2024

Mechanical Engineering Master's course

UNIVERSITY OF DUNAÚJVÁROS

Content

¶

COURSE DESCRIPTION

Mechanical Engineering Master's Course (Mechanical Engineering)	
Institution responsible for education	University of Dunaújváros
ID of institution	FI60345
Address	2400 Dunaújváros, Táncsics Mihály utca 1/A
Responsible leader	István András, Dr. habil. Rector
Leaders responsible for education	
Institution responsible for course	Technical Institute
Director of institute	Róbert Sánta Dr. habil.
Responsible for course	Róbert Sánta Dr. habil.
Specialisations	
Lifetime management specialization	András Nagy Dr. PhD
Modern material structure and technology specialization	Zsolt Csepeli Dr. PhD
Parameters of education	
Level of education	Master education
Educational level	Master's degree (MSc)
Qualification indicated in the diploma in Hungarian	okleveles gépészmérnök
Qualification indicated in the diploma in English	Mechanical Engineer
Time of education	4 semesters
Number of credit scores to be acquired	120 credit

¶

Condition for admission	
a) To be considered for full credit: bachelor's degree in mechanical engineering.	
b) To be admitted to the master's programme, you must have obtained at least 40 credits (including at least 12 credits in mathematics, at least 5 credits in physics and at least 20 credits in professional studies) out of the 70 credits listed below: - 20 credits in basic sciences (mathematics, physics, mechanics, materials science, thermodynamics); - 10 credits in economic and human sciences (economics, management, environment, quality assurance, occupational health and safety, social sciences); - 40 credits in the field of professional knowledge (general engineering, machine and product design, structural engineering, materials science and technology, information technology, measurement and signal processing, control engineering, safety engineering, energy technology, machinery and processes, production technology, production automation, quality assurance, logistics, vehicles and mobile machinery, chemical and environmental processes, electrical engineering and electrical engineering). In the master's programme, the missing credits in the listed areas must be acquired in accordance with the study and examination regulations of the higher education institution.	
c) To the input b. The input can be primarily counted by completing the credits specified in b: from the engineering field of study, materials engineering, safety engineering, military and security engineering, light industrial engineering, civil engineering, engineering geology, engineering management, chemical engineering, environmental engineering, energy engineering, industrial product and design engineering, transport engineering, automotive engineering, mechatronics engineering, electrical engineering, and agricultural engineering in the field of agricultural engineering.	
Professional practice	The professional practice shall take at least 4 weeks
Conditions for issuing a 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
Diploma work	The diploma work consists in the solution of a mechanical engineering task or elaboration of a research task arising in a specific professional field that, relying on the knowledge acquired by the student during his/her studies, can be completed during a semester by means of studying additional special literature and under the management of internal and industrial consultants. By means of the diploma work, the candidate certifies that he/she obtained adequate skill in the practical application of the knowledge acquired, is capable of performing mechanical engineering tasks and, in addition to the curriculum, is also familiar with and capable of applying other professional literature in a value crating way. Formal requirements: the size of diploma work shall be 50 to 70 pages.

Final examination	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.
Lifetime management specialization	DUEN(L)-MUG-150 Lifetime management DUEN(L)-MUG-255 Maintenance strategies DUEN(L)-MUG-250) Inspectional Methods of Machine Condition
Modern material structure and technology specialization	DUEL-MGT-110 Information technology in materials science DUEL-MUA-111 Material and Structure Analysis DUEL-MGT-011 Innovative applications of polymers and composites
Diploma average	The result of diploma shall be calculated as follows: (SE + D + TA)/3. Arithmetical mean of marks for final examination subjects (SE), Mark for diploma work (D) awarded by the Final Examination Committee, weighted study average (TA) related to the total number of credits acquired during the full study period except the preparation of diploma work
Qualification of diploma	excellent 4.51 – 5.00; good 3.51 – 4.50; average 2.51 – 3.50; acceptable 2.00 – 2.50
Conditions for issuing a diploma	Successful completion of the final examination is a prerequisite for the award of a diploma certifying the completion of higher education.
Work order	Full-time (regular)

Required engineering competences

Knowledge:

- Know the general and specific mathematics, natural and social sciences principles, rules, relationships and procedures for the technical field of agriculture.
- Comprehensive understanding of global social and economic developments. - Do you know the theories, and the relationship between them make up the terminology is essential in technical areas.
- Know and understand the technical field of activities for knowledge and basic facts, and the limits of the expected directions of progress and development.
- Knowledge and understanding related to the technical area and the occupation of a key importance in other areas (mainly in logistics, management, environmental protection, quality control, information technology, legal, economic, labor and fire protection, safety areas) terminology, the main specifications and criteria.
- In-depth knowledge and understanding of knowledge acquisition, data collection methods in the technical field, their ethical constraints and problem-solving techniques.
- A comprehensive overview of important structural properties of materials used in mechanical and areas of application.
- Details of the rules of the technical documentation created. Familiar productivity tools and methods necessary for the occupation specialty legislation related to driving.
- Provides a related engineering field measurement and test theoretical knowledge. - Do you know a related engineering field of information and communication technologies.
- Know and understand the related computer modeling and simulation engineering skill of the art tools and methods.

- Wide range of theoretical and practical preparedness, methodological and practical knowledge of complex engineering systems and processes for the design, production, modeling, operation and management.
- Comprehensive knowledge of Mechanical design of machines, systems and process design methods.

Skills:

- Technical problems solving in field gained the ability to apply general and specific mathematics, natural and social sciences principles, rules, relationships and processes.
- Ability of the relevant technical field theories and related terminology when applied to solve problems in innovative ways.
- Ability to specific problems in the field of professional and versatile interdisciplinary approach to solve.
- The ability to organize in cooperation with experts from the related disciplines in problem solving.
- The use of modern methods of data acquisition to knowledge and innovative ways to be able to solve specific technical problems arising in the art.
- Can information and communication technologies and methods used to solve technical problems.
- Are you ready to trade territory, language and conduct at least one foreign language publications, presentations and business negotiations.
- After due practice is able to perform managerial tasks.
- Laboratory testing and analysis, evaluation and documentation of test results Able materials used in the engineering field.
- Are you ready to process and organize information gathered during the operation of engineering systems and processes to analyze, draw conclusions.
- Ability to original ideas to enrich the knowledge base of engineering sciences.
- Ability to apply integrated knowledge of machinery, mechanical equipment, systems and processes in engineering materials and technologies, and related areas of electronics and information technology professionals.
- Ability Based on a system-oriented, process-oriented way of thinking global design complex systems to learn.
- Ability to plan and manage complex technical, economic, environmental, and human resource utilization.
- Ability to design engineering systems and processes, used for organizing and operating procedures, models, their application and further development of information technologies.
- Ready for mechanical systems, technologies and processes, quality assurance, metrology, and process control for solving tasks you.
- Ability to deal with problems in creative and flexible to solve complex tasks, as well as lifelong learning and commitment to diversity and value-based side.

Attitude:

- An open and receptive to learn and adopt credible mediation of the technical field in a professional, technological development and innovation.
- It takes a professional and ethical values related to the technical area.
- Seek technical areas related to the development of new methods and tools to collaborate. Mind profound vocation.
- Striving to both its own staff and continuous self-knowledge and training to develop.
- Endeavor to respect the work and organizational culture of ethical principles are complied with.
- Strives to comply with the quality requirements are complied with.
- Strives for environmental awareness, according to health awareness and sustainability expectations organize and carry out tasks.
- Seek a broad, comprehensive literacy acquisition.
- Shall be guided by the requirements of sustainability and energy efficiency.
- Seek professional work individually or in groups to plan and execute the tasks at a high level.
- Striving to perform the work of a complex approach based on system-based and process-oriented way of thinking.
- Examining the possibility of setting the research, development and innovation objectives in its work and seek to implement them.
- Work towards the application of acquired technical knowledge of observable phenomena thorough knowledge of, the laws of the description, to explain.
- Committed to high standards, quality work toward, shows an example of staff for the purposes of this approach.
- Committed to the expansion of new areas of mechanical engineering knowledge with scientific evidence.

- Mechanical power turn-themed research and development projects, to achieve this goal, in cooperation with members of the development team will mobilize theoretical and practical knowledge and skills.
- Committed to the health and safety culture towards health promotion.

Autonomy and responsibility

- Knowledge and experience acquired in formal, non-formal and informal sharing of information reporting forms specializes in cultivating.
- Evaluate the work of his subordinates, critical comments of sharing promotes professional development.
- Independently be able to solve engineering problems.
- Assume a proactive role in solving technical problems.
- Take responsibility for part of the process taking place under his command.
- Working independently in the field to professional decisions.
- Responsible colleagues and subordinates and encourage ethical profession.
- Work in solving problems independently and proactively occurs.
- Bears responsibility for sustainability, occupational health and safety culture and awareness towards the environment.
- The decisions carefully, to other areas of expertise (mainly legal, economic, energy and environmental) in consultation with representatives be autonomous, assume any liability.
- In making its decision takes account of environmental protection, quality management, consumer protection, product liability, the principle and application of equal access, occupational health and safety, technical, economic and legal regulations, as well as engineering ethics basic specifications.

DAYTIME MECHANICAL ENGINEERING MASTERS COURSE

Full time	Mechanical Engineering MSc															
Subject code	Subject name	Credit	Requirement	Semester - Classes per week												Prerequisite
				1			2			3			4			
				T	P	L	T	P	L	T	P	L	T	P	L	
-	Specialization	5	-	-	-	-										-
DUEN-IMA-150	Mathematics (M) 1.	5	E	2	1	0										-
DUEN-MGT-250	Energetics and Environmental Politics	5	E	2	1	0										-
DUEN-MUA-152	Up-to-date Material and Production Technologies	5	E	2	0	1										-
DUEN-MUG-116	Measuring Technologies and Signal Processing	5	M	1	0	2										-
DUEN-MUG-154	Mechanics	5	E	2	2	0										-
-	Specialization	10	E				-	-	-							-
DUEN-MUA-254	The Damage of Engineering Materials	5	E				2	1	0							-
DUEN-MUT-150	Physics	5	E				1	1	1							-
DUEN-MUT-152	Engineering Heat and Fluid Dynamics	5					2	0	1							
DUEN-TVV-252	Management Skills	5	E				2	1	0							-
-	Specialization	5	M							-	-	-				-
DUEN-MGT-158	Building energy	5	E							2	1	0				-
DUEN-MUG-095	Project Tasks	5	S							0	5	0				-
DUEN-MUG-096	Degree Planning 1.	10	M							0	4	0				-
DUEN-MUG-156	Reliability Theory and Structure Integration Analysis	5	E							2	0	1				DUEN-MUA-254, DUEN-MUG-154
-	Optional course - master	5	-										-	-	-	-
-	Specialization	5	-										-	-	-	-
DUEN-MGT-000	Internship (4 weeks)	0	S										0	0	0	-
DUEN-MUG-097	Degree Planning 2.	20	M										0	12	0	-
	Number of Theoretical/Practice/Lab classes per week			9	4	3	7	3	2	4	10	1	0	12	0	
	Total number of classes per week			**16**			**12**			**15**			**12**			
	Total credit points			**120**												

LIFETIME MANAGEMENT																		
Subject code	Subject name	Credit	Requirement	Semester - Classes per week														Prerequisite
				1			2			3			4					
				T	P	L	T	P	L	T	P	L	T	P	L			
DUEN-MUG-150	Lifetime management	5	E	2	1	0												-
DUEN-MUA-256	Assembly and Repairment Technologies	5	E				2	0	1									-
DUEN-MUG-255	Maintenance Strategies	5	E				2	1	0									-
-	Optional course - specialization	5	-							-	-	-						-
DUEN-MUG-250	Inspectional Methods of Machine Condition	5	E										2	0	1			DUEN-MUG-116
	Number of Theoretical/Practice/Lab classes per week			2	1	0	4	1	1	0	0	0	2	0	1			
	Total number of classes per week			**3**			**6**			0			**3**					
	Total credit points			**25**														

MODERN MATERIAL STRUCTURE AND TECHNOLOGY																		
Subject code	Subject name	Credit	Requirement	Semester - Classes per week														Prerequisite
				1			2			3			4					
				T	P	L	T	P	L	T	P	L	T	P	L			
DUEN-MGT-110	Information technology in materials science	5	M	2	1	0												-
DUEN-MGT-010	Cyberphysical systems	5	M				2	0	1									-
DUEN-MUA-111	Material and Structure Analysis	5	M				2	0	1									-
-	Optional course - specialization	5	-							-	-	-						-
DUEN-MGT-011	Innovative application of polymers and composites	5	M										2	0	1			-
	Number of Theoretical/Practice/Lab classes per week			2	1	0	4	0	2	0	0	0	2	0	1			
	Total number of classes per week			**3**			**6**			0			**3**					
	Total credit points			**25**														

LIFETIME MANAGEMENT - Optional course - specialization																		
Subject code	Subject name	Credit	Requirement	Semester - Classes per week														Prerequisite
				1			2			3			4					
				T	P	L	T	P	L	T	P	L	T	P	L			
DUEN-MUA-112	Weldability	5	M							2	0	1						-
DUEN-MUA-115	Special Materials and Technologies	5	M							2	0	1						-
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	4	0	2	0	0	0			
	Total number of classes per week			0			0			**6**			0					
	Total credit points			**10**														

MODERN MATERIAL STRUCTURE AND TECHNOLOGY - Optional course - specialization																		
Subject code	Subject name	Credit	Requirement	Semester - Classes per week														Prerequisite
				1			2			3			4					
				T	P	L	T	P	L	T	P	L	T	P	L			
DUEN-MGT-124	Simulation of heat treatment and welding processes	5	M							2	0	1						-
DUEN-MST-110	Nanotechnology	5	M							2	0	1						-
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	4	0	2	0	0	0			
	Total number of classes per week			0			0			**6**			0					
	Total credit points			**10**														

Optional course - master																		
Subject code	Subject name	Credit	Requirement	Semester - Classes per week														Prerequisite
				1			2			3			4					
				T	P	L	T	P	L	T	P	L	T	P	L			
DUEN-MGT-222	Simulation of metallurgy and welding processes	5	M										2	1	0			-
DUEN-MUG-220	Computer and modelling simulation	5	M										1	0	2			DUEN-IMA-250
	Number of Theoretical/Practice/Lab classes per week			0	0	0	0	0	0	0	0	0	3	1	2			
	Total number of classes per week			0			0			0			**6**					
	Total credit points			**10**														

Part time	Mechanical Engineering MSc															
Subject code	**Subject name**	**Credit**	**Requirement**	**Number of classes per semester**												**Prerequisite**
				1			**2**			**3**			**4**			
				T	P	L	T	P	L	T	P	L	T	P	L	
-	Specialization	5	-	-	-	-										-
DUEL-IMA-150	Mathematics (M) 1.	5	E	10	5	0										-
DUEL-MGT-250	Energetics and Environmental Politics	5	E	10	5	0										-
DUEL-MUA-152	Up-to-date Material and Production Technologies	5	E	10	0	5										-
DUEL-MUG-116	Measuring Technologies and Signal Processing	5	M	5	0	10										-
DUEL-MUG-154	Mechanics	5	E	10	10	0										-
-	Specialization	10	E				-	-	-							-
DUEL-MUA-254	The Damage of Engineering Materials	5	E				10	5	0							-
DUEL-MUT-150	Physics	5	E				5	5	5							-
DUEL-MUT-152	Engineering Heat and Fluid Dynamics	5					10	0	5							
DUEL-TVV-252	Management Skills	5	E				10	5	0							-
-	Specialization	5	M							-	-	-				-
DUEN-MGT-158	Building energy	5	V							10	5	0				-
DUEL-MUG-095	Project Tasks	5	S							0	25	0				-
DUEL-MUG-096	Degree Planning 1.	10	M							0	20	0				-
DUEL-MUG-156	Reliability Theory and Structure Integration Analysis	5	E							10	0	5				DUEL-MUA-254, DUEL-MUG-154
-	Optional course - master	5	-										-	-	-	-
-	Specialization	5	-										-	-	-	-
DUEL-MGT-000	Industrial internship (4 weeks)	0	S										0	0	0	-
DUEL-MUG-097	Degree Planning 2.	20	M										0	60	0	-
	Number of Theoretical/Practice/Lab classes per semes			45	20	15	35	15	10	20	50	5	0	60	0	
	Total number of classes per semester			**80**			**60**			**75**			**60**			
	Total credit points			**120**												

LIFETIME MANAGEMENT																
Subject code	**Subject name**	**Credit**	**Requirement**	**Number of classes per semester**												**Prerequisite**
				1			**2**			**3**			**4**			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MUG-150	Lifetime management	5	E	10	5	0										-
DUEL-MUA-256	Assembly and Repairment Technologies	5	E				10	0	5							-
DUEL-MUG-255	Maintenance Strategies	5	E				10	5	0							-
-	Optional course - specialization	5	-							-	-	-				-
DUEL-MUG-250	Inspectional Methods of Machine Condition	5	E										10	0	5	DUEL-MUG-116
	Number of Theoretical/Practice/Lab classes per semes			10	5	0	20	5	5	0	0	0	10	0	5	
	Total number of classes per semester			**15**			**30**			0			**15**			
	Total credit points			**25**												

MODERN MATERIAL STRUCTURE AND TECHNOLOGY																
Subject code	**Subject name**	**Credit**	**Requirement**	**Number of classes per semester**												**Prerequisite**
				1			**2**			**3**			**4**			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MGT-110	Information technology in materials science	5	M	10	5	0										-
DUEL-MGT-010	Cyberphysical systems	5	M				10	0	5							-
DUEL-MUA-111	Material and Structure Analysis	5	M				10	0	5							-
-	Optional course - specialization	5	-							-	-	-				-
DUEL-MGT-011	Innovative application of polymers and composites	5	M										10	0	5	-
	Number of Theoretical/Practice/Lab classes per semes			10	5	0	20	0	10	0	0	0	10	0	5	
	Total number of classes per semester			**15**			**30**			0			**15**			
	Total credit points			**25**												

LIFETIME MANAGEMENT - Optional course - specialization																
Subject code	**Subject name**	**Credit**	**Requirement**	**Number of classes per semester**												**Prerequisite**
				1			**2**			**3**			**4**			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MUA-112	Weldability	5	M							10	0	5				-
DUEL-MUA-115	Special Materials and Technologies	5	M							10	0	5				-
	Number of Theoretical/Practice/Lab classes per semes			0	0	0	0	0	0	20	0	10	0	0	0	
	Total number of classes per semester			0			0			**30**			0			
	Total credit points			**10**												

MODERN MATERIAL STRUCTURE AND TECHNOLOGY - Optional course - specialization																
Subject code	**Subject name**	**Credit**	**Requirement**	**Number of classes per semester**												**Prerequisite**
				1			**2**			**3**			**4**			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MGT-124	Simulation of heat treatment and welding processes	5	M							10	0	5				-
DUEL-MST-110	Nanotechnology	5	M							10	0	5				-
	Number of Theoretical/Practice/Lab classes per semes			0	0	0	0	0	0	20	0	10	0	0	0	
	Total number of classes per semester			0			0			**30**			0			
	Total credit points			**10**												

Optional course - master																
Subject code	**Subject name**	**Credit**	**Requirement**	**Number of classes per semester**												**Prerequisite**
				1			**2**			**3**			**4**			
				T	P	L	T	P	L	T	P	L	T	P	L	
DUEL-MGT-222	Simulation of metallurgy and welding processes	5	M										10	5	0	-
DUEL-MUG-220	Computer and modelling simulation	5	M										5	0	10	DUEL-IMA-250
	Number of Theoretical/Practice/Lab classes per semes			0	0	0	0	0	0	0	0	0	15	5	10	
	Total number of classes per semester			0			0			0			**30**			
	Total credit points			**10**												

Mathematics (M) 1.

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Matematika (M) 1.</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="4">Mathematics (M) 1.</td><td>Code</td><td>DUEN(L)-IMA-150</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="5">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="5"></td></tr>
<tr><td colspan="2">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</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">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="3">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">László Bognár, 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="7">Goals, development objectives
Knowledge of calculation methods and algorithms serving for solving mathematical problems that occur in the technical life and, as a result of getting acquainted with the use of up-to-date mathematical program packages suitable to be used in solving technical problems, making the student capable of elaborating and implementing calculation procedures for everyday technical mathematical tasks by using mathematical software.</td></tr>
<tr><td colspan="3" 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">Small-room board exercises for up to 20 people</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You are familiar with the general and specific mathematical, natural and social science principles, rules, contexts and procedures necessary for the field of technical field.
You have a comprehensive knowledge of global social and economic processes. – You are familiar with the fundamental theories, contexts and terminology that make up them.
You know and understand the basic facts, boundaries and expected directions of development and development in the technical field.</td></tr>
<tr><td colspan="7">Ability
Capable of designing, organising and performing self-study.
It is capable of identifying routine professional problems, identifying, formulating and resolving the practical and practical background necessary to resolve them (using standard operations in practice).
Capable of creating basic models of technical systems and processes.</td></tr>
<tr><td colspan="7">Attitude
It shall endeavour to contribute to the development of new methods and tools related to the technical field. His sense of vocation deepened.
Strive striving to develop both your own knowledge and your staff’s knowledge through continuous self-training and training.
Strive striving to acquire a wide range of comprehensive literacy.</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 development 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.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="7">Probability theory: notable distributions occurring in the technical practice. Elementary complex functions, limit value, continuity. Differentiability of complex functions. Cauchy-Riemann equations, harmonic functions, analytic functions, Taylor’s series. Integration of complex functions. Cauchy’s integral theorem, Cauchy’s integral</td></tr>
</table>

	formulas, Liouville's theorem, meromorf functions, Laurent's series, residuum theorem and its applications, conform mappings, Laplace transform, convolution. Solving linear differential equations by using Laplace transform. Boundary-value problems for second order linear differential equations. Bessel's differential equation, Bessel's functions, Legendre's differential equation, Legendre's polynoms. Generalized Fourier series, orthogonality properties, Parseval's theorem.
Types of student activities	Lecture: Written text processing with note-taking 40%, theoretical material self-processing 20%, task solution 40%.
Required literature and contact details	• László Csernyák (ed.): Probability Calculation, Budapest, Nemzeti Tankönyvkiadó, 2007, 216 p. ISBN 978-963-19-5949-9 • Pál Szász: Elements of differential and integral calculus II. Budapest, Typotex, 2001, pp. 444-564, ISBN 963-932-605-4 • János Tóth, Péter Simon L.: Differential Equations, Budapest, Typotex, 2009, pp. 141-149, ISBN 978-963-279-057-2 •
Recommended literature and contact details	• László Hanka, Miklós Zalay: Complex Function Exemplar, Budapest, Műszaki K., 2010, 416 p. ISBN 978-963-16-2816-6 • Pál Szász: Elements of differential and integral calculus II. Budapest, Typotex, 2001, 606 p. ISBN 963-932-605-4
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Energetics and Environmental Politics

Name of the subject		in Hungarian		Energetika és környezetpolitika					Level	MSc	
		in English		Energetics and Environmental Politics					Code	DUEN(L)-MGT-250	
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		Róbert Sánta, PhD			schedule	College professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Understand the fundamentals of energy, its impact on the environment, and how to align corporate environmental policy objectives to help solve global environmental problems.	
Typical delivery methods	Presentation	Projector, ppt presentation
	Practice	Student seminar presentations
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** A comprehensive knowledge of the basic facts, trends and limits of the subject area of engineering and economics. Knowledge of the general and specific rules, contexts and procedures necessary for the operation of the field of engineering. Comprehensive knowledge of the main theories and problem-solving methods in the field. Has an applied knowledge of the measurement procedures used, their tools, instruments and measuring equipment. Understand, characterise and model the structure and function of the structural units and elements of systems, the design and interrelationship of the system elements used.	
	Ability The student is able to analyse at a basic level the disciplines that make up the knowledge base of technical and economic disciplines, to synthesise interrelationships and to make appropriate evaluations. The student is able to apply the most important terminologies, theories and procedures of the technical discipline in the performance of related tasks. The student is able to plan, organise and conduct independent learning. The student is able 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. The student is able to understand and use literature, computer and library resources specific to the field. The student is able to apply the acquired IT knowledge to the solution of problems in the field. The student is able to construct basic models of systems and processes. The student is able to communicate orally and in writing in his/her mother tongue in a professionally appropriate manner in his/her field of specialisation.	
	Attitude The student assumes and authentically represents the social role of its profession and its fundamental relationship with the world. Open to learning about, accepting and authentically communicating professional and technological developments and innovations in the field of engineering. Seeks to solve problems, preferably in cooperation with others. Have the stamina and tolerance of monotony to carry out practical activities. Applies his/her acquired technical knowledge to gain a thorough understanding of observable phenomena, to describe and explain their laws. complies with and observes the relevant safety, health, environmental, quality assurance and control requirements.	
	Autonomy and responsibility Independently thinks through and develops comprehensive, well-founded professional questions based on given sources, even in unexpected decision-making situations. In the performance of his/her professional duties, he/she will also cooperate with qualified professionals from other disciplines (primarily technical, economic and legal). He/she will share his/her experience with his/her colleagues, thus contributing to 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	Basic energy production processes and their environmental impact. Introduction to and comparison of fossil, renewable and nuclear energy production. Introduction to environmental management. Introduction to the basic principles of environmental policy. The relationship between environmental audits and environmental policy. Life cycle analysis and its use.
Types of student activities	Listen to lectures, give small presentations, discuss. Preparation at home.
Required literature and contact details	• Endre Kiss Environmental protection and energy management. Electronic note, Moodle system • Mizuta Yutaka: Environmental management and life cycle analysis, Moodle note • Moser M.,Pálmai Gy.: The Basics of Environmental Protection National Textbook Publisher, Budapest, 1992 • U. Förstner: Environmental Technology, Springer-Verlag Budapest, 1993 • U. U. Peststner, U.S. University of Applied Sciences, Budapest, 2000
Recommended literature and contact details	• Teaching materials and catalogues of the Department of Physics, Environment Laboratory, as well as materials in foreign languages.
Description of tasks to be submitted/measurement reports	Hallgatói kiselőadások power pointjai
Description and timetable of the workshops	Full-time students: Test with explicit questions, planning exercises in weeks 6 and 13, Part time students: Test with explicit questions, planning exercises in weeks 2 and 4.

Up-to-date Material and Production Technologies

Name of the subject		in Hungarian		Korszerű anyag- és gyártástechnológiák					Level	MSc	
		in English		Up-to-date Material and Production Technologies					Code	DUEN(L)-MUA-152	
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	E	5	english	
Part time	150/15	per term	10	per term	0	per term	5				
Teacher responsible for the subject				Name		Gábor Vizi, PhD			schedule	college teacher	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** By mastering the material of the subject, students learn about today's modern material separation technologies, as well as the special technologies with which modern structural materials can also be processed,	
Typical delivery methods	Presentation	For all students, using a large speaker, a board presentation, a projector or an overhead projector
	Practice	Small-room board exercises for up to 20 people
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** He knows the fundamental theories and relationships of the technical field and the terminology that builds them up. Knows and understands the basic facts, limits and expected directions of development and development of the knowledge and activity system of the technical field.	
	Ability Capable of designing, organising and performing self-study. It is capable of identifying routine professional problems, identifying, formulating and resolving the practical and practical background necessary to resolve them (using standard operations in practice). Capable of creating basic models of technical systems and processes.	
	Attitude It shall endeavour to contribute to the development of new methods and tools related to the technical field. His sense of vocation deepened. o - Strives to develop both your own knowledge and your staff's knowledge through continuous self-training and training. o - Strives to comply with and enforce the ethical principles of the culture of work and organisation. o - Strives to comply with and enforce quality requirements. o - Strives to acquire a wide range of comprehensive literacy.	
	Autonomy and responsibility Even in unexpected decision-making situations, it independently takes a look at the broad, underlying professional issues and development 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.	
Short description of the subject content	Overview of modern cutting operations. High-speed cutting, high-speed milling, characteristics and areas of application. Ultra-precision and micro machining. Characteristics and application of hard machining. Nanotechnologies. Grouping and characteristics of high energy density machining utilizing different physical principles. Modern processing methods with high energy density. Mechanical, chemical and thermal energy utilization processes. Characteristics of radial machining. Characteristics and applications of ultrasonic machining, abrasive water jet cutting. Electroerosion machining. Processing with plasma and laser. Processing with electron and ion beams	

Types of student activities	Lecture: Written text processing with note-taking 40%, theoretical material self-processing 20%, task solution 40%.
Required literature and contact details	• 1. Takács János: Korszerű technológiák a felülettulajdonságok alakításában, Műegyetemi Kiadó, 2004, p346 • 2. Niebel-Draper-Wysk: Modern manufacturing process Engineering, Mc Graw-Hill Publishing Company 1989, p986.
Recommended literature and contact details	• 1. Dudás I.: Gépgyártástechnológia III. A megmunkáló eljárások és szerszámaik. Fogazott alkatrészek gyártása és szerszámaik. Miskolci Egyetemi Kiadó, 2003., p539 • 2. Dudás Illés: Gépgyártástechnológia I., Gépgyártástechnológia alapjai, Miskolci Egyetemi Kiadó, Miskolc, 2000. • 3. T. Jagadeesha: Non-Traditional Machining Processes, I K International Publishing House, 2016, p268
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Measuring Technologies and Signal Processing

Name of the subject		in Hungarian		Méréstechnika és jelfeldolgozás					Level	MSc	
		in English		Measuring Technologies and Signal Processing					Code	DUEN(L)-MUG-116	
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	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	Professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Based on an understanding of the relationships between measurement and modelling, the student should be able to design individual measurements, including the use of advanced signal processing and interpretation skills.	
Typical delivery methods	Presentation	For all the students in high-performance, board performance. Using a projector (33.33% of total hours)(13 hours)
	Practice	
	Laboratory	Up to 30 people in groups of table counting exercises and lab measurements. (66.66% of total hours) (26 hours)
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** You are familiar with and understand in detail the methods of knowledge, data collection, their ethical limitations and problem-solving techniques in the technical field. o Have knowledge of metrology and measurement theory related to the engineering field. You are familiar with information and communication technologies related to the engineering field. o You know and understand the tools and methods of computer modeling and simulation related to the field of mechanical engineering. - You have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes.	
	Ability o It is able to apply the theories and related terminology in a given technical field in an innovative way when solving problems. o It is capable of a versatile interdisciplinary approach and resolution of specific problems within its field. o 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. o It is able to use information and communication technologies and methods to solve technical problems.	
	Attitude o Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his legalities. o Committed to high-quality, quality work, sets an example for your colleagues to apply this approach. -	
	Autonomy and responsibility Its decisions shall take into account the principles and application of environmental protection, quality, consumer protection, product liability, equal opportunity access, health and safety at work, technical, economic and legal regulations and the basic requirements of engineering.	
Short description of the subject content	Measurement and modelling, the role of modelling in measurement, classification and properties of models. Types of measurement tasks, the development of the necessary models. Cross-check, validation, verification and calibration of models. Measurement uncertainty and evaluation. Extended uncertainty. Determination of resulting standard uncertainty on the basis of independent input (measured) quantities	

	and correlated quantities. Practical examples and methods of calculation. Metrology concept and requirement system. Rules for the communication of measurement results. Quality management system in the laboratory. Evaluation of the measurement results by computerised methods. Economical estimation procedures for the reliability of measurement results. Practical mastery of statistical tests. Zero hypothesis and counterhypothesis, one-sided and two-sided hypothesis test, first- and second-species errors. Test the match of two expected values. Comparison of experiential standard deviations, decision on the adequacy of the measurement. Estimate the goodness and measurement uncertainty of the parameters obtained from the function join from the empirical data. Signals and signal systems: amplitude distribution and measurement, correlation functions and measurement, spectrum, coherence and phase function measurement, autoregession modelling, sequential quotation test, basics of fuzzy modelling, wavelet principle and mathematics. Series measurement with programs (LABView); Measurement with a laser measuring arm, data recirculation for the preparation of a rapid prototype and for the redesign of the measured element (reverse engineering practice); Measurement with Digimatic (Mitutoyo); 3D measurement and reconstruction with measuring microscope. Measurements and finite battery modeling.
Types of student activities	Processing heard text with note-taking and recording of material using your own and electronically available note 40% Self-carrying measurement exercises 20% Tasks managed and self-processing 20% Solve test tasks 20%
Required literature and contact details	• Mallat: A wavelet tour to signal processing, 3rd edition, Academic Press, 2008 moodle.duf.hu • International metrological interpretive dictionary, OMH, Budapest, MTA MMSZ ltd kft, 1998 49p. ISBN 963-03-5779-8-
Recommended literature and contact details	• Péter Bölöni, György Pataki, Introduction to General Metrology, OMH, Budapest, 1988, 582p. • István Zoltán: Measurement Technology, University Textbook, Technical University Publishing House, 1997 (55029) ,Textbook, University Publishing House
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Mechanics

Name of the subject		in Hungarian		Mechanika					Level	MSc	
		in English		Mechanics					Code	DUEN(L)-MUG-154	
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	2	per week	0	E	5	english	
Part time	150/15	per term	10	per term	10	per term	0				
Teacher responsible for the subject				Name		Róbert Sánta, PhD			schedule	Professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** By completing the subject, the student should be able to identify and model major flexibility issues and, in simpler cases, solve them; in addition, the interpretation and modelling of basic mechanical vibration phenomena.	
Typical delivery methods	Presentation	For all students, using a large speaker, a board presentation, a projector or an overhead projector
	Practice	Small-room board exercises for up to 20 people
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** He has knowledge of metrology and measurement theory related to the engineering field. - He is familiar with information and communication technologies related to the engineering field. You know and understand the tools and methods of computer modelling and simulation related to the field of mechanical engineering. - You have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes.	
	Ability In solving a problem, it is able to organise cooperation with experts in related fields. 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.	
	Attitude It shall endeavour to contribute to the development of new methods and tools related to the technical field. His sense of vocation deepened. Strive striving to develop both your own knowledge and your staff's knowledge through continuous self-training and training. It strives to comply with and enforce the ethical principles of the culture of work and organisation. It strives to comply with and enforce quality requirements.	
	Autonomy and responsibility It is self-sufficient to solve engineering tasks. Take the initiative to solve technical problems. Assume responsibility for the sub-processes under your control. It makes professional decisions on its own in its field of operation. Encourages your staff and subordinates to practise their professions in a responsible and ethical way. When solving professional problems, it acts independently and proactively	
Short description of the subject content	Determination of the stresses and displacement of statically indefinite structures. Use a power method, prescribe the connection condition (compatibility) equation system, and resolve it. Use of a power method for specially constructed structures, multi-support straight brackets, the Clapeyron equation. The basis for calculating voltages in curved shaft symmetric shells once and twice. Thick-walled pipes, shrink binding, pipe diagram. Sizing for load capacity, plastic load-bearing reserve for statically determined	

	and statically indefinite structures. It is complex to reduce a degree of freedom of swinging systems. Prescribing a reduced swing system and its motion equation based on the items learned in classical dynamics. Prescribing a reduced swing system and its motion equation using an energy method, using lagrange motion equations, general coordinates. Vibrations of multi-freedom systems, matrix shape of motion equations. Examine and resolve your own value problem in simpler cases. Bending swings. Methods of vibration reduction, passive and active vibration reduction.
Types of student activities	Lecture: Written text processing with note-taking 40%, theoretical material self-processing 20%, task solution 40%.
Required literature and contact details	• János Égert - Zoltán Nagy: Mechanics (Movement Studies), Győr, Széchenyi István University, 2006. • Béla Csizmadia - Ernő Nándori: Mechanics for Engineers (Strength of Science), National Textbook Publisher, Budapest 1999. • Béla Csizmadia - Ernő Nándori: Mechanics for Engineers (Movement Studies), National Textbook Publisher, Budapest 1997. • Attila Hegedűs: Fundamentals of Technical Vibration Theory, Szent István University Press, Gödöllő, 2009.
Recommended literature and contact details	• István Nagy: Technical diagnostics I. Vibration diagnostics, 2006, ISBN: 9630608073 • Ferenc Dömötör: Vibration Diagnostics I., 2008, DF Publisher • Ferenc Dömötör: Vibration Diagnostics II., 2011, DF Publisher
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Engineering Heat and Fluid Dynamics

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Műszaki hő- és áramlástan</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="4">Engineering Heat and Fluid Dynamics</td><td>Code</td><td>DUEN(L)-MUT-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 colspan="2">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</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">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="3">Teacher responsible for the subject</td><td>Name</td><td colspan="3">Róbert Sánta, 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="6">Goals, development objectives
After completing the course, students will be able to play in mechanical measurement, modelling and planning of thermal and flow processes.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">For all the students in high-performance, board performance. Use a projector (66.66% of total hours)(26 hours)</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Laboratory</td><td colspan="5">A table counting exercise in groups of up to 30 people. (33.33% of total hours) (1 p.m.)</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
He is fully familiar with the basic facts, directions and boundaries of the field of technical expertise.
You are familiar with the general and specific mathematical, natural and social science principles, rules, contexts and procedures necessary for the field of technical field.
You are familiar with the concept system related to your field, the most important contexts and theories</td></tr>
<tr><td colspan="6">Ability
In solving a problem, it is able to organise cooperation with experts in related fields.
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
Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his legalities.
Committed to high-quality, quality work, he sets an example for his colleagues to apply this approach.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
Taking responsibility for his own work and the work of his peers.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">Deepen the heat and flow processes known in the BSc and learn more about the theoretical context. An overview of the basic flow equations and how they are applied, and an extension mainly of non-stationer and dynamic processes. Characteristics of turbulent flows, turbulence modelling. Boundary layers, free rays, multiphase flows. Learn about heat transport and the basics of non-equilibrium thermodynamics. Exchangers. Laboratory exercises: state-of-the-art flow and thermal measurement methods, numerical simulation methods and their applications, in the framework of the solution of tasks, in particular in mechanical structures.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="6">Processing heard text with note-taking and recording of material using your own and electronically available note 40%
Self-carrying measurement exercises 20%
Tasks managed and self-processing 20%
Solve test tasks 20%</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="6">• Dr. Ferenc Szlivka: Heat-and Flow Technology Dunaújváros. 2019
• Miklós Blahó: Selected problems in Fluid Mechanics
• MOODLE system</td></tr>
</table>

Recommended literature and contact details	• Meinhard T. Schobeiri, Advanced Fluid Mechanics and Heat Transfer for Engineers and Scientists, Springer Cham, ISBN978-3-030-72924-0, eBook ISBN978-3-030-72925-7
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

The Damage of Engineering Materials

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Mérnöki anyagok károsodása</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="4">The Damage of Engineering Materials</td><td>Code</td><td>DUEN(L)-MUA-254</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 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">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="3">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="2">Zsolt Csepeli, 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
o The aim of this subject is to enable students to investigate material degradations based on their knowledge of materials science and material testing. Based on their former studies and the knowledge gained in this subject, students will be able to collect information and samples on the spot, to highlight the cause of the degradations and to prevent additional damages.</td></tr>
<tr><td colspan="3" 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="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge
Students have detailed knowledge of the theoretical background of the degradation of materials, and are familiar with material testing methods.</td></tr>
<tr><td colspan="6">Ability
Students are able to evaluate the information collected during investigation of the degradations, and are able to define the appropriate questions.</td></tr>
<tr><td colspan="6">Attitude
Try to apply state-of-the-art knowledge and methods to detect, analyse and prevent material failures.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
Can work independently and takes responsibility. Cooperates with experts from other fields to solve the revealed problems but can make their own decisions.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">Failure modes and effect analysis. Materials selection for failure prevention. Failure related to metalworking, casting, welding and heat treating operations. Structural life assessment methods. Failure analysis and life assessment of structural components and equipment. Conducting a failure investigation. Determination and classification of damage. Tools and techniques in failure analysis. Creep and stress rupture failures. Corrosion-related failures. Hydrogen damage and embrittlement. Fundamentals of wear failures. Failures of manufactured components and assemblies. Failures of shafts, sliding bearings, rolling-element bearings, tools and dies.</td></tr>
<tr><td colspan="3">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="3">Required literature and contact details</td><td colspan="6">• Failure Analysis and Prevention, ASM Handbook Volume 11, 2002
• Fatigue and Fracture, ASM Handbook Volume 19, 1996</td></tr>
<tr><td colspan="3">Recommended literature and contact details</td><td colspan="6">• Fractography, ASM Handbook Volume 12, 1987</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>

Physics

Name of the subject		in Hungarian		Fizika					Level	MSc	
		in English		Physics					Code	DUEN(L)-MUT-150	
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		Endre Kiss, PhD			schedule	College professor	
Training objective and justification of the course (content, output, location in the curriculum)				**Goals, development objectives** To study thebasics of modern Physics with special emphases of the Physics of material testing, fracture mechanics, and surface phenomena							
Typical delivery methods				Presentation	For all students, using a large speaker, a board presentation, a projector or an overhead projector						
				Practice	Small-room board exercises for up to 20 people						
				Laboratory	Measurement in measuring pairs in the Physics laboratory						
				Other							
Requirements (expressed in terms of learning outcomes)				**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.						
				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, organizing 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.						
				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.
	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.
Short description of the subject content	Overview and revival of BSC physics education. Properties of light, microscope, spectroscope, Schlieren equipment. Foundations of atomic physics and quantum mechanics. Properties of solid supheasians. Electron microscopes (SEM TEM, and their application in the material test. The crystal structure of solid shards. Amorphous structures. Structure of the surface of solid supheasi. Surface phenomena and their application in the material test. Surface plasmonos, quantum dots and other structures. Absorption, Auger spectroscopy. The basics of fracture mechanics.
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	• Gruber: Physics for Engineers • Endre Kiss Engineering Physics/Engineering Physics, Electronic Note/Electronic book, Moodle.duf.hu/Mérnöki Physics • Lab Exercises Guides/Syllabuses for laboratory practices, Moodle/duf/en • Serway: Physics for Engineers
Recommended literature and contact details	• Ágoston Budó: Experimental Physics I, II, III. (National Textbook Publisher, Budapest, 1997) • R. Feynmann: Modern Physics 1, 2, 3, 5, 7, 9 (Technical Publishing House, Budapest, 1986)-
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Management Skills

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Vezetési ismeretek</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="4">Management Skills</td><td>Code</td><td>DUEN(L)-TVV-252</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="6">Institute of Social Sciences, Department of Management and Entrepreneurship</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 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">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="3">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Mónika Rajcsányi-Molnár, 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 subject matter is aimed at making the students acquainted with the fundamentals of strategic thinking and planning, the project thinking management and the system thinking production management, while relying on the management-organization fundamental knowledge obtained during their BSc studies. Through the attainment of knowledge transferred, the students are capable of understanding the planning processes that take place in work organizations, allocating the resources in a successful way and solving the problems in an efficient way. The practical examples promote the students in utilizing their theoretical knowledge and recognizing the relevant relationships.</td></tr>
<tr><td colspan="3" 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">Using projector and additional materials (max. 30 students).</td></tr>
<tr><td>Laboratory</td><td colspan="5"></td></tr>
<tr><td>Other</td><td colspan="5"></td></tr>
<tr><td colspan="3" rowspan="3">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge
Knows the fundamental aspects of his profession, the most important concepts, requirements, relationships and procedures.
Has knowledge of the principles and methods for shaping and changing the organisational behaviour of organisations and institutions.
Learns the fundamentals, theoretical and methodological foundations of strategic thinking and strategic management.
Knows the methodological basics and techniques of managerial learning, information gathering, data processing and their ethical constraints and problem-solving methods.
Recognises the importance of managerial efficacy and they know which factors, in which degree foster this.
Knows the relationship between projects and corporate strategy, understands their and production management’s systematic interpretations.</td></tr>
<tr><td colspan="6">Ability
Able to master the global design of complex systems based on a systems-based, process-oriented mindset.
Ability to complexly plan and manage the use of technical, economic, environmental and human resources.
Able to manage the work of their own and for others effectively, able to manage workgroups.
Able to lead, plan, manage, check and develop the material and information processes of enterprises and work organizations.
Able to identify problems and to integrate their knowledge in order to solve the problems and able to use the techniques and methods of problem solving in regard to their application possibilities.
Has high sense of responsibility, (self)respect, analysing and synthetizing ability.</td></tr>
<tr><td colspan="6">Attitude
Strives to develop the knowledge of both himself and his employees through continuous self- and further training.
Open to accommodate new innovative approaches. Open and willing to work in groups and to share knowledge with others.
Strives to make decisions in coherence with the relevant legal and ethical norms.
Strives to adhere to the ethical principles of work and organizational culture.</td></tr>
</table>

	Strives to perform work with a complex approach applying systematic and process-oriented thinking. Examines research, development and innovation possibilities and aims to effectuate them during work.
	Autonomy and responsibility Acts independently and proactively when solving professional problems and initiating new practices. Able to manage, organise and supervise an organisational unit by taking responsibility for the organisation and their colleagues. Take responsibility for keeping professional, legal and ethical norms and rules in connection with their work and behaviour. Able to undertake the responsibilities in the management of an organization's technical and financial processes. They are responsible for sustainability.
Short description of the subject content	Characteristics of strategic thinking and planning, historical overview. Strategic planning processes and phases. Company environment, methodology of its analysis and evaluation. Development of company objectives, their levels and planning of implementation. Definition and regulation of competences, responsibilities and tasks. Characterization of organizational capabilities. Development of value chain. Relationships between the projects and company strategy. System of project management, methodological means of leading and organizing projects. Concept of production, management and production management and their interpretation in system theory respect. Production process and its structural types.
Types of student activities	Processing of theoretical material with control and independently 40% Task solution with management and independently 40% Analysing case studies, group work. Processing complex exercises in teams 20%. Gathering professional information corresponding the subject matters, processing and presentation 20%
Required literature and contact details	• Balaton Károly - Hortoványi Lilla - Incze Emma - Laczkó Márk -Szabó Zsolt Roland - Tari Ernő: Stratégiai menedzsment, Budapest: Akadémiai Kiadó Zrt., 2017. 338 p. ISBN 9789630594745 • Csath Magdolna: Stratégiai tervezés és vezetés a 21. században,Budapest: Nemzeti Tankönyvkiadó, 2004. 356 p. ISBN 9789631952513 • Eric Verzuh: Projektmenedzsment, Budapest: HVG Könyvek, 2006. 424 p. ISBN 9789637525773 • Koltai Tamás: Termelésmenedzsment, Budapest: Typotex, BME, GT, 2006. 280 p. ISBN 9789632790350
Recommended literature and contact details	• Pataki Béla: A technológia menedzselése, Budapest: Typotex, 2006. 180 p. ISBN 9789639548701
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Project Tasks

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="6">Projektfeladat</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="6">Project Tasks</td><td>Code</td><td>DUEN(L)-MUG-095</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="8">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="8"></td></tr>
<tr><td colspan="2">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</td><td>150/65</td><td>per week</td><td>0</td><td>per week</td><td>5</td><td>per week</td><td>0</td><td rowspan="2">S</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/25</td><td>per term</td><td>0</td><td>per term</td><td>25</td><td>per term</td><td>0</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td colspan="4">Name</td><td colspan="2">Mrs. Ildikó Angerer Petrovickij, PhD</td><td>schedule</td><td>Professor</td></tr>
<tr><td colspan="3">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="8">Goals, development objectives
The aim of the course's education is to educate students about the current technical by solving tasks independently or primarily in small groups, group work, with tools and methods. After a successful course, students will be able to and to solve it in groupwork, to ensure that work and results are document, interpretation and evaluation.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7"></td></tr>
<tr><td>Practice</td><td colspan="7">Consultation with the industrial and university consultants</td></tr>
<tr><td>Laboratory</td><td colspan="7"></td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge
You are familiar with the rules for the preparation of technical documentation. - You are familiar with the organisational tools and methods associated with management; the technical legislation necessary for the exercise of the profession.
Have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes.
Have comprehensive knowledge of machine, system and process design methods in the engineering field.</td></tr>
<tr><td colspan="8">Ability
Prepared for processing and organizing, analysing and drawing conclusions of information collected during the operation of mechanical systems and processes.
It is able to enrich the knowledge base of the mechanical field with original ideas.
It is able to apply integrated knowledge of machinery, mechanical equipment, systems and processes, mechanical materials and technologies, and related electronics and information technology.
It is capable of mastering the global design of complex systems based on a system-oriented, process-oriented mind-set.</td></tr>
<tr><td colspan="8">Attitude
Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his legalities.
Committed to high-quality, quality work, he sets an example for his colleagues to apply this approach.</td></tr>
<tr><td colspan="8">Autonomy and responsibility
Taking responsibility for his own work and the work of his peers</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="8">Students can receive part-time tasks from the current application, research and innovation tasks of the Departments of Technology and solve problems brought by themselves from industry, in small groups or individually. Students independently explore and interpret problems, use the processing of domestic and international literature to gain an insight into the subject area, then formulate various solutions for implementation, sometimes conducting model experiments. In solving the tasks, the students apply the knowledge they have learned independently.
The tasks for longevity management are primarily related to materials science, material technologies, repair and assembly, measurement and signal processing, and material testing and diagnostics. The task can be prepared for the diploma plan task.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="8">Regular consultation with industrial and university consultants. Incorporate the proposals into the forthcoming project report or the diploma plan paper. Continuous</td></tr>
</table>

	development and documentation of the thesis at an appropriate level.
Required literature and contact details	• Guide to the preparation of thethesis and diploma design. Extended version 2. UNIVERSITY PUBLISHER • Recommended by a consultant, the topic is processed by literature.
Recommended literature and contact details	• Dr. Pál Majoros: Research methodology or how to write a good diploma thesis easily and quickly. National Textbook Publisher, Budapest, 1997.
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Degree Planning 1.

<table>
<tr><td colspan="3" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Diplomatervezés 1.</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="4">Degree Planning 1.</td><td>Code</td><td>DUEN(L)-MUG-096</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 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>150/52</td><td>per week</td><td>0</td><td>per week</td><td>4</td><td>per week</td><td>0</td><td rowspan="2">M</td><td rowspan="2">10</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/20</td><td>per term</td><td>0</td><td>per term</td><td>20</td><td>per term</td><td>0</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">Mrs. Ildikó Angerer Petrovickij, PhD</td><td>schedule</td><td>Professor</td></tr>
<tr><td colspan="3">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's education is to educate students about the current technical by solving tasks independently or primarily in small groups, group work, with tools and methods.
After a successful course, students will be able to and to solve it in groupwork, to ensure that work and results are document, interpretation and evaluation.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6"></td></tr>
<tr><td>Practice</td><td colspan="6">consultation with an industrial and university consultant</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
You are familiar with the rules for the preparation of technical documentation. - You are familiar with the organisational tools and methods associated with management, the technical legislation necessary for the exercise of the profession.
Have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes.
Have comprehensive knowledge of machine, system and process design methods in the engineering field.</td></tr>
<tr><td colspan="7">Ability
Prepared for processing and organizing, analysing and drawing conclusions of information collected during the operation of mechanical systems and processes.
It is able to enrich the knowledge base of the mechanical field with original ideas.
It is able to apply integrated knowledge of machinery, mechanical equipment, systems and processes, mechanical materials and technologies, and related electronics and information technology.
It is capable of mastering the global design of complex systems based on a system-oriented, process-oriented mindset.</td></tr>
<tr><td colspan="7">Attitude
Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his legalities.
Committed to high-quality, quality work, he sets an example for his colleagues to apply this approach.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Taking responsibility for his own work and the work of his peers.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="7">Students can receive part-time tasks from the current application, research and innovation tasks of the Departments of Technology and solve problems brought by themselves from industry, in small groups or individually. Students independently explore and interpret problems, use the processing of domestic and international literature to gain an insight into the subject area, then formulate various solutions for implementation, sometimes conducting model experiments. In solving the tasks, the students apply the knowledge they have learned independently.
The tasks for longevity management are primarily related to materials science, material technologies, repair and assembly, measurement and signal processing, and material testing and diagnostics. Prepare the task for the diploma plan task. It's about 30% of the total.</td></tr>
</table>

Types of student activities	Regular consultation with industrial and university consultants. Incorporate the proposals into the forthcoming project report or the diploma plan paper. Continuous development and documentation of the thesis at an appropriate level.
Required literature and contact details	• Guide to the preparation of the thesis and diploma design. Extended version 2. UNIVERSITY PUBLISHER • Recommended by a consultant, the topic is processed by literature.
Recommended literature and contact details	• Dr. Pál Majoros: Research methodology or how to write a good diploma thesis easily and quickly. National Textbook Publisher, Budapest, 1997
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Reliability Theory and Structure Integration Analysis

Name of the subject		in Hungarian		Megbízhatóság elmélet és szerkezeti integritás elemzés					Level	MSc	
		in English		Reliability Theory and Structure Integration Analysis					Code	DUEN(L)-MUG-156	
Responsible educational unit				Institute of Technology, Department of Mechanical Engineering and Energy							
Name of compulsory prior learning DUEN(L)-				MUG-154 MUA-254							
Type		Presentation		Practice		Laboratory		Requirement	Credit	Language of education	
Full time	150/39	per week	2	per week	0	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		Péter Trampus, PhD			schedule	Professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Understand the elements and modelling of reliability. Having the knowledge, the student should be able to understand the most important concepts of technical life (security, reliability and risk) and their practical interpretation and application. Knowledge of the basics of fracture mechanics should be able to contain the crack. to determine the parameters needed to analyse the integrity of structures.	
Typical delivery methods	Presentation	Large lecture for all students, board lecture. Using a projector (66.66% of total hours) (26 hours)
	Practice	
	Laboratory	Board counting practice in groups of up to 30 people. (33.33% of total hours) (13 hours)
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Has a wide range of theoretical and practical training, methodological and practical knowledge for the design, manufacture, modelling, operation and management of complex mechanical systems and processes. Has a comprehensive knowledge of machine, system and process design methods in the mechanical field.	
	Ability Ability to apply and further develop procedures, models, information technologies used in the design, organization and operation of mechanical systems and processes. Prepared for quality assurance of mechanical systems, technologies and processes, solving measurement and process control tasks. Ability to deal creatively with problems, solve complex tasks flexibly, and with lifelong learning and commitment to diversity and value.	
	Attitude It strives to adhere to and adhere to quality requirements. Strives to organize and perform its tasks in accordance with the expectations of environmental awareness, health awareness and sustainability.	
	Autonomy and responsibility Shares the acquired knowledge and experience with the practitioners of his / her field in formal, non-formal and informal forms of information transfer. Evaluates the work of his subordinates, promotes their professional development by sharing critical remarks. In making its decisions, it takes into account the principles and application of environmental protection, quality management, consumer protection, product liability, equal access, occupational health and safety, technical, economic and legal regulations, and basic ethical standards.	
Short description of the subject content	Basic concepts and parameters of reliability. Impact of environment and load. Measurement and extrapolation of reliability characteristics of systems and equipment. Modelling the reliability of systems. Classification of models, modelling procedures. Determination of characteristics on an analytical and simulation basis. Characterization of performance and fault tolerance. Development of the system of tools used to assess reliability. Fundamentals of fracture mechanics. Linearly elastic fracture mechanics: stress intensity factor; energy theory; deformation theory. Linearly elastic fracture mechanism with a small plastic range. Plastic fracture mechanics. Fracture criteria.	

	Factors influencing the structural integrity (safe operation) of engineering structures: operating loads and conditions, material properties and their changes (damage processes) and various discontinuities. Dual criterion method (R6). Probabilistic fracture mechanics analysis. The concept of crack sensitivity of structures, its significance in the selection of non-destructive tests and in the evaluation of the reliability of fracture mechanical tests.
Types of student activities	Processing of heard text with notes and recording of the material using own and electronically available notes 40% Performing measurement exercises independently 20% Controlled and independent processing of tasks 20% Solving test tasks 20%
Required literature and contact details	• Birolini, A.: Reliability Engineering, Springer Verlag GmbH, 2007.. http://mek.oszk.hu/01100/01190/ •
Recommended literature and contact details	• Rausand, M., Hoyland, A.: System Reliability Theory: Models, Statistical Methods and Applications, 2nd edition, Wiley, Hobolen, 2004. • Broek, D.: The Practical Use of Fracture Mechanics Klujwer Academic Publishers, London, ISBN 0-7923-0223-0, 1988. p.1-522.
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Building energy

Name of the subject		in Hungarian		Épületenergetika					Level	MSc	
		in English		Building energy					Code	DUEN(L)-MGT-125	
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		Róbert Sánta, 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 provide students with the necessary knowledge in all aspects of building services engineering: heating, cooling, ventilation and air conditioning (HVAC), water supply and sewerage, renewable energy sources.	
Typical delivery methods	Presentation	For all the students in high-performance, board performance. Use a projector.
	Practice	Using projector and additional materials
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** You know the basics of building services engineering. Ability to critically approach a design task with a building services engineering solution. Ability to apply the appropriate energy source and building services engineering system to the design task. Understands the basic rules of building services engineering design.	
	Ability Ability to think through the building services concept of the building to be designed, and to determine the approximate space requirements of each structure. Ability to draw up a conceptual design of the building services of a building. Ability to coordinate architectural design with building services engineering. Ability to develop and apply different types of building services engineering solutions to the task. Can apply effectively the building services engineering and electrical systems studied in the design.	
	Attitude Collaborate with the teacher and fellow students to expand their knowledge. Continually develops his/her knowledge through learning. Open to learning about the necessary IT systems and to finding correct and creative solutions for building energy design. Strives for accurate and error-free problem solving. Strives to solve and complete practical tasks to a high standard. Strive to comply with legal and ethical standards in all situations encountered in the course of work.	
	Autonomy and responsibility Independently performs basic building services engineering tasks, thinking through problems and solving them. Open to informed critical comments. His/her approach to problems is characterised by a good balance between collaboration and independent work. He/she takes responsibility for his/her work and for any group work produced.	
Short description of the subject content	The basic elements of building energy, basic concepts and relationships of weather, building energy, basic concepts of thermal conditions, concepts and calculations of heat loss, heat gain and heat demand. Building water supply and drainage systems, system design, system components. Principles of sizing. Heating systems for buildings, design of systems. Elements of heating systems. Basic calculations related to the design of heating systems. Relevant standards specifications. Introduction to air duct networks. Thermal design of air ducts. Control of air handling systems. Calculation of ventilation air mass and volume flow rates. Methods for calculating fresh air flow rates. Wiring diagram for heat recovery fresh air ventilation/air heating systems. Types of heat recovery units. Heat recovery and recirculation ventilation-air-cooling system wiring diagram, application.	
Types of student activities	Processing heard text with note-taking and recording of material using your own and electronically available note 40% Self-carrying measurement exercises 20%	

	Tasks managed and self-processing 20% Solve test tasks 20%
Required literature and contact details	• Csoknyai, T., Zöld, A .: Building energy. TERC Publishing House, Budapest, 2013. (online, available on the website) • Audel HVAC Fundamentals, Volume 1: Heating Systems, Furnaces and Boilers All New 4th Edition by James E. Brumbaugh (Author), ISBN 13 978-0764542060
Recommended literature and contact details	• Fundamentals of HVACR 3rd Edition by Carter Stanfield (Author), David Skaves (Author), ISBN10 0134016165
Description of tasks to be submitted/measurement reports	Completion and submission of a conceptual design for the building services of a family house - all parts - heating, ventilation, water supply and sewerage - at a minimum satisfactory level (40%).The final deadline for submission of the home assignments is the end of the semester.
Description and timetable of the workshops	The subject ends with a mid-year mark. The grade for the course is the average of 2 ZHs. Correction/exam make-ups: in week 14 or until the end of the 2nd week of the exam period, 1 correction of an unsuccessful ZH assignment is possible.

Degree Planning 2.

Name of the subject		in Hungarian		Diplomatervezés 2.					Level	MSc	
		in English		Degree Planning 2.					Code	DUEN(L)-MUG-097	
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	150/156	per week	0	per week	12	per week	0	M	20	english	
Part time	150/60	per term	0	per term	60	per term	0				
Teacher responsible for the subject				Name		Mrs. Ildikó Angerer Petrovickij, PhD			schedule	Professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The aim of the course's education is to educate students about the current technical o by solving tasks independently or primarily in small groups, group work, with tools and methods. After a successful course, students will be able to and to solve it in groupwork, to ensure that work and results are document, interpretation and evaluation.	
Typical delivery methods	Presentation	
	Practice	consultation with an industrial and university consultant
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** You are familiar with the rules for the preparation of technical documentation. - You are familiar with the organisational tools and methods associated with management, the technical legislation necessary for the exercise of the profession. Have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes. Have comprehensive knowledge of machine, system and process design methods in the engineering field.	
	Ability Prepared for processing and organizing, analysing and drawing conclusions of information collected during the operation of mechanical systems and processes. It is able to enrich the knowledge base of the mechanical field with original ideas. It is able to apply integrated knowledge of machinery, mechanical equipment, systems and processes, mechanical materials and technologies, and related electronics and information technology. It is capable of mastering the global design of complex systems based on a system-oriented, process-oriented mindset.	
	Attitude Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his legalities. Committed to high-quality, quality work, he sets an example for his colleagues to apply this approach.	
	Autonomy and responsibility Taking responsibility for his own work and the work of his peers.	
Short description of the subject content	Students can receive part-time tasks from the current application, research and innovation tasks of the Departments of Technology and solve problems brought by themselves from industry, in small groups or individually. Students independently explore and interpret problems, use the processing of domestic and international literature to gain an insight into the subject area, then formulate various solutions for implementation, sometimes conducting model experiments. In solving the tasks, the students apply the knowledge they have learned independently. The tasks for longevity management are primarily related to materials science, material technologies, repair and assembly, measurement and signal processing, and material testing and diagnostics. The task is to prepare a diploma plan 100% of the total.	
Types of student activities	Regular consultation with industrial and university consultants. Incorporate the proposals into the forthcoming project report or the diploma plan paper. Continuous	

	development and documentation of the thesis at an appropriate level. Finish your thesis by
Required literature and contact details	• Guide to the preparation of the thesis and diploma design. Extended version 2. UNIVERSITY PUBLISHER • Recommended by a consultant, the topic is processed by literature.
Recommended literature and contact details	• Dr. Pál Majoros: Research methodology or how to write a good diploma thesis easily and quickly. National Textbook Publisher, Budapest, 1997
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

LIFETIME MANAGEMENT SPECIALIZATION

Lifetime management

<table>
<tr><td colspan="3" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Élettartam gazdálkodás</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="4">Lifetime management</td><td>Code</td><td>DUEN(L)-MUG-150</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 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">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="3">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="3">Péter Trampus, PhD</td><td>schedule</td><td>Professor</td></tr>
<tr><td colspan="3">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="7">Goals, development objectives
Having been learned the elements of life management of industrial facilities, on the basis of the reliability of operation and maintenance, the economy of the production process and taking further (quality, safety and environmental) aspects into consideration the student should be able to design the necessary actions, to make the decisions and arrangements in order to optimize the service life of an equipment or an industrial facility
In the past decades, life management became an independent, multidisciplinary area of engineering. Its key task is to have actual information on condition of operating systems and components, to maintain their function in accordance with the designer’s intent which is a serious economic and quality / safety question as well.
To be able to answer these questions one has to know the design principles of the systems and components; the technological processes, from which operation loading and other environmental conditions can be derived; the performance of the structural and functional materials used under operation loads and environment, i.e. the materials degradation processes, and the impact of the flaws and other inhomogeneities if any.
The student has to be able to apply in skill level the methods of determination of loading in the component materials, as well as the methodologies to monitor and mitigate materials degradations. He/she has to be able to optimize operation and maintenance activities in order to achieve life management goals.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">Lectures using projector, flip chart</td></tr>
<tr><td>Practice</td><td colspan="6">Maximum 20 students, calculations, demonstrations</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6">Preparation of home works, individual learning, studying literature</td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge
Knows the design principles of components; the technological processes from which the normal and off-normal loading and other operating conditions can be derived; the behaviour of structural and functional materials and the degradation processes and effects; the impact of flaws and other geometrical inhomogeneities in the materials.</td></tr>
<tr><td colspan="7">Ability
Can apply the methodologies for determination of component loading (stress/strain states) and detection and mitigation of degradations. Can optimize operation and maintenance taking the goals of life management into account. Understands and applies the online and printed technical literature pertaining to life management.</td></tr>
<tr><td colspan="7">Attitude
Seeks to contribute to the development of new methods and tools related to the technical field. Tries to utilize environmentally friendly technologies and to save built and natural environment. Tries to use energy-saving procedures and technologies.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Determines the methodology of analyses and/or inspection and testing; performs the analyses and the inspection or test, oversees the processes, the correctness of the calculated or measured / registered data, the quality of documentation responsible for the reliability of results.</td></tr>
</table>

Short description of the subject content	The definition of lifetime and operational/service life. Life management as the complex of technical and economic arrangements (with the purpose of the optimization of the service life of industrial facilities and their equipment while maximizing the profit). The degradations and other losses of functions in the structural materials induced by the operation. Aging processes. Running out of the life of components and systems. The safety aspects of component aging (decrease of the safety margin). Ageing of the design philosophies and the applied technologies. Mitigating actions: aging management, reconstruction, replacement (restoration of the safety margin). Connection between maintenance and life management. Spare part strategies (inventory management, disappearance and replacement of producers and suppliers). The human aspects of life management.
Types of student activities	Participation in the lectures (20%), practicum (20%), home work (10%), preparation of presentation (10%), individual learning (40%).
Required literature and contact details	• Shah, V. N., Macdonald, P. E. (1993): Aging and Life Extension of Major Light Water Reactor Components. Eslevier, Amsterdam. • Integrity for Life: Structural Integrity Assessment for Life Cycle Management (ed. Flewitt et al), EMAS Publishing, UK, 2004. • Presentation slides (in Moodle)
Recommended literature and contact details	• Materials Ageing and Life Management (ed. B. Raj et al), Vol. 1-3. Allied Publishers, New Delhi, 2000. • Understanding and mitigating ageing in nuclear power plants (ed. P. Tipping), Woodhead Publishing, Oxford, 2010
Description of tasks to be submitted/measurement reports	Home works (in Moodle)
Description and timetable of the workshops	1 written test, 1 home work

Assembly and Repairment Technologies

<table>
<tr><td colspan="3" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="5">Szerelési és javítási technológiák</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="5">Assembly and Repairment Technologies</td><td>Code</td><td>DUEN(L)-MUA-256</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">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>Name</td><td colspan="3">András Nagy, 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
Based on attaining the procedures and instruments of mounting and restoration technologies, the mounting and restoration strategies, the planning methods of mounting and restoration processes, the students shall be capable of planning mounting and repair technologies as well as managing their application. In addition, they shall be capable of determining the costs of technologies as well as selecting the technology suitable for the given purpose based on technical and economic aspects.</td></tr>
<tr><td colspan="4" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">Lecture using projector.</td></tr>
<tr><td>Practice</td><td colspan="6">Using projector and additional materials.</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
Knows in detail the rules for preparing technical documentation.
Knows the organizational tools and methods related to management, the legislation of the field required for the practice of the profession.
Has knowledge of measurement technology and measurement theory related to the field of engineering.
Knows information and communication technologies related to mechanical engineering.</td></tr>
<tr><td colspan="7">Ability
Able to master the global design of complex systems based on a systems-based, process-oriented mindset.
Ability to complexly plan and manage the use of technical, economic, environmental and human resources.
Able to apply and further develop procedures, models, information technologies used in the design, organization and operation of mechanical systems and processes.</td></tr>
<tr><td colspan="7">Attitude
Seeks to contribute to the development of new methods and tools related to the technical field.
Strives to develop the knowledge of both himself and his employees through continuous self- and further training.
Strives to adhere to and adhere to the ethical principles of work and organizational culture.
Strives to adhere to and adhere to quality requirements.
Strives to organize and perform its tasks in accordance with the expectations of environmental awareness, health awareness and sustainability.</td></tr>
<tr><td colspan="7">Autonomy and responsibility
Able to solve engineering tasks independently.
Takes the initiative in solving technical problems.
Take responsibility for the sub-processes under your control.
Makes professional decisions independently in its field of operation.
Encourages its employees and subordinates to practice responsibly and ethically.
Acts independently and proactively when solving professional problems.
They are responsible for sustainability, occupational health and safety culture and environmental awareness.</td></tr>
</table>

Short description of the subject content	Place and part the mounting plays in planning of technology. Component parts of mounting units. Analysis of mounting: functional and technological analysis of the product to be mounted. Methods of assuring the mounting tolerance. Deterministic and stochastic models of mounting. Mounting procedures and their means. Mounting of workpieces, assembly (joining), control, special mounting procedures. Specification of tools, devices, machines, requisites, mounting demands and the necessary activities: mounting tree, graph of activities. General model of mounting process, event-oriented tree. Restoration by using mechanical methods; welding, soldering and brazing, thermal spray, sticking and plastic technology. Determining welding materials for hardfacing, planning the necessary pre-heating and heat treatment technology. Technologies of high energy density to modify surface integrity and surface solidifying procedures.
Types of student activities	Processing of theoretical material with control 60% Independent processing of theoretical material 40% Task solution with management 15% Task independent processing 85%
Required literature and contact details	• Richard Crowson, Assembly Processes: Finishing, Packaging, and Automation (Handbook of Manufacturing Engineering, Second Edition) 1st Edition, Kindle Edition, ISBN-13 978-0849355653, 2006.
Recommended literature and contact details	• Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight, Product Design for Manufacture and Assembly (Manufacturing Engineering and Materials Processing, 74) 3rd Edition, ISBN-13 978-1420089271, 2010.
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	2 tests, 5 and 12 weeks, 2 homeworks and 2 presentations.

Maintenance Strategies

Name of the subject		in Hungarian		Karbantartási stratégiák					Level	MSc	
		in English		Maintenance Strategies					Code	DUEN(L)-MUG-255	
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		Szabó Attila, PhD			schedule	College associate professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Based on the attainment of modern trends in maintenance strategies, the students become capable of planning and optimizing the maintenance activities, recognizing and eliminating the weak points of equipment, selecting durability improving technologies and planning specific maintenance technologies.	
Typical delivery methods	Presentation	Lecture using projector.
	Practice	Using projector and additional materials.
	Laboratory	
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Has a wide range of theoretical and practical training, methodological and practical knowledge for the design, manufacture, modeling, operation and management of complex mechanical systems and processes. Has a comprehensive knowledge of machine, system and process design methods in the mechanical field	
	Ability Ability to apply and further develop procedures, models, information technologies used in the design, organization and operation of mechanical systems and processes. Prepared for quality assurance of mechanical systems, technologies and processes, solving measurement and process control tasks. Ability to solve creative problems, solve complex tasks flexibly, as well as lifelong learning and commitment to diversity and value-based	
	Attitude Strives to organize and perform its tasks in accordance with the expectations of environmental awareness, health awareness and sustainability	
	Autonomy and responsibility Shares the acquired knowledge and experience with the practitioners of his / her field in formal, non-formal and informal forms of information transfer. Evaluates the work of his subordinates, promotes their professional development by sharing critical remarks. In making its decisions, it takes into account the principles and application of environmental protection, quality management, consumer protection, product liability, equal access, occupational health and safety, technical, economic and legal regulations, and basic ethical standards.	
Short description of the subject content	Maintenance systems and strategies. Connection between maintenance and production. General maintenance philosophies/strategies: failure based corrective maintenance (FBCM), planned preventive maintenance (PM), condition based maintenance (CBM, CCM, CM); reliability centered maintenance (RCM), total productive maintenance (TPM), risk based maintenance (RBM, RBIM), parameter condition based maintenance (PCBM), automatic maintenance (AM). Instruments of RCM. Methods serving the analysis of reliability. Instruments of TPM. Applications of maintenance strategies. Strategies of rigid cycle structure. Strategies of flexible cycle structure. Strategy based on economic and reliability criteria. Substitution interventions. Restoration (repair) processes. Restoration methods. Problems of lifetime (durability). Lifetime increasing technologies. Relationships	

	between properties, stress and technologies. Place and part of qualifying the traditional surface transforming technologies, modern thin layers, plasma procedures, laser procedures as well as surface layers in the development of maintenance strategies.
Types of student activities	Processing of theoretical material with control 60% Independent processing of theoretical material 40% Task solution with management 15% Task independent processing 85%
Required literature and contact details	• Terry Wireman, Maintenance Strategy Series - Six Book Bundle Hardcover, August 26, 2014, ISBN-13 978-1941872277 • Terry Wireman, Total Productive Maintenance (Volume 1) Second Edition, ISBN-13 978-083113172, 2005.
Recommended literature and contact details	• Anthony Kelly, Strategic Maintenance Planning, 1st Edition - May 10, 2006, Paperback ISBN: 9780750669924, eBook ISBN: 9780080478999
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	2 tests, 5 and 12 weeks, 2 homeworks and 2 presentations.

Inspectional Methods of Machine Condition

<table>
<tr><td rowspan="2">Name of the subject</td><td colspan="2">in Hungarian</td><td colspan="5">Gépállapot ellenőrzési módszerek</td><td>Level</td><td>MSc</td></tr>
<tr><td colspan="2">in English</td><td colspan="5">Inspectional Methods of Machine Condition</td><td>Code</td><td>DUEN(L)-MUG-250</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="7">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="7">MUG-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>2</td><td>per week</td><td>0</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="3">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">András Nagy, PhD</td><td>schedule</td><td>Professor</td></tr>
<tr><td colspan="3">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="8">Goals, development objectives
Students will be able to use machine status based on state-of-the-art non-destructive material testing and intervention-free diagnostics, based on practical examples method of determination and the planning of the audit itself..</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7">For all the students in high-performance, board performance. Use a projector (66.66% of total hours)(13 hours)</td></tr>
<tr><td>Practice</td><td colspan="7"></td></tr>
<tr><td>Laboratory</td><td colspan="7">Up to 30 people in groups of table counting exercises and lab measurements. (33.44% of total hours).</td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge
You are familiar with and understand in detail the methods of knowledge, data collection, their ethical limitations and problem-solving techniques in the technical field.
Have knowledge of metrology and measurement theory related to the engineering field.
You are familiar with information and communication technologies related to the engineering field.
You know and understand the tools and methods of computer modelling and simulation related to the field of mechanical engineering. - You have extensive theoretical and practical skills, methodological and practical knowledge in the design, manufacture, modelling, operation and management of complex mechanical systems and processes.</td></tr>
<tr><td colspan="8">Ability
It is able to apply the theories and related terminology in a given technical field in an innovative way when solving problems.
It is capable of a versatile interdisciplinary approach and resolution of specific problems within its field.
In solving a problem, it is able to organise cooperation with experts in related fields.
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.</td></tr>
<tr><td colspan="8">Attitude
Using his acquired technical knowledge, he strives to gain as much knowledge as possible about observable phenomena, to describe and explain his legalities.
Committed to high-quality, quality work, sets an example for your colleagues to apply this approach.</td></tr>
<tr><td colspan="8">Autonomy and responsibility
Its decisions shall take into account the principles and application of environmental protection, quality, consumer protection, product liability, equal opportunity access, health and safety at work, technical, economic and legal regulations and the basic requirements of engineering.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="8">Technology tracking; planning for the necessary data processing; noise and vibration analyses; non-destructive material tests (visual, ultrasonic, swirlcurrent, acoustic emission, fast camera, thermal imaging); intervention-free diagnostics (measurement of noise and fluctuations, use of inherent noise sources in diagnostics, coherence, wavelet, fuzzy and correlation methods in practice, autoregession, use of SPRT). Voltage foci of machinery and materials; condition check and vibration types of</td></tr>
</table>

	rotating machines, mathematical modelling of vibrations and flows, rotary machine testing in practice. Failure statistics and use in failure analysis, probability risk assessment, average time between two failures and expected time to failure; development of causal analyses, data sets and knowledge bases. Use fluctuation models and their time-dependent differential equations in frequency space through examples. Availability, monitoring and analysis of technological processes for machine status.
Types of student activities	Processing heard text with note-taking and recording of material using your own and electronically available note 40% Self-carrying measurement exercises 20% Tasks managed and self-processing 20% Solve test tasks 20%
Required literature and contact details	• Oliver Fodor - Gábor Pór: Destructive and non-destructive techniques, e-learning curriculum, Dunaújváros College, TAMOP 4.1.2 / A, 2011, moodle.duf.hu • Own literature research, according to the criteria given: • http://literature.rockwellautomation.com/idc/groups/public/documents/webassets/browseresults.hcst?familyTitle=General%20Information&categoryTitle=Condition%20Monitoring&xLanguage=EN%20%20English&CategoryId=3636&FamilyId=3638&passedLangVal=EN%20%20English. • ISO (2011). ISO 17359:2011, Condition monitoring and diagnostics of machines - General guidelines. • The International Organization for Standardization (ISO)
Recommended literature and contact details	• Randall, Robert Bond: Vibration-based condition monitoring: industrial, automotive and aerospace applications. Chichester: Wiley, 2011. 308 p. ISBN: 978-0-470-74785-8 • Kusek, Jody Zall, Rist, Ray C.: Ten steps to a results-based monitoring and evaluation system: a handbook for development practitioners. Washington, Dc: World Bank, 2004. • Idhammar, Torbjörn: Condition Monitoring Standards. Vol 1-4. Raleigh: IDCON, 2001-2009.
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

MODERN MATERIAL STRUCTURE AND TECHNOLOGY SPECIALIZATION

Information technology in materials science

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="3">Anyaginformatika</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="3">Information technology in materials science</td><td>Code</td><td>DUEN(L)-MGT-110</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 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 1</td><td>per week 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 10</td><td>per term 5</td><td>per term 0</td></tr>
<tr><td colspan="2">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="2">Péter Bereczki, 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="6">Goals, development objectives
Introduction to the main engineering and information systems used in materials science and technology. Introduction to materials selection processes, computer-based materials selection systems and general characteristics of systems for the IT support of materials technology processes.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">Lecture using projector.</td></tr>
<tr><td>Practice</td><td colspan="5">Using projector and additional materials.</td></tr>
<tr><td>Laboratory</td><td colspan="5"></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
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. Knowledge of the terminology, the most important relationships and theories related to the field. Knowledge of the materials used in the field of mechanical engineering, their production methods and conditions of use. He/she has a working knowledge of the measurement procedures, instruments, apparatus and measuring equipment used in mechanical engineering. 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 engineering. 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.</td></tr>
<tr><td colspan="6">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 discipline in the performance of related tasks. Ability to identify routine technical problems and to identify, formulate and solve (by practical application of standard operations) 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.</td></tr>
<tr><td colspan="6">Attitude
It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering. He/she will strive to ensure that his/her self-learning in mechanical engineering is continuous and consistent with his/her professional goals. Using the technical knowledge acquired, he/she shall endeavour to gain a thorough understanding of observable phenomena, to describe and explain their laws.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
Responsibly uphold and represent the values of the engineering profession, and be open to professionally informed critical comments. Monitor legislative, technical, technological and administrative changes in the field. Assumes responsibility for the consequences of his/her technical analyses, the resulting proposals and the decisions taken.</td></tr>
</table>

Short description of the subject content	Classification of materials used in engineering practice. Evolution of materials, the world of materials. Material information, development direction of modern steels. Motivations for Material Selection. Steps in the design process. Relationship between design and material selection. Basic tasks of material selection. Material selection concepts. Main aspects of material selection. Technical aspects: functional, performance, safety and technological suitability, sizing, environmental and recyclability aspects. Relationship between material selection and manufacturing processes. Crystallisation, fabric structure, mechanical properties of ferroalloys. Equilibrium and non-equilibrium g-a transformations in Fe-C alloys. Microscopic and macroscopic consequences of cold working of metals. The Ashby concept of material selection. Material selection at the conceptual design stage. Interpretation and derivation of material indices. Material property maps, material property diagrams and their application in the material selection process. Material properties, basic mechanical material properties. Parameters determining the basic properties of materials and their relationship. Introduction to Cambridge Materials Selector and its application in computer aided materials selection. Introduction to the CES software system: use of the different functions. Interpretation, construction, main types and applications of column and bubble diagrams. Material selection based on complex criteria. Development of individual exercises on the topic of Material Selection (CES) in the context of a classroom exercise Typical forms of damage to metals Microscopic examination, surface preparation Material selection according to demand I.: Material selection according to mechanical properties. Aspects of material selection for static strength Materials selection by stress II: Mechanical properties of material selection. Material selection based on stiffness criteria. Development of individual assignments on Material Selection (CES) in a classroom exercise Material selection according to demand III: Material selection according to dynamic stresses. The concept and characteristics of toughness. Sizing philosophies for dynamic stresses. Material selection according to stresses IV: Material selection under repeated stresses. Sizing philosophies for repetitive stress. Technical information systems. Sources of information on materials, logical steps and methods of obtaining information. Searching electronic literature databases. Study of online materials information systems and materials databases on the Internet. Material selection for surface durability I: Material selection under corrosion stress. Development of individual assignments on Engineering Information Systems in the context of a classroom exercise. Surface Durability Materials Selection II: Material selection under abrasive stress
Types of student activities	Processing heard text with note-taking and recording of material using your own and electronically available note 40% Self-carrying measurement exercises 20% Tasks managed and self-processing 20% Solve test tasks 20%
Required literature and contact details	• Presentation in moodle • S.Z. Cai, Q.F. Zhang, X.P. Xu, D.H. Hu and Y.M. Qu, Materials Science, Computer and Information Technology, ISBN-13 (eBook): 9783038265566, 2014 • Ehrenfried Zschech, Caroline Whelan, Thomas Mikolajick, Materials for Information Technology, Springer London, eBook ISBN978-1-84628-235-5, 2006.
Recommended literature and contact details	• https://www.ensingerplastics.com/en-us/shapes/plastic-material-selection • Shubham Tayal, Parveen Singla, Ashutosh Nandi, J. Paulo Davim, Computational Technologies in Materials Science, ISBN 9781003121954, 250 Pages 152 B/W Illustrations, Published October 6, 2021 by CRC Press.
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Cyberphysical systems

Name of the subject		in Hungarian		Kiber-fizikai rendszerek					Level	MSc	
		in English		Cyberphysical systems					Code	DUEN(L)-MGT-010	
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		Endre Kiss, PhD			schedule	professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** To introduce future engineers to the main principles of cyber-physical systems, introduce the basic methods by which physical devices (hardware) and their virtual representation (software) are inextricably connected and interact with other similar devices (network).	
Typical delivery methods	Presentation	For all the students in high-performance, board performance. Use a projector.
	Practice	
	Laboratory	Up to 30 people in groups of table counting exercises and lab measurements. (33.44% of total hours).
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** To have detailed knowledge of the scientific and technical theories and practical procedures related to the materials engineering profession, including cyber physical systems. To have some application knowledge related to modern production technology. To be basically familiar with the information and communication technologies related to his professional activities and cyber-financial systems. To have knowledge in the field of some modern production technologies.	
	Ability To be able to apply certain knowledge related to the planning and operation of materials production, shaping and processing technologies in relation to modern production technologies. To be able to perform certain organizational and management tasks related to the field in a systematic manner. To be able to process and organize the information collected during the operation of modern production systems and processes, and draw certain conclusions by modeling the processes. To contribute to the planning of complex systems by using a system approach and process-oriented way of thinking. To be able to apply typical production technology procedures corresponding to his specialization.	
	Attitude To strive to put the latest results of his field at the service of his own development. To strive to enforce the requirements of sustainability and energy efficiency. To strive to plan and execute his tasks independently or in a work group at a high professional level. To strive to carry out his work in a complex approach based on a systemic and process-oriented way of thinking. In the course, to examine the possibility of setting research, development and innovation goals and strives to achieve them.	
	Autonomy and responsibility To act independently and proactively when solving professional problems. To be responsible for sustainability and environmental awareness. To share the experiences with the colleagues, thus helping them to develop. To assume responsibility for the consequences of his technical analyses, the proposals formulated on the basis of them and the resulting decisions.	

Short description of the subject content	Acquiring the basic knowledge related to cyber-physical systems, getting to know the basic elements that play a role in the construction and operation of the equipment, in connection with the implementation of modern production technology. With this knowledge, you will master the most important factors related to the application of cyber-physical systems and their development, and you will be able to provide support in connection with the introduction of these technologies. Presentation: Definition of cyber-physical systems, presentation of examples of cyber-physical systems. Characteristics of cyber-physical systems and IIoT systems, connection with the field of Industry 4.0. Presentation of the possibilities of Small and Big Data and artificial intelligence methods, connection to process control systems. Laboratory: Examples of cyber-physical systems, their examination, assembly of a simpler cyber-physical system as part of a project task. Two hours every two weeks on a daytime schedule.
Types of student activities	
Required literature and contact details	• Subject-related supporting materials made available through the learning support framework (https://moodle.uniduna.hu/login/index.php) • Edward A. Lee and Sanjit A. Seshia, IntroductiontoEmbedded Systems, A Cyber-Physical Systems Approach, SecondEdition, ISBN 978-1-312-42740-2, 2015(http://LeeSeshia.org) • Lee, Edward A. and Seshia, Sanjit A.: Introduction to Embedded Systems, A Cyber-Physical Systems Approach, http://LeeSeshia.org, ISBN 978-0-557-70857-4, 2011.
Recommended literature and contact details	• Rajeev Alur, Principles of Cyber-Physical Systems, ISBN 978-0-262-02911-7, 2015(https://mitpress.mit.edu/books/principles-cyber-physical-systems) • M. Broy: Cyber-Physical Systems, Springer, 2010
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Material and Structure Analysis

Name of the subject		in Hungarian		Anyag- és szerkezetvizsgálat					Level	MSc	
		in English		Material and Structure Analysis					Code	DUEN(L)-MUA-111	
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	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		Zsolt Csepeli, PhD			schedule	university associate professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Fundamental test methods for the study of the atomic, micro- and macro-structure of solids, as well as the principles of operation and applications of the most important test tools.	
Typical delivery methods	Presentation	PPT presentations
	Practice	
	Laboratory	laboratory material tests
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Requirements for engineering structures and the general properties of the structural material. Test methods that verify the suitability of the chosen structural material for the given application. Transferability of laboratory test results to structures.	
	Ability Able to select and design a laboratory testing process for the actual /given properties. Able to coordinate the laboratory testing procedures and interpret the results Understand and uses the online and printed literature in Hungarian and foreign languages specific to her/his field.	
	Attitude With a creative approach strives for the continuous development for the applied test methods. It strives to apply environmentally procedures and to protect the built and natural environment. It strives to use material and energy saving process and technologies.	
	Autonomy and responsibility Define the examination procedures and perform the examination independently or control the process, the registered data and the quality of the documentation. Taking responsibility for his own work and the work of his peers.	
Short description of the subject content	The content of the course connected to the following logical chain: In order to determine the necessary material and structural properties it is important to know the requirements of the given structure and material. Such are, for example the design requirement of the structure (mechanical loads, environmental effects), special aspects of manufacturability, and this includes property change that occur as a result of use/operation (material damage). Test procedures must be chosen that modelling the stress and damage process on a laboratory scale, and the result of the test are suitable for assessing the safe and reliable use of the structure/material.	
Types of student activities		
Required literature and contact details	• Derek Seward, Understanding Structures, Red Globe Press London, https://doi.org/10.1007/978-1-349-12083-3, 1994. • Tisza M. (szerk.) Anyagvizsgálat . Miskolc: Miskolci Egyetemi Kiadó. 2008. 495p. • Prohászka J. Fémek és Ötvözetek mechanikai tulajdonságai. Budapest: Műegyetemi Kiadó. 2001. 409p.	
Recommended literature and contact details	• Nondestructive Testing Handbook. Colombos , Oh: American Society for Nondestructive Testing 1997-2007. Vol. 1-7, Third edition	

	• Fémek hegesztett kötéseivel szemben támasztott követelmények, a hegesztett kötések vizsgálata. In: Szunyogh László (szerk.): Hegesztés és rokon technológiák. Budapest: GTE, 2007. ISBN 978-963-420-910-2
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	1 closing thesis during the semester, in case of its sufficient grade obtaining a signature, than an exam based on the set of item issued from the semester curriculum

Innovative application of polymers and composites

Name of the subject		in Hungarian		Polimerek és kompozitok innovatív alkalmazásai					Level	MSc	
		in English		Innovative application of polymers and composites					Code	DUEN(L)-MGT-011	
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	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		Béla Palotás, PhD			schedule	Professor emeritus	

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 new methods of producing polymers and composites, the possibilities of bonding technologies and the industrial applications of these materials.	
Typical delivery methods	Presentation	All students in lecture, presentation on the blackboard. Use of a computer projector.
	Practice	
	Laboratory	(Workshop) lab exercise, use of projector.
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knowledge of the potential uses of advanced polymers and composites, ability to take a position on application technology issues, ability to select bonding technologies and design technologies.	
	Ability Ability to perform certain organisational and management tasks related to the field in a systematic way. Ability to process and organise information gathered during the operation of modern manufacturing systems and processes. Contribute to quality assurance, metrology and process control tasks for material manufacturing systems and technologies. Ability to perform specific tests, process, evaluate and document measurement results.	
	Attitude 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.	
	Autonomy and responsibility Act independently and proactively when solving professional problems. Demonstrates responsibility in the area of sustainability and environmental awareness. Shares his/her experience with colleagues to help them develop. Assumes responsibility for the consequences of his/her technical analyses, proposals and decisions.	
Short description of the subject content	Classification of polymers, their production methods and bonding processes. Measurement of polymers. Classification of composites, their preparation and bonding methods. Sizing of composites. Applications of these materials in vehicles, aircraft, rapid prototyping, additive manufacturing.	
Types of student activities	Active participation in lectures, classroom exercises and laboratory exercises.	
Required literature and contact details	• Downloadable lecture notes from www.duf.hu, • Welding pocket book I. (Welding procedures), Cokom Mérnökiroda Kft., Budapest 2023. • Welding pocket book II. (Welding production technology), Cokom Mérnökiroda Kft., Budapest 2023.	
Recommended literature and contact details	• László M. Vass - Géza Bodor: Polymer Materials Structure, University of Technology, Budapest, 2005	
Description of tasks to be submitted/measurement reports		
Description and timetable of the workshops	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.	

Weldability

Name of the subject			in Hungarian	Hegeszthetőség					Level	MSc	
			in English	Weldability					Code	DUEN(L)-MUA-112	
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	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		Béla Palotás, PhD			schedule	Professor emeritus	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The aim of the course is to provide an understanding of the causes of weld cracks/defects and how to avoid them, as well as the rules for welding different materials.	
Typical delivery methods	Presentation	All students in lecture, presentation on the blackboard. Use of a computer projector.
	Practice	For each student in lecture, example solution. Using a computer projector.
	Laboratory	(Workshop) lab exercise, use of projector.
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** The student will know the rules for making flawless joints, be able to prescribe the necessary preheating and post-heating for a given material, and will also learn the correct choice of welding material and the correct welding sequences.	
	Ability Ability to perform certain organisational and management tasks related to the field in a systematic way. Ability to process and organise information gathered during the operation of modern manufacturing systems and processes. Contribute to quality assurance, metrology and process control tasks for material manufacturing systems and technologies. Ability to perform specific tests, process, evaluate and document measurement results.	
	Attitude 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.	
	Autonomy and responsibility Act independently and proactively when solving professional problems. Demonstrates responsibility in the area of sustainability and environmental awareness. Shares his/her experience with colleagues to help them develop. Assumes responsibility for the consequences of his/her technical analyses, proposals and decisions.	
Short description of the subject content	Welding heat processes, modelling of heat processes in different cases, calculation of different heat cycles and cooling rates. Causes of welding cracks (crystallization, cold, terracing and reheating cracks), crack avoidance. Calculation of preheating temperatures. Investigation of crack susceptibilities. Welding heat induced material structural anomalies and their avoidance. Weld stresses, deformations, correct welding sequences. Modelling of weld stresses and strains. Correct selection of welding materials for different applications. Welding rules for non-alloyed, mild and high alloy steels (hot strength, cold suction, heat and corrosion resistant and tool steels). Overlay welding of tools. Welding rules for cast irons. Welding rules for non-ferrous and light metals. Making mixed joints. Rules for welding ceramics and composites. Welding of polymers. Soldering and bonding techniques.	
Types of student activities	Active participation in lectures, classroom exercises and laboratory exercises.	
Required literature and contact details	• Downloadable lecture notes from www.duf.hu • Welding pocket book I. (Welding procedures), Cokom Mérnökiroda Kft., Budapest 2023,	

	• Welding pocket book II. (Welding production technology), Cokom Mérnökiroda Kft., Budapest 2023
Recommended literature and contact details	• Welding and allied technologies, GTE. Budapest, 2007 • Dr. Károly Bödök: Corrosion resistance of non-alloyed, low-alloyed and high-alloyed structural steels, with special reference to their weldability, Corweld Ltd., Bp.1997.
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	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.

Special Materials and Technologies

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Különleges anyagok és technológiák</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="4">Special Materials and Technologies</td><td>Code</td><td>DUEN(L)-MUA-115</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="6">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="2">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>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 0</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="2">Teacher responsible for the subject</td><td>Name</td><td colspan="3">Zsolt Csepeli, PhD</td><td>schedule</td><td>College professor</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 course, students should be able to approach and solve materials science and technology problems in life cycle management in a modern way and to apply the latest results of materials science in an informed way.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">Projector, ppt lectures, learning materials available in moodle.</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Laboratory</td><td colspan="5">Laboratory measurements and calculations</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
Knowledge of metrology and measurement theory in the field of mechanical engineering. You will have a broad theoretical and practical background, methodological and practical knowledge of the design, manufacture, modelling, operation and management of complex engineering systems and processes.</td></tr>
<tr><td colspan="6">Ability
Ability to perform laboratory testing and analysis of materials used in the engineering field, evaluate and document test results. Ability to process, organise, analyse and draw conclusions from information collected during the operation of engineering systems and processes. Ability to contribute original ideas to the knowledge base in the field of mechanical engineering. Ability to apply an integrated knowledge of machinery, mechanical equipment, systems and processes, materials and technologies for mechanical engineering, and related electronics and information technology. Ability to master the global design of complex systems based on a systems and process-oriented mindset. Ability to plan and manage the use of technical, economic, environmental and human resources in a complex way.</td></tr>
<tr><td colspan="6">Attitude
They strive to work in a complex approach based on a systems and process-oriented mindset. Explore and pursue research, development and innovation objectives.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
It takes its decisions independently, in consultation with other disciplines, and takes responsibility for them.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="6">Technologies to repair damaged (e.g. worn) surfaces. Application conditions for so-called cold metals. So-called cold metals as PMCs. Techniques and technology of laser cladding. Production of metal powders by gas and/or liquid sputtering. Rapid prototyping technology. Requirements for parts manufactured by rapid prototyping. Possible materials for rapid prototyping. Laser hardening of worn surfaces of large components. Surface hardening of parts subjected to intense abrasion using a combination of laser alloying and nitriding. Controlled crystallisation of alloys. Manufacturing technology of single crystal turbine blades from Ni-based superalloys. Metallurgical and thermal aspects of 'fibre-reinforced' composites made from eutectic alloys by directional crystallisation. Production technologies for ultrafine-grained (UFG) or nano-grained (NG) metals and alloys. ECAP, HPT and MF technologies. Characteristics of metal matrix particle reinforced composites with enhanced creep resistance, production of ODS materials by powder metallurgy (HIP) technology. Production of amorphous alloys by rapid cooling (RS) techniques. Preconditions for the formation of the amorphous state. Mechanical, corrosion and magnetic properties of amorphous ribbons. Compositional variations of high entropy HEA alloys. Mechanism of deformation of amorphous HEA alloys. The phenomenon of shape</td></tr>
</table>

	memory, members of the NITINOL family of alloys, applications based on the phenomenon of one and two way shape memory. Silicon nitride as wear resistant structural material, engine valve made of silicon nitride. Different modifications of carbon from diamond to graphene. Applications as a functional and structural material.
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 measurement exercises 30%. Supervised and independent processing of tasks 30%.
Required literature and contact details	• János Prohászka, Mechanical properties of metals and alloys, Technical University of Budapest, 2001, Chapter 7: Creep, pp. 247-273. • Dunaújváros College TÁMOP 4.2.2. report Literature summary, 2010. • Li Myong Son, Verő Balázs: A W9 típusú, gyengén ötvözött szerszámacél szuperképlékeny állapota, Bányászati és Kohászati Lapok - Kohászat, 1988. 10. • András Csanádyné - Erika Kálmán - Géza Konczos (eds.): Introduction to the World of Nanostructured Materials Centre for Chemical Research ELTE Eötvös Kiadó, 2009. pp. 25-30. • István Artinger - Gábor Csikós - György Krállics - Árpád Németh - Béla Palotás: Technology of Metals and Ceramics, University of Technology Publishing House, 1997, Chapter 7: Ceramics 7-1 to 7-16.
Recommended literature and contact details	• Werkstoffwissenschaft Hereusgegeben von Werner Schatt - Hartmut Woseli; Deutscher Verlag für Grundstoffindustrie Stuttgart 1996 • Yuqing Weng: Ultra-fine Grained Steels, Metallurgical Industry Press, Springer, 2003 • WENG Yu-qing, SUN Xin-jun, DONG Han: Overview on the Theory of Deformation Induced Ferrite Transformation • Verő Balázs és szerzőtársai: Anyagtudományi modellezés: moodle.duf.hu/course/category.php?id=400
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.

Simulation of heat treatment and welding processes

Name of the subject		in Hungarian		Hőkezelési és hegesztési eljárások szimulációja					Level	MSc	
		in English		Simulation of heat treatment and welding processes					Code	DUEN(L)-MGT-124	
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		Péter Bereczki, PhD			schedule	College professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** The purpose of the subject is to present the simulation and prepare modeling procedures, methods and existing programs for their use, and assist in the planning and monitoring of such programs.	
Typical delivery methods	Presentation	projector, ppt lectures 1 hour per week, study materials are available in moodle
	Practice	
	Laboratory	to apply the softwares and to solve exercises
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knowledge of modeling and simulation of welding and heat treatment processes, available knowledge of existing software. Knowledge of designing simulation programs, modeling user-level knowledge of software.	
	Ability Ability to use welding and heat treatment programs, mathematical and physical models preparation, planning of program systems, input and output data for defining and formulating programming requirements. To be capable to test the software and software systems	
	Attitude Solving IT tasks with adequate persistence and tolerance for monotony. With a creative approach, the software and procedures used are continuous development. Efforts are made to save energy and materials, or for the application of technologies.	
	Autonomy and responsibility With a considerable degree of independence, to think through comprehensive and special professional questions and develops them based on given sources. Formed a professional opinion known in advance for decision-making represents independently in situations. To plan and to carry out the activities independently. Responsibility in new, complex decision-making situations takes responsibility for their environmental and social effects. To get involved in research and development projects in the project group in order to achieve the goal autonomously, in cooperation with the other members of the group, to mobilize the theoretical and practical knowledge and skills. In contexts of varying complexity and varying degrees of computability, methods and applies a wide range of techniques independently in practice.	
Short description of the subject content	Presentation: Summary of heat treatment procedures. The rules of heating, keeping warm and cooling. Heat treatment of different materials. Possibilities of heat treatment modeling. Summary of welding procedures. Construction of welding software. Welding modeling options. Lab: Heat treatment modeling case studies. Designing heat management software principles. Learning about heat treatment simulation programs. Welding software presentation. Welding Modeling Case Studies. Welding software design rules.	
Types of student activities	Processing of heard text by taking notes and recording the material on your own and electronically using an available note 40% Independent completion of laboratory exercises 20%	

	Preparing a semester assignment 20% Solving test tasks 20%
Required literature and contact details	• Palotás B., Farkas A.: CAD/CAM systems in the welding technologies. Globe Edit - OmniScriptum GmbH, Saarbrücken. 2016 ISBN: 978-3-330-80646-7 • Metals Handbook, Vol. 4. Heat Treating, ASM Handbook. 10th edition, 1991 • Welding and relation technologies, (Handbook), GTE, Budapest, 2007
Recommended literature and contact details	• Comsol, Ansys software descriptions, catalogies, Guides, technological literatures/articles.
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Nanotechnology

Name of the subject		in Hungarian		Nanotechnológia					Level	MSc	
		in English		Nanotechnology					Code	DUEN(L)-MST-110	
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		Judit Pázmán, PhD			schedule	Professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** Material engineers must know the properties of various composite materials, their production methods and their area of use. The student should be able to perform a specific technical to select a composite material suitable for the process. Properties of micro and nano composites based on the optimal material selection.	
Typical delivery methods	Presentation	projector, ppt lectures 1 hour per week, study materials are available in moodle
	Practice	
	Laboratory	laboratory practice, production and testing of composite specimens
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** To know the basic types of materials (metals, polymers and ceramics) and their production technologies, including the production technologies of composite materials. To know the micro and nanostructures used in electronics, their characteristic properties and production technology.	
	Ability To be able to apply product and technological design related calculation and modelling principles and methods. To be able to select the optimal raw materials for the given application and to specify production technology for the production of the composite product. To understand and to use the online and printed literature in Hungarian and in a foreign language.	
	Attitude With a creative approach, the applied technologies and procedures strive to be continuous development. To strive to use environmentally conscious technologies, both built and natural to protect the environment. Efforts are made to save energy and materials, or for the application of technologies.	
	Autonomy and responsibility To determine the properties of the various products and to checks the quality of work phases characterizing the technology and to perform the quality control of sub-tasks. Assesses and rationalizes energy consumption related to material production.	
Short description of the subject content	Types of technical materials (metals and alloys, ceramics, polymers, semiconductors). Grain-reinforced, fiber-reinforced, layered composites, their production technologies, properties, areas of use, development possibilities. Sandwich structures, wood. The analysis of the properties of metals and other technical materials and trends in their changes. Polymer matrix and ceramic matrix composite materials. Micro and nano electronics materials. Layer-forming technologies, electronic thin layers (lithography, etching, chemical mechanical polishing). Scanning Probe Technologies. Nanocomposites, fullerene, graphite and carbon nanotubes, ceramic nanotubes and particles production. 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). Problems of material selection.	
Types of student activities	Processing of heard text by taking notes and recording the material on your own and electronically using an available note 40%	

	Independent completion of laboratory exercises 20% Preparing a semester assignment 20% Solving test tasks 20% 2 tests during the
Required literature and contact details	• Rainer Waser: Nanoelectronics and Information technology, Wiley-VCH, 2005. II-III. pp187-498
Recommended literature and contact details	• Yanhui Liu et al.: Metallic glass nanostructures of tunable shape and composition, NATURE COMMUNICATIONS | 6:7043 | DOI: 10.1038/ncomms8043 | • www.nature.com/naturecommunications • Zhuofei Gan et al.: High-fidelity and clean nanotransfer lithography using structureembedded and electrostatic adhesive carriers; Microsystems & Nanoengineering (2023) 9:8, • www.nature.com/micronan;
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	

Simulation of metallurgy and welding processes

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Metallurgia és hegesztési eljárások szimulációja</td><td>Level</td><td>MSc</td></tr>
<tr><td>in English</td><td colspan="4">Simulation of metallurgy and welding processes</td><td>Code</td><td>DUEN(L)-MGT-222</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 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="3">Teacher responsible for the subject</td><td>Name</td><td colspan="3">Péter Bereczki, PhD</td><td>schedule</td><td></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 subject is to present the simulation and prepare modeling procedures, methods and existing programs for their use, and assist in the planning and monitoring of such programs.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">projector, ppt lectures, study materials are available in moodle</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Laboratory</td><td colspan="5">to apply the softwares and to solve exercises</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
Knowledge of modeling and simulation of welding and heat treatment processes, available knowledge of existing software. Knowledge of designing simulation programs, modelling user-level knowledge of software</td></tr>
<tr><td colspan="6">Ability
Ability to use welding and heat treatment programs, mathematical and physical models preparation, planning of program systems, input and output data for defining and formulating programming requirements.
To be capable to test the software and software systems.</td></tr>
<tr><td colspan="6">Attitude
Solving IT tasks with adequate persistence and tolerance for monotony
With a creative approach, the software and procedures used are continuous development.
Efforts are made to save energy and materials, or for the application of technologies.</td></tr>
<tr><td colspan="6">Autonomy and responsibility
With a considerable degree of independence, to think through comprehensive and special professional questions and develops them based on given sources.
Formed a professional opinion known in advance for decision-making represents independently in situations.
To plan and to carry out the activities independently.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">Summary of heat treatment procedures. The rules of heating, keeping warm and cooling.
Heat treatment of different materials. Possibilities of heat treatment modeling. Summary of welding procedures. Construction of welding software. Welding modeling options.
Heat treatment modeling case studies. Designing heat management software principles. Learning about heat treatment simulation programs. Welding software presentation. Welding Modeling Case Studies. Welding software design rules.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="6">Processing of heard text by taking notes and recording the material on your own and electronically
using an available note 40%
Independent completion of laboratory exercises 20%
Preparing a semester assignment 20%
Solving test tasks 20%</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="6">• Palotás B., Farkas A.: CAD/CAM systems in the welding technologies. Globe Edit - OmniScriptum GmbH, Saarbrücken. 2016 ISBN: 978-3-330-80646-7
• Metals Handbook, Vol. 4. Heat Treating, ASM Handbook. 10th edition, 1991</td></tr>
</table>

	• Welding and relation technologies, (Handbook), GTE, Budapest, 2007
Recommended literature and contact details	• Comsol, Ansys software descriptions, catalogies, Guides, technological literatures/articles.
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	2 tests during the semester, the average of these gives the semester mark.

Computer and modelling simulation

Name of the subject		in Hungarian		Számítógépes modellezés és szimuláció					Level	MSc	
		in English		Computer and modelling simulation					Code	DUEN(L)-MUG-220	
Responsible educational unit				Institute of Technology, Department of Mechanical Engineering and Energy							
Name of compulsory prior learning DUEN(L)-				IMA-250							
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	Assistant professor	

Training objective and justification of the course (content, output, location in the curriculum)	**Goals, development objectives** To acquaint students with the most important numerical modelling procedures and a brief introduction to the mathematical and numerical modelling of complex technical-physical processes occurring in engineering practice. With this knowledge, students will be able to study processes occurring in the wider vertical of mechanical science, as well as finite element strength calculations (VEM) of mechanical equipment, computer modelling of thermal and flow processes using ANSYS CFX.	
Typical delivery methods	Presentation	Large lecture for all students, board lecture. Using a projector (66.66% of total hours) (26 hours)
	Practice	
	Laboratory	Board counting practice in groups of up to 30 people. (33.33% of total hours) (13 hours)
	Other	
Requirements (expressed in terms of learning outcomes)	**Knowledge** Knows and understands the tools and methods of computer modelling and simulation related to the field of mechanical engineering. - Has a wide range of theoretical and practical training, methodological and practical knowledge for the design, manufacture, modelling, operation and control of complex mechanical systems and processes. Has a comprehensive knowledge of machine, system and process design methods in the field of engineering ...	
	Ability Prepared for the processing and systematization of information collected during the operation of mechanical systems and processes, for analysis and for drawing conclusions. Able to enrich the knowledge base of the mechanical engineering field with original ideas. Ability to apply integrated knowledge in the fields of machinery, mechanical equipment, systems and processes, mechanical materials and technologies, and related electronics and informatics. Able to master the global design of complex systems based on a systems-based, process-oriented mind-set.	
	Attitude Strives to conduct its work in a complex approach based on a systems-based and process-oriented mind-set. In the course of its work, it examines the possibility of setting research, development and innovation goals and strives to achieve them. By applying the acquired technical knowledge, he strives to get to know the observable phenomena as thoroughly as possible, to describe and explain their laws.	
	Autonomy and responsibility He (She) shares his (her) acquired knowledge and experience with formal, non-formal and informal forms of information transfer with practitioners in kis (her) field. Evaluate the work of your subordinates by sharing critical comments promotes their professional development. Able to solve engineering tasks independently. Takes the initiative in solving technical problems.	

Short description of the subject content	Numerical solution possibilities of mathematical models describing strength and heat and flow processes. The most commonly used numerical methods, discretization methods, the basics of the finite volumetric method. Basic iterative solution methods for systems of linear equations with a special coefficient matrix obtained during discretization (Gauss-Seidel, Conj. Grad, Multi Grid). Advantages, disadvantages and applicability of the methods. Structure of the ANSYS and ANSYS-CFX program system, INPUT / OUTPUT data, definition and interpretation of boundary conditions, mathematical form of each boundary condition. Strength applications using finite element program, shape optimization. Solving major heat and flow problems with a finite volume program.
Types of student activities	Processing of heard text with notes and recording of the material using own and electronically available notes 40% Performing measurement exercises independently 20% Controlled and independent processing of tasks 20% Solving test tasks 20%
Required literature and contact details	• György Popper, Ferenc Csizmás: Numerical Methods for Engineers, Budapest, Akad. K. • Typotex, 1993. 166 p. ISBN 963-05-6454-8 • Gábor Ladányi: Finite element calculation methods, E-learning curriculum, Dunaújváros College, TAMOP 4.1.2 / A, 2011, moodle.duf.hu • ANSYS user manual
Recommended literature and contact details	• Stoyan Gisbert: Numerical Mathematics for Engineers and Programmers, Typotex ISBN 978-963-9664-41-8 • Stoyan Gisbert, Takó Galina: Numerical Methods 1., Typotex (2005) • Stoyan Gisbert: MATLAB, Typotex, ISBN 9639548499, 9789639548497
Description of tasks to be submitted/measurement reports	
Description and timetable of the workshops	