys and the basic technological methods. He/she knows the requirements and standards in the fields of occupational health and safety, fire protection and environmental protection.	
	Ability Ability to apply the related computational and modelling principles and methods of product and process design. Understands and applies the environmental, health and safety and accident prevention requirements specific to his/her area of specialisation, and is able to adapt processes to meet requirements. Understands and uses the online and printed literature in Hungarian and foreign languages specific to his/her field of specialisation.	
	Attitude You have the stamina and monotony tolerance to carry out practical activities. He/she strives to use environmentally friendly technologies and to protect the built and natural environment. Tends to use energy and material-saving processes and technologies.	
	Autonomy and responsibility It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks. Assess and rationalise the energy consumption related to the production of materials. Assess and seek to reduce the environmental impact of production.	
Short description of the subject content	Basic knowledge of ductile metal forming. Structural aspects of plastic deformation. Classification of forming processes. Metrics of deformation. Cold and hot forming. Friction relations. Plasticity of metals. Stress state, flow conditions. Rolling. Geometry of the rolling crack. Hot rolling. Classification of rolled products. Structure and main units of rolling mills. Hot rolling of flat products. Bending. Pre-stretching and finish rolling. Rolling of shaped products (profiles). Modern versions of rolling technologies (CSP, ISP, etc.). Cooling, coiling, finishing. Cold rolling. Preparation of the starting product. Pickling. Reversing and one-way cold rolling. Properties of rolled products. Coating technologies for plates (plastic, metallic layers, etc.). Rolling of bars, tubes. Bar drawing technologies. Forging technologies. Technological principles of patent forging. Typical patent forging operations. Seamless forging. Determination of the basic parameters of the required forming machine, machine selection. Forming parameters of the forging process. Drawing. Drawing technologies. Wire drawing. Pipe pulling with wall thinning. Pullability conditions. Further processing of flat products, plates (cutting, bending, deep drawing . Production of welded tubes.	
Types of student activities	Attend lectures and take notes, solve problems, process in-formation.	
Required literature and contact details	• Author: George Wypych, Handbook of Plasticizers, 4th Edition - February 8, 2023 • Hardback ISBN: 9781774670224 eBook ISBN: 9781774670231	
Recommended literature and contact details	• • NORBERT A. J. PLATZER, EDMUND H. IMMERGUT, HERMAN F. MARK, M. C. SHEN, A. V. TOBOLSKY, KURT UEBERREITER, ROBERT KOSFELD, S. J. FUSCO, R. C. MAGGART, W. F. OVERBERGER, L. O.	

	RAETHER, H. R. GAMRATH, ALFRED COENEN, HEINRICH HOPFF, DIETRICH BRAUN, D. H. ROTENBERG, M. C. SHEN, A. V. TOBOLSKY, H. BREUER, , Norbert A. J. Platzer, Plasticization and Plasticizer, American Chemical Society, ISBN • 9780841222281
Description of tasks to be submitted/measurement reports	Last lecture of the term.
Description and timetable of the workshops	

Environmental policy and protection against radioactivity

<table>
<tr><td rowspan="2" colspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Környezetpolitika és sugárvédelem</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Environmental policy and protection against radioactivity</td><td>Code</td><td>DUEN(L)-MGT-210</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>2</td><td>per week</td><td>0</td><td>per week</td><td>1</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>0</td><td>per term</td><td>5</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Éva Kovács-Bokor, PhD</td><td>schedule</td><td>Senior lecturer</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The student will learn about the most important environmental issues, global warming, carbon dioxide emissions, carbon dioxide emissions and ways to reduce global warming; the 3 E's harmonisation. In addition, learn about renewable energy sources, energy production (fossil, nuclear, renewables), the basics of environmental management, environmental policy. Learn about types of radioactive radiation, methods of reducing the intensity of radiation and its effects on the human body.</td></tr>
<tr><td rowspan="4" colspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">For all students in a large lecture hall with a blackboard presentation. Use of projector or overhead projector</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">Laboratory demonstrations and experiments</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td rowspan="3" colspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knowledge of the basic facts, directions and limits of the subject area of engineering.
Knowledge of the general and specific mathematical, scientific and social principles, rules, relationships and procedures necessary for the operation of the field of engineering.
Knowledge of the terminology, the most important contexts and theories related to the field.
Comprehensive knowledge of the methods of knowledge acquisition and problem-solving in the main theories of the field.
Comprehensive knowledge of basic economic, business and legal rules and tools.
Knowledge of measurement procedures at an applied level.
Has an applied knowledge of the requirements and standards of health and safety at work, fire protection, safety and health at work, and environmental protection in the field of his/her specialisation.
Comprehensive knowledge of the management, environmental protection and quality assurance principles, their limits and requirements, which are intrinsically linked to the field.</td></tr>
<tr><td colspan="7">Ability
The ability to analyse at a basic level the disciplines that make up the knowledge base of the technical field, to synthesise relationships and to make appropriate evaluations.
Ability to plan, organise and conduct independent learning.
Ability to identify routine professional problems, to identify, formulate and solve (using standard operations in practice) the theoretical and practical background necessary to solve them.
Ability to understand and use literature, computer and library resources specific to the field.
Ability to apply the acquired IT knowledge to the solution of problems in the field.
Ability to apply and enforce safety, fire safety and hygiene rules and regulations.
Ability to communicate orally and in writing in his/her mother tongue and in at least one foreign language in a professionally appropriate manner, in accordance with his/her field of specialisation.</td></tr>
<tr><td colspan="7">Attitude
It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering.
It strives to make self-learning a means to achieve its professional goals.
He/she takes decisions in complex and unexpected decision-making situations in full respect of legal and ethical standards.
Seek to solve problems, preferably in cooperation with others.
Strive to maintain self-development in the field on an ongoing basis and in line with professional goals.
He/she strives to solve problems and make management decisions by listening to the opinions of his/her supervisors, preferably in cooperation.
Have the stamina and tolerance of monotony required to carry out practical activities.
Open to the use of IT tools.</td></tr>
</table>

	Open and receptive to the application of new, modern and innovative practices and methods related to organic farming and health awareness. In the course of his/her work, he/she observes and complies with the relevant safety, health, environmental protection, quality assurance and control requirements.
	Autonomy and responsibility Responsibly upholds and represents the values of the engineering profession, and is open to professionally informed critical comment. In the performance of his/her professional duties, he/she will cooperate with qualified professionals from other disciplines (primarily technical, economic and legal). Identify shortcomings in the technologies used, process risks and take the initiative to mitigate them. Monitor legislative, technical, technological and administrative changes in the field. Under the direction of the line manager, manages the work of the staff assigned to him/her and supervises the operation of machinery and equipment. Assesses the efficiency, effectiveness and safety of the work of subordinates. Supervises the professional development of his/her subordinates. Sharing his/her experience with his/her colleagues in order to support their development. Takes responsibility for the consequences of his/her technical analyses, the proposals he/she makes and the decisions he/she takes. Translated with www.DeepL.com/Translator (free version)
Short description of the subject content	The main environmental issues of the moment are global warming, carbon dioxide emissions and sequestration, the impact of human activity on global warming, carbon dioxide emissions and ways to reduce global warming. The 3 E harmonisation. Life expectancy and polluting emissions of fossil fuels and nuclear feedstocks. Accounting for renewable energy sources and the significance of their environmental emissions. Energy production options, combined fossil, nuclear and renewable energies, basics of environmental management, environmental policy. Radioactivity and the interaction of different materials, absorption of radiation. Reduction of radiation intensity by different walls, thin film walls. Effects of radiation on the human body, decontamination procedures.
Types of student activities	Processing of heard text by taking notes and recording the material using your own notes and those available electronically 80% Development of test questions 20%
Required literature and contact details	• Endre Kiss: Environmental protection and energy management (electronic note)
Recommended literature and contact details	• Martin James E: Physics for radioactivity, Wiley-VCM Verlag GMBH, 2013 • Nikjoo Mooshang: Interaction of radiation with Matter, Taylor and Francis 2019
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	Week 7: I. Test Week 12: II. Test

Coating Processes

Name of the subject	in Hungarian	Felületi és vékonyréteg technikák	Level	BSc
	in English	Coating Processes	Code	DUEN(L)-MST-254
Responsible educational unit		Institute of Technology, Department of Structural Integrity		
Name of compulsory prior learning DUEN(L)-		MST-210		

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/52	per week	1	per week	2	per week	1	E	5	english
Part time	150/20	per term	5	per term	10	per term	5			
Teacher responsible for the subject				Name		Andrea Szabó, PhD			schedule	Senior lecturer

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Students should be familiar with coatings commonly used in industry and their manufacturing technologies. They should know the behaviour of metals and metal alloys to acids and alkalis and to weathering, and thus be able to select the appropriate prevention and coating design based on their corrosion behaviour. The student will know the atomic and structural structure of metals and alloys, their chemical properties, their behaviour to acids and alkalis, and will be able to select and formulate coatings on the surface of metals to avoid these corrosive failures. It can also increase the added value of certain products by applying surface coatings.

Typical delivery methods	Presentation	Projector, ppt presentation
	Practice	
	Laboratory	Laboratory presentations and experiments
	Other	

Requirements (expressed in terms of learning outcomes)	**Knowledge** Understand the purpose of surface treatment, the classification of surface treatment methods. Knowledge of the causes of corrosion, reactions of metals with acids, oxygen and alkalis. Understands the electrochemical basis of corrosion. Knowledge of the basic concepts and technical terminology of corrosion. Understands the types of corrosion. Knowledge of the corrosive effects of chemicals. Understands the rules for material selection according to corrosion criteria. Understand the corrosion damage of non-alloy and low alloy steels. Identifies corrosion damage in highly alloyed steels, including stainless steels. Understands the corrosion behaviour of aluminium alloys and its relationship to the method of manufacture. Understand standard methods of corrosion testing and the basic context for the evaluation of test results. Understands surface contamination and macro and micro surface cleaning methods. Understands the processes of electroplating, chemical metal deposition, electroless nickel plating. Knowledge of physical and chemical vapour deposition technologies.
	Ability The ability to distinguish between the different forms of corrosion. Ability to plan the sequence and work order of corrosion tests. Carry out a complete corrosion inspection of a product. Interpret the results of a corrosion test. Propose improvements to previously used coating technology in the light of the test results.
	Attitude Collaborate with classmates and the teacher to develop knowledge. Strive to continuously improve their knowledge of surface treatment techniques. Open to learning and applying modern inspection techniques. Strives for accuracy in both numerical and laboratory exercises. A creative approach to the continuous improvement of applied technologies and procedures.
	Autonomy and responsibility Independently carry out experimental design tasks based on the guidance and resources provided. Assesses the environmental pressures associated with production and seeks to reduce them. Assesses and rationalises energy use related to material production. Performs occupational health and safety duties.
Short description of the subject content	The student will be familiar with and be able to apply coating technologies, the properties of different types of coatings and their applications. The student will learn about the behaviour of metals in corrosive media and different metal deposition techniques. Gas phase metal deposition techniques (PVD, CVD). Metal deposition from liquid phase

	(electroplating, chemical metal deposition). Solid phase deposition (plating). Anodising of aluminium. Surface hardening. Wear resistant surface coating (nitriding, boriding, carbonising, carbonitriding, cementation). Painting techniques, paint coating test methods.
Types of student activities	Active participation in lectures and laboratory exercises.
Required literature and contact details	• Modern metal surface treatment and waste management methods (PHARE HU-0008-02-01-0062). University of Miskolc Centre for Continuing Education, 2004. • Endre Berecz: Chemistry for Technicians, ISBN 963 18 6825 7
Recommended literature and contact details	• Peter M. Martin: Introduction to Surface Engineering and Functionally Engineered Materials, Wiley & Sons, 2011. • Mahmood Aliofkhazrai: Modern Surface Engineering Treatments; In Tech, 2013. ASM Handbook, Surface treatment Volume
Description of tasks to be submitted/measurement reports	1 Report during the semester (examination of paint layers, examination of chemical nickel layer)
Description and timetable of the workshops	

Thesis Project 1.

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Szakdolgozat 1. Kutatásmódszertan MUI</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Thesis Project 1.</td><td>Code</td><td>DUEN(L)-MUG-090</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Social Sciences, Department of Economics</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/26</td><td>per week</td><td>2</td><td>per week</td><td>0</td><td>per week</td><td>0</td><td rowspan="2">S</td><td rowspan="2"></td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/10</td><td>per term</td><td>10</td><td>per term</td><td>0</td><td>per term</td><td>0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Tamás Zahola</td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
The aim of the course is to prepare future economists to identify the problems to be researched and to apply the results in practice. The student should be able to observe professionally, to prepare objective data collection instruments and questionnaires to monitor his/her observations and to record his/her experiences in textual or numerical form.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6"></td></tr>
<tr><td>Practice</td><td colspan="6">small group tabletop exercises, guided group work</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knowledge of the key contexts and theories of farming and the terminology that underpins them.</td></tr>
<tr><td colspan="7">Ability
Ability to analyse at a basic level the concepts that make up the knowledge base of the management discipline, to formulate synthetically the interrelationships and to make adequate evaluations.
Ability to use and understand the literature, computer and library resources specific to the field of management.</td></tr>
<tr><td colspan="7">Attitude
He is open to authentically communicate the overall thinking and essential features of his profession.
He is committed to continuous self-education in the field of economics.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Independently think through broad, underpinning policy questions and resources.
Collaboration and responsibility with qualified professionals in the field.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7"></td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Text interpretation
- Processing information individually and in groups
- Clashing opinions
- Debate and argumentation skills
- Working in a group
- Mastering forms of advocacy</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">•</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">•</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Entrepreneurship

Name of the subject	in Hungarian	Vállalkozástan		Level	BSc
	in English	Entrepreneurship		Code	DUEN(L)-TVV-122
Responsible educational unit		Institute of Social Sciences, Department of Management and Entrepreneurship			
Name of compulsory prior learning DUEN(L)-					

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	2	per week		M	5	english
Part time	150/15	per term	5	per term	10	per term	0			
Teacher responsible for the subject				Name		Odorige Cathérine Enorédia			schedule	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The curriculum provides a comprehensive knowledge of entrepreneurship, including the creation, operation, transformation, liquidation, financial management and the management of assets and liabilities. The student will be able to review the essence of corporate management, its procedures and to understand and apply corporate (business) law and other regulations. They will be familiar with the economic, financial, human, material and property characteristics and components of companies, the risks inherent in the activities of companies, their types, the characteristics of international and domestic corporate cooperation and will be able to apply these at a skill level. In addition to theoretical knowledge, practical features will also be explored.

Typical delivery methods	Presentation	In a classroom for lectures (100-150 people) using a computer, projector, flipchart or whiteboard.
	Practice	In a classroom suitable for project work (20-30 students), using a computer, projector, flipchart or whiteboard. Group work and various forms of peer work.
	Laboratory	
	Other	

Requirements (expressed in terms of learning outcomes)	**Knowledge** Understand the concepts of business management. Understand the mechanisms of action of a company. Knowledge of the legal background of companies, their internal and external environment. Knowledge of the management systems, objectives and strategies of companies.
	Ability Ability to use the terminology of the field in a professional manner. Ability to identify and define the resources of companies. Ability to implement the basics of business management. Ability to understand the steps of corporate objectives and strategy. Ability to understand and use relevant literature.
	Attitude Open to actively interpreting changing communication communities and social situations. Sensitive to solving problems arising from the functioning of relationships. Receptive to seizing opportunities for development.
	Autonomy and responsibility Take responsibility for your own development. Cooperates with others, looking for ways to solve problems. Takes responsibility for the development of his/her working environment
Short description of the subject content	The emergence of companies, their concept, the legal background of their operation. The macro and micro, external and internal environment of the company. The company as an economic system, characteristics of economic systems, basic concepts of their operation. The purpose of the enterprise, its objectives and strategy. Economic decisions of companies. Description of corporate resources and activity system. Assets and liabilities of the company, financing of the company. Organisation and management of companies. Resource management of companies. Introduction to corporate production, services, material processes. Internal and external logistics of the company. Human resource management in the company. Sources and role of corporate information. Corporate innovation. Corporate revenue and cost management. The concept of quality, total quality management and control (TQM). Corporate strategy, strategic guiding principles, strategic management, strategy development, implementation and control. Controlling. The role of business planning, presentation. Corporate ethics, responsibility, culture in the operation of companies. Outsourcing, its development, types, ways of implementation. Corporate partnerships
Types of student activities	Individual and group activities: participation in individual and small group exercises, participation in guided company role-play, analysis of case studies, analysis of complex company simulations.
Required literature and contact details	•

Recommended literature and contact details	•
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Research Thesis

<table>
<tr><td rowspan="2" colspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="4">Szakdolgozat - ANYBSC</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="4">Research Thesis</td><td>Code</td><td>DUEN(L)-MUA-091</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="6">1-6 félév minden tárgyának teljesítése</td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/156</td><td>per week</td><td>0</td><td>per week</td><td>12</td><td>per week</td><td>0</td><td rowspan="2">S</td><td rowspan="2">15</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/60</td><td>per term</td><td>0</td><td>per term</td><td>60</td><td>per term</td><td>0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Andrea Szabó, PhD</td><td>schedule</td><td>Senior lecturer</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Building on previous subjects, the student has acquired a comprehensive knowledge that enables him/her to solve an engineering problem (heat treatment, plastic forming, failure detection, materials testing). To demonstrate this, the student will prepare a thesis, in which he/she will transform the knowledge acquired in each subject into a complex body of knowledge, and will be able to see the engineering problem, solve it and produce a systematic summary of it.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6"></td></tr>
<tr><td>Practice</td><td colspan="6">The solution and support of theoretical and practical tasks of the thesis in the context of consultation</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knowledge of the basic physico-chemical processes in material systems, their (basic) mathematical description, with particular reference to the laws of thermodynamics and kinetics. A broad knowledge of the atomic, micro- and macro-structure of solids, the basic methods for the study of structure and the principles of operation of basic devices and the processes that give rise to structures. Detailed knowledge of the principles of operation of machinery and equipment used in the production of materials, basic technologies for the production and shaping of metals and their alloys (plastic forming and casting). Knowledge of the basic techniques of heat treatment and surface treatment. Knowledge of basic technologies for the production of ceramics (including glass and binders) and composite materials. Knowledge of basic technologies for the production and processing of polymers. Systematic knowledge of the energy characteristics, energy efficiency requirements and energy supply options of the technologies in the field.</td></tr>
<tr><td colspan="7">Ability
Ability to apply the related computational and modelling principles and methods of product and process design. Ability to interpret and characterise the structure and function of the structural units and elements of mechanical systems, the design and interrelationship of the system elements used. Understand and use online and printed literature in Hungarian and foreign languages typical of his/her field of specialisation.</td></tr>
<tr><td colspan="7">Attitude
The student takes a creative approach to continuously improve the technologies and processes used. It strives to use environmentally sound technologies and to protect the built and natural environment. strive to use energy and material-saving processes and technologies</td></tr>
<tr><td colspan="7">Autonomy and responsibility
It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks. Assesses and seeks to reduce the environmental impact of production. Assess and rationalise energy consumption related to the production of materials.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">Within the framework of the course, the student prepares the tasks required in the thesis (draft), which are both theoretical, i.e. a theoretical study of the literature on the given topic, and the evaluation of practical experiments and experimental results of the engineering task and the comparison of the test results with the literature data.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">literature research, consultation, laboratory exercises</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">•</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">•</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Professional Internship

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="4">Szakmai gyakorlat - ANYBSC</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="4">Professional Internship</td><td>Code</td><td>DUEN(L)-MUA-093</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="6"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/0</td><td>per week</td><td>0</td><td>per week</td><td>0</td><td>per week</td><td>0</td><td rowspan="2">S</td><td rowspan="2"></td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/0</td><td>per term</td><td>0</td><td>per term</td><td>0</td><td>per term</td><td>0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Andrea Szabó, PhD</td><td>schedule</td><td>Senior lecturer</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Building on previous subjects, the student has acquired a comprehensive knowledge that enables him/her to solve an engineering problem (heat treatment, plastic forming, failure detection, materials testing). To demonstrate this, the student will prepare a thesis, in which he/she will transform the knowledge acquired in each subject into a complex body of knowledge, and will be able to see the engineering problem, solve it and produce a systematic summary of it.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6"></td></tr>
<tr><td>Practice</td><td colspan="6">The solution and support of theoretical and practical tasks of the thesis in the context of consultation</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knowledge of the basic physico-chemical processes in material systems, their (basic) mathematical description, with particular reference to the laws of thermodynamics and kinetics. A broad knowledge of the atomic, micro- and macro-structure of solids, the basic methods for the study of structure and the principles of operation of basic devices and the processes that give rise to structures. Detailed knowledge of the principles of operation of machinery and equipment used in the production of materials, basic technologies for the production and shaping of metals and their alloys (plastic forming and casting). Knowledge of the basic techniques of heat treatment and surface treatment. Knowledge of basic technologies for the production of ceramics (including glass and binders) and composite materials. Knowledge of basic technologies for the production and processing of polymers. Systematic knowledge of the energy characteristics, energy efficiency requirements and energy supply options of the technologies in the field.</td></tr>
<tr><td colspan="7">Ability
Ability to apply the related computational and modelling principles and methods of product and process design. Ability to interpret and characterise the structure and function of the structural units and elements of mechanical systems, the design and interrelationship of the system elements used. Understand and use online and printed literature in Hungarian and foreign languages typical of his/her field of specialisation.</td></tr>
<tr><td colspan="7">Attitude
It takes a creative approach to continuously improve the technologies and processes used. It strives to use environmentally sound technologies and to protect the built and natural environment. strive to use energy and material-saving processes and technologies</td></tr>
<tr><td colspan="7">Autonomy and responsibility
It determines the properties of the different products, checks the quality of the work phases specific to the technology and performs quality management of the sub-tasks. Assesses and seeks to reduce the environmental impact of production. Assess and rationalise energy consumption related to the production of materials.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">The student designs and carries out the practical tasks related to the thesis, performs the necessary tests, evaluates the test results and summarises them in at least 20 pages.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Consultation, laboratory exercises, tasks in an industrial environment</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">•</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">•</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Management

Name of the subject	in Hungarian	Menedzsment	Level	BSc
	in English	Management	Code	DUEN(L)-TVV-114

Responsible educational unit	Institute of Social Sciences, Department of Management and Entrepreneurship
Name of compulsory prior learning DUEN(L)-	

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	2	per week	0	M	5	english
Part time	150/15	per term	5	per term	10	per term	0			
Teacher responsible for the subject				Name					schedule	Associate professor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The aim of the course is to familiarise students with the most important aspects of the management of work organisations, to provide an overview of the "special" dimensions of management and the factors that determine them. To develop students' professional competences and theoretical knowledge, the course provides an overview of management-organisational concepts and their main models. Through the knowledge imparted, the course will enable students to analyse and develop work organisations; to develop skills in the application of the management techniques and methods taught. Practical examples help to interpret theoretical knowledge and to identify relevant contexts.	
Typical delivery methods	Presentation	Teacher presentation, with explanations and practical examples. Students' comments on some topics, sharing their experiences, followed by a teacher's summary. All students present together in a large lecture with projector and presentation technique.
	Practice	Max. In classrooms of 30 students, using interactive methods, small groups of 5-6 students and individual work, projector, overhead projector and presentation techniques.
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knowledge of the basic factors, key concepts, requirements, contexts and procedures of management and organisation science. Acquires the theoretical and methodological foundations for the performance of management tasks and the exercise of functions. Knowledge of the procedures and methods frequently used in planning, organisation and management. Knowledge of leadership style models and their role in effective leadership behaviour. Knowledge of methods of understanding and analysing management and decision-making systems in work organisations, their ethical limitations and their potential for improvement. Understand and identify with the importance of corporate social responsibility. Understands the ethical responsibilities of management and its role in the effective functioning of the firm.	
	Ability Ability to demonstrate and exercise managerial functions. Distinguish between management styles on the basis of advantage and disadvantage and apply the appropriate style as necessary. Distinguish between long and short-term tasks and consequences. Ability to creatively analyse the purpose, process and organisational system of a work organisation. Ability to organise own and others' work effectively and humanely, and to lead work teams. Ability to manage, organise, control and coordinate the development of the company's material and information processes. A good sense of responsibility, assessment (self-assessment), analysis and synthesis.	
	Attitude He is open and able to accept different opinions, which are not his own. Willing and able to work in a team and share knowledge with others. Interest and commitment to continuous professional development. Strives to make decisions in full respect of legal and ethical standards. She has a comprehensive systems approach.	
	Autonomy and responsibility It builds and initiates new areas of knowledge and new practices with creative autonomy. He/she is able to take a leading role and to engage in a high level of cooperation in the formulation of practical issues affecting the future of his/her work and organisation. He/she takes responsibility for the consequences of his/her actions and decisions. Ability to perform autonomously the management tasks related to the technical and economic processes of the enterprise and the management of operations. Has a sense of responsibility for sustainable development.	
Short description of the subject content	The world of business, organisations, businesses and companies. Business and its environment. Business and management, organisational and management functions. Management, leadership, governance and how they relate to each other. Managerial roles and levels. Historical overview of management. Management trends, schools and concepts.	

	Similarities and differences. Planning: hierarchy of organisational objectives and levels of planning, long, short term and operational planning, methods of planning. Organisation: structural change, processes, understanding of organisations, division of labour and the arrangement of divisions, creating process and organisational structures, structural characteristics of organisations, types of organisations and their characteristics. Management: enforcement of authority, setting standards, measurement, evaluation and correction, managing day-to-day problems, monitoring and controlling, tools for strategic management. Personal leadership: leadership behaviour and leadership style, identities and differences in theories of leadership style and conclusions to be drawn. Politics and ethics in organisational life. Interpretation, areas and sources of business ethics. Characteristics of ethical behaviour and ethical business. The concept of a responsible company, an introduction to corporate social responsibility. Ethical responsibilities of management within the company.
Types of student activities	Guided and independent study of theoretical material, Problem solving with guidance and independently. Analysis of case studies, group work. Solving complex problems, cooperation in team work. Collecting, processing and presenting information related to
Required literature and contact details	•
Recommended literature and contact details	•
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Product management and value analysis

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Termékmenedzsment és értékelemzés</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Product management and value analysis</td><td>Code</td><td>DUEN(L)-TVV-118</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Social Sciences, Department of Management and Entrepreneurship</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>2</td><td>per week</td><td>1</td><td>per week</td><td></td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>5</td><td>per term</td><td>0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3"></td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6"></td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knowledge and understanding of the tools and methods of computer modelling and simulation in the field of mechanical engineering - Broad theoretical and practical knowledge, methodological and practical skills for the design, manufacture, modelling, operation and management of complex mechanical systems and processes. Comprehensive knowledge of machine, system and process design methods in the field of mechanical engineering.</td></tr>
<tr><td colspan="7">Ability
Ability to master the global design of complex systems based on a systems and process-oriented thinking. o Ability to plan and manage the use of technical, economic, environmental and human resources in a complex way. o Ability to apply and develop procedures, models and information technologies used in the design, organisation and operation of engineering systems and processes. Skills in quality assurance, metrology and process control of engineering systems, technologies and processes. Ability to deal creatively with problems, to solve complex problems in a flexible manner, and to engage in lifelong learning and commitment to diversity and value-based approaches</td></tr>
<tr><td colspan="7">Attitude
It strives to improve its own knowledge and that of its staff through continuous self- and further training. Strive to respect and enforce ethical principles of work and organisational culture. Strive to meet and enforce quality standards. Strive to organise and carry out their tasks in accordance with environmental, health and sustainability standards. Strive to acquire a broad and comprehensive literacy. Strive to implement sustainability and energy efficiency requirements. Strive to plan and carry out tasks to a high professional standard, either independently or in a team. Strive to carry out their work in a complex approach based on a systems and process-oriented thinking. In the course of his/her work, he/she will explore the possibility of setting research, development and innovation objectives and strive to achieve them. Using his/her technical knowledge, he/she seeks to gain a better understanding of observable phenomena and to describe and explain their laws.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
It takes its decisions independently, in consultation with other disciplines (mainly legal, economic, energy and environmental), and takes responsibility for them. In its decisions, it takes account of the principles and application of environmental protection, quality, consumer protection, product liability, equal access, health and safety at work, technical, economic and legal regulation and engineering ethics.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">The basic concept of value analysis, its main characteristics, tools, types of value analysis (Value Analysis, Value Engineering, Value Control, Value Investment, Value Management). Methods of product selection, principles of selecting team members, main steps of the value analysis process, definition of product functions, steps of function costing, methods of designing and testing variants, philosophy and rules of Total Product Management, environmental aspects, basic features of life cycle analysis, principles of life cycle management, maintenance expectations.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Processing what you've heard 40% Processing published material 20% Organising what you've learned 20% Solving test papers 20%</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">•</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">•</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
</table>

Description and timetable of the workshops	

Basics of nuclear safety

Name of the subject		in Hungarian		Nukleáris biztonság alapjai				Level	BSc	
		in English		Basics of nuclear safety				Code	DUEN(L)-MGT-117	
Responsible educational unit				Institute of Technology, Department of Mechanical Engineering and Energy						
Name of compulsory prior learning DUEN(L)-										
Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	2	per week	0	per week	1	M	5	english
Part time	150/15	per term	10	per term	0	per term	5			
Teacher responsible for the subject				Name		Miklós Horváth, PhD		schedule	College professor	
Training objective and justification of the course (content, output, location in the curriculum)				**Goals, development objectives** A series of introductory lectures to give the student an overview of the history of nuclear energy, the types of nuclear power plants currently in operation and planned for the future, the journey of uranium ore from mining to burial, and trends, and to anticipate what they will learn in more detail in each subject.						
Typical delivery methods				Presentation	For all students in a large lecture hall with a blackboard presentation					
				Practice	For all students in a lecture room with projector.					
				Laboratory						
				Other						
Requirements (expressed in terms of learning outcomes)				**Knowledge** Have a comprehensive knowledge of the basic facts, trends and limits of the subject area of engineering. Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field. You know the terminology, key concepts and theories related to your field. You have a comprehensive knowledge of the main theories and problem-solving methods in your field. Comprehensive knowledge of basic economic, business and legal rules and tools. He has a thorough knowledge of the structural materials used in the field of mechanical engineering, the methods of their manufacture and the conditions of their application. Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes. Comprehensive knowledge of the operating principles and structural units of the machinery, power tools, mechanical equipment and tools used. He/she knows the measuring procedures used in mechanical engineering, their instruments, instruments and measuring equipment. He/she knows the expectations and requirements of the occupational safety, fire protection, safety and occupational health areas related to his/her field of specialisation, as well as the relevant environmental protection regulations. Comprehensive knowledge of the basics, limits and requirements of logistics, management, environmental protection, quality assurance, information technology, law and economics, which are integrally related to the field of engineering. In-depth knowledge of learning, knowledge acquisition, data collection methods, their ethical limitations and problem-solving techniques in mechanical engineering. Knowledge of the methods and tools of business economics and cost-benefit analysis based on technical principles. Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used. Apply the related computational and modelling principles and methods of engineering product, process and technology design.						
				Ability The ability to analyse at a basic level the disciplines that make up the knowledge base of the technical field, to synthesise relationships and to make appropriate evaluations. Ability to apply the most important terminology, theories and procedures of the technical field in the performance of related tasks. Ability to plan, organise and carry out independent learning. Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background. Ability to understand and use literature, computer and library resources specific to their field. The acquired IT knowledge can be applied to the solution of tasks in the field. Ability to build basic models of technical systems and processes. The ability to use their knowledge in a creative way to manage their workplace resources effectively.						

	In the course of his/her work, he/she is able to apply and enforce safety, fire safety and hygiene rules and regulations. Ability to communicate in a professionally appropriate manner, orally and in writing, in your mother tongue and at least one foreign language. Ability to apply the technical specifications related to the operation of mechanical systems, the principles and economic context of setting up and operating machinery and mechanical equipment. The ability to manage and control the production processes of specialised technology, with a view to quality assurance and quality control. Ability to diagnose mechanical failures, select troubleshooting operations, solve repair tasks
	Attitude It assumes and authentically represents the social role of its profession and its fundamental relationship with the world. It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering. You strive to make your self-training a means to achieve your professional goals. Make decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards. It tries to solve problems in cooperation with others, where possible. Strive to keep their self-training in mechanical engineering continuous and in line with their professional goals. It strives to solve its tasks and make management decisions by listening to the opinions of the colleagues it manages, preferably in cooperation. You have the stamina and tolerance for monotony needed to carry out practical activities. You are open to the use of IT tools, you strive to learn and use software in the field of mechanical engineering, and you know and use at least one of these programs to a proficient level. Open and receptive to new, modern and innovative practices and methods related to organic farming and health awareness. Using his/her technical knowledge, he/she strives to understand the observable phenomena as thoroughly as possible, to describe and explain their laws. In the course of his/her work, he/she observes and complies with the relevant safety, health, environmental, quality assurance and control requirements.
	Autonomy and responsibility In unexpected decision situations, he/she independently thinks through and develops comprehensive, substantiating professional questions on the basis of given sources. Responsibly upholds and represents the values of the engineering profession, and is open to professionally informed critical comment. In the performance of his/her professional duties, he/she will cooperate with qualified professionals from other disciplines (primarily technical, economic and legal). Identify shortcomings in the technologies used, process risks and take the initiative to mitigate them. Monitor legislative, technical, technological and administrative changes in the field. Under the direction of the line manager, manages the work of the staff assigned to him/her and supervises the operation of machinery and equipment. Assesses the efficiency, effectiveness and safety of the work of subordinates. He/she shall ensure that the professional development of his/her subordinates is promoted, and shall manage and support their efforts in this direction, applying the principle of equal access. Sharing his/her experience with his/her colleagues in order to support their development. He/she is responsible for the consequences of his/her technical analyses, the proposals he/she makes and the decisions he/she takes.
Short description of the subject content	The evolution of security philosophy. The basics of modern security philosophy. Risk and security. Technical aspects of security philosophy, implementing defence in depth. International security requirements. IAEA and EU security standards. Domestic regulatory requirements, Nuclear Safety Regulations. Safety functions. Safe heat removal from the reactor active zone. Safe heat removal from the spent fuel pool. Safety systems. Reliability and safety. Verification of design safety, safety reports and safety analyses. Safety management during the operating period, Operating Conditions and Limits.
Types of student activities	Processing of heard text by note-taking and recording of material using own notes and electronically available notes 80% Development of test questions 20%
Required literature and contact details	• • Fundamentals of Nuclear Safety (electronic note, rapporteur's note) • • Elter J., Gadó J., Holló E., Lux I. (eds.): Safety of Nuclear Reactors, ELTE Eötvös Kiadó, ISBN 978-963-312-180-1, Budapest, 2013 • • Materials on MOODLE
Recommended literature and contact details	• • Nuclear Safety Regulations Volumes 1-10 and Guides (OAH website)

	• • IAEA Safety Standards (Safety Fundamentals, Safety Standards, Safety Guides) (IAEA website)
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	Week 7: I final examination Week 12: II final examination Week 13: any paper can be substituted

Basics of Atomenergetics

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Atomenergetikai alapismeretek</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Basics of Atomenergetics</td><td>Code</td><td>DUEN(L)-MGT-118</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning
DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>2</td><td>per week</td><td>1</td><td>per week</td><td>0</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>5</td><td>per term</td><td>0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Miklós Horváth, PhD</td><td>schedule</td><td>College professor</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
A series of introductory lectures to give the student an overview of the history of nuclear energy, the types of nuclear power plants currently in operation and planned for the future, the journey of uranium ore from mining to burial, and trends, and to anticipate what they will learn in more detail in each subject.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">For all students in a large lecture hall with a blackboard presentation. Use of projector or overhead projector.</td></tr>
<tr><td>Practice</td><td colspan="6">Practice, example</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Have a comprehensive knowledge of the basic facts, trends and limits of the subject area of engineering.
Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.
You know the terminology, key concepts and theories related to your field.
You have a comprehensive knowledge of the main theories and problem-solving methods in your field</td></tr>
<tr><td colspan="7">Ability
The ability to analyse at a basic level the disciplines that make up the knowledge base of the technical field, to synthesise relationships and to make appropriate evaluations.
Ability to apply the most important terminology, theories and procedures of the technical field in the performance of related tasks.
Ability to plan, organise and carry out independent learning.
Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.
Ability to understand and use literature, computer and library resources specific to their field.
The acquired IT knowledge can be applied to the solution of tasks in the field.
Ability to build basic models of technical systems and processes.
The ability to use their knowledge in a creative way to manage their workplace resources effectively.
In the course of his/her work, he/she is able to apply and enforce safety, fire safety and hygiene rules and regulations.</td></tr>
<tr><td colspan="7">Attitude
It assumes and authentically represents the social role of its profession and its fundamental relationship with the world.
It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering.
You strive to make your self-training a means to achieve your professional goals.
Make decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards.
It tries to solve problems in cooperation with others, where possible.
Strive to keep their self-training in mechanical engineering continuous and in line with their professional goals.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
In unexpected decision situations, he/she independently thinks through and develops comprehensive, substantiating professional questions on the basis of given sources. Responsibly uphold and represent the values of the engineering profession, and be open to professionally informed critical comments.
In carrying out his/her professional duties, he/she will also cooperate with qualified professionals from other fields (primarily technical, economic and legal).
Identify the shortcomings of the technologies used, the risks of the processes and initiate measures to reduce them.
Monitor legislative, technical, technological and administrative changes in the field.</td></tr>
</table>

	Directs the work of the personnel assigned to him/her, supervises the operation of machinery and equipment, based on the instructions of the workplace manager
Short description of the subject content	The history of nuclear reactors. The Bomb 1939-1945,-47; The first atomic bomb. Accidents Nuclear power plant generations. From the uranium vein to the graveyard. The safety principles. The entire uranium life cycle Uranium ore mining. Fuel cell production. Nuclear power plant use (source: npp.hu). Temporary storage. Reprocessing. Waste management. Final disposal. Reactor physics. Fundamentals of nuclear physics. Criticality (four and six factor formulae). Point kinetics. Building blocks of reactors. Reactor calculations. From transport equation to point kinetics backwards. Reactor kinetics equations with late neutrons Solutions to the transport equation, critical reactor state. Multiplication factor, concept of reactivity. Diffusion approximation. Space dependence calculations. Treatment of reactor ores in reactor physics. Mechanical engineering. .The main components of the primary circuit. Other main equipment of the primary circuit. Elements of the primary circuit safety protection system. The secondary circuit heat cycle processes. Thermohydraulics of the reactor plant. Main factors to increase the safety of nuclear power plants. Fission nuclear power generation of the future. .Fusion power generation
Types of student activities	Taking notes on what you have heard and recording the material using your own notes and those available electronically 80% Developing test questions 20%
Required literature and contact details	• Gábor Pór:Nuclear Energy Basics textbook • Materials on MOODLE • International Atomic Energy Agency textbook, https://www-pub.iaea.org/MTCD/Publications/PDF/P082_scr.pdf • Gyula Csom:Nuclear Power Plant Operation I. - Fundamentals of Reactor Physics and Technology (Technical University of Budapest, 1997) • Gyula Csom:Nuclear Power Plants Operation II/1 - Operation of Energetic Nuclear Reactors (Műegyetemi Kiadó, Budapest, 2005) By: Operational knowledge (University of Dunaújváros, university note, in progress)
Recommended literature and contact details	• Zoltán Szatmáry: Introduction to Reactor Physics, (Akadémiai Kiadó, Budapest, 2000) • Duderstadt, J and Hamilton, L.: Nuclear Reactor Analyses (Wiley, New York, 1976) • Bell, G. I., and Glasstone, S.: Nuclear Reactor Theory (American Nuclear Society, 1970) • Dénes Bódizs:Measurement Techniques for Nuclear Radiation (Typotex, Budapest, 2009) • G. F. Knoll, Radiation Detection and Measurement, 3rd Edition (John Wiley & Sons, Inc., 2000.)
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Ensuring the integrity of equipment

<table>
<tr><td rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="3">Berendezések integritásának biztosítása</td><td>Level</td><td colspan="2">BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="3">Ensuring the integrity of equipment</td><td>Code</td><td colspan="2">DUEN(L)-MGT-119</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="3">Name of compulsory prior learning DUEN(L)-</td><td colspan="6"></td></tr>
<tr><td colspan="2">Type</td><td>Presentation</td><td>Practice</td><td>Laboratory</td><td></td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week 2</td><td>per week 1</td><td>per week 0</td><td></td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term 10</td><td>per term 5</td><td>per term 0</td><td></td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td>Name</td><td colspan="2">Péter Trampus, PhD</td><td>schedule</td><td colspan="2">Professor emeritus</td></tr>
</table>

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** the goals of ensuring equipment integrity encompass safety, reliability, compliance, quality, asset management, environmental protection, and risk management. By prioritizing equipment integrity, organizations can safeguard their people, assets, and reputation while enhancing operational performance and sustainability.	
Typical delivery methods	Presentation	For all students in a large lecture hall with a blackboard presentation. Use of projector or overhead projector
	Practice	
	Laboratory	Measurements and examples
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering. Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field. You know the terminology, key concepts and theories related to your field. You have a comprehensive knowledge of the main theories and problem-solving methods in your field. Comprehensive knowledge of basic economic, business and legal rules and tools. He/she has a thorough knowledge of the structural materials used in the field of mechanical engineering, the methods of their manufacture and the conditions of their application. Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes. Comprehensive knowledge of the operating principles and structural units of the machinery, power tools, mechanical equipment and tools used. He/she knows the measuring procedures used in mechanical engineering, their instruments, instruments and measuring equipment.	
	Ability The ability to analyse at a basic level the disciplines that make up the knowledge base of the technical field, to synthesise relationships and to make appropriate evaluations. Ability to apply the most important terminologies, theories and procedures of the technical field in the performance of related tasks. Ability to plan, organise and carry out independent learning. Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background. Ability to understand and use literature, computer and library resources specific to their field. The acquired IT knowledge can be applied to the solution of tasks in the field. Ability to build basic models of technical systems and processes. The ability to use their knowledge in a creative way to manage their workplace resources effectively.	
	Attitude It assumes and authentically represents the social role of its profession and its fundamental relationship with the world. It tries to solve problems in cooperation with others, where possible. Strive to keep their self-training in mechanical engineering continuous and in line with their professional goals. It strives to solve its tasks and make management decisions by listening to the opinions of the colleagues it manages, preferably in cooperation. It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering. You strive to make your self-training a means to achieve your professional goals. Make decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards	

	Autonomy and responsibility In unexpected decision situations, he/she independently thinks through and develops comprehensive, substantiating professional questions on the basis of given sources. Responsibly uphold and represent the values of the engineering profession, and be open to professionally informed critical comments. In carrying out his/her professional duties, he/she will also cooperate with qualified professionals in other fields (primarily technical, economic and legal). Identify the shortcomings of the technologies used, the risks of the processes and initiate measures to reduce them. Monitor legislative, technical, technological and administrative changes in the field. Directs the work of the personnel assigned to him/her, supervises the operation of machinery and equipment, based on the instructions of the workplace manager. Assesses the efficiency, effectiveness and safety of the work of subordinates. He/she is attentive to promoting the professional development of his/her subordinates, to managing and supporting their efforts in this direction, and to applying the principle of equal access.
Short description of the subject content	The concepts of functional and structural integrity and a coherent system for ensuring them. Their role in safety and availability. Tools: maintenance, monitoring, inspection and testing. Ageing processes and effects, ageing management. Purpose and system of maintenance. Modern maintenance strategies and techniques (condition-based, reliability-centred, risk-based). Optimisation of maintenance. Purpose and system of periodic inspection. Elements of an effective periodic inspection (performance, risk aspects). The role of non-destructive testing in periodic inspection. Qualification of inspection systems.
Types of student activities	Processing of heard text by note-taking and recording of material using own notes and electronically available notes 80% Development of test questions 20%
Required literature and contact details	• Lecture notes in Moodle • Safety of Nuclear Power Plants II (eds.: J. Elter, J. Gadó, E. Holló, I. Lux), ELTE Eötvös Kiadó, Budapest, 2013 • Gyula Csom:Nuclear Power Plant Operation I. - Fundamentals of Reactor Physics and Technology (Technical University of Budapest, 1997) • Gyula Csom:Nuclear Power Plants Operation II/1 - Operation of Energetic Nuclear Reactors (Műegyetemi Kiadó, Budapest, 2005) By: Operational knowledge (University of Dunaújváros, university note, in progress)
Recommended literature and contact details	• • Zoltán Szatmáry: Introduction to Reactor Physics, (Akadémiai Kiadó, Budapest, 2000) • • Duderstadt, J and Hamilton, L.: Nuclear Reactor Analyses (Wiley, New York, 1976) • • Bell, G. I., and Glasstone, S.: Nuclear Reactor Theory (American Nuclear Society, 1970) • • Dénes Bódizs:Measurement Techniques for Nuclear Radiation (Typotex, Budapest, 2009) • • G. F. Knoll, Radiation Detection and Measurement, 3rd Edition (John Wiley & Sons, Inc., 2000.)
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Equipments of Nuclear Power Plants

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Atomerőművek berendezései</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="4">Equipments of Nuclear Power Plants</td><td>Code</td><td>DUEN(L)-MGT-152</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="6"></td></tr>
<tr><td>Type</td><td>Presentation</td><td>Practice</td><td>Laboratory</td><td>Requirement</td><td>Credit</td><td colspan="2">Language of education</td></tr>
<tr><td>Full time 150/39</td><td>per week 2</td><td>per week 1</td><td>per week 0</td><td rowspan="2">E</td><td rowspan="2">5</td><td colspan="2" rowspan="2">english</td></tr>
<tr><td>Part time 150/15</td><td>per term 10</td><td>per term 5</td><td>per term 0</td></tr>
<tr><td colspan="2">Teacher responsible for the subject</td><td>Name</td><td colspan="2">Péter Trampus, PhD</td><td>schedule</td><td colspan="2">Professor emeritus</td></tr>
<tr><td colspan="2">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="6">Goals, development objectives
After completing the subject, the student should know the engineering technology systems and equipment of the pressurized water nuclear power plant, the task, structure and operation of the main equipment. In possession of this knowledge, he should be able to perform independent engineering or management and coordination work in the design, operation, maintenance and inspection of equipment.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">Lectures with blackboard and projector.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Laboratory</td><td colspan="5">Carrying out experiments and calculation.</td></tr>
<tr><td>Other</td><td colspan="5"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge
has extensive theoretical and practical preparation, methodological and practical knowledge for the planning and operation of complex energy conversion, supply and user systems and processes</td></tr>
<tr><td colspan="6">Ability
In solving a problem, it is able to organise cooperation with experts in related fields.
o It can solve specific technical problems in its field in an innovative way using state-of-the-art knowledge acquisition and data collection methods.
It is able to use information and communication technologies and methods to solve technical problems.
Prepared to conduct publication, presentation and discussions in your field, in your native language and in at least one foreign language.</td></tr>
<tr><td colspan="6">Attitude
Constantly monitors his work, results, and conclusions. Expands your knowledge of energy management and sustainability through continuous learning. The student is open to the use of information technology tools. Strives to get to know and routinely use the tools needed for energy management and economic problem-solving. Develops your ability to provide accurate and error-free problem solving, engineering precision, and accuracy. Applies the principles of energy efficiency, sustainability, and environmental awareness in solving energy management tasks. Monitors changes in power plant technologies. Publishes his/her results following his/her professional rules. Publishes his/her opinions and views without offending others.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
Collaborates with the instructor and fellow students to expand knowledge. Accepts well-founded professional and other critical remarks. As part of a team, you work with his/her fellow students to solve tasks in some situations. With his knowledge, he makes a responsible, well-founded decision based on his analysis. Feels responsible for energy, the problems of energy management, and the sustainable use of the environment, as well as present and future generations. The student is committed to the principles and methods of systematic thinking and problem-solving.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="6">The main technological systems of the pressurized water nuclear power plant (primary and secondary circuits).
Primary circuit equipment: reactor equipment (reactor tank, reactor cover, internal structures), reactor cooling circuit equipment (main circulation line, main circulation pump), pressure control system equipment (volume compensation tank), steam generator, zone failure cooling system equipment, other safety system equipment, primary circuit auxiliary system equipment.
Secondary circuit equipment: feed water preheating system equipment, turbine, generator. Condensate system equipment (turbine condenser).
Heating element transfer, spent heating element treatment equipment</td></tr>
<tr><td colspan="2">Types of student activities</td><td colspan="6">Understanding and assimilation of the topics of presentations 50%
Testing of materials 30%
Laboratory exercises 20%</td></tr>
<tr><td colspan="2">Required literature and contact details</td><td colspan="6">• [1] Atomerőművek üzemtana, II. kötet, Az energetikai reaktorok üzemtana, Budapest, 2012.</td></tr>
</table>

Recommended literature and contact details	• [2] Csom Gyula, Atomerőművek üzemtana, Műegyetemi Kiadó, Budapest 2005
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Basic Priciples of Hydrogen Technology

Name of the subject		in Hungarian		Hidrogéntechnológia kémiai alapjai					Level	BSc	
		in English		Basic Priciples of Hydrogen Technology					Code	DUEN(L)-MGT-257	
Responsible educational unit				Institute of Technology, Department of Mechanical Engineering and Energy							
Name of compulsory prior learning DUEN(L)-											
Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education	
Full time	150/39	per week	2	per week	1	per week	0	E	5	english	
Part time	150/15	per term	10	per term	5	per term	0				
Teacher responsible for the subject				Name		Imre Kovács, PhD			schedule	College associate professor	
Training objective and justification of the course (content, output, location in the curriculum)				**Goals, development objectives** Students will learn about the chemical and physical properties of hydrogen, its compounds, the production of hydrogen in laboratory and industrial settings, and the production of high-purity hydrogen. Students will also learn about elementary adsorption processes at the solid-gas interface, diffusion through solids (metals) and membranes, and electrochemical processes in materials containing active hydrogen.							
Typical delivery methods				Presentation	For all students in a large lecture hall with a blackboard presentation. Use of projector.						
				Practice	For all students in a large lecture hall with a blackboard presentation. Use of projector.						
				Laboratory							
				Other							
Requirements (expressed in terms of learning outcomes)				**Knowledge** The student will learn about the elements of knowledge related to hydrogen; The student will understand the knowledge required to work with this energy storage material; The student will recognise the links between the resources associated with such a chemical and the economy-society.							
				Ability The student is able to consider social, economic and energy choices and their consequences through examples; The student will be able to explore the systemic links between energy, economics and the environment.							
				Attitude At the end of the course, the student will be committed to the use of greener energy sources, including hydrogen, to protect the environment and to use energy in an environmentally responsible way. The student will assume responsibility for his/her own activities and for the preservation of the natural environment, and for cooperating with the social environment.							
				Autonomy and responsibility decides independently, takes responsibility							
Short description of the subject content				This course aims to introduce the basics of inorganic and physical chemistry in relation to hydrogen. Its production, physical and chemical properties, and future uses.							
Types of student activities				Presentation: Processing of lectures with notes 40%, independent processing of theoretical material 20%, preparation of lab notes 40%							
Required literature and contact details				• Csepeli-Kovács: Chemistry and Materials Science notebook							
Recommended literature and contact details				•							
Description of tasks to be submitted/measurement reports				Full-time: A total of 3 assignments to be submitted during the semester. By correspondence: A total of 2 papers to be written during the semester.							
Description and timetable of the workshops				At the end of the semester, in the 13th week of the semester, a 100-point essay.							

Engineering construction

Name of the subject		in Hungarian		Gépszerkesztés					Level	BSc
		in English		Engineering construction					Code	DUEN(L)-MGT-112
Responsible educational unit				Institute of Technology, Department of Mechanical Engineering and Energy						
Name of compulsory prior learning DUEN(L)-				MGT-111						
Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	1	per week	2	per week	0	M	5	english
Part time	150/15	per term	5	per term	10	per term	0			
Teacher responsible for the subject				Name		Róbert Sánta, PhD			schedule	Associate professor
Training objective and justification of the course (content, output, location in the curriculum)				**Goals, development objectives** and their interactions. In heating, cooling, ventilation and air conditioning, the systems, system components, and						
Typical delivery methods				Presentation	For all students, in a large lecture, presentation on a whiteboard, projector or on-line using MS Teams, using a computer network.					
				Practice	Group work presentations					
				Laboratory						
				Other						
Requirements (expressed in terms of learning outcomes)				**Knowledge** You know the terminology, key concepts and theories related to your field. Comprehensive knowledge of the methods of knowledge acquisition and problem-solving in the main theories of the field. Has a thorough understanding of machine design principles and methods, machine technology, control procedures and operational processes. Comprehensive knowledge of the operating principles and structural units of the machinery and power tools, mechanical equipment and tools used. Understand, characterise and model the structure and operation of the components and elements of mechanical engineering systems, and the design and interrelationship of the system components used. Apply the related computational and modelling principles and methods of mechanical product, process and technological design.						
				Ability Perform the job according to your qualifications. Ability to plan, organise and carry out independent learning. Ability to identify, formulate and solve (through the practical application of standard operations) routine professional problems, and to identify, formulate and solve (through the practical application of standard operations) the theoretical and practical background necessary for their solution.						
				Attitude Open to learning and absorbing knowledge related to mechanical engineering related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field.						
				Autonomy and responsibility Taking responsibility for your own work and the work of others.						
Short description of the subject content				Typical surfaces and bodies of engineering practice. Plane intersection of plane bodies. Plane section of curved bodies. Passing through flat bodies. Passing of curved bodies. The ISO tolerance system. Tolerances for length dimensions. Fits. Surface quality metrics and how they are specified. Typical design of cast, welded and machined parts. Reconstruction of machine parts (reverse engineering).						
Types of student activities				Processing theoretical material with guidance 20 % Independent processing of theoretical material 20 % Problem solving with guidance 20 % Independent processing of tasks 40 % Laboratory measurements with guidance - Preparation of laboratory reports -						
Required literature and contact details				• Moodle						
Recommended literature and contact details				• Robert L. Norton: Machne Design - An Integrated Approach, 2006, Pearson Prentice Hall Upper Saddle River NJ. - Franz Koenigsberger, Machine tool structure,ISBN 10: 008013405X						
Description of tasks to be submitted/measurement reports										
Description and timetable of the workshops										

Hydrogenstorage technologies

<table>
<tr><td rowspan="2" colspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="2">Hidrogéntárolási technológiák</td><td colspan="3"></td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="2">Hydrogenstorage technologies</td><td colspan="3"></td><td>Code</td><td>DUEN(L)-MGT-155</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>2</td><td>per week</td><td></td><td>per week</td><td>1</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>0</td><td>per term</td><td>5</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Róbert Sánta, PhD</td><td>schedule</td><td></td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Gas storage options, including methods of hydrogen storage. The main content of the course includes. Electrochemical and chemical hydrogen storage. Hydrogen storage in C-based matrix.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">For all students in a large lecture hall with a blackboard presentation. Projector use</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">All students participate in a metrology lab demonstration</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You will learn about the possibilities of storing hydrogen. In addition to traditional storage technologies, you will learn about modern storage methods such as Metal-H systems and electrochemical hydrogen storage methods</td></tr>
<tr><td colspan="7">Ability</td></tr>
<tr><td colspan="7">Attitude
Open to learning and absorbing knowledge related to the subject Hydrogen Storage Technologies related to his/her qualification and area of expertise. Interested in new methods and tools related to the field</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Felelősségvállalás saját munkája és társai munkája iránt.</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">Hydrogen storage is seen as a key technology for both stationary and mobile power generation. In this course, students will learn about the most common gas storage technologies, including new technologies for efficient storage and distribution of hydrogen.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Presentation: Processing of heard text with notes 60%, independent processing of theoretical material 30%, independent research 10%. Lecture: Processing of heard text with notes 60%, independent processing of theoretical material 30%, independent research</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• • Hydrogen Storage Technologies, Mehmet Sankir (Editor), Nurdan Demirci Sankir (Editor) 2018
• • Solid-State Hydrogen Storage Walker Gavin (University of Nottingham UK) 2008</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• Hydrogen Storage Technology Klebanoff Lennie Taylor and Francis, 2016</td></tr>
<tr><td colspan="4">Description of tasks to be submitted/measurement reports</td><td colspan="7"></td></tr>
<tr><td colspan="4">Description and timetable of the workshops</td><td colspan="7"></td></tr>
</table>

Industrial knowledge

Name of the subject	in Hungarian	Üzemtani ismeretek	Level	BSc
	in English	Industrial knowledge	Code	DUEN(L)-MGT-213
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Name of compulsory prior learning DUEN(L)-				

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	2	per week		per week	1	E	5	english
Part time	150/15	per term	10	per term	0	per term	5			
Teacher responsible for the subject				Name		Gábor Ladányi			schedule	Master instructor

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The student will understand the basic reactor physics and thermohydraulics processes in the reactor active zone. Understand the factors that influence reactivity. Recognise the links between the technological systems and the behaviour of the active zone. Be able to assess the role of an engineering system in the safety of the active zone. Understand how design and safety analysis are linked through an iterative process.	
Typical delivery methods	Presentation	Lectures with blackboard and projector.
	Practice	
	Laboratory	Carrying out experiments and calculation.
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering. Knowledge of the general and specific mathematics required to operate in the field of engineering, principles, rules, contexts and procedures of natural and social sciences. Knowledge of the terminology, the most important relationships and theories related to the field. Comprehensive knowledge of the main theories in the field of knowledge acquisition and problem solving and problem-solving methods. Comprehensive knowledge of basic economic, business and legal rules and tools. Thorough knowledge of structural materials used in engineering, their production methods and conditions of use. Has a basic knowledge of the principles and methods of machine design, machine construction technology, control procedures and operating processes. Comprehensive knowledge of the operating principles and structural units of the machinery, power tools, mechanical equipment and tools used. Knowledge of measuring procedures, their tools, instruments and measuring equipment used in mechanical engineering. Has an working knowledge of occupational health and safety and fire prevention related to his/her area of specialisation, safety, health and safety at work and environmental protection requirements in the field of the activity. Comprehensive knowledge of the basics, limits and requirements of logistics, management, environmental protection, quality assurance, information technology, law and economics, which are integrally related to the field of engineering. In-depth knowledge of the learning, knowledge acquisition, data collection and management of the mechanical engineering discipline. methods of learning, learning, research and data collection, their ethical limitations and problem-solving techniques. Knowledge of the methods and tools of business economics and engineering-based cost-benefit analysis. Understand, characterise and model the structure and operation of the components and elements of engineering systems, the design and interrelationship of the system components used. Apply the related computational and modelling principles and methods of mechanical product, process and process design.	
	Ability Ability to carry out a basic analysis of the disciplines that make up the knowledge system of the technical field, to synthesising and evaluating contexts. Ability to understand the main terminologies, theories and procedures of the technical discipline in the performance of related tasks. Ability to plan, organise and conduct independent learning. Ability to identify routine technical problems and to identify, formulate and solve (by the practical application of standard operations) the theoretical and practical background required to solve them. Ability to understand and use literature specific to his/her field of specialisation, computing, library resources. Ability Ability to carry out a basic analysis of the disciplines that make up the knowledge system of the technical field, to synthesising and evaluating contexts.	

	Ability to understand the main terminologies, theories and procedures of the technical discipline in the performance of related tasks. Ability to plan, organise and conduct independent learning. Ability to identify routine technical problems and to identify, formulate and solve (by the practical application of standard operations) the theoretical and practical background required to solve them. Ability to understand and use literature specific to his/her field of specialisation, computing, library resources. Ability to apply the acquired knowledge in the field of information technology to the solution of problems in the field apply the knowledge and skills acquired in the field Ability to construct basic models of technical systems and processes. Ability to use knowledge in a creative way, using the resources of the workplace effectively manage their workplace effectively. Ability to apply and comply with safety, fire safety and hygiene rules and regulations in the course of his/her work. Ability to apply, orally and in writing, in a professionally appropriate manner, in accordance with the area of competence communicate in his/her mother tongue and at least one foreign language. Ability to apply the technical specifications relating to the operation of mechanical systems, the the principles of setting up and operating machinery and mechanical equipment, and the principles of economic efficiency the economic context. Ability to manage and control technical production processes, taking into account the elements of quality assurance and quality control. Ability to diagnose mechanical breakdowns and to select remedial actions, solve repair technology problems.
	Attitude It assumes and authentically represents the social role of its profession and its fundamental relationship with the world. Open to professional, technological development and innovation in the field of engineering and innovation in the technical field. strives to make self-learning a means of achieving professional goals. Takes decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards. Seek to solve problems, preferably in cooperation with others. He/she shall endeavour to pursue continuous and professional development in the field of mechanical engineering. in line with his professional goals. He/she strives to solve problems and make management decisions by listening to the opinion of his/her supervisor, preferably in cooperation. Possesses sufficient stamina and tolerance of monotony to carry out practical activities have the ability to perform tasks with. Open to the use of information technology tools and has a good knowledge and application of software in the field of engineering, with at least one such program at a proficiency level. Open and receptive to the application of new, modern and innovative practices and methods related to organic farming and health awareness. Applies his/her acquired technical knowledge to gain a better understanding of observable phenomena and to describe and explain their laws. In the course of his/her work, he/she shall apply the relevant safety, health, environmental and quality assurance and control requirements.
	Autonomy and responsibility In unexpected decision situations, he/she independently thinks through and develops comprehensive, substantiating professional questions on the basis of given sources. Responsibly upholds and represents the values of the engineering profession, and is open to professionally informed critical comment. In the performance of his/her professional duties, he/she will cooperate with qualified professionals from other disciplines (primarily technical, economic and legal). Identify shortcomings in the technologies used, process risks and take the initiative to mitigate them. Monitor legislative, technical, technological and administrative changes in the field. Under the direction of the line manager, manages the work of the staff assigned to him/her and supervises the operation of machinery and equipment. Assesses the efficiency, effectiveness and safety of the work of subordinates. He/she shall ensure that the professional development of his/her subordinates is promoted, and shall manage and support their efforts in this direction, applying the principle of equal access. Sharing his/her experience with his/her colleagues in order to support their development. He/she is responsible for the consequences of his/her technical analyses, the proposals he/she makes and the decisions he/she takes.

Short description of the subject content	Beam decay, NAA. Basic concepts in reactor physics: transport equation, diffusion approximation, cross section, neutron spectrum, reactivity coefficients. Moderation. Inherent safety. Reactor physics framework parameters and their derivation. Charge design. Zone thermohydraulics: heat conduction from fuel to moderator, DNBR. RIA analyses flow. Fuel behaviour. Relationship between framework parameters-safety analyses-technical design. Manoeuvring: reactor control modes, rod, boric acid, steam generator, Xe process. In-core, ex-core measurements.
Types of student activities	Laboratory and simulator exercises
Required literature and contact details	• • Gábor Pór:Nuclear Energy Basics textbook • • Materials on MOODLE • • International Atomic Energy Agency textbook, https://www-pub.iaea.org/MTCD/Publications/PDF/P082_scr.pdf • • Gyula Csom:Nuclear Power Plant Operation I. - Fundamentals of Reactor Physics and Technology (Technical University of Budapest, 1997) • • Gyula Csom:Nuclear Power Plants Operation II/1 - Operation of Energetic Nuclear Reactors (Műegyetemi Kiadó, Budapest, 2005) By: Operational knowledge (University of Dunaújváros, university note, in progress)
Recommended literature and contact details	• Zoltán Szatmáry: Introduction to Reactor Physics, (Akadémiai Kiadó, Budapest, 2000) • Bell, G. I., and Glasstone, S.: Nuclear Reactor Theory (American Nuclear Society, 1970) • • Dénes Bódizs:Measurement Techniques for Nuclear Radiation (Typotex, Budapest, 2009) • G. F. Knoll, Radiation Detection and Measurement, 3rd Edition (John Wiley & Sons, Inc., 2000.)
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

NPP measurements and NDT

Name of the subject		in Hungarian		Üzemi mérések és anyagvizsgálatok					Level	BSc	
		in English		NPP measurements and NDT					Code	DUEN(L)-MGT-256	
Responsible educational unit				Institute of Technology, Department of Structural Integrity							
Name of compulsory prior learning DUEN(L)-											
Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education	
Full time	150/39	per week	2	per week	1	per week	0	E	5	english	
Part time	150/15	per term	10	per term	5	per term	0				
Teacher responsible for the subject				Name		Gábor Pór, PhD			schedule	Professor emeritus	
Training objective and justification of the course (content, output, location in the curriculum)				**Goals, development objectives** Students learn the modern model-based measurement philosophy, which enables the measurement of reactor parameters that cannot be measured directly, learn about the most important nuclear power plant-specific, primarily primary circuit measurement chains, and get an overview of material testing techniques used in destructive and non-destructive nuclear power plants.							
Typical delivery methods				Presentation	Projector, ppt presentation materials						
				Practice							
				Laboratory							
				Other							
Requirements (expressed in terms of learning outcomes)				**Knowledge** Students get to know the primary circuit measurement methods and typical data collection and evaluation systems of nuclear power plants. He knows the measuring tools and methods used in the primary circuit of nuclear power plants.							
				Ability Students are able to set up a suitable measuring device in a nuclear power plant environment, think through its consequences and proper operation, develop the measurement procedure and measurement evaluation							
				Attitude Forms cooperation with his/her group mates and the instructor during the expansion of knowledge.							
				Autonomy and responsibility Able to independently learn nuclear power plant measurement procedures and prepare a study based on international literature, with risk analysis							
Short description of the subject content				Neutron flux measurements; Temperature measurements; In-zone neutron detectors, DPZ transmitters (KNI chains); Pressure measurements; Traffic measurements; Vibration measurements. Reactivity coefficients, heating element temperature: Measurement philosophy model-based measurements. Nuclear power plant data collection systems. Hungarian data collector VERONA. Human-machine communication. Built-in reactor physics calculations in the new Verona. ALPS (Advanced Loose Part. System) is the modern acoustic system for searching for loose parts. Destructive and non-destructive tests: the six most important non-destructive methods and their role in nuclear power plants.							
Types of student activities				Participation in lectures, preparation of an independent study based on literature							
Required literature and contact details				• IAEA relating materials from internet or on Moodle							
Recommended literature and contact details				• IAEA relating materials from internet or on Moodle							
Description of tasks to be submitted/measurement reports				Presentation and study of nuclear power plant systems based on pre-agreed literature: 1 ppt presentation approx. 20 slides and an essay describing it							
Description and timetable of the workshops											

Metrology

Name of the subject	in Hungarian	Gépészeti méréstechnika	Level	BSc
	in English	Metrology	Code	DUEN(L)-MUG-213
Responsible educational unit		Institute of Technology, Department of Mechanical Engineering and Energy		
Name of compulsory prior learning DUEN(L)-		MUG-257 MUG-222		

Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education
Full time	150/39	per week	2	per week	0	per week	1	M	5	english
Part time	150/15	per term	10	per term	0	per term	5			
Teacher responsible for the subject				Name		Gábor Pór, PhD			schedule	Professor emeritus

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The attendants must be able to analyse the tribology systems, determine the structural and load data, have to be able to identify the mayor wearing processes in the wave of tribological properties. The life time and third body most be determined generally. They have to plan and run tribological systems on the basis of properties of lubrication state. They have to learn the different fields of the applied tribology (processing, mechanical structures, thermal prime mover), as well as the related supplier systems run and configuration.	
Typical delivery methods	Presentation	In a classroom with the use of projector or computer in each lecture.
	Practice	Flipchart, blackboard and other multimedia equipment in smaller seminar rooms suitable for group work
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knows and uses the basic concepts of firing technology in practice. The students understand and uses knowledge of combustion theory in environmental protection. The student knows the processes that take place in domestic and industrial boilers. The student interprets the structure of the special steam turbine, the way of energy conversion. The student knows the structure of the reaction steam turbine, the way of energy conversion. The student understands the design of a gas turbine for energy purposes, the role of his turbine, compressor and firebox. The student is aware of the main features of the construction of a gas turbine used in aviation. The student informed about the operation of the compressor refrigerator. The student understands the structure of the compression and spark ignition engine, the processes that take place in them. The student is aware of the possibilities of increasing the performance of internal combustion engines, their advantages and disadvantages.	
	Ability Performs the job according to his/her qualifications. Ability to plan, organise and carry out independent learning. The ability to manage and control the production processes of specialised technology, with a view to quality assurance and quality control	
	Attitude Student strives to meet and enforce quality standards. Student strives to organise and carry out their tasks in accordance with environmental, health and sustainability standards. Using student's technical knowledge, Student will seek to gain a better understanding of observable phenomena and to describe and explain their laws.	
	Autonomy and responsibility Taking responsibility for your own work and the work of others.	
Short description of the subject content	The mechanical tools of the direct linear dimensioning. The mechanical tools of the relative linear dimensioning. Optical linear dimensioning instruments. Gauge blocks. Coordinate measuring instrument. Angular measurement. Extension and strength measuring. The operation principle, the main sources of errors and the application techniques of the dynamometer, extensometer and the dislocation-meter. Mechanical examinations, the application possibilities of the stressing examinations. Processing of measuring results with statistical methods. The estimation of measuring results.	
Types of student activities	Processing heard text with notes 60% Task-based organisation of information 10% Independent processing of tasks 30%.	
Required literature and contact details	• • Materials on MOODLE • • GUM (Guide ot Uncertainty of Measurement	
Recommended literature and contact details	• • Jay L. Bucher, The Metrology Handbook Hardcover – April 1, 2004, springer, ISBN-13: 978-0873896207 • • Heather A. Wade, The ASQ Metrology Handbook, Third Edition (eBook), Published 2023, ISBN: 9781636940205, Item Number: E1596	

Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Production Technology

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Gyártástechnológia</td><td>Level</td><td>BSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Production Technology</td><td>Code</td><td>DUEN(L)-MUG-252</td></tr>
<tr><td colspan="4">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="4">Name of compulsory prior learning DUEN(L)-</td><td colspan="7">MUG-152</td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>2</td><td>per week</td><td>1</td><td>per week</td><td></td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>5</td><td>per term</td><td>0</td></tr>
<tr><td colspan="4">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Gábor Vizi, PhD</td><td>schedule</td><td>Associate professor</td></tr>
<tr><td colspan="4">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Understanding the basics of manufacturing technology FORMULAR FORMATIONS Understanding the theoretical basis of plastic forming. Knowledge of plastic forming technologies, production equipment and tools. CUTTING - Understanding the principles and implications of machining - Understanding the basic machining processes - Calculation and selection of process data - Calculation of machine time and standard time and cost - Understanding other machining processes</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td colspan="2">Presentation</td><td colspan="5">For all students, in a large lecture, using a whiteboard, projector or overhead projector</td></tr>
<tr><td colspan="2">Practice</td><td colspan="5">Small table top exercises for up to 20 people</td></tr>
<tr><td colspan="2">Laboratory</td><td colspan="5"></td></tr>
<tr><td colspan="2">Other</td><td colspan="5"></td></tr>
<tr><td colspan="4" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes.
Apply the related computational and modelling principles and methods of engineering product, process and technology design.</td></tr>
<tr><td colspan="7">Ability
Performs the job according to his/her qualifications.
Ability to plan, organise and carry out independent learning.
The ability to manage and control the production processes of specialised technology, with a view to quality assurance and quality control.</td></tr>
<tr><td colspan="7">Attitude
He/she is open to learning and absorbing knowledge related to engineering technology related to his/her qualification and area of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Taking responsibility for your own work and the work of others</td></tr>
<tr><td colspan="4">Short description of the subject content</td><td colspan="7">THE FORMAL FORMATION PROCEDURES The theoretical basis of metal formation. Classification of non-ferrous forming processes. Forging, stamping, rolling technologies, production equipment and tools. Seamless tube manufacturing technology, production equipment. Plate forming technologies. Punching and blanking technologies, equipment and tools. Bending theory, technology, machines and tools. Theory, technology and tools for deep drawing. Techniques, tools and machinery for cold heading and cold flow. Casting technology, processes and tools. CHIPPING PROCEDURES Chipping methods and characteristics of chipping. Turning, planing, drilling, milling, grinding. Optimum determination of the number of passes, feeds and cycles for each type of machining. Calculation of the main machine time. Selection of the appropriate machine. Calculation of the standard time. Cost analysis. Non-conventional procedures. Other machining processes (hobbing, sawing, serrations, etc.). Determination of the prefabrication.</td></tr>
<tr><td colspan="4">Types of student activities</td><td colspan="7">Processing theoretical material with guidance 5 %
Independent processing of theoretical material 40 %
Task solving with guidance 15 %
Independent processing of tasks 40 %</td></tr>
<tr><td colspan="4">Required literature and contact details</td><td colspan="7">• • Dr. Stevan Firstner: Manufacturing technology (machining) note (J1). Dunaújváros College Publishing Office, 2007.
• • Dr. Firstner Stevan: Manufacturing Technology (machining) study guide (TU1) - note. First Engineering Technology (TU TU).
• • Zsoltné Fülöp, Metal technology (chipless forming processes) (J2) Dunaújváros College Publishing Office, 2008.
• • Zsoltné Fülöp, Study Guide for the subject "Metal Technology" (chipless forming processes) (TU2) Dunaújváros College Publishing Office, 2008.</td></tr>
<tr><td colspan="4">Recommended literature and contact details</td><td colspan="7">• • Illés Dudás: Machine Manufacturing Technology I.(GM), Miskolc University Publishing House, 2000.</td></tr>
</table>

	• • Gál Gaszton-Kiss Antal-Sárvári József-Tisza Miklós: Plastic Cold Formation, Tankönyvkiadó, Budapest, 1981. p. 360. Ziaja György: Plastic Formation, Tankönyvkiadó, Budapest, 1978. p. 396
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	