2024

# MECHANICAL ENGINEERING BSC

UNIVERSITY OF DUNAÚJVÁROS

CONTENT

## DESCIPTION OF THE DEGREE STUDY PROGRAM

| **Mechanical Engineering BSc** | |
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| (Mechanical Engineering) | |
| The higher educational institution responsible for the study program: | University of Dunaújváros |
| Identification number of higher educational institution: | FI60345 |
| Address of higher educational institution: | Táncsics Mihály utca 1/A, 2400 Dunaújváros |
| Authorized head of the institution | Dr. István András, Rector |
| **Responsible persons for the study program** | |
| Responsible institute: | Institute of Engineering Sciences |
| Director of institute: | Dr. habil. Róbert Sánta, PhD |
| Responsible person for the study program: | Dr. Szabó Attila, PhD, college associate professor |
| **Specializations (majors) and responsible persons:** | |
| Machine Maintenance and Technical Diagnostic | Dr. Szabó Attila, PhD, college associate professor |
| Green Transformation | Dr. Kovács-Bokor Éva, PhD, college associate professor |
| Nuclear Energy | Dr. Wizner Krisztián, PhD, college associate professor |
| **Main aspects of the study program:** | |
| Precondition of student application acceptance: | General Certificate of Education or a certificate of secondary school final exam, that certificate, which is required to start a higher educational study program in the home country of the student, the level of the required English language knowledge to start bachelor studies: IELTS 5.5 |
| Level of educational program: | undergraduate |
| Level of qualification: | bachelor (BSc) |
| Description of qualification in the diploma in Hungarian | gépészmérnök |
| Description of qualification in the diploma in English | Mechanical Engineer |
| Scheme of Study: | 7 semesters |
| Credit points to be acquired: | 210 |
| The objectives of the training and the professional competencies to be acquired | The aim of the training is to train mechanical engineers who are capable of operate machinery and mechanical equipment and and maintenance of machinery and equipment, the introduction of engineering technologies, and the organisation and management of work, the technical and technical the tasks of technical development, research and design of average complexity the requirements of the labour market; and a sufficient depth of theoretical knowledge for the second stage of training a second cycle of training. |
| Criteria for choosing a specialisation | Completion of 90 credits |
| | In the semester specified in the curriculum, at least one specialization is started, which most students choose. Starting more than one specialization is only possible if at least 15 people have chosen it. |
| Practical training | In the 7th (last) semester, at least 6 weeks of organized practice at a professional practice location |
| Final certificate (diploma) as a condition for the issue of | 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."<br><br>The University makes the award of the diploma (diploma) conditional on the completion of the foreign language requirement, which is the |

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| | 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. |
| Nuclear Energy specialisation final examination subjects | ZV1:<br>Fluid machinery DUEN (L)-MGT-212<br>Heat engines DUEN(L)-MGT-151<br>Basics of Atomenergetics DUEN(L)-MGT-118.<br><br>ZV2:<br>Basics of nuclear safety DUEN(L)-MGT-117;<br>Equipments of Nuclear Power Plants DUEN(L)-MGT-152;<br>Ensuring the integrity of equipment DUEN(L)-MGT-119; |
| Machine Maintenance and Technical Diagnostic specialisation final examination subjects | ZV1:<br>Maintenance strategy DUEN(L)-MGT-254,<br>Maintenance technologies 2.DUEN(L)-MGT-253<br>Tribology DUEN(L)-MUG-118<br><br>ZV2:<br>Industrial drive technology DUEN(L)-MGT-251;<br>Technical Diagnostics 1. DUEN(L)-MUG-157<br>Technical Diagnostics 2. DUEN(L)-MUG-219 |
| Green Transformation specialisation final examination subjects | ZV1:<br>Fluid machinery DUEN (L)-MGT-212;<br>Heat engines DUEN(L)-MGT-151<br>Basics of energy saving and conservation DUEN(L)-MGT-153<br><br>ZV2:<br>Energy management DUEN(L)-MGT-114;<br>Renewable energy DUEN(L)-MGT-115<br>Novel techniques of environmental protection DUEN(L)-MGT-216 |
| 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;<br>good 3.51 – 4.50;<br>average 2.51 – 3.50;<br>acceptable 2.00 – 2.50 |
| Conditions for the award of a diploma | Successful completion of the final examination is a prerequisite for the award of a diploma certifying the completion of higher education. |
| Language education | English |
| Physical Education | Over 4 semesters, 2 hours per week (full-time only) |

| Study order: | Full-time course |
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Expected engineering competencies

**a) knowledge**

- Has a comprehensive knowledge of the basic facts, directions and boundaries of the subject of the technical field.
- Knows the general and specific mathematical, natural and social science principles, rules,
- connections and procedures necessary for the operation of the technical field.
- Knows the conceptual system, the most important contexts and theories related to his / her field.
- Comprehensive knowledge of knowledge acquisition and problem solving methods of the main theories of his / her field.
- Comprehensive knowledge of basic economic, business and legal rules and tools.
- Has an in-depth knowledge of the structural materials used in the field of mechanical engineering, the methods of their production and the conditions of their application.
- Basic knowledge of machine design principles and methods, machine building technology, control engineering procedures and operational processes.
- Has a comprehensive knowledge of the operating principles and structural units of the applied work and power machines, mechanical equipment and devices.
- Comprehensively knows the measurement procedures used in mechanical engineering, their tools, instruments and measuring equipment.
- Familiar with the expectations and requirements of the fields of work and fire protection, safety technology and occupational health required for his / her field of expertise, as well as the relevant regulations of environmental protection.
- Comprehensive knowledge of the basics of logistics, management, environmental protection, quality assurance, information technology, law, economics, their boundaries and requirements, which are integral to the field of mechanical engineering.
- Has an in-depth knowledge of the learning, knowledge acquisition and data collection methods of the field of mechanical engineering, their ethical limitations and problem-solving techniques.
- Knowledge of methods and tools for cost-benefit analysis in the corporate economy and on a technical basis.
- Can interpret, characterize and model the structural units of mechanical systems, the structure and operation of their elements, the design and connection of the applied system elements.
- Can apply the number of objectives, modeling principles and methods of mechanical product, process and technological design.

**b) skills**

- Is able to perform a basic analysis of the disciplines that make up the knowledge system of the technical field, to formulate the connections synthetically and to perform adequate evaluation activities.
- Is able to apply the most important terminologies, theories and procedures of the given technical field when performing the tasks related to them.
- Ability to plan, organize and perform independent learning.
- Ability to identify routine professional problems, to explore, formulate and solve (using practical operations in practice) the theoretical and practical background needed to solve them.
- Is able to understand and use the typical literature, computer and library resources of his / her field.
- Is able to apply the acquired IT knowledge in solving the tasks arising in his / her field.
- Ability to create basic models of technical systems and processes.
- Able to use his knowledge in a creative way to effectively manage the resources of his workplace.
- Able to apply and comply with safety, fire protection and hygiene rules and regulations in the course of his work.
- Ability to communicate orally and in writing in his / her mother tongue and at least one foreign language in a professionally adequate manner, in accordance with his / her field of expertise.
- Able to apply technical regulations related to the operation of mechanical systems, the principles of setting up and operating machines and mechanical equipment, and economic contexts.
- Ability to manage and control technological production processes, keeping in mind the elements of quality assurance and quality control.
- Able to diagnose mechanical failures, select remedial operations, solve repair technology tasks

**c) attitude**

- Undertakes and authentically represents the social role of its profession, its fundamental relationship with the world.
- Open to getting to know and accept professional, technological development and innovation in the technical field, and to mediate it authentically.
- Strives to make self-education a means of achieving its professional goals.

- Makes its decision in full compliance with legal and ethical standards, even in situations that require a complex approach or in unexpected decision-making situations.
- Strives to solve problems as much as possible in collaboration with others.
- Strives for its self-education in the field of mechanical engineering to be continuous and in line with its professional goals.
- Strives to solve its tasks and management decisions by getting to know the opinions of the supervised employees, preferably in cooperation.
- Has adequate endurance and monotony tolerance to perform practical activities.
- Open to the use of IT tools, seeks to learn and apply software belonging to the field of mechanical engineering, knows and manages at least one such program at a skill level.
- Open and receptive to the application of new, modern and innovative procedures and methods related to organic farming and health awareness.
- Applying the acquired technical knowledge, he strives to get to know the observable phenomena as thoroughly as possible, to describe and explain their laws.
- In the course of his work, observes and complies with the relevant safety, health protection, environmental protection and quality assurance and control requirements.

**d) Autonomy and responsibility**

- Even in unexpected decision-making situations, independently considers and develops comprehensive, fundamental professional issues on the basis of specific sources.
- Recognizes and represents the values of the engineering profession responsibly, openly accepts professionally grounded critical remarks.
- In the course of performing professional duties, he/she also cooperates with qualified specialists in other fields (primarily technical, as well as economic and legal).
- Identifies the shortcomings of the applied technologies, the risks of the processes and initiates the measures to reduce them.
- Monitors legislative, technical, technological and administrative changes in the field.
- On the basis of the instructions of his/her workplace manager, he/she manages the work of the assigned personnel, supervises the operation of the machines and equipment.
- Evaluates the efficiency, effectiveness and safety of the work of subordinates.
- Pays attention to the promotion of the professional development of its subordinates, to the management and assistance of their efforts in this direction, and to the application of the principle of equal access.
- Share your experiences with your co-workers, thus helping their development.
- Takes responsibility for the consequences of your technical analyzes, proposals based on them, and decisions made.

## CURRICULUM TABLES

| Full time | Mechanical Engineering BSc | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject code | Subject name | Credit | Requirement | Semester - Classes per week | | | | | | | | | | | | | | | | | | | | | | | Prerequisite |
| | | | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | | |
| | | | | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | | |
| DUEN-IMA-100 | Tutorial mathematics | 0 | S | 0 | 2 | 0 | | | | | | | | | | | | | | | | | | | | - |
| DUEN-IMA-152 | Engineering Mathematics 1. | 5 | E | 0 | 3 | 0 | | | | | | | | | | | | | | | | | | | | - |
| DUEN-ISF-010 | Informatics | 5 | M | 0 | 0 | 3 | | | | | | | | | | | | | | | | | | | | - |
| DUEN-MGT-111 | Engineering representation | 5 | M | 1 | 2 | 0 | | | | | | | | | | | | | | | | | | | | - |
| DUEN-MUG-152 | Mechanics 1. | 5 | E | 1 | 2 | 0 | | | | | | | | | | | | | | | | | | | | - |
| DUEN-MUG-212 | CAD | 5 | M | 0 | 0 | 3 | | | | | | | | | | | | | | | | | | | | - |
| DUEN-MUT-151 | Engineering Physics | 5 | E | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | - |
| DUEN-IMA-212 | Engineering Mathematics 2. | 5 | M | | | | 0 | 0 | 3 | | | | | | | | | | | | | | | | | DUEN-IMA-152 |
| DUEN-MST-210 | Industrial materials | 5 | M | | | | 1 | 0 | 2 | | | | | | | | | | | | | | | | | - |
| DUEN-MUG-222 | Basics of machine design | 5 | M | | | | 2 | 1 | 0 | | | | | | | | | | | | | | | | | DUEN-MUG-212, DUEN-MUG-152, DUEN-MGT-111 |
| DUEN-MUG-257 | Mechanics 2. | 5 | E | | | | 1 | 2 | 0 | | | | | | | | | | | | | | | | | DUEN-MUG-152 |
| DUEN-MUT-250 | Heat and Fluid Dynamics | 5 | E | | | | 1 | 1 | 1 | | | | | | | | | | | | | | | | | DUEN-MUT-151 |
| DUEN-TVV-122 | Entrepreneurship | 5 | M | | | | 1 | 2 | 0 | | | | | | | | | | | | | | | | | - |
| DUEN-IMA-110 | Mathematics 3. | 5 | M | | | | | | | 0 | 3 | 0 | | | | | | | | | | | | | | DUEN-IMA-152 |
| DUEN-MGT-112 | Engineering construction | 5 | M | | | | | | | 1 | 2 | 0 | | | | | | | | | | | | | | DUEN-MGT-111 |
| DUEN-MUA-116 | Technology of Structural Materials | 5 | M | | | | | | | 1 | 0 | 2 | | | | | | | | | | | | | | - |
| DUEN-MUG-153 | Mechanics 3. | 5 | E | | | | | | | 1 | 2 | 0 | | | | | | | | | | | | | | DUEN-MUG-152 |
| DUEN-TVV-111 | Human Resource Managment | 5 | M | | | | | | | 1 | 2 | 0 | | | | | | | | | | | | | | - |
| DUEN-TVV-114 | Management | 5 | M | | | | | | | 1 | 2 | 0 | | | | | | | | | | | | | | - |
| - | Optional course | 5 | - | | | | | | | | | | - | - | - | | | | | | | | | | | - |
| DUEN-MGT-211 | Basics of energetics | 5 | M | | | | | | | | | | 2 | 0 | 1 | | | | | | | | | | | - |
| DUEN-MGT-212 | Fluid machinery | 5 | M | | | | | | | | | | 2 | 0 | 1 | | | | | | | | | | | DUEN-MUT-250 |
| DUEN-MGT-251 | Industrial drive technology | 5 | E | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | | DUEN-MUG-152, DUEN-MUG-222 |
| DUEN-MGT-252 | Industrial automatics | 5 | E | | | | | | | | | | 1 | 2 | 0 | | | | | | | | | | | DUEN-IMA-152 |
| DUEN-MUG-252 | Production Technology | 5 | E | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | | DUEN-MUG-152 |
| - | Specialisation | 20 | - | | | | | | | | | | | | | - | - | - | | | | | | | | - |
| - | Optional course | 5 | - | | | | | | | | | | | | | - | - | - | | | | | | | | - |
| DUEN-MGT-151 | Heat engines | 5 | E | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | DUEN-MGT-212 |
| - | Specialisation | 20 | - | | | | | | | | | | | | | | | | - | - | - | | | | | - |
| - | Optional course | 5 | - | | | | | | | | | | | | | | | | - | - | - | | | | | - |
| DUEN-MUG-213 | Metrology | 5 | M | | | | | | | | | | | | | | | | 2 | 0 | 1 | | | | | DUEN-MUG-257, DUEN-MUG-222 |
| - | Optional course | 5 | - | | | | | | | | | | | | | | | | | | | - | - | - | | - |
| DUEN-MUG-091 | Thesis project | 15 | S | | | | | | | | | | | | | | | | | | | 0 | 9 | 0 | | finishing all subject of the 1-6 semester |
| DUEN-MUG-093 | Professional Practice | 0 | S | | | | | | | | | | | | | | | | | | | 0 | 0 | 0 | | - |
| DUEN-MUG-117 | Quality Management | 5 | M | | | | | | | | | | | | | | | | | | | 2 | 1 | 0 | | - |
| DUEN-MUT-110 | Environmental protection and energy management | 5 | M | | | | | | | | | | | | | | | | | | | 2 | 0 | 1 | | - |
| | **Number of Theoretical/Practice/Lab classes per week** | | | 3 | # | 7 | 6 | 6 | 6 | 5 | # | 2 | 9 | 4 | 2 | 2 | 1 | 0 | 2 | 0 | 1 | 4 | # | 1 | | |
| | **Total number of classes per week** | | | **20** | | | **18** | | | **18** | | | **15** | | | **3** | | | **3** | | | **15** | | | | |
| | **Total credit points** | | | **210** | | | | | | | | | | | | | | | | | | | | | | |

| MACHINE MAINTENANCE AND TECHNICAL DIAGNOSTICS | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Subject code | Subject name | Credit | Requirement | Semester - Classes per week | | | | | | | | | | | | | | | | | | | | | | | | Prerequisite |
| | | | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | | | |
| | | | | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | | | |
| DUEN-MGT-113 | Maintenance technologies 1. | 5 | M | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | DUEN-MUG-222 |
| DUEN-MUG-111 | Production planning, CAM | 5 | M | | | | | | | | | | | | | 2 | 0 | 1 | | | | | | | | | | DUEN-MUG-252 |
| DUEN-MUG-118 | Tribology | 5 | M | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | DUEN-MUG-222 |
| DUEN-MUG-157 | Technical Diagnostics 1. | 5 | E | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | DUEN-MUG-153, DUEN-IMA-110 |
| DUEN-MGT-253 | Maintenance technologies 2. | 5 | E | | | | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | DUEN-MGT-113 |
| DUEN-MGT-254 | Maintenance strategy | 5 | E | | | | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | DUEN-MGT-113 |
| DUEN-MUG-216 | Complex Machine Designing | 5 | M | | | | | | | | | | | | | | | | 0 | 0 | 2 | | | | | | | - |
| DUEN-MUG-219 | Technical Diagnostics 2. | 5 | M | | | | | | | | | | | | | | | | 2 | 0 | 1 | | | | | | | DUEN-MUG-157 |
| | **Number of Theoretical/Practice/Lab classes per week** | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 1 | 6 | 2 | 3 | 0 | 0 | 0 | | | | |
| | **Total number of classes per week** | | | 0 | | | 0 | | | 0 | | | 0 | | | **12** | | | **11** | | | 0 | | | | | | |
| | **Total credit points** | | | **40** | | | | | | | | | | | | | | | | | | | | | | | | |

| GREEN TRANSFORMATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject code | Subject name | Credit | Requirement | Semester - Classes per week | | | | | | | | | | | | | | | | | | | | | | | | Prerequisite |
| | | | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | | | |
| | | | | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | | | |
| DUEN-MGT-114 | Energy management | 5 | M | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | - |
| DUEN-MGT-115 | Renewable energy | 5 | M | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | DUEN-MUT-250 |
| DUEN-MGT-153 | Basics of energy saving and conservation | 5 | E | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | - |
| DUEN-TGT-252 | Sustainable Finance and Bigtech Companies in Finance | 5 | E | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | - |
| DUEN-MGT-215 | Practical application of renewable energy sources | 5 | E | | | | | | | | | | | | | | | | 0 | 0 | 3 | | | | | | | - |
| DUEN-MGT-216 | Novel techniques of environmental protection | 5 | E | | | | | | | | | | | | | | | | 2 | 0 | 1 | | | | | | | - |
| DUEN-MGT-257 | Basic Priciples of Hydrogen Technology | 5 | E | | | | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | - |
| DUEN-MGT-258 | Basics of the circular economy | 5 | E | | | | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | - |
| | **Number of Theoretical/Practice/Lab classes per week** | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 4 | 0 | 6 | 2 | 4 | 0 | 0 | 0 | | | | |
| | **Total number of classes per week** | | | 0 | | | 0 | | | 0 | | | 0 | | | **12** | | | **12** | | | 0 | | | | | | |
| | **Total credit points** | | | **40** | | | | | | | | | | | | | | | | | | | | | | | | |

| NUCLEAR ENERGY | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject code | Subject name | Credit | Requirement | Semester - Classes per week | | | | | | | | | | | | | | | | | | | | | | | | Prerequisite |
| | | | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | | | |
| | | | | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | | | |
| DUEN-MGT-117 | Basics of nuclear safety | 5 | M | | | | | | | | | | | | | 2 | 0 | 1 | | | | | | | | | | - |
| DUEN-MGT-118 | Basics of Atomenergetics | 5 | M | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | - |
| DUEN-MGT-119 | Ensuring the integrity of equipment | 5 | M | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | - |
| DUEN-MGT-152 | Equipments of Nuclear Power Plants | 5 | E | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | | | | - |
| DUEN-MGT-213 | Industrial knowledge | 5 | M | | | | | | | | | | | | | | | | 2 | 0 | 1 | | | | | | | - |
| DUEN-MGT-214 | Operation and maintenance practice | 5 | M | | | | | | | | | | | | | | | | 0 | 0 | 3 | | | | | | | - |
| DUEN-MGT-255 | Radiation protection and environmental policy | 5 | E | | | | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | - |
| DUEN-MGT-256 | NPP measurements and NDT | 5 | E | | | | | | | | | | | | | | | | 2 | 1 | 0 | | | | | | | - |
| | **Number of Theoretical/Practice/Lab classes per week** | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 1 | 6 | 2 | 4 | 0 | 0 | 0 | | | | |
| | **Total number of classes per week** | | | 0 | | | 0 | | | 0 | | | 0 | | | **12** | | | **12** | | | 0 | | | | | | |
| | **Total credit points** | | | **40** | | | | | | | | | | | | | | | | | | | | | | | | |

| Part time | Mechanical Engineering BSc | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject code | Subject name | Credit | Requirement | Number of classes per semester | | | | | | | | | | | | | | | | | | | | | Prerequisite |
| | | | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | |
| | | | | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | |
| DUEL-IMA-100 | Tutorial mathematics | 0 | S | 0 | 10 | 0 | | | | | | | | | | | | | | | | | | | - |
| DUEL-IMA-152 | Engineering Mathematics 1. | 5 | E | 0 | 15 | 0 | | | | | | | | | | | | | | | | | | | - |
| DUEL-ISF-010 | Informatics | 5 | M | 0 | 0 | 15 | | | | | | | | | | | | | | | | | | | - |
| DUEL-MGT-111 | Engineering representation | 5 | M | 5 | 10 | 0 | | | | | | | | | | | | | | | | | | | - |
| DUEL-MUG-152 | Mechanics 1. | 5 | E | 5 | 10 | 0 | | | | | | | | | | | | | | | | | | | - |
| DUEL-MUG-212 | CAD | 5 | M | 0 | 0 | 15 | | | | | | | | | | | | | | | | | | | - |
| DUEL-MUT-151 | Engineering Physics | 5 | E | 5 | 5 | 5 | | | | | | | | | | | | | | | | | | | - |
| DUEL-IMA-212 | Engineering Mathematics 2. | 5 | M | | | | 0 | 0 | 15 | | | | | | | | | | | | | | | | DUEL-IMA-152 |
| DUEL-MST-210 | Industrial materials | 5 | M | | | | 5 | 0 | 10 | | | | | | | | | | | | | | | | - |
| DUEL-MUG-222 | Basics of machine design | 5 | M | | | | 10 | 5 | 0 | | | | | | | | | | | | | | | | DUEL-MUG-212, DUEL-MUG-152, DUEL-MGT-111 |
| DUEL-MUG-257 | Mechanics 2. | 5 | E | | | | 5 | 10 | 0 | | | | | | | | | | | | | | | | DUEL-MUG-152 |
| DUEL-MUT-250 | Heat and Fluid Dynamics | 5 | E | | | | 5 | 5 | 5 | | | | | | | | | | | | | | | | DUEL-MUT-151 |
| DUEL-TVV-122 | Entrepreneurship | 5 | M | | | | 5 | 10 | 0 | | | | | | | | | | | | | | | | - |
| DUEL-IMA-110 | Mathematics 3. | 5 | M | | | | | | | 0 | 15 | 0 | | | | | | | | | | | | | DUEL-IMA-152 |
| DUEL-MGT-112 | Engineering construction | 5 | M | | | | | | | 5 | 10 | 0 | | | | | | | | | | | | | DUEL-MGT-111 |
| DUEL-MUA-116 | Technology of Structural Materials | 5 | M | | | | | | | 5 | 0 | 10 | | | | | | | | | | | | | - |
| DUEL-MUG-153 | Mechanics 3. | 5 | E | | | | | | | 5 | 10 | 0 | | | | | | | | | | | | | DUEL-MUG-152 |
| DUEL-TVV-111 | Human Resource Managment | 5 | M | | | | | | | 5 | 10 | 0 | | | | | | | | | | | | | - |
| DUEL-TVV-114 | Management | 5 | M | | | | | | | 5 | 10 | 0 | | | | | | | | | | | | | - |
| - | Optional course | 5 | - | | | | | | | | | | - | - | - | | | | | | | | | | - |
| DUEL-MGT-211 | Basics of energetics | 5 | M | | | | | | | | | | 10 | 0 | 5 | | | | | | | | | | - |
| DUEL-MGT-212 | Fluid machinery | 5 | M | | | | | | | | | | 10 | 0 | 5 | | | | | | | | | | DUEL-MUT-250 |
| DUEL-MGT-251 | Industrial drive technology | 5 | E | | | | | | | | | | 10 | 5 | 0 | | | | | | | | | | DUEL-MUG-152, DUEL-MUG-222 |
| DUEL-MGT-252 | Industrial automatics | 5 | E | | | | | | | | | | 5 | 10 | 0 | | | | | | | | | | DUEL-IMA-152 |
| DUEL-MUG-252 | Production Technology | 5 | E | | | | | | | | | | 10 | 5 | 0 | | | | | | | | | | DUEL-MUG-152 |
| - | Specialisation | 20 | - | | | | | | | | | | | | | - | - | - | | | | | | | - |
| - | Optional course | 5 | - | | | | | | | | | | | | | - | - | - | | | | | | | - |
| DUEL-MGT-151 | Heat engines | 5 | E | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | DUEL-MGT-212 |
| - | Specialisation | 20 | - | | | | | | | | | | | | | | | | - | - | - | | | | - |
| - | Optional course | 5 | - | | | | | | | | | | | | | | | | - | - | - | | | | - |
| DUEL-MUG-213 | Metrology | 5 | M | | | | | | | | | | | | | | | | 10 | 0 | 5 | | | | DUEL-MUG-257, DUEL-MUG-222 |
| - | Optional course | 5 | - | | | | | | | | | | | | | | | | | | | - | - | - | - |
| DUEL-MUG-091 | Thesis project | 15 | S | | | | | | | | | | | | | | | | | | | 0 | 45 | 0 | finishing all subject of the 1-6 semester |
| DUEL-MUG-093 | Professional Practice | 0 | S | | | | | | | | | | | | | | | | | | | 0 | 0 | 0 | - |
| DUEL-MUG-117 | Quality Management | 5 | M | | | | | | | | | | | | | | | | | | | 10 | 5 | 0 | - |
| DUEL-MUT-110 | Environmental protection and energy management | 5 | M | | | | | | | | | | | | | | | | | | | 10 | 0 | 5 | - |
| | **Number of Theoretical/Practice/Lab classes per se** | | | 15 | 50 | 35 | 30 | 30 | 30 | 25 | 55 | 10 | 45 | 20 | 10 | 10 | 5 | 0 | 10 | 0 | 5 | 20 | 50 | 5 | |
| | **Total number of classes per semester** | | | **100** | | | **90** | | | **90** | | | **75** | | | **15** | | | **15** | | | **75** | | | |
| | **Total credit points** | | | **210** | | | | | | | | | | | | | | | | | | | | | |

| MACHINE MAINTENANCE AND TECHNICAL DIAGNOSTICS | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject code | Subject name | Credit | Requirement | Number of classes per semester | | | | | | | | | | | | | | | | | | | | | | Prerequisite |
| | | | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | |
| | | | | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | |
| DUEL-MGT-113 | Maintenance technologies 1. | 5 | M | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | DUEL-MUG-222 |
| DUEL-MUG-111 | Production planning, CAM | 5 | M | | | | | | | | | | | | | 10 | 0 | 5 | | | | | | | DUEL-MUG-252 |
| DUEL-MUG-118 | Tribology | 5 | M | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | DUEL-MUG-222 |
| DUEL-MUG-157 | Technical Diagnostics 1. | 5 | E | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | DUEL-MUG-153, DUEL-IMA-110 |
| DUEL-MGT-253 | Maintenance technologies 2. | 5 | E | | | | | | | | | | | | | | | | 10 | 5 | 0 | | | | DUEL-MGT-113 |
| DUEL-MGT-254 | Maintenance strategy | 5 | E | | | | | | | | | | | | | | | | 10 | 5 | 0 | | | | DUEL-MGT-113 |
| DUEL-MUG-216 | Complex Machine Designing | 5 | M | | | | | | | | | | | | | | | | 0 | 0 | 10 | | | | - |
| DUEL-MUG-219 | Technical Diagnostics 2. | 5 | M | | | | | | | | | | | | | | | | 10 | 0 | 5 | | | | DUEL-MUG-157 |
| | **Number of Theoretical/Practice/Lab classes per se** | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 15 | 5 | 30 | 10 | 15 | 0 | 0 | 0 | |
| | **Total number of classes per semester** | | | 0 | | | 0 | | | 0 | | | 0 | | | **60** | | | **55** | | | 0 | | | |
| | **Total credit points** | | | **40** | | | | | | | | | | | | | | | | | | | | | |

| GREEN TRANSFORMATION | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject code | Subject name | Credit | Requirement | Number of classes per semester | | | | | | | | | | | | | | | | | | | | | | Prerequisite |
| | | | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | |
| | | | | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | |
| DUEL-MGT-114 | Energy management | 5 | M | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | - |
| DUEL-MGT-115 | Renewable energy | 5 | M | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | DUEL-MUT-250 |
| DUEL-MGT-153 | Basics of energy saving and conservation | 5 | E | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | - |
| DUEL-TGT-252 | Sustainable Finance and Bigtech Companies in Finance | 5 | E | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | - |
| DUEL-MGT-215 | Practical application of renewable energy sources | 5 | E | | | | | | | | | | | | | | | | 0 | 0 | 15 | | | | - |
| DUEL-MGT-216 | Novel techniques of environmental protection | 5 | E | | | | | | | | | | | | | | | | 10 | 0 | 5 | | | | - |
| DUEL-MGT-257 | Basic Priciples of Hydrogen Technology | 5 | E | | | | | | | | | | | | | | | | 10 | 5 | 0 | | | | - |
| DUEL-MGT-258 | Basics of the circular economy | 5 | E | | | | | | | | | | | | | | | | 10 | 5 | 0 | | | | - |
| | **Number of Theoretical/Practice/Lab classes per se** | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 20 | 0 | 30 | 10 | 20 | 0 | 0 | 0 | |
| | **Total number of classes per semester** | | | 0 | | | 0 | | | 0 | | | 0 | | | **60** | | | **60** | | | 0 | | | |
| | **Total credit points** | | | **40** | | | | | | | | | | | | | | | | | | | | | |

| NUCLEAR ENERGY | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Subject code | Subject name | Credit | Requirement | Number of classes per semester | | | | | | | | | | | | | | | | | | | | | | Prerequisite |
| | | | | 1 | | | 2 | | | 3 | | | 4 | | | 5 | | | 6 | | | 7 | | | |
| | | | | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | T | P | L | |
| DUEL-MGT-117 | Basics of nuclear safety | 5 | M | | | | | | | | | | | | | 10 | 0 | 5 | | | | | | | - |
| DUEL-MGT-118 | Basics of Atomenergetics | 5 | M | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | - |
| DUEL-MGT-119 | Ensuring the integrity of equipment | 5 | M | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | - |
| DUEL-MGT-152 | Equipments of Nuclear Power Plants | 5 | E | | | | | | | | | | | | | 10 | 5 | 0 | | | | | | | - |
| DUEL-MGT-213 | Industrial knowledge | 5 | M | | | | | | | | | | | | | | | | 10 | 0 | 5 | | | | - |
| DUEL-MGT-214 | Operation and maintenance practice | 5 | M | | | | | | | | | | | | | | | | 0 | 0 | 15 | | | | - |
| DUEL-MGT-255 | Radiation protection and environmental policy | 5 | E | | | | | | | | | | | | | | | | 10 | 5 | 0 | | | | - |
| DUEL-MGT-256 | NPP measurements and NDT | 5 | E | | | | | | | | | | | | | | | | 10 | 5 | 0 | | | | - |
| | **Number of Theoretical/Practice/Lab classes per se** | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 15 | 5 | 30 | 10 | 20 | 0 | 0 | 0 | |
| | **Total number of classes per semester** | | | 0 | | | 0 | | | 0 | | | 0 | | | **60** | | | **60** | | | 0 | | | |
| | **Total credit points** | | | **40** | | | | | | | | | | | | | | | | | | | | | |

# SUBJECT DESCRIPTIONS

## Tutorial mathematics

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Matematika felzárkóztató</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="4">Tutorial mathematics</td><td>Code</td><td>DUEN(L)-IMA-100</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="6"></td></tr>
<tr><td colspan="3">Name of compulsory prior learning<br>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>150/26</td><td>per week</td><td>0</td><td>per week</td><td>2</td><td>per week</td><td>0</td><td rowspan="2"></td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/10</td><td>per term</td><td>0</td><td>per term</td><td>10</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">Antal Joós, 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<br>Based on the preliminary knowledge assessment, this course is recommended for students studying in the bachelor courses in economics and management, materials engineering, mechanical engineering, business informatics, computer engineering, technical management, and in the higher vocational courses in engineering, economics, and management. The aim is to acquire basic mathematical knowledge, to raise students' mathematical knowledge, skills, and competences to a level appropriate for the preparation of higher education studies and for the completion of mathematics courses.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5"></td></tr>
<tr><td>Practice</td><td colspan="5">Classroom exercises, student-prepared papers, presentations, case studies</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="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge</td></tr>
<tr><td colspan="6">Ability<br>Ability to apply the mathematical knowledge and activities learned. Ability to apply the problem-solving methods and procedures learned. Ability to develop and defend their own solution plans in discussions (argumentative debating skills) in relation to the mathematical concepts learnt. Ability to organise his/her own learning process effectively, to find and use different learning resources (print, electronic).</td></tr>
<tr><td colspan="6">Attitude<br>Open to learning about and embracing mathematically based, applied mathematical developments and innovations related to your qualifications and area of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="6">Autonomy and responsibility<br>Taking responsibility for your own work and the work of others.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">The material for the intermediate mathematics exam.<br>Operations with complex numbers. Set theory, the concept of a function.<br>Number sequences, powers, roots, order of operations. Logarithm, solutions of linear and quadratic equations. Solving problems in text. Exercise problems from the numeracy exercise in Engineering Mathematics 1.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="6">Task solving with guidance 60 %, Independent processing of tasks 40 %</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="6">• Lay, D. C.: Linear Algebra and its applications, 4th edition, Addison-Wesley, 2012.<br>• Stewart, J.: Complex Numbers, Additional Topic to Essential Calculus, 2nd edition, 2013, pp. 1-11.<br>• Smith, R. T., Minton, R. B.: Calculus: Early transcendental functions, 4th edition, McGraw Hill, New York, 2012.</td></tr>
<tr><td colspan="3">Recommended literature and contact details</td><td colspan="6">• Electronic content and learning material in Moodle and/or in Neptun systems.</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">During the semester, full-time and correspondence students write 1 final examination in week 13. The final examination is assessed according to the Examination and Study Regulations</td></tr>
</table>

## Engineering Mathematics 1.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Mérnöki matematika 1. | | | | | | | Level | BSc | |
| | in English | Engineering Mathematics 1. | | | | | | | Code | DUEN(L)-IMA-152 | |
| Responsible educational unit | | Institute of Information Technology, Department of Mathematics and Computer Science | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 0 | per week | 3 | per week | 0 | E | 5 | english | |
| Part time | 150/15 | per term | 0 | per term | 15 | per term | 0 | | | | |
| Teacher responsible for the subject | | Name | | | | Antal Joós, PhD | | | schedule | Associate Professor | |
| Training objective and justification of the course (content, output, location in the curriculum) | | **Goals, development objectives**<br>To acquire the mathematical foundations necessary to master the subjects, and to broaden mathematical knowledge for the study of the literature. | | | | | | | | | |
| Typical delivery methods | | Presentation | | | | | | | | | |
| | | Practice | Small tables, computational exercises. | | | | | | | | |
| | | Laboratory | | | | | | | | | |
| | | Other | | | | | | | | | |
| Requirements (expressed in terms of learning outcomes) | | **Knowledge**<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field. | | | | | | | | | |
| | | Ability to plan, organise and carry out independent learning. | | | | | | | | | |
| | | **Attitude**<br>Open to learning about and embracing mathematically based, applied mathematical developments and innovations related to their qualifications and areas of expertise.<br>Interested in new methods and tools related to the field. | | | | | | | | | |
| | | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others | | | | | | | | | |
| Short description of the subject content | | Operations with complex numbers. Set theory, the concept of a function. Number sequences limit, convergence criteria. Basic properties of univariate real functions, limit, continuity. Interpretation of differential coefficient of univariate real functions, relation between differentiability and continuity, derivative function, differential of differentiable function. General differentiation rules, differentiation of elementary functions. Mean value theorems of differential calculus, higher order differential coefficients, L'Hospital's rule, function disjunction. Concept of Riemann integral, conditions for integrability, properties of definite integral, mean value theorem of integral calculus, Newton-Leibniz formula. The primitive function, the indefinite integral and some of its properties, basic integrals. Integration methods. Improprius integral. Basic properties of multivariate real functions, differential calculus, calculation of extremal values. | | | | | | | | | |
| Types of student activities | | Processing theoretical material with guidance 10%<br>Independent processing of theoretical material 30%<br>Task solving with guidance 30 %<br>Independent processing of tasks 30 % | | | | | | | | | |
| Required literature and contact details | | • Kovács J. - Takács G. - Takács M.: Analysis. 16th edition. Takis, Analysis, 16th Edition, Budapest, National Textbook Publisher, 2004.<br>• Dr. M. Takács (ed.): Dr. Dr. M. M. (in Hungarian). Dr. Takis (in Hungarian). Dunaújváros, Publishing Office of Dunaújváros College, 2010. | | | | | | | | | |
| Recommended literature and contact details | | • P. Horváth: Multiple choice exercises for mathematics exercises. 2nd revised edition. Dunaújváros, Publishing Office of Dunaújváros College, 2008.<br>• Dr. M. Takács: Complex numbers example book. 3rd revised edition. Dunaújváros, Publishing Office of Dunaújváros College, 2009. | | | | | | | | | |
| Description of tasks to be submitted/measurement reports | | | | | | | | | | | |
| Description and timetable of the workshops | | | | | | | | | | | |

## Informatics

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="5">Informatika</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="5">Informatics</td><td>Code</td><td>DUEN(L)-ISF-010</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Informatics, Department of Software Development and Applications</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td>Presentation</td><td>Practice</td><td>Laboratory</td><td>Requirement</td><td>Credit</td><td colspan="2">Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week 0</td><td>per week 0</td><td>per week 3</td><td rowspan="2">M</td><td rowspan="2">5</td><td colspan="2" rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term 0</td><td>per term 0</td><td>per term 15</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td colspan="2">Name</td><td colspan="2">Nagy Bálint, 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<br>The students should be able to manage graphical operating system surely.<br>The students should be able to browse the Internet and send emails.<br>The students should be able to prepare documents with a word processing program and create spreadsheet by using spreadsheet program.<br>The students should be able to prepare and manage simple databases.<br>They should be able to prepare simple presentations as well.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5"></td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Laboratory</td><td colspan="5">In classrooms with the use of projector and computer, students solve individual tasks on the computers, using programs, with teacher assistance. Computer based exercises, individual tasks.</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<br>Students familiar with the general and specific mathematics, informatics principles, rules, relationships and procedures of the user programs in the field of information technology. They have adequate expertise in the IT field specialist knowledge of specific tools for selecting tools and to carry out its tasks.</td></tr>
<tr><td colspan="6">Ability<br>Students are able to perform partial activities independently during solving more complex system problems. They apply their studied problem solving methods and procedures efficiently in expertly tasks</td></tr>
<tr><td colspan="6">Attitude<br>Students are interested in new methods and tools related to IT section. Students consider their own professional competences and activities on reflective way. Open to understand and accommodate professional, technological development and innovation area.</td></tr>
<tr><td colspan="6">Autonomy and responsibility<br>Students strive for efficient and quality work. The responsible for the technical operations carried out independently.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">Confident use of operating system: managing files and folders.<br>Goal-oriented use of the Internet, knowledge of NETiquette. Targeted search on the Internet. Use of email programs.<br>Word processing with MS Word word processor program: Basic text editing operations, creating tables, applying styles, creating a table of contents and other lists, and creating mail merges.<br>Spreadsheet management with MS Excel spreadsheet program: Creating, uploading and formatting tables, using cell references, formulas, functions, charts as data visualization, applying simple database operations, managing and visualizing data.<br>Making a presentation with MS PowerPoint or Prezi: basic slide editing and formatting operations, using the slide master, slide templates, applying styles, slideshow settings and presentation techniques.<br>Independent, creative use of any kind of innovative IT tools and applications</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="6">Heard information processing by creating notes, systematization of information has led by tasks (40%) Self-processing (individual) tasks (60%)</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="6">• WORD 2010 All-In-One for Dummies by Doug Lowe with Ryan Williams, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet)<br>• EXCEL 2010 All-In-One for Dummies by Greg Harvey, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet)<br>• ACCESS 2010 All-In-One for Dummies by Margaret Levine Young, Alison Barrows, and Joseph C. Stockman, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet)</td></tr>
</table>

| | |
|---|---|
| | • POWER POINT 2010 All-In-One for Dummies by Doug Lowe, Wiley Publishing Inc., 2010, Indianapolis, Indiana (free pdf on Internet)<br>• The Internet for Dummies 12th edition by John R. Levine – Margaret Levine Young, Wiley Publishing Inc, Indiana (free pdf on Internet)<br>• OFFICE 2010 All-in-one for Dummies by Peter Weverka, Wiley Publishing, Inc. Indiana (free pdf on Internet) |
| Recommended literature and contact details | • Electronic literature in Moodle or in Neptun. Microsoft Office Tutorial and examples (Internet). |
| Description of tasks to be submitted/measurement reports | The student has the opportunity to solve a Word and Excel tasks on a topic of his or her own choice that match and are consistent with the learning materials of the semester. The extra point will be included in the final grade. It is necessary to discuss |
| Description and timetable of the workshops | At the end of each topic, students write closed papers, typically:<br>- Week 5: Word processing computer-based test<br>- Week 11: Spreadsheet management computer-based test<br>In case of any computer-based tests, the opportunity for replacement and correction is |

## Engineering representation

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="5">Műszaki ábrázolás</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="5">Engineering representation</td><td>Code</td><td>DUEN(L)-MGT-111</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td 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>1</td><td>per week</td><td>2</td><td>per week</td><td></td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>10</td><td>per term</td><td>0</td></tr>
<tr><td colspan="2">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">Gábor Vizi, PhD</td><td>schedule</td><td>Associate professor</td></tr>
<tr><td colspan="2">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="8">Goals, development objectives<br>The student should be able to perform any variation of the basic constructions found in descriptive geometry. Recognise the elementary constructions needed to solve various complex problems and be able to determine their correct sequence. Be able to select the optimal solution for a given situation from a range of possible solutions. The student should be familiar with the theory and practice of technical drawing projections and sections. The student should be able to edit technical drawings of machine parts using conventional tools, to read technical drawings. The student should be able to construct dimensional drawings of machine parts.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7">All students in a large lecture, using lecture, Power Point and overhead projector</td></tr>
<tr><td>Practice</td><td colspan="7">Small group exercises for up to 25 people, sketching and editing</td></tr>
<tr><td>Laboratory</td><td colspan="7"></td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field.<br>Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes.<br>Comprehensive knowledge of the operating principles and structural units of the machines, power tools, mechanical equipment and tools used.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used.</td></tr>
<tr><td colspan="8">Ability<br>Performs the job according to his/her qualifications.<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.</td></tr>
<tr><td colspan="8">Attitude<br>Open to learning about and embracing developments in machine design related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="8">Autonomy and responsibility<br>Taking responsibility for your own work and the work of others.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="8">Image plane, coordinate system, projection. Representation of a point, real line and point image. Law of projection and of change of view. Mutual positions of spatial elements. Projections dependent on the positions of a straight line, lines of deviation and intersection. Transversals, notable lines of a plane. True magnitude of the plane, constructions with rotation. Intersection of two planes, angles of inclination, distances. Solving problems with basic constructions. Basic standards of technical drawing design. Theoretical overview of projection systems in engineering practice. Application of views, views. Use of sections and sections. Dimensioning on engineering drawings. Grids of dimensions.</td></tr>
<tr><td colspan="2">Types of student activities</td><td colspan="8">Theoretical processing with guidance 20 % Theoretical processing with guidance 20 % Problem solving with guidance 20 % Problem solving with guidance 40 % Laboratory measurements with guidance - Preparation of laboratory reports -</td></tr>
<tr><td colspan="2">Required literature and contact details</td><td colspan="8">• Illustrative Geometry Basic Tasks (Guide and practical exercises, Tamás Zahola)<br>• László Tóth- Tamás Zahola: Mechanical Engineering. Zahra Zahola. Főiskolai Kiadó</td></tr>
</table>

| | |
|---|---|
| Recommended literature and contact details | • Károly Koffán: 15 lectures. 15 lectures. Főiskolai Kiadó.<br>• Koffán Károly: 15 exercises. College notes. College Publishing House. |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Mechanics 1.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Mechanika 1. | | | | | | | Level | BSc | |
| | in English | Mechanics 1. | | | | | | | Code | DUEN(L)-MUG-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 | 1 | per week | 2 | per week | 0 | E | 5 | english | |
| Part time | 150/15 | per term | 5 | per term | 10 | per term | 0 | | | | |
| Teacher responsible for the subject | | Name | | Béla Palotás, PhD | | | | | schedule | Profesor emeritus | |

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|---|---|---|
| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Students will learn the mechanical principles of designing simple engineering structures by applying the concepts and contexts presented in the lectures to exercises and home preparation. You will learn the concepts and practical relationships of statics and strength of materials. | |
| Typical delivery methods | Presentation | All students in a large lecture, using lecture, Power Point and overhead projector. |
| | Practice | Small table for up to 25 people, calculation exercises |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field. | |
| | **Ability**<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.<br>Ability to build basic models of technical systems and processes. | |
| | **Attitude**<br>Open to learn about and embrace developments in mechanics related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | Statics of a material point: concept of vector, operations that can be performed on vectors. Force, force system, equilibrium. Statics of rigid bodies: concept of rigid body. Concept of momentum. Equivalence of force systems, reduction. Concept of force. Equilibrium of rigid body. Ideal constraints. Determination of force systems for spatial and planar force systems. Statics of supports: support elements, supports and constraints, concepts and principles of determination of internal forces and stresses, relationships between stresses. Fundamentals of strength of materials: basic concepts, subdivision, methods of strength of materials, purpose of strength tests, requirements for structural elements, the tensile diagram and mechanical properties that can be derived from it. Determination of mechanical stresses under simple loading conditions. Concept and definition of stress state. Evaluation of stress state, principal stresses, principal stress directions. Elements of strain state: specific strains and angular distortions. Evaluation of strain state. Relationship between strain and stress state elements. Equivalent stress concept, theories. | |
| Types of student activities | Theoretical processing with guidance/independent: 15/35 %<br>Task completion with guidance/independent: 15/35 % | |
| Required literature and contact details | • Dr. Sándor Vigh: Mechanics. College notes | |
| Recommended literature and contact details | • Engineering Mechanics I. Elementary Statics, Workbook, Departmental Working Group, Dunaújváros, ME DFK Publishing Office, 1994.<br>• Engineering Mechanics II/1. Elementary Strength, Workbook, Dunaújváros, DF Kiadó, 2000. | |

| | |
|---|---|
| | • Dr Vigh S. . Engineering Mechanics IV. Cross-sectional Characteristics. college note, Dunaújváros, DF Kiadó, Dunaújváros, 1998.Engineering Mechanics I. Exemplar: part 1, Dunaújváros, DF Kiadói Hivatal, 2000.<br>• Technical Mechanics II. Manual: II/A, , Dunaújváros , DF Publishing Office, 2000. |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

# CAD

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | CAD | | | | | Level | BSc | |
| | | in English | | CAD | | | | | Code | DUEN(L)-MUG-212 | |
| 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 | | per week | 0 | per week | 3 | M | 5 | english | |
| Part time | 150/15 | per term | 0 | per term | 0 | per term | 15 | | | | |
| Teacher responsible for the subject | | | | Name | | Gábor Vizi, PhD | | | schedule | Assistant professor | |

| | | |
|---|---|---|
| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The student should be familiar with the practice of computer geometric modelling. Be able to build parametric geometric models of parts that "survive" design changes and incorporate design intent. Be able to select the optimum modeling sequence and method for the task at hand from a variety of possible modeling sequences and methods. Be able to build an assembly from the parts created. Be able to produce technical drawings of components and assemblies that best meet the requirements of the applicable drawing standards. | |
| Typical delivery methods | Presentation | |
| | Practice | |
| | Laboratory | Computer laboratory exercise |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Apply the related computational and modelling principles and methods of engineering product, process and technology design. | |
| | **Ability**<br>Ability to plan, organise and carry out independent learning.<br>Ability to build basic models of technical systems and processes. | |
| | **Attitude**<br>Open to learning about and embracing developments in CAD related to your qualifications and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | The student will learn the practice of computer geometric modelling through computer laboratory sessions using a modern parametric modelling system (SolidWorks). You will learn the use of commands to create machine parts. You will learn how to build assemblies. You will be able to create technical drawing documentation that best complies with current standards in your engineering work, based on the component and assembly models you have already built. | |
| Types of student activities | Processing theoretical material with guidance 20 %<br>Independent processing of theoretical material 20 %<br>Task solving with guidance 20 %<br>Independent processing of tasks 40 %<br>Laboratory measurements under supervision<br>Preparation of laboratory reports | |
| Required literature and contact details | • SolidWorks Online Help | |
| Recommended literature and contact details | • Specifications and documentation for the SolidWorks software system | |
| Description of tasks to be submitted/measurement reports | | |
| Description and timetable of the workshops | | |

## Engineering Physics

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Mérnöki fizika | | | | | Level | BSc | |
| | | in English | | Engineering Physics | | | | | Code | DUEN(L)-MUT-151 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 1 | per week | 1 | per week | 1 | E | 5 | english | |
| Part time | 150/15 | per term | 5 | per term | 5 | per term | 5 | | | | |
| Teacher responsible for the subject | | | | Name | | Miklós Horváth, PhD | | | schedule | College professor | |

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

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|---|---|
| Description of tasks to be submitted/measurement reports | Measurement reports from laboratory exercises |
| Description and timetable of the workshops | Examination papers in weeks 7 and 13: The papers contain 10 test questions, 2 theoretical questions to be explained and 2 problems to be solved, for which a total of 100 points can be awarded. |

## Engineering Mathematics 2.

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="5">Mérnöki matematika 2.</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="5">Engineering Mathematics 2.</td><td>Code</td><td>DUEN(L)-IMA-212</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Information Technology, Department of Mathematics and Computer Science</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="7">IMA-152</td></tr>
<tr><td colspan="2">Type</td><td>Presentation</td><td colspan="2">Practice</td><td>Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>0</td><td>per week</td><td>0</td><td>per week</td><td>3</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>0</td><td>per term</td><td>0</td><td>per term</td><td>15</td></tr>
<tr><td colspan="2">Teacher responsible for the subject</td><td>Name</td><td colspan="3">László Bognár, PhD</td><td colspan="2">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="7">Goals, development objectives<br>The purpose of the course is to make the students familiar with analysing data using statistical methods and tools. Having covered this course students understand the objective of probability and statistics, they know the different ways of gathering data, analysing datasets with statistical software and they can make inferences for real world situations based on samples of data.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">These formal lectures mostly aim at transferring information.<br>Students are expected to take personal notes in addition to the course text, slides or transparencies.</td></tr>
<tr><td>Practice</td><td colspan="6"></td></tr>
<tr><td>Laboratory</td><td colspan="6">Students are expected to be actively involved. Whether it is about exercises, feedback on an assignment or practicing statistical data analysis with software package personal input will always be expected.</td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge<br>Students will have a solid foundation of analysing processes or phenomena described by quantitative data.<br>Students will demonstrate their ability to apply statistics in other fields at an appropriate level and demonstrate their ability to apply knowledge acquired from their major to real world models.<br>Students will demonstrate mastery of data analysis and statistical concepts by communicating critically reasoned analysis through written and oral presentations.<br>Students will acquire up-to-date skills and/or applications of computer use related to future career choices.</td></tr>
<tr><td colspan="7">Ability<br>Students will be able to read, interpret, and critically analyse journal articles in the related field.</td></tr>
<tr><td colspan="7">Attitude<br>Collaborate with classmates and the teacher to develop knowledge.<br>Open to learning and applying modern investigative techniques.<br>Strives for accuracy in both numerical and laboratory exercises.</td></tr>
<tr><td colspan="7">Autonomy and responsibility<br>Taking responsibility for your own work and the work of others.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="7">During the course students will be engaged in the following topics: introduction, descriptive statistics, probability, random variable, method of estimation, test of hypotheses, simple linear regression</td></tr>
<tr><td colspan="2">Types of student activities</td><td colspan="7">Frontal work 30%<br>Individual or group work 50%<br>Testing 20%</td></tr>
<tr><td colspan="2">Required literature and contact details</td><td colspan="7">• James T. McClave, P. George Benson, Terry Sincich : Statistics for Business and Economics. Ed 12th. Pearson Education, Inc. 2014.<br>• Douglas C. Montgomery George C. Runger : Applied Statistics and Probability for Engineers. Ed 5th. John Wiley & Sons Inc. 2011.<br>• Moodle textbook</td></tr>
<tr><td colspan="2">Recommended literature and contact details</td><td colspan="7">• http://onlinestatbook.com/2/index.html<br>• James T. McClave, P. George Benson, Statistics for business and economics, Twelfth edition, Info Tech, Inc., University of Florida.</td></tr>
</table>

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

## Industrial materials

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="5">Műszaki anyagismeret</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="5">Industrial materials</td><td>Code</td><td>DUEN(L)-MST-210</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Structural Integrity</td></tr>
<tr><td colspan="3">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>1</td><td>per week</td><td>0</td><td>per week</td><td>2</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>0</td><td>per term</td><td>10</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">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="8">Goals, development objectives<br>The aim of the course is to provide students with a basic knowledge of chemistry, through which they will become familiar with the structure of materials, the electron shell structure that determines material properties, the types of chemical bonds that determine macroscopic properties, and the microscopic structure and methods of analysis of different types of materials (metals, ceramics, polymers). Students will learn about the relationships between the structure and properties of materials, enabling them to select the most suitable materials for a given application in simple cases.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7">Projector, ppt lectures, learning materials available in moodle.</td></tr>
<tr><td>Practice</td><td colspan="7"></td></tr>
<tr><td>Laboratory</td><td colspan="7">Laboratory measurements and calculations</td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="3" rowspan="3">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering. Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the field of engineering. Thorough knowledge of the materials used in the field of engineering, the methods of their manufacture and the conditions of their use.</td></tr>
<tr><td colspan="8">Ability<br>Ability to plan, organise and carry out independent learning.</td></tr>
<tr><td colspan="8">Attitude<br>Open to learning and absorbing knowledge related to chemistry and materials related to their qualifications and areas of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="8">Autonomy and responsibility<br>It takes its decisions independently, in consultation with other disciplines, and takes responsibility for them.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="8">Atomic structure. The structure of the periodic table. Electron configuration. Types and characteristics of chemical bonding. Electron affinity, electronegativity, oxidation number. Strong bonds. Weak bonds. General characterisation of metals, reactivity. Basic knowledge of organic chemistry. Grouping of carbon compounds, nomenclature. Isomerism. Main reactions of organic substances. Interconnection of macromolecules as a basis for polymer production. Basic knowledge of silicate chemistry. Basic knowledge of colloid chemistry. State change in solid phase processes. Polymorphic transformation. Types of engineering materials. Structure - processing - properties interaction. Crystal structure, crystal systems. Crystal, crystallite. Crystal lattice defects. Movement of atoms in matter, diffusion. Phases and constituents of metallic materials. Significance, definition of equilibrium phase diagrams. Rules for reading two and three component equilibrium phase diagrams. Basic types of two-element equilibrium phase diagrams.</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="8">Processing of heard text with annotation 50%.<br>Conducting material tests 30%.<br>Evaluation of measurements, preparation of report 20%..</td></tr>
<tr><td colspan="3">Recommended literature and contact details</td><td colspan="8">• Balázs Verő, Éva Dénes, Zsolt Csepeli:Introduction to the Engineering Materials Science, Főiskolai Kiadó, Dunaújváros<br>• Éva Dénes, Péter Farkas, Zsoltné Fülöp, Zoltán Szabó.</td></tr>
<tr><td colspan="3">Description of tasks to be submitted/measurement reports</td><td colspan="8">• Dr. Tamás Tóth: Mechanical properties of materials and methods of their investigation. Főiskolai Kiadó, Dunaújváros, Hungary</td></tr>
<tr><td colspan="3">Description and timetable of the workshops</td><td colspan="8">The student shall draw up a measurement report on the measurements carried out.</td></tr>
<tr><td colspan="3"></td><td colspan="8">A final paper in weeks 6 and 12 from the lectures and laboratory classes.</td></tr>
</table>

## Basics of machine design

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Géptervezés alapjai | | | | | Level | BSc | |
| | | in English | | Basics of machine design | | | | | Code | DUEN(L)-MUG-222 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-212<br>MUG-152<br>MGT-111 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 1 | per week | | M | | 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**<br>The student should know the construction and operation of typical machine parts, components, assemblies and sub-assemblies used in engineering practice. Be able to select standard parts for such units, determine the main dimensions, and design the associated components. Be able to prepare drawing documentation of units using traditional and computer tools. The student will be able to apply the knowledge acquired in Mechanical Engineering I, CAD and Mechanics I to the construction of simple structures and assemblies. | |
| Typical delivery methods | Presentation | All students in a large lecture, using lecture, Power Point and overhead projector |
| | Practice | Small group of up to 25 people, sketching, drafting, calculation exercises |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field.<br>Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes.<br>Comprehensive knowledge of the operating principles and structural units of the machines, power tools, mechanical equipment and tools used.<br>In-depth knowledge of learning, knowledge acquisition, data collection methods, their ethical limitations and problem-solving techniques in mechanical engineering.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used.<br>Apply the related computational and modelling principles and methods of engineering product, process and technology design. | |
| | **Ability**<br>Performs the job according to his/her qualifications.<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.<br>Ability to build basic models of technical systems and processes.<br>Routinely identifies professional problems, explores and formulates the theoretical and practical background necessary to solve them, and solves them by applying standard operations in practice. | |
| | **Attitude**<br>Open to learning and absorbing knowledge related to mechanical engineering related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | Repetitive parts or units of machinery performing the same function and having a similar design - machine components. Definition, grouping, description, description, representation, strength dimensioning, correct construction, operation and maintenance of machinery parts. The main machine components or groups to be discussed in detail | |

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| | are: drive and connecting screws, shafts, shaft couplings, couplings, bearings, belt drives, gears. In the discussion of the subjects, the emphasis is on the illustration and overview of the parts/assemblies. |
| Types of student activities | Processing theoretical material with guidance 20 %<br>Independent processing of theoretical material 20 %<br>Task solving with guidance 20 %<br>Independent processing of tasks 40 %<br>Laboratory measurements under supervision<br>Preparation of laboratory reports. |
| Required literature and contact details | • László Tóth- Tamás Zahola: Mechanical Engineering. Zahra Zahola. Főiskolai Kiadó<br>• Dr. Péter Szendrő and co-authors, Mechanical Engineering BSc. textbook, 2007. Mezőgazda Kiadó, Budapest, 758 p. |
| Recommended literature and contact details | • Dr. József Őze: Mechanical Elements I/2. I/3. I/4. I/5. I/6. I/7. I/8. manuscripts.1.<br>• Árpád Zsáry:Machine Elements II., Budapest, 1991.<br>• György Diószegi: Mechanical Engineering Handbook. Technical Book Publishing House, Budapest, 1988.<br>• István Majdán: Technical Pocketbook. Technical Book Publishing House, Budapest, 1995.<br>• Géza Nagy: Atlas of Mechanical Engineering. GTE ME Machine Elements Department, Budapest, 1991<br>• 4000 SKF Bearing Master Catalogue |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Mechanics 2.

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| Name of the subject | | in Hungarian | | Mechanika 2. | | | | | Level | BSc | |
| | | in English | | Mechanics 2. | | | | | Code | DUEN(L)-MUG-257 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-152 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 1 | per week | 2 | per week | 0 | E | 5 | english | |
| Part time | 150/15 | per term | 5 | per term | 10 | per term | 0 | | | | |
| Teacher responsible for the subject | | | | Name | | Béla Palotás, PhD | | | schedule | Professor emeritus | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The student will learn the mechanical principles of complex structure design by applying the concepts and contexts presented in the lectures to exercises and home preparation. You will learn about the statics of structures, limit states of use, the basics of the finite element method. | |
| Typical delivery methods | Presentation | All students in a large lecture, using Power Point and overhead projector. |
| | Practice | Small table for up to 25 people, calculation exercises |
| | Laboratory | 12-person laboratory exercise in solid mechanics and finite elements |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field. | |
| | **Ability**<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.<br>Ability to build basic models of technical systems and processes. | |
| | **Attitude**<br>Open to learn about and embrace developments in mechanics related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | Statics of structures: classification of supporting structures. Articulated multi-girder, triple-jointed frame, truss and additional support structures - strength analysis, determination of support forces and loads. Rope structures. Friction, slip connections and their application in engineering. Applied strength of materials: working principles of strength of materials. Their application to the determination of displacements of rod structures. Approximate methods for determining displacements. Basic concepts of the finite element method. Solution of statically indeterminate structures by force method. Stability problems of flexible bodies: in-plane and spatial rod deflection, buckling. Flexible-ductile deformations, dimensioning of rod structures using ductile principles. Fatigue phenomenon, control. Phenomenon of ridge fracture, checking. | |
| Types of student activities | Theoretical material processing with guidance/independently: 20/30%<br>Task completion with guidance/independent: 10/20 %<br>Laboratory work under supervision: 20 % | |
| Required literature and contact details | • Szőnyiné Passa Erzsébet - Dr. Koppány Imre: Mechanics - Supporting Structures I/A, Budapest, Nemzeti Tankönyvkiadó 1998.<br>• Dr. Vigh S. ed.: Technical mechanics II/B college notes, Dunaújváros, DF Kiadó, Dunaújváros, 2003. | |
| Recommended literature and contact details | • Departmental Working Group: Engineering Mechanics I. Elementary Statics, Workbook, Dunaújváros, ME DFK Publishing Office, 1994.<br>• Departmental Working Group: Engineering Mechanics II/2. Applied Strength, Workbook. DF Publishing House, Dunaújváros, 2002. | |

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| | • Dr. Sándor Vigh - Béláné Szlávik - Dr. Gyula Izsák: Technical Mechanics I. Manual Part 2, Dunaújváros, DF Publishing Office, 2000.<br>• Dr. Vigh S.ed.: Engineering Mechanics II. Tutorial II/B, college notes. DF Kiadó, Dunaújváros, 1998. |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Heat and Fluid Dynamics

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Hő- és áramlástan | | | | | Level | BSc | |
| | | in English | | Heat and Fluid Dynamics | | | | | Code | DUEN(L)-MUT-250 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUT-151 | | | | | | | |
| 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**<br>The study of the practical problems solutions in heat and fluid dynamics. | | | | | | | |
| Typical delivery methods | | | | Presentation | For all students, using a large speaker, a board presentation, a projector or an overhead projector | | | | | | |
| | | | | Practice | For every students, problem solving in small groups | | | | | | |
| | | | | Laboratory | Measurements in pairs | | | | | | |
| | | | | Other | | | | | | | |
| Requirements (expressed in terms of learning outcomes) | | | | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific rules, contexts and procedures for the operation of the technical field.<br>You know the terminology, key concepts and theories related to your field.<br>Comprehensive knowledge of the main theories in the field of knowledge acquisition and problem solving your methods.<br>He/she knows the measuring procedures used in mechanical engineering, their instruments, instruments and measuring equipment.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used. | | | | | | |
| | | | | **Ability**<br>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.<br>Ability to apply the most important terminology, theories and procedures of the technical field in the performance of related tasks.<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, and the principles and techniques needed to solve them to explore, formulate and (standard operations in practice).<br>Ability to understand and use literature, computer and library resources specific to their field.<br>The acquired IT knowledge can be used to perform tasks in the field of apply it in your solution.<br>Ability to build basic models of technical systems and processes.<br>Ability to communicate in their mother tongue in a professionally appropriate manner, orally and in writing, according to their field of specialisation. | | | | | | |
| | | | | **Attitude**<br>It assumes and authentically represents the social role of its profession and its fundamental relationship with the world.<br>It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering.<br>It tries to solve problems in cooperation with others, where possible.<br>Sufficient stamina and tolerance of monotony to carry out practical activities has.<br>Using his/her technical knowledge, he/she strives to understand the observable phenomena as thoroughly as possible, to describe and explain their laws. | | | | | | |
| | | | | **Autonomy and responsibility**<br>In unexpected decision situations, he/she independently thinks through and develops comprehensive, substantiating professional questions on the basis of given sources.<br>In carrying out his/her professional duties, he/she will also cooperate with qualified professionals in other fields (primarily technical, economic and legal).<br>He shares his experience with his colleagues, helping them to develop.<br>It takes responsibility for the consequences of its technical analyses, its proposals and its decisions. | | | | | | |

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| Short description of the subject content | The basics of fluid dynamics and thermodynamics. Euler and Bernoully equations, Haagen-Poiseuille equations, viscosity, laminar and turbulent flow, pressure drag in turbulent flow. Pressure drop in fittings. Impulse theorem. Similarity. Solid body in viscous substance. Intensive and extensive quantities. Uneversal and unified gas law. The mechanical work and the heat, and the firstlaw of thermodynamics. Isochoric, isobaric, isotherm and adiabatic processes. The politropic process. Cycles. Otto and Diesel cycles. Enthalpy, entropy, the second law of thermodynamics. Real gases. Thermal energy transport, conductance. convection and radiation. Heat pump and refrigerator. |
| Types of student activities | Lecture: Written text processing with note-taking 40%, theoretical material self-processing 20%, task solution 40%.<br>Labor: Heard text processing with note-taking 10%, home preparation for measurement 20%, measurement 40%, minutes preparation 30%. |
| Required literature and contact details | • Kiss E. Heat and Fluid Dynamics Electronic notes (Moodle)<br>• Kiss E. Heat and Fluid Dynamics Problem solving Electronic notes (Moodle)<br>• Kiss E. Laboratory syllabuses Electronic notes (Moodle) |
| Recommended literature and contact details | • Dr Gruber, Dr Blahó: Mechanics of Fluids, Tankönyvkiadó, Budapest, 1973<br>• Grósz Gy. Thermodynamics, BME 1996 |
| Description of tasks to be submitted/measurement reports | Full time: 5 measurement reports<br>Part time: 3 measurement reports |
| Description and timetable of the workshops | There are two tests during the semester. the first is in the 6th, and the second in the 13th week. The test is consisting of 10 freechoise questions (max. 30 points), two assay questions (max 20 points), and two problems tos olve for 50 points. If the res |

## Entrepreneurship

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| Name of the subject | in Hungarian | Vállalkozástan | | | | | | | Level | BSc | |
| | in English | Entrepreneurship | | | | | | | Code | DUEN(L)-TVV-122 | |
| Responsible educational unit | | Institute of Social Sciences, Department of Management and Entrepreneurship | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | | | | | | | | |
| Type | Presentation | Practice | | Laboratory | | Requirement | Credit | Language of education | | | |
| Full time 150/39 | per week 1 | per week | 2 | per week | | M | 5 | english | | | |
| Part time 150/15 | per term 5 | per term | 10 | per term | 0 | | | | | | |
| Teacher responsible for the subject | | Name | | Odorige Cathérine Enorédia | | | schedule | | | | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The learning material gives board knowledge in entrepreneurial skills such as establishing, operating and transforming firms, handling their assets and financial issues. By the end of the course the students will be able to use their managerial, entrepreneurial and business legal knowledge in practice. | |
| Typical delivery methods | Presentation | In a classroom with the use of projector or computer in each lecture. |
| | Practice | Flipchart, blackboard and other multimedia equipment in smaller seminar rooms suitable for group work |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Students will know the basic terms of entrepreneurship, understand the effect mechanisms of operating firms, know the legal background of companies, their internal and external environments, know the economic systems, aims and strategies of firms. | |
| | **Ability**<br>Students will be able to use terms of this field professionally,<br>to identify and determine the resources of companies,<br>to understand the steps of company aims and strategies, to understand and use the relevant literature. | |
| | **Attitude**<br>They are open and willing to discuss all points of the cases, as well as express their opinion, but without disclosing any important information about the circumstances of their own company. They have sensibility to find potentials for development. | |
| | **Autonomy and responsibility**<br>Students feel responsibility for both their development and environment. They cooperate with each other. They have sensibility to find possible resolving opportunities for problems. | |
| Short description of the subject content | The value chain and creation of double value both for buyers and suppliers. The technical and economic connections of value chain. The customer value and logistic buyer satisfaction. The customer value and the internet. The supply chain: system (network) of business relationships. The role of suppliers. Potential suppliers and the internet. Evaluation of suppliers, the criteria of supplier evaluation in internet. Strategic procurement. The methods and importance of demand anticipation in production logistics. Resource planning systems with buyer's cooperation. Management of customer relationship (CRM). The criteria of CRM systems (soft wares). The importance of services and its logistic problems. International transport. Competitiveness and supply chain management.<br>Integration of supply chain. Measurement of supply chains. Tendencies in supply chain management. | |
| Types of student activities | Case study analysis, Presentations, Individual work, Frontal class work, Essay writing | |
| Required literature and contact details | • William D. Bygrave - Andrew Zacharakis (2014): Entrepreneurship, 3rd Edition, John Wiley &Sons, DUE Library Materials on MOODLE | |
| Recommended literature and contact details | • Jerome Katz, Richard Green (2014) Entrepreneurial Small Business. 4th ed. McGraw-Hill International Ed., ISBN: 978-0078029424, DUE Library | |
| Description of tasks to be submitted/measurement reports | Processing and analysis of 1 chosen case study (On week 8th) | |
| Description and timetable of the workshops | Midterm tests on weeks 7th and 12th. Supplementary test on week 13th | |

## Mathematics 3.

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Matematika 3. | | | | | | | Level | BSc | |
| | in English | Mathematics 3. | | | | | | | Code | DUEN(L)-IMA-110 | |
| Responsible educational unit | | Institute of Information Technology, Department of Mathematics and Computer Science | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | IMA-152 | | | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 0 | per week | 3 | per week | 0 | M | 5 | english | |
| Part time | 150/15 | per term | 0 | per term | 15 | per term | 0 | | | | |
| Teacher responsible for the subject | | Name | | | | Nagy Bálint, PhD | | | schedule | Associate professor | |

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

## Engineering construction

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Gépszerkesztés | | | | | | | Level | BSc | |
| | in English | Engineering construction | | | | | | | Code | DUEN(L)-MGT-112 | |
| Responsible educational unit | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | MGT-111 | | | | | | | | | |
| Type | Presentation | Practice | | Laboratory | | Requirement | Credit | Language of education | | | |
| Full time 150/39 | per week 1 | per week | 2 | per week | 0 | M | 5 | english | | | |
| Part time 150/15 | per term 5 | per term | 10 | per term | 0 | | | | | | |
| Teacher responsible for the subject | | Name | | Róbert Sánta, PhD | | | schedule | Associate professor | | | |
| Training objective and justification of the course (content, output, location in the curriculum) | | **Goals, development objectives** and their interactions. In heating, cooling, ventilation and air conditioning, the systems, system components, and | | | | | | | | | |
| Typical delivery methods | | Presentation | For all students, in a large lecture, presentation on a whiteboard, projector or on-line using MS Teams, using a computer network. | | | | | | | | |
| | | Practice | Group work presentations | | | | | | | | |
| | | Laboratory | | | | | | | | | |
| | | Other | | | | | | | | | |
| Requirements (expressed in terms of learning outcomes) | | **Knowledge**<br>You know the terminology, key concepts and theories related to your field.<br>Comprehensive knowledge of the methods of knowledge acquisition and problem-solving in the main theories of the field.<br>Has a thorough understanding of machine design principles and methods, machine technology, control procedures and operational processes.<br>Comprehensive knowledge of the operating principles and structural units of the machinery and power tools, mechanical equipment and tools used.<br>Understand, characterise and model the structure and operation of the components and elements of mechanical engineering systems, and the design and interrelationship of the system components used.<br>Apply the related computational and modelling principles and methods of mechanical product, process and technological design. | | | | | | | | | |
| | | **Ability**<br>Perform the job according to your qualifications.<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify, formulate and solve (through the practical application of standard operations) routine professional problems, and to identify, formulate and solve (through the practical application of standard operations) the theoretical and practical background necessary for their solution. | | | | | | | | | |
| | | **Attitude**<br>Open to learning and absorbing knowledge related to mechanical engineering related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field. | | | | | | | | | |
| | | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | | | | | | | | | |
| Short description of the subject content | | Typical surfaces and bodies of engineering practice. Plane intersection of plane bodies. Plane section of curved bodies. Passing through flat bodies. Passing of curved bodies. The ISO tolerance system. Tolerances for length dimensions. Fits. Surface quality metrics and how they are specified. Typical design of cast, welded and machined parts. Reconstruction of machine parts (reverse engineering). | | | | | | | | | |
| Types of student activities | | Processing theoretical material with guidance 20 % Independent processing of theoretical material 20 % Problem solving with guidance 20 % Independent processing of tasks 40 % Laboratory measurements with guidance - Preparation of laboratory reports - | | | | | | | | | |
| Required literature and contact details | | • Moodle notes | | | | | | | | | |
| Recommended literature and contact details | | • Robert L. Norton: Machne Design - An Integrated Approach, 2006, Pearson Prentice Hall Upper Saddle River NJ. - Franz Koenigsberger, Machine tool structure,ISBN 10: 008013405X | | | | | | | | | |
| Description of tasks to be submitted/measurement reports | | | | | | | | | | | |
| Description and timetable of the workshops | | A final paper in weeks 6 and 12 from the lectures and laboratory classes. | | | | | | | | | |

## Technology of Structural Materials

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Szerkezeti anyagok technológiája | | | | | Level | BSc | |
| | | in English | | Technology of Structural Materials | | | | | Code | DUEN(L)-MUA-116 | |
| Responsible educational unit | | | | Institute of Technology, Department of Structural Integrity | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MST-210 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 1 | per week | 0 | per week | 2 | M | 5 | english | |
| Part time | 150/15 | per term | 5 | per term | 0 | per term | 10 | | | | |
| Teacher responsible for the subject | | | | Name | | Zsolt Csepeli, PhD | | | schedule | College professor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The aim of the course is to enable students to select the materials and production technologies best suited to the purpose. To this end, they will learn about the production, properties and uses of the most important metallic and non-metallic structural materials, as well as the processes of modification (alloying, casting, plastic forming, heat treatment and surface treatment) and forming (casting, plastic forming) of these materials.<br>technologies. Students will learn about the operation and application of the main bulk and pressure welding processes. | |
| Typical delivery methods | Presentation | Projector, ppt lectures, learning materials available in moodle. |
| | Practice | |
| | Laboratory | Tabletop exercise and/or laboratory measurement. Use of overhead projector. |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, trends and limits.<br>In-depth knowledge of the structural materials used in engineering, their methods of manufacture and conditions of use. | |
| | **Ability**<br>Ability to plan, organise and carry out independent learning. | |
| | **Attitude**<br>Open to learning and absorbing knowledge related to his/her qualifications and field of engineering. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>It takes its decisions independently, in consultation with other disciplines, and takes responsibility for them. | |
| Short description of the subject content | Metal production: pig iron production, steel production, continuous casting, aluminium production by electrolysis. Fe-Fe3C equilibrium phase diagram. Classification of steel and aluminium alloys, their characteristic properties. Germ formation and growth. Transformation diagrams for isothermal and continuous cooling. Formation of non-equilibrium tissue elements. Primary and secondary tissue structure. Tissue structure and mechanical properties of hot worked alloys. Forging, stamping, hot rolling, tube making processes. Metallurgical phenomena in cold forming. Fabric structure and mechanical properties of cold formed alloys. Plate forming technologies: straightening of base materials, material separation by thermal or shear stress, forming by bending, deep drawing, stretch forming. Full section heat treatments. Surface heat treatments. Operation and application of the main bulk and press welding processes. Preparation and processing of polymers and ceramics, their typical properties. | |
| Types of student activities | Processing of heard text with annotation 50%.<br>Conducting material tests 30%.<br>Evaluation of measurements, preparation of report 20%. | |
| Required literature and contact details | • Dr. József Verő - Dr. Mihály Káldor: Metallurgy. Textbook Publishing House, Budapest, 1977<br>• Dr. Éva Dénes, Dr. Péter Farkas, Mrs Zsolt Fülöp and Dr. Zoltán Szabó.<br>• Főiskolai Kiadó, Dunaújváros, 2008<br>• Dr. Tamás Tóth: Ferroalloys. National Textbook Publishing House, Budapest. 2002.<br>• TÁMOP e-learning course material: moodle.duf.hu; moodle.mk.uni-pannon.hu<br>• www.tankonyvtar.hu | |

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| Recommended literature and contact details | • Tamás Tóth: Mechanical properties of materials and methods of their investigation, Főiskolai Kiadó, Dunaújváros, 2004 |
| Description of tasks to be submitted/measurement reports | The student shall draw up a measurement report on the measurements carried out. |
| Description and timetable of the workshops | A final paper in weeks 6 and 12 from the lectures and laboratory classes. |

## Mechanics 3.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Mechanika 3. | | | | | Level | BSc | |
| | | in English | | Mechanics 3. | | | | | Code | DUEN(L)-MUG-153 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-152 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 1 | per week | 2 | per week | 0 | E | 5 | english | |
| Part time | 150/15 | per term | 5 | per term | 10 | per term | 0 | | | | |
| Teacher responsible for the subject | | | | Name | | Miklós Horváth, PhD | | | schedule | | |

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|---|---|---|
| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Students will learn the kinetic and kinematic properties of material points, rigid bodies and simple mechanisms by applying the concepts and relationships presented in the lectures to exercises and home preparation. Gain knowledge of the classification and operation of mechanisms commonly encountered in engineering practice. Knowledge of collision and vibration phenomena of elastic bodies. | |
| Typical delivery methods | Presentation | All students in a large lecture, using lecture, Power Point and overhead projector |
| | Practice | Small group of up to 25 people, sketching, drafting, calculation exercises |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field. | |
| | **Ability**<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.<br>Ability to build basic models of technical systems and processes. | |
| | **Attitude**<br>Open to learning and absorbing knowledge related to mechanical engineering related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | Amount of motion, permittivity, kinetic energy, work of force and torque, power of a point of matter. Kinetic theorems. Rigid body concept, types of motion, elementary motions. State of velocity of rigid body, velocity diagram. State of acceleration of rigid body, acceleration diagram. Amount of motion of rigid body, perpendicularity, kinetic energy. Kinetic theorems for a rigid body. Rolling of rigid body and catcher motion about stationary axis. Static and dynamic balancing. Kinetics of structures by classical and reduction method. Summary of material point rocking theory. One degree of freedom bending and torsional vibration. Multi-degree of freedom vibration systems. Collision of solid bodies. Concepts, characterisation and classification of mechanisms, structure, kinematic analysis. Kinematics of drives (gears, belt, friction and chain drives). Mechanisms commonly found in mechanical engineering. | |
| Types of student activities | Theoretical processing with guidance/independent: 15/35 %<br>Task completion with guidance/independent: 20/29 %<br>Laboratory measurements under supervision: 1 % | |
| Required literature and contact details | • Csizmadia ed. Mechanika III/B főiskolai jegyzet, Budapest, Tankönyvkiadó<br>Departmental Working Group: Mechanics III/1. Dynamics (basics) Workbook, Dunaújváros, DF Kiadó Dunaújváros | |
| Recommended literature and contact details | • Dr. Vigh S. ed: Technical mechanics III. tutorial, college note, Budapest, Tankönyvkiadó, 2000<br>• Dr. Béla M. Csizmadia - Dr. Ernő Nádori: Mechanics for engineers. Engineers for Mechanical Engineers. National Textbook Publisher, 1999. | |

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|---|---|
| | • Dr. István Sályi: Mechanisms: the basics of the kinematics and dynamics of machines, Budapest, Textbook Publishing House, 1973. |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Human Resource Managment

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Emberi erőforrás menedzsment | | | | | | | Level | BSc | |
| | in English | Human Resource Managment | | | | | | | Code | DUEN(L)-TVV-111 | |
| Responsible educational unit | | Institute of Social Sciences, Department of Management and Entrepreneurship | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | | | | | | | | |
| Type | Presentation | Practice | | Laboratory | | Requirement | Credit | Language of education | | | |
| Full time 150/39 | per week 1 | per week | 2 | per week | 0 | M | 5 | english | | | |
| Part time 150/15 | per term 5 | per term | 10 | per term | 0 | | | | | | |
| Teacher responsible for the subject | | Name | | Mónika Rajcsányi-Molnár, PhD | | | schedule | College professor | | | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The goal of the course is to develop the essential skills required of employees at the workplace and to expand students' HR management skills.<br>The course broadens the students' knowledge and gives abilities to manage the labor market institutions and policies, workplace and labor market characteristics, the system of labor relations, competence and motivation management, personnel management activities, organizational behavior, organizational communication, human resource management case studies, occupational safety and health project management. | |
| Typical delivery methods | Presentation | In a classroom with the use of projector or computer in each lecture. |
| | Practice | In a classroom with the use of projector or computer in each lecture. |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>The students know the basic facts, relationships, boundaries, limitations in human resource management (HRM) system of knowledge and activity.<br>They know and understand the processes and procedures for the modalities of human activities.<br>They familiar with the business of manufacturing and service processes, human and social relationships, their impact on human resources.<br>knows that a key element in the prosperity of the people working successfully. | |
| | **Ability**<br>The students can apply the analyzing methods and tasks (planning, organizing, and thinking in alternatives, inspection) on theoretical and practical grounds.<br>They are able to achieve the tasks assigned to them without control and inspection.<br>They can plan, schedule and complete the tasks within their scope of responsibility.<br>They can make the suggestions and decisions and take measures required for successfully solving a task within their own scope of competence.<br>They are capable of understanding the cause-result relationship and using analyzing skills in the activity chain of planning-organizing-decision preparing-decision-making<br>They can c apply the roles connected to employment and use and utilize managerial competences.<br>They are able to formulate an opinion of their own, deliver and defend it. | |
| | **Attitude**<br>Good negotiators are patient, well-educated and have empathy, i.e. they can identify with the representatives of the other side and accept their opinion.<br>Good, future-oriented bargainers respect their counterpart, are trustworthy and not aggressive.<br>It takes into account the employment practices of legal, ethical and professional rules.<br>Susceptible to accommodate new information, new tasks that require collaboration.<br>Considers it important for individual career planning.<br>It strives to lifelong learning and help the staff as well. | |
| | **Autonomy and responsibility**<br>In professional questions negotiators can play the role of a decision-maker and are able to solve problems alone. They can tackle problems as responsible persons, i.e. can decide if it is a need in a certain negotiation phase or situation to cooperate with others.<br>Ability to select its own staff, taking into account the specified criteria.<br>Ability to independently supply the areas it controls human processes.<br>Sense of responsibility for subordinates working fellow. | |
| Short description of the subject content | Evolution of the human resource management. Environmentally determination of HRM. The HRM place in the organizational structure. The HRM's activities and tasks. Job planning, analysis, competency models. Career management, career planning alignment of individual and organizational career opportunities. The workforce training and development opportunities. | |

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| | Performance evaluation and feedback management. Compensation and incentive systems.<br>Industrial relations system. Management of organizational changes. New trends in HRM practice. |
| Types of student activities | Pair work presentation<br>Group work (case study analysis) |
| Required literature and contact details | • David Campbell & Tom Craig (2011): Organisation and the Business Environment, Second edition, Routledge Publishing, USA<br>• Materials on Moodle<br>• Handouts from the lecturer |
| Recommended literature and contact details | • TORRINGTON, Derek – HALL, Laura – TAYLOR, Stephen (2005): Human Resource Management. Pearson Education Limited, Essex, England.810 p. ISBN 978-0-273-68713-9<br>• ARMSTRONG, Michael (2009): A handbook of Human Resource Management Practice, 11th ed. London: Kogan Page 1062 p. ISBN 0-7494-4631-5<br>• http://www.academia.edu/1418840/ARMSTRONGS_HANDBOOK_OF_HUMAN_RESOURCE_MANAGEMENT_PRACTICE) |
| Description of tasks to be submitted/measurement reports | Students have to take a final test |
| Description and timetable of the workshops | Multi-choice questions |

## Management

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Menedzsment | | | | | Level | BSc | |
| | | in English | | Management | | | | | Code | DUEN(L)-TVV-114 | |
| Responsible educational unit | | | | Institute of Social Sciences, Department of Management and Entrepreneurship | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 1 | per week | 2 | per week | 0 | M | 5 | english | |
| Part time | 150/15 | per term | 5 | per term | 10 | per term | 0 | | | | |
| Teacher responsible for the subject | | | | Name | | Mónika Rajcsányi-Molnár | | | schedule | College teacher | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The aim of the course is to familiarise students with the most important aspects of the management of work organisations, to provide an overview of the "special" dimensions of management and the factors that determine them. In order to develop the professional competences and theoretical knowledge of students, the course provides an overview of the concepts and major models of management organisation. Through the knowledge imparted, the course enables students to analyse and develop work organisations; to develop skills in the application of the management techniques and methods taught. Practical examples help to interpret theoretical knowledge and to identify relevant contexts. | |
| Typical delivery methods | Presentation | Teacher presentation, with explanations and practical examples. Students' comments on some topics, sharing their experiences, followed by a teacher's summary. All students present together in a large lecture with projector and presentation technique. |
| | Practice | Max. In classrooms of 30 students, using interactive methods, small groups of 5-6 students and individual work, projector, overhead projector and presentation techniques. |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Knowledge of the basic factors, key concepts, requirements, contexts and procedures of management and organisation science.<br>You will acquire the theoretical and methodological basis for the performance of management tasks and the exercise of functions.<br>You know the procedures and methods often used in planning, organising and managing.<br>You know the leadership style models and understand their role in effective leadership behaviour.<br>He/she knows the methods of understanding and analysing the management and decision-making systems of work organisations, their ethical limits and their possibilities for improvement.<br>Understand and identify with the importance of corporate social responsibility. Understands the ethical responsibilities of management and its role in the effective functioning of the company. | |
| | **Ability**<br>Ability to demonstrate and exercise managerial functions. Distinguish between management styles on the basis of advantage and disadvantage and apply the appropriate style as necessary.<br>It distinguishes between long-term and short-term tasks and consequences.<br>Ability to creatively analyse the purpose, process and organisational system of a work organisation.<br>Ability to organise his/her own and others' work effectively and humanely, and to lead working groups.<br>The ability to manage, organise, control and coordinate the development of the company's financial and information processes.<br>A sense of responsibility, assessment (self-assessment), analysis and synthesis skills are well developed. | |
| | **Attitude**<br>He is open and able to accept different opinions, which are not his own. Willing and able to work in a team and share knowledge with others.<br>His interest and commitment foster his continuous professional development.<br>It strives to ensure that its decisions are taken in full respect of the law and ethical standards.<br>It has a comprehensive systems approach. | |

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| | **Autonomy and responsibility**<br>It builds and initiates new areas of knowledge and new practices with creative autonomy.<br>He/she can take a leading role and participate in a high level of cooperation in the formulation of practical issues affecting his/her work and the future of his/her organisation.<br>Take responsibility for the consequences of your actions and decisions.<br>The ability to independently perform management tasks related to the technical-economic processes of the enterprise, the management of operations.<br>A sense of responsibility for sustainable development. |
| Short description of the subject content | The world of business, organisations, businesses and companies. Business and its environment. Business and management, organisational and management functions. Management, leadership, governance and how they relate to each other. Managerial roles and levels.<br>A historical overview of leadership. Management trends, schools and concepts. Similarities and differences.<br>Planning: hierarchy of organisational goals and levels of planning, long, short term and operational planning, methods of planning.<br>Organisation: change of structure, processes, understanding of organisations, division of labour and arrangement of divisions, creation of process and organisational structures, structural characteristics of organisations, types of organisations and their characteristics.<br>Management: enforcement of authority, setting standards, measurement, evaluation and correction, dealing with day-to-day problems, monitoring and controlling, strategic management tools.<br>Personal leadership: leadership behaviour and leadership style, identities and differences in theories of leadership style and the conclusions to be drawn.<br>Politics and ethics in organisational life. Understanding, areas and sources of business ethics. Characteristics of ethical behaviour and ethical business. The concept of a responsible company, an introduction to corporate social responsibility. Ethical responsibilities of management within the company. |
| Types of student activities | Guided and independent study of theoretical material, Problem solving with guidance and independently.<br>Analysis of case studies, group work. Solving complex tasks, cooperation in team work. Collecting, processing and presenting information on a professional topic. |
| Required literature and contact details | • Teaching aids and ppt's to help you work through the different chapters of management. Compiled by Enikő Nagy, 2016, available in moodle<br>• Angyal Á: Corporate Social Responsibility, Corporate Governance, Kossuth, Bp. 2009. |
| Recommended literature and contact details | • Csaba Deák - Balázs Heidrich - Éva Heidrich: Management skills. Booklands 2000 Publisher, 2006, ISBN: 9789632025209<br>• Miklós Dobák:Organizational forms and leadership. Akadémia Kiadó, Bp. 2008, ISBN: 9769630583406<br>• Angyal Á: Corporate Social Responsibility, Corporate Governance, Kossuth, Bp. 2009. ISBN: 9789630959957<br>• Csaba Deák: Management skills. Booklands, Békéscsaba. 2002.<br>• Miklós Dobák et.al.:Organizational forms and leadership. Budapest, KJK-Kerszöv, 2004.<br>• Antal Zs.- Kis N.: Organization administration and management. Management and Management of Management and Management. downloaded 05.08.2016.<br>• http://vtki.uni-nke.hu/uploads/media_items/antal-zsuzsanna_-kiss-norbert-tamas-szervezetigazgatas-es-menedzsment.original.pdf<br>• Vígvári: The revaluation of the control function and the challenges of modern management. http://193.6.12.228/uigtk/uipz/hallgatoi/ellcikk.pdf<br>• Noémi Piricz: Fair behaviour in business networks.In: Budapest University of Technology and Economics, Department of Management and Business Economics (ed.) Paper of the XXI National Conference of the Association for Marketing Education and Research, Budapest, 27-28 August 2015.Conference place and time: Budapest, Hungary, 2015.08.27 - 2015.08.28. 517-525. (ISBN:978-963-313-189-3) |
| Description of tasks to be submitted/measurement reports | |

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| Description and timetable of the workshops | |

## Basics of energetics

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="5">Energetika alapjai</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="5">Basics of energetics</td><td>Code</td><td>DUEN(L)-MGT-211</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td 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">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>0</td><td>per term</td><td>5</td></tr>
<tr><td colspan="2">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">Róbert Sánta, PhD</td><td>schedule</td><td>Associate professor</td></tr>
<tr><td colspan="2">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="8">Goals, development objectives<br>interpret and apply the installation and installation specifications of appliances.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7">For all students in a lecture room with projector or on-line using MS Teams.</td></tr>
<tr><td>Practice</td><td colspan="7">Small group of up to 25 people, sketching, drafting, calculation exercises</td></tr>
<tr><td>Laboratory</td><td colspan="7"></td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the field of engineering.<br>Knowledge of the terminology, the most important relationships and theories related to the field.<br>Comprehensive knowledge of the methods of knowledge acquisition and problem solving in the main theories of the field.<br>Comprehensive knowledge of basic economic, business and legal rules and tools.<br>Knowledge of the main structural materials used in the field of energy and their conditions of use.<br>Comprehensive knowledge of the basic principles and methods of operation of energy systems and processes and of energy conversion machines and technologies.</td></tr>
<tr><td colspan="8">Ability<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the field of engineering.<br>Knowledge of the terminology, the most important relationships and theories related to the field.<br>Comprehensive knowledge of the methods of knowledge acquisition and problem solving in the main theories of the field.<br>Comprehensive knowledge of basic economic, business and legal rules and tools.<br>Knowledge of the main structural materials used in the field of energy and their conditions of use.<br>Comprehensive knowledge of the basic principles and methods of operation of energy systems and processes and of energy conversion machines and technologies.</td></tr>
<tr><td colspan="8">Attitude<br>Open and receptive to energy, health and environmentally conscious design and operation principles and methods. He/she shall strive for continuous self-learning in the field of energy, in line with his/her professional goals. Carries out and makes management decisions by listening to the opinions of management and other staff. In his/her work, he/she shall apply the requirements of efficiency, sustainability and environmental and health awareness. Assume and authentically represent the role of the profession in society and its fundamental relationship with the world. He/she takes decisions in complex and unexpected decision-making situations, taking full account of legal and ethical standards. He/she is open to the use of information technology tools, and seeks to learn and use expert systems for planning and decision support in the field of energy.</td></tr>
<tr><td colspan="8">Autonomy and responsibility<br>In unexpected decision situations, he/she independently thinks through and develops comprehensive, well-founded professional questions on the basis of given sources. Responsibly upholds and represents the values of the engineering profession and is open to professionally informed critical comment.</td></tr>
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| Short description of the subject content | The role and fields of energetics. The three subsystems of energy, - production, generation, - transport, distribution, storage, - end-use of energy. Energy indicators, energy efficiency. Energy aspects of sustainable development. Primary and secondary energy needs. Fossil, nuclear fuels and renewable energy sources, their use and environmental impact. Introduction to pressurised water nuclear power, combined heat and power and renewable energy sources. Energy conversion processes in pressurised water nuclear power plants, combined heat and power generation. |
| Types of student activities | Presentation: Processing of the text with notes 70%, independent processing of theoretical material 30%, |
| Required literature and contact details | • https://energy.ec.europa.eu/system/files/2020-01/hu_final_necp_main_hu_0.pdf<br>• Materials on MOODLE |
| Recommended literature and contact details | • Ősz J.: Energetika jegyzet .ppt formátumban a www.energia.bme.hu honlapon.<br>• Büki G.: Energetika, Műegyetemi kiadó, 2000.<br>• Büki G.: Erőművek. Műegyetemi Kiadó, 2004. Oktatási segédanyagok: www.energia.bme.hu |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Fluid machinery

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| Name of the subject | in Hungarian | Áramlástechnikai gépek | | | | | | | Level | BSc | |
| | in English | Fluid machinery | | | | | | | Code | DUEN(L)-MGT-212 | |
| Responsible educational unit | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | MUT-250 | | | | | | | | | |
| Type | Presentation | Practice | | Laboratory | | Requirement | | | Credit | Language of education | |
| Full time 150/39 | per week 2 | per week | 0 | per week | 1 | M | | | 5 | english | |
| Part time 150/15 | per term 10 | per term | 0 | per term | 5 | | | | | | |
| Teacher responsible for the subject | | Name | | Miklós Horváth, PhD | | | | | schedule | College professor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>You know the terminology, key concepts and theories related to your field.<br>Comprehensive knowledge of the operating principles and structural units of the machines, power tools, mechanical equipment and tools used.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used. | |
| Typical delivery methods | Presentation | For all students in a large lecture hall with a blackboard presentation |
| | Practice | |
| | Laboratory | Manual editing exercise in groups of up to 30 |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, trends and limits of the subject area of engineering.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field.<br>Comprehensive knowledge of the operating principles and structural units of the machinery, power tools, mechanical equipment and tools used.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used. | |
| | **Ability**<br>Students should have a basic understanding of mechanical engineering after listening to this course. They should be familiar with the basic operation and energy processes of machines and be able to apply them in practice.<br>After completing the course, students should be able to draw hydraulic circuit diagrams.<br>Students will gain skills in pneumatic actuation, PLC applications and programming | |
| | **Attitude**<br>He is open to learning about and accepting technical engineering problems related to his qualifications and area of expertise. Interested in new methods and tools in mechanical pneumatics and hydraulics. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | General machine learning. Types of physical quantities used in mechanical engineering, their definition, application, conversions. Systems of measurement. Conversion between different measurement systems.<br>Characteristics of constant speed operation of machines. Loss of energy transfer, machine efficiency, variable speed operation, starting, stopping. Hydraulics. Pumps and motors, hydraulic power cylinders. Proportional pressure limiters, pressure reducers, flow regulators. Pipes, pipe fittings, batteries, filters. Switching technology. Pneumatics Characteristics and applications of pneumatic actuators. Pneumatic components. Basic connections. Introduction and identification of elements. Operation of pneumatic elements, examples of applications. | |
| Types of student activities | Processing theoretical material with guidance 30 % Processing theoretical material independently 25 %<br>Guided task solving 10 % Independent task processing 12 %<br>2 papers from the presentation material<br>Laboratory measurements under supervision 10% Preparation of laboratory reports 13% | |

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| Required literature and contact details | • Attila Kovács: General Mechanical Engineering (university note) Műegyetemi Kiadó, Bp. 1999..<br>• Zobory I. - Szabó A.: General Mechanical Engineering (university note) Műegyetemi Kiadó, Bp. 1998.<br>• Kjell Evensen-Jul Ruud : Basics of pneumatics, MECMAN EGER Ltd. Budapest 1994,<br>• FESTO: Introduction to pneumatics P111. Festo Ltd. 2001.<br>• FluidSIM simulation software on the institutional network Hydraulics<br>• Mannesmann-Rexroth Gmbh: What you need to know about hydraulics Volume 1 Number: RU 00301/4.82 |
| Recommended literature and contact details | • Imre Dolgos:Operation of machinery I.<br>• National Textbook Publishing House, 1998. Budapest<br>• Pattantyús Á. Géza:Operation of machinery, Műszaki Könyvkiadó, 1983. Budapest |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Industrial drive technology

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Gépészeti hajtástechnika | | | | | | | Level | BSc | |
| | in English | Industrial drive technology | | | | | | | Code | DUEN(L)-MGT-251 | |
| Responsible educational unit | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | MUG-152<br>MUG-222 | | | | | | | | | |
| 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 | | | | Tamás Zahola | | | schedule | Master instructor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The student should know the construction and operation of typical machine parts, components, assemblies and sub-assemblies used in engineering practice. Be able to design such units. Be able to prepare the drawing documentation of the units, mainly using computer tools. The student will be able to apply the knowledge acquired in Mechanical Engineering and Mechanics to the creation and design of complex structures. | |
| Typical delivery methods | Presentation | All students in a large lecture, using lecture, Power Point and overhead projector |
| | Practice | Computer-aided design exercise for up to 20 students. |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Knowledge of the general and specific rules, contexts and procedures for the operation of the technical field.<br>Familiarity with the terminology, the main contexts and theories related to the field.<br>Comprehensive knowledge of the main theories of the field in terms of knowledge acquisition and problem solving<br>methods of problem solving.<br>Basic knowledge of machine design principles and methods, control procedures and operational processes.<br>Has an applied knowledge of measurement procedures, their tools, instruments and measuring equipment used in mechanical engineering.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used. | |
| | **Ability**<br>Performs the job according to his/her qualifications.<br>Ability to plan, organise and carry out independent learning.<br>The ability to manage and control the production processes of specialised technology, with a view to quality assurance and quality control. | |
| | **Attitude**<br>He/she is open to learning and absorbing knowledge related to engineering technology related to his/her qualification and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | Design of complex machinery structures: strength design, correct structural design, operation and maintenance. The subject matter of the course concentrates on drive technology in addition to other topics not previously covered but relevant to engineering practice. Flexible (belt) drives, clutches, gear drives, springs, brakes, pipes and fittings, seals. | |
| Types of student activities | Processing theoretical material with guidance 20 %<br>Independent processing of theoretical material 20 %<br>Problem solving with guidance 20 %<br>Independent processing of tasks 40 %<br>Laboratory measurements with guidance<br>Preparation of laboratory reports | |
| Required literature and contact details | • B.N Sarkar, Fundamentals of Industrial Drives Paperback, Publisher : Phi Learning pvt Ltd; 1st edition (February 17, 2011), ISBN-13 : 978-8120344334<br>• Materials on MOODLE | |

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| Recommended literature and contact details | • Imre Dolgos: Operation of machinery I.<br>• National Textbook Publishing House, 1998. Budapest<br>• Pattantyús Á. Géza: Operation of machinery, Műszaki Könyvkiadó, 1983. Budapest |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Industrial automatics

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Ipari automatizálás</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="4">Industrial automatics</td><td>Code</td><td>DUEN(L)-MGT-252</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">IMA-152</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>1</td><td>per week</td><td>2</td><td>per week</td><td>0</td><td rowspan="2">E</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>5</td><td>per term</td><td>10</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">András Nagy, 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<br>Introduce students to the essential elements of control and regulation technology, the most important parts of process control, with particular emphasis on process control, manufacturing automation. Developing PLC programming skills in students</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">In a classroom with the use of projector, Power Point and computer in each lecture</td></tr>
<tr><td>Practice</td><td colspan="5">Flipchart, blackboard and other multimedia equipment in smaller seminar rooms suitable for group work max. 25 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="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge<br>Knows the conceptual system related to his/her field of expertise, the most important contexts and theories.<br>Comprehensive knowledge of the methods of acquiring knowledge and problem solving of the main theories of his/her field.<br>Basic knowledge of industrial control systems and methods, manufacturing technology, control engineering procedures.<br>Comprehensive knowledge of the operating principles and structural units of industrial control, mechanical equipment and devices.<br>Can interpret, characterize and model the structure and operation of the structural units and elements of automated systems, the design and connection of the applied system elements</td></tr>
<tr><td colspan="6">Ability<br>He performs a work that matches his qualifications.<br>Ability to plan, organize and perform independent learning.<br>Able to identify routine professional problems, explore and formulate the theoretical and practical background needed to solve them, and solve them (using practical operations in practice).</td></tr>
<tr><td colspan="6">Attitude<br>Strives to learning about and accepting automation design developments related to his qualification and field of expertise. Interested in new methods and tools related to the field</td></tr>
<tr><td colspan="6">Autonomy and responsibility<br>Responsibility for one's own work and the work of others</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="6">Fundamentals of control engineering, control and regulation technology basics. Characteristics, goodness, and types of control and regulation. Signals and systems, descriptive characteristics, block diagrams. Methodology of system description. Mappings, modeling, simulation. Structural and block diagrams. Deterministic test signals. Static and dynamic optimization. Fourier and Laplace transformation. Frequency response. Characteristics of fuzzy control. Basic steps of PLC programming, step and ladder programming, SCADA systems. Basics of sensors and actuators, connections. Industrial field bus systems, protocols.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="6">Processing of theoretical material with control 20% Independent processing of theoretical material 20% Problem solution with control 20% Independent processing of tasks 40%</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="6">• Materials on MOODLE</td></tr>
<tr><td colspan="3">Recommended literature and contact details</td><td colspan="6">• Conner Gareth: Scenic Automation Handbook, ISBN9781138850279, 2018<br>• Fabrizio Frigeni: Industrial Robotics Control, EAN9781484289884, 2022</td></tr>
<tr><td colspan="3">Description of tasks to be submitted/measurement reports</td><td colspan="6">Project work</td></tr>
<tr><td colspan="3">Description and timetable of the workshops</td><td colspan="6">Mid term exam on the 9th week</td></tr>
</table>

## Production Technology

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Gyártástechnológia | | | | | Level | BSc | |
| | | in English | | Production Technology | | | | | Code | DUEN(L)-MUG-252 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-152 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 1 | per week | 0 | E | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 5 | per term | 0 | | | | |
| Teacher responsible for the subject | | | | Name | | Gábor Vizi, PhD | | | schedule | Associate professor | |

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|---|---|---|
| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Understanding the basics of manufacturing technology FORMULAR FORMATIONS Understanding the theoretical basis of plastic forming. Knowledge of plastic forming technologies, production equipment and tools. CUTTING - Understanding the principles and implications of machining - Understanding the basic machining processes - Calculation and selection of process data - Calculation of machine time and standard time and cost - Understanding other machining processes | |
| Typical delivery methods | Presentation | For all students, in a large lecture, using a whiteboard, projector or overhead projector |
| | Practice | Small table top exercises for up to 20 people |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes.<br>Apply the related computational and modelling principles and methods of engineering product, process and technology design. | |
| | **Ability**<br>Performs the job according to his/her qualifications.<br>Ability to plan, organise and carry out independent learning.<br>The ability to manage and control the production processes of specialised technology, with a view to quality assurance and quality control. | |
| | **Attitude**<br>He/she is open to learning and absorbing knowledge related to engineering technology related to his/her qualification and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | THE FORMAL FORMATION PROCEDURES The theoretical basis of metal formation. Classification of non-ferrous forming processes. Forging, stamping, rolling technologies, production equipment and tools. Seamless tube manufacturing technology, production equipment. Plate forming technologies. Punching and blanking technologies, equipment and tools. Bending theory, technology, machines and tools. Theory, technology and tools for deep drawing. Techniques, tools and machinery for cold heading and cold flow. Casting technology, processes and tools. CHIPPING PROCEDURES Chipping methods and characteristics of chipping. Turning, planing, drilling, milling, grinding. Optimum determination of the number of passes, feeds and cycles for each type of machining. Calculation of the main machine time. Selection of the appropriate machine. Calculation of the standard time. Cost analysis. Non-conventional procedures. Other machining processes (hobbing, sawing, serrations, etc.). Determination of the prefabrication. | |
| Types of student activities | Processing theoretical material with guidance 5 %<br>Independent processing of theoretical material 40 %<br>Task solving with guidance 15 %<br>Independent processing of tasks 40 % | |
| Required literature and contact details | • Dr. Stevan Firstner: Manufacturing technology (machining) note (J1). Dunaújváros College Publishing Office, 2007.<br>• Dr. Firstner Stevan: Manufacturing Technology (machining) study guide (TU1) - note. First Engineering Technology (TU TU).<br>• Zsoltné Fülöp, Metal technology (chipless forming processes) (J2) Dunaújváros College Publishing Office, 2008. | |

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| | • Zsoltné Fülöp, Study Guide for the subject "Metal Technology" (chipless forming processes) (TU2) Dunaújváros College Publishing Office, 2008. |
| Recommended literature and contact details | • Illés Dudás: Machine Manufacturing Technology I.(GM), Miskolc University Publishing House, 2000.<br>• Gál Gaszton-Kiss Antal-Sárvári József-Tisza Miklós: Plastic Cold Formation, Tankönyvkiadó, Budapest, 1981. p. 360. Ziaja György: Plastic Formation, Tankönyvkiadó, Budapest, 1978. p. 396 |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Heat Engines

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Hőenergetikai gépek | | | | | Level | BSc | |
| | | in English | | Heat engines | | | | | Code | DUEN(L)-MGT-151 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MGT-212 | | | | | | | |
| 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 | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The aim of the course is to introduce the students to the equipment implementing the thermodynamic cycles and the real processes taking place in them. The basic knowledge of combustion technology required to understand these is also passed on, so that some of the problems in everyday life can be easily understood (eg fire for grilling, operation of a domestic boiler, air conditioning, heat pump heating, operation of internal combustion engines, air pollution). |
| Typical delivery methods | Presentation: In a classroom with the use of projector or computer in each lecture<br>Practice: Group work and presentations<br>Laboratory:<br>Other: |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Knows and uses the basic concepts of firing technology in practice. The students understand and uses knowledge of combustion theory in environmental protection. The student knows the processes that take place in domestic and industrial boilers. The student interprets the structure of the special steam turbine, the way of energy conversion. The student knows the structure of the reaction steam turbine, the way of energy conversion. The student understands the design of a gas turbine for energy purposes, the role of his turbine, compressor and firebox. The student is aware of the main features of the construction of a gas turbine used in aviation. The student informed about the operation of the compressor refrigerator. The student understands the structure of the compression and spark ignition engine, the processes that take place in them. The student is aware of the possibilities of increasing the performance of internal combustion engines, their advantages and disadvantages. |
| | **Ability**<br>The student is able to identify combustion processes in real equipment. The student is able to describe real systems with abstract thermodynamic models. The student distinguishes between solutions for different abatement methods. The student is able to represent thermodynamic processes in state diagrams. The student applies to solve more complex thermodynamic problems in real equipment. The student distinguishes between the operating, control and design solutions of different mixing systems. Apply his knowledge of thermodynamics, recognize deviations from theoretical processes. The student selects the type of chiller to suit your needs. The student describes the control methods of steam turbines and their design elements. The student describes the cycle losses of an internal combustion engine (Diesel, Otto, Wankel). |
| | **Attitude**<br>Student strives to meet and enforce quality standards.<br>Student strives to organise and carry out their tasks in accordance with environmental, health and sustainability standards.<br>Using student's technical knowledge, Student will seek to gain a better understanding of observable phenomena and to describe and explain their laws. |
| | **Autonomy and responsibility**<br>Student shares her acquired knowledge and experience through formal, non-formal and informal information transfer with those in her field.<br>Student demonstrates responsibility for sustainability, health and safety culture and environmental awareness.<br>In student's decisions, it takes account of the principles and application of environmental protection, quality, consumer protection, product liability, equal access, health and safety at work, technical, economic and legal regulation and engineering ethics. |
| Short description of the subject content | The course aims to acquaint students with the special operating and design knowledge of energy equipment. Accordingly, multistage chillers, heat pumps, and absorption chillers are presented. Using a systems approach, they acquire methods for designing fuel cells, solar cells, and ORC cycles. Students will become familiar with the losses, |

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| | characteristic curves, and modeling of the combustion process and heat losses in internal combustion engines. Using a systems approach, they are familiar with the solutions used in gas engines, steam, and gas turbines. Students can master the methods used to reduce sustainability and environmental impact. |
| Types of student activities | Processing heard text with notes 60% Task-based organisation of information 10% Independent processing of tasks 30%. |
| Required literature and contact details | • Fundamentals of Heat Engines, Author(s):Jamil Ghojel PhD, First published:28 February 2020 Print ISBN:9781119548768 \|Online ISBN:9781119548829 \|DOI:10.1002/9781119548829<br>• Materials on MOODLE |
| Recommended literature and contact details | • P.K.Nag-Basic and Applied Thermodynamics-Tata Mc Graw Hill Publishing Company, 2002<br>• R.K.Rajput-Engineering Thermodynamics-Laxmi Publications<br>• S.C.Somasundaram-Thermal Engineering-New Age International (P) Ltd,1996<br>• Ferziger, J.H., Peric, M.: Computational Methods for Fluid Dynamics, Springer, 1999 |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Metrology

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Gépészeti méréstechnika | | | | | Level | BSc | |
| | | in English | | Metrology | | | | | Code | DUEN(L)-MUG-213 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-257<br>MUG-222 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 0 | per week | 1 | M | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 0 | per term | 5 | | | | |
| Teacher responsible for the subject | | | | Name | | Gábor Pór, PhD | | | schedule | Professor emeritus | |

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

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| | • Heather A. Wade, The ASQ Metrology Handbook, Third Edition (eBook), Published 2023, ISBN: 9781636940205, Item Number: E1596 |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Thesis project

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| Name of the subject | | in Hungarian | | Szakdolgozat - GEPBSC | | | | | Level | BSc | |
| | | in English | | Thesis project | | | | | Code | DUEN(L)-MUG-091 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | 1-6 félév minden tárgyának teljesítése | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/117 | per week | 0 | per week | 9 | per week | 0 | S | 15 | english | |
| Part time | 150/45 | per term | 0 | per term | 45 | per term | 0 | | | | |
| Teacher responsible for the subject | | | | Name | | Tamás Zahola | | | schedule | Mater instructor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Work based on independent literature review and data collection, as well as individual consultation, using the information learned during the training and collected during the internship. | |
| Typical delivery methods | Presentation | |
| | Practice | The student prepares his/her thesis independently in individual consultations in 100% of the practice. |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>The student, summarising the knowledge acquired during the course and the results of the work placement, prepares a thesis on the chosen topic in the field of computer science and electronics integrated engineering as a synthesis of his/her studies. The thesis is an independent work requiring the creative use of the knowledge acquired. The thesis shall be supervised and assisted by a supervisor and shall be at least 50 pages long and no longer than 80 pages. | |
| | **Ability**<br>The student should be able to solve problems in mechanical engineering design work based on what has been learned. Recognise the elementary structures required to solve various complex problems and be able to determine their correct sequence.<br>You can choose the optimal solution for the situation from a range of possible solutions. Be able to train and represent complex shapes in engineering practice.<br>The student should be proficient in the independent use of standards and drafting aids, sketching and editing component drawings, and drafting machine assemblies. The student should be familiar with the conceptual structure of the ISO tolerance and fitment system for the correct specification of tolerances, tolerances and fits. Be able to specify accuracy specifications for machine parts. Know, be able to define and prescribe the surface finish metrics of machine parts.<br>Be able to design machine parts with a typical design for a given production technology. Be able to reconstruct the technical drawing of real machine parts so that the part or a substitute part can be produced from the drawing.<br>Be able to understand and analyse problems in industrial processes (e.g. maintenance problems) and make recommendations for their improvement.<br>Be able to present and document problems and solutions appropriately. | |
| | **Attitude**<br>Open to learning and absorbing engineering knowledge related to your qualifications and area of expertise. Interested in new methods and tools related to the field. And able to incorporate them into the thesis. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and applying technical standards | |
| Short description of the subject content | The student, summarising the knowledge acquired during the course and the results of the professional practice, prepares a thesis on the chosen topic in the field of mechanical engineering integrated with computer science and electronics. The thesis is an independent work requiring the creative use of the knowledge acquired. The thesis is prepared under the regular guidance and guidance of a supervisor | |
| Types of student activities | Regular consultation with industry and academic consultants. Incorporation of suggestions into the thesis. Continuous development and documentation of the thesis at the appropriate level. | |
| Required literature and contact details | • A guide to the thesis. 2nd expanded and revised edition. University publisher<br>• Materials on MOODLE | |

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

## Professional Practice

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Szakmai gyakorlat - GEPBSC | | | | | | | Level | BSc | |
| | in English | Professional Practice | | | | | | | Code | DUEN(L)-MUG-093 | |
| 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 | 150/0 | per week | 0 | per week | 0 | per week | 0 | S | 5 | english | |
| Part time | 150/0 | per term | 0 | per term | 0 | per term | 0 | | | | |
| Teacher responsible for the subject | | Name | | Tamás Zahola | | | | | schedule | Mater instructor | |
| Training objective and justification of the course (content, output, location in the curriculum) | | **Goals, development objectives**<br>The student should be able to perform engineering activities under professional supervision | | | | | | | | | |
| Typical delivery methods | | Presentation | | | | | | | | | |
| | | Practice | | | | | | | | | |
| | | Laboratory | | | | | | | | | |
| | | Other | | | | | | | | | |
| Requirements (expressed in terms of learning outcomes) | | **Knowledge**<br>Has a comprehensive knowledge of the basic facts, trends and boundaries of the subject area of the technical field.<br>Knows the conceptual system, the most important relationships and theories related to his field of expertise.<br>He has a comprehensive knowledge of the main theories of his field of knowledge acquisition and problem solving methods.<br>He has a thorough knowledge of the learning, knowledge acquisition and data collection methods of the field of mechanical engineering, their ethical limitations and problem-solving techniques. | | | | | | | | | |
| | | **Ability**<br>Performs a job corresponding to his qualifications.<br>Able to apply the most important terminologies, theories and procedures of the given technical field when performing related tasks.<br>Ability to plan, organize and carry out independent study.<br>In the course of his work, he is able to apply and comply with safety, fire protection and hygiene rules and regulations.<br>Able to communicate in a professionally adequate manner, orally and in writing, in his native language and at least one foreign language, according to his field of expertise.<br>Able to apply the technical regulations related to the operation of mechanical engineering systems, the principles and economic correlations of the adjustment and operation of machines and mechanical equipment. | | | | | | | | | |
| | | **Attitude** | | | | | | | | | |
| | | **Autonomy and responsibility** | | | | | | | | | |
| Short description of the subject content | | | | | | | | | | | |
| Types of student activities | | | | | | | | | | | |
| Required literature and contact details | | • | | | | | | | | | |
| Recommended literature and contact details | | • | | | | | | | | | |
| Description of tasks to be submitted/measurement reports | | | | | | | | | | | |
| Description and timetable of the workshops | | | | | | | | | | | |

## Quality Management

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Minőségirányítás | | | | | Level | BSc | |
| | | in English | | Quality Management | | | | | Code | DUEN(L)-MUG-117 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 1 | per week | 0 | M | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 5 | per term | 0 | | | | |
| Teacher responsible for the subject | | | | Name | | Mrs. Ildikó Angerer Petrovickij, PhD | | | schedule | Associate professor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The student should be able to understand the basic concepts of quality, to review the main areas of quality, to analyse the different approaches and evolution of the concept of quality, its difference from the concept of conformity, to interpret the relations between the actors of production and service processes in the light of quality, to formulate the role and structure of quality management in enterprises, to describe the structure of the "quality house". The student will be familiar with the structure of the national quality system, the TQM philosophy and its impact on management, employees and the environment, the purpose of quality awards and the essence of their requirements, the role of standards, their national and international system and their role in EU quality policy, the method of interpretation of standards and textual analysis of the structure of a system to meet the requirements of a system standard, the use of management standards (MIR, KIR /EMAS, ISO 14001/, MEBIR) and the application of quality and environmental management systems methods and techniques, the European system of conformity certification. | |
| Typical delivery methods | Presentation | For all students, in a large lecture, presentation on a whiteboard, projector or on-line using MS Teams, using a computer network. |
| | Practice | Group work, presentations |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>The student knows the terminology, key concepts and theories related to your field. Basic knowledge of quality and environmental management principles and methods, quality and environmental management procedures and operational processes. Understand, characterise and model the structure and operation of the building blocks and elements of quality and environmental management systems, and the design and interrelationship of the system elements used. | |
| | **Ability**<br>Ability to plan, organise and carry out independent learning. Ability to manage and control technologically specialised production processes, taking into account the elements of quality assurance and quality control. | |
| | **Attitude**<br>Open to learning and absorbing knowledge related to quality and environmental management systems related to his/her qualifications and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | The course provides a general overview of the technical aspects of building and operating a quality management system and the process approach to building management systems. It takes into account the legal background, the requirements of the documentation system and the techniques that facilitate quality improvement. It presents the main elements of the ISO 9000 system and the different quality awards and, in addition, briefly covers the Environmental Management Systems (ISO 14001, EMAS) and MEBIR. | |
| Types of student activities | Processing heard text with notes 60% Task-based organisation of information 10% Independent processing of tasks 30%. | |
| Required literature and contact details | • Note on quality and environmental management systems, Moodlem Dr. Géza Gremsperger. Note DF, downloadable help files from Moodle. | |
| Recommended literature and contact details | • A.R.Tenner - I.J.DeToro: Total Quality Management Technical Publishers. Budapest. 1997. | |

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| Description of tasks to be submitted/measurement reports | 2 essays to be submitted on a topic of your choice |
| Description and timetable of the workshops | In the semester period, in weeks 7 and 13, a total of 2 independent project papers/case studies of your choice on topics related to quality management, environmental management systems (ISO 14001, EMAS) and MEBIR systems, 8-15 pages in length, illustrated |

## Environmental protection and energy management

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Környezetvédelem és energiagazdálkodás</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="4">Environmental protection and energy management</td><td>Code</td><td>DUEN(L)-MUT-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 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">Endre Kiss, 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<br>The students get acquinted with the subject and the general problems of environmental protection, the technologies of abatement and elimination of pollutant’s.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">Presentation in a lecture room for everyone using computer driven projector</td></tr>
<tr><td>Practice</td><td colspan="5"></td></tr>
<tr><td>Laboratory</td><td colspan="5">Measurement in laboratory in pairs (max 11 pairs)</td></tr>
<tr><td>Other</td><td colspan="5"></td></tr>
<tr><td colspan="2" rowspan="3">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge<br>Knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, relationships and procedures necessary for the operation of the field of engineering.<br>Knowledge of the terminology, the most important contexts and theories related to the field.<br>Comprehensive knowledge of the methods of knowledge acquisition and problem-solving in the main theories of the field.<br>Comprehensive knowledge of basic economic, business and legal rules and tools.<br>Knowledge of measurement procedures at an applied level.<br>Has an applied knowledge of the requirements and standards of health and safety at work, fire protection, safety and health at work, and environmental protection in the field of his/her specialisation.<br>Comprehensive knowledge of the management, environmental protection and quality assurance principles, their limits and requirements, which are intrinsically linked to the field.</td></tr>
<tr><td colspan="6">Ability<br>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.<br>Ability to plan, organise and conduct independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve (using standard operations in practice) the theoretical and practical background necessary to solve them.<br>Ability to understand and use literature, computer and library resources specific to the field.<br>Ability to apply the acquired IT knowledge to the solution of problems in the field.<br>Ability to apply and enforce safety, fire safety and hygiene rules and regulations.<br>Ability to communicate orally and in writing in his/her mother tongue and in at least one foreign language in a professionally appropriate manner, in accordance with his/her field of specialisation.</td></tr>
<tr><td colspan="6">Attitude<br>It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering.<br>It strives to make self-learning a means to achieve its professional goals.<br>He/she takes decisions in complex and unexpected decision-making situations in full respect of legal and ethical standards.<br>Seek to solve problems, preferably in cooperation with others.<br>Strive to maintain self-development in the field on an ongoing basis and in line with professional goals.<br>He/she strives to solve problems and make management decisions by listening to the opinions of his/her supervisors, preferably in cooperation.<br>Have the stamina and tolerance of monotony required to carry out practical activities.<br>Open to the use of IT tools.<br>Open and receptive to the application of new, modern and innovative practices and methods related to organic farming and health awareness.</td></tr>
</table>

| | |
|---|---|
| | In the course of his/her work, he/she observes and complies with the relevant safety, health, environmental protection, quality assurance and control requirements. |
| | **Autonomy and responsibility**<br>Responsibly upholds and represents the values of the engineering profession, and is open to professionally informed critical comment.<br>In the performance of his/her professional duties, he/she will cooperate with qualified professionals from other disciplines (primarily technical, economic and legal).<br>Identify shortcomings in the technologies used, process risks and take the initiative to mitigate them.<br>Monitor legislative, technical, technological and administrative changes in the field.<br>Under the direction of the line manager, manages the work of the staff assigned to him/her and supervises the operation of machinery and equipment.<br>Assesses the efficiency, effectiveness and safety of the work of subordinates.<br>Supervises the professional development of his/her subordinates.<br>Sharing his/her experience with his/her colleagues in order to support their development.<br>Takes responsibility for the consequences of his/her technical analyses, the proposals he/she makes and the decisions he/she takes.<br>Translated with www.DeepL.com/Translator (free version) |
| Short description of the subject content | Basics of ecology. The subject, the questions, and purpose of environmental protection. The biological and geological environment. Cycles. The gas cover of Earth. The most important pollutants of air. The properties of dust pollution in the air. The general properties dust collection. Settling chambers and collectors with flow direction transformation. Cyclones. Basics of bag filters. Operating and cleaning of bag filters. Introduction of electrostatic precipitators. Powders with low and high electric resistance. The parts of electrostatic precipitators. Bag filter with electrostatic charging and their applications. Electrostatic precipitation with pulse energisation, abatement and decomposition of gases. Adsorption and absorption processes. Scrabbers. Oxidation methods. Burning technologies. Odor abatement. The measurement of air pollution. The properties of the natural waters, and their pollution, self cleaning. Water treatment technologies and their equipments. The pollution of soil. Waste and their treatment. Noise and vibration as environmental protection. Radioactive pollution. |
| Types of student activities | Lecture:the making notes: studiing the text independently, labor: studying the information, making reports |
| Required literature and contact details | • Kiss E,: Environmental Protection and Economical usage of Energy (on Moodle drive)<br>• 2. Environmental Science Toward a Sustainable Future Richard T. Write, Bernard J. Nebel, Prentice Hall |
| Recommended literature and contact details | • . The Biosphere, Ian Bradbury, Belhaven Press<br>• 4. Air Pollution, Its Origin and Control, Kenneth Wark and Cecil F. Warner, Harper and Row<br>• 5. Hazardous Waste Management Michael D. LaGrega, McGraw Hill<br>• 6. Drinking Water Quality, N.F. Gray, Wiley |
| Description of tasks to be submitted/measurement reports | Laboratory report according to schedule |
| Description and timetable of the workshops | Assay type test at the 6th week and at the last week |

# MACHINE MAINTENANCE AND TECHNICAL DIAGNOSTICS

## Maintenance technologies 1.

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Gépüzemfenntartási technológiák 1.</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="4">Maintenance technologies 1.</td><td>Code</td><td>DUEN(L)-MGT-113</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="7">MUG-222</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 colspan="3">Name</td><td colspan="2">Szabó Attila, PhD</td><td>schedule</td><td>College 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<br>Be able to analyze damage processes and reduce their impact. Be able to choose restoration technologies based on the knowledge of the damage. Be able to plan the disassembly and assembly technologies, as well as the preceding and subsequent operations, analyze and solve assembly dimension chains.</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">projector, ppt presentations</td></tr>
<tr><td>Practice</td><td colspan="6">projector, ppt presentations</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="3">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge<br>Able to analytically examine the damage processes of machines and equipment, uncover causes of errors and professionally eliminate them.</td></tr>
<tr><td colspan="7">Ability<br>Performs a job corresponding to his qualifications.<br>Able to plan, organize and carry out independent study.<br>Able to diagnose mechanical failures, select remedial actions, solve repair technology tasks</td></tr>
<tr><td colspan="7">Attitude<br>He is open to learning about and receiving knowledge related to machine maintenance related to his qualification and field of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="3">Short description of the subject content</td><td colspan="7">Autonomy and responsibility<br>Taking responsibility for your own work and the work of your peers.</td></tr>
<tr><td colspan="3">Types of student activities</td><td colspan="7">The damaging effects occuring on the surface of machine parts and volume and their consequences. Classification of the breakdowns. The surface quality; factors affecting the surface quality. Analysis of damages. The connection between the damages and the recovery technologies affecting the surface quality. The selection of recovery technologies. Cleaning the machines. Dismounting and assembly of the machines. Planning the dismounting and assembly technologies.</td></tr>
<tr><td colspan="3">Required literature and contact details</td><td colspan="7">Processing theoretical course material with guidance: 60 %<br>Independent processing of theoretical course material: 40 %<br>Task solution with guidance 15 %<br>Processing tasks independently 85%</td></tr>
<tr><td colspan="3">Recommended literature and contact details</td><td colspan="7">• Lech Pawlowski, The Science and Engineering of Thermal Spray Coatings, John Wiley & Sons, 2008<br>• Machine Maintenance I. Edited by Dr. Janik József. Jan Janik J. Janik, Főiskolai Kiadó, Dunaújváros, 2001.<br>• Materials on MOODLE</td></tr>
<tr><td colspan="3">Description of tasks to be submitted/measurement reports</td><td colspan="7">• William A. Bowditch; Kevin E. Bowditch; Mark A. Bowditch, Welding Technology Fundamentals Goodheart-Willcox, 2009</td></tr>
<tr><td colspan="3">Description and timetable of the workshops</td><td colspan="7">Completion of 2 homework assignments during the semester</td></tr>
<tr><td colspan="3"></td><td colspan="7">2 tests during the semester</td></tr>
</table>

## Production planning, CAM

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Gyártástervezés, CAM | | | | | Level | BSc | |
| | | in English | | Production planning, CAM | | | | | Code | DUEN(L)-MUG-111 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-252 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 0 | per week | 1 | M | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 0 | per term | 5 | | | | |
| Teacher responsible for the subject | | | | Name | | Gábor Vizi, PhD | | | schedule | College associate professor | |

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|---|---|---|
| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Familiarisation with micro-design documentation in manufacturing technology.<br>Familiarity with and use of the operations plan, operations instructions and accompanying documentation.<br>Understand the technological role and design of appliances and participate in the design of a simple appliance.<br>To learn about the construction and operation of NC-controlled machining machines, the function and application of machine components.<br>Gain CNC programming experience. Gain CAM programming experience. | |
| Typical delivery methods | Presentation | For all students, in class, on whiteboard or computer. Use of projector (50% of all lessons). |
| | Practice | |
| | Laboratory | For all students in class. Using computer and CNC machines (25% of all lessons). |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field. | |
| | **Ability**<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.<br>Ability to build basic models of technical systems and processes. | |
| | **Attitude**<br>Taking responsibility for your own work and the work of others. | |
| | **Autonomy and responsibility** | |
| Short description of the subject content | Choice of prefabricated products. Determining the grid tolerances of the prefabricated parts and calculating the final dimensions. Presentation of a numerical example. Concept of operation and preparation of the sequence of operations. Development of operation instructions. Forms of execution of the operation plan. Presentation of an example. Implementation of technological documentation. Organisation of documentation. Bases, base selection error, size chains. The process of designing apparatus. Static, kinematic and dynamic calculations. Sizing of components of apparatus. Drilling, milling and turning devices and their main functions and characteristics. Demonstration of the appliances manufactured. Design of CNC lathes and machining centres. Basics of programming CNC machines through a simulation system. Standards for CNC machines. NCT control instructions. Tooling of CNC machines. Solving a concrete technical problem (programming). Understanding the CNC programming process for lathes and milling machines. Understanding CAM formal processes. Demonstration of the development of a concrete example. | |
| Types of student activities | Processing theoretical material with guidance 20 %<br>Independent processing of theoretical material 20 %<br>Task solving with guidance 20 %<br>Independent processing of tasks 40 % | |
| Required literature and contact details | • Dr. Stevan Firstner, Production Planning, CAM, Practical (P) (manuscript), Dunaújváros College 2007. | |

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|---|---|
| | • Hiram E. Grant, Example of workpiece grippers, Technical Book Publishing, Budapest 1970<br>• Description of EdgeCAM software,<br>• NCT simulator software description |
| Recommended literature and contact details | • Egon Lechner: Elements of the construction of turning devices.<br>• Manufacturing technology, BME note<br>• NCT 2000 programming manual, machine manual<br>• Illés Dudás: Mechanical Engineering I. ME note |
| Description of tasks to be submitted/measurement reports | Solving a complex production planning problem.<br>Participation in exercises at least 70 %<br>Submission and satisfactory completion of the mid-term assignment<br>Positive assessment of the final knowledge assessment.<br>1. Written exam (Developing an engineering design for a given component) 25 ÷ 50 points.<br>2. ZH (Writing NC program, Solving a complex milling and turning problem with EdgeCAM) 25 ÷ 50 points<br>These are used to determine the grade:<br>- 51 - 60 points: sufficient,<br>- 61 - 70 points: medium,<br>- 71 - 80 points: good,<br>- 81 - 100 points: excellent |
| Description and timetable of the workshops | |

## Tribology

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Tribológia | | | | | Level | BSc | |
| | | in English | | Tribology | | | | | Code | DUEN(L)-MUG-118 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-222 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 1 | per week | 0 | M | 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 | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The attendants must be able to analyse the tribology systems, determine the structural and load data, have to be able to identify the mayor wearing processes in the wiev of tribological properties. The life time and third body most be determined generally. They have to plan and run tribological systems on the basis of propertise of lubrication state. They have to learn the different fields of the applied tribology (processing, mechanical structures, thermal prime mover), as well as the related supplier systems run and configuration. | |
| Typical delivery methods | Presentation | projector, ppt presentations |
| | Practice | projector, ppt presentations |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>He get to know machine design principles and methods, machine manufacturing technology procedures based on tribological aspects.<br>He has a comprehensive knowledge of the tribological processes taking place in used work and power machines and mechanical equipment. | |
| | **Ability**<br>Performs a job corresponding to his qualifications.<br>Able to plan, organize and carry out independent study.<br>Able to diagnose mechanical failures, select remedial actions, solve repair technology tasks. | |
| | **Attitude**<br>He is open to learning about and receiving knowledge related to tribology related to his qualification and field of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of your peers. | |
| Short description of the subject content | Definition of tribology. Description of tribological systems. Friction processes. Analysation of tribological processes. Surface quality of mechanical parts. The propertiese of surface layers. The relation between tribological duty and wearing mechanisms. Type of wearings. The practical methods of wearing measurement. The analytical method of wearing determination. Introduction of lubricants. Lubricants propertiese. Investigation of lubricants. Selection of lubricants. Selections of structural materials. Grading of lubrication states: Hydrodynamic lubrication (HD, EHD), Boundary lubrication, Extreme pressure lubrication, Process tribology: cutting, hot and cool deformation. Lubrication of mechanical parts and structures. | |
| Types of student activities | Processing theoretical course material with guidance: 60 %<br>Independent processing of theoretical course material: 40 %<br>Task solution with guidance 15 %<br>Processing tasks independently 85% | |
| Required literature and contact details | • R Gohar (Imperial College London, UK) & H Rahnejat (Loughborough University, UK): FUNDAMENTALS OF TRIBOLOGY<br>• Machine Maintenance I. Edited by Dr. Janik József, Dunaújváros, 2001.<br>• Jenő Szántó:Tribology, Budapest 1991.<br>• Valasek I. Tóth I.: Machining tribology,Budapest, Tribotechnik Kft. 2003.<br>• Valasek I. Auer J.: Lubricants and their viscous substances, Budapest, Tribotechnik Kft. 2003.<br>• Valasek I. Budinszki J.: Lubrication of machine components, Budapest, Tribotechnik Kft. 2003 | |

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|---|---|
| Recommended literature and contact details | • Gwidon Stachowiak and Andrew W Batchelor : Engineering Tribology, Third Edition Prasanta Sahoo |
| Description of tasks to be submitted/measurement reports | Completion of 2 homework assignments during the semester |
| Description and timetable of the workshops | 2 tests during the semester |

## Technical Diagnostics 1.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Műszaki diagnosztika 1. | | | | | Level | BSc | |
| | | in English | | Technical Diagnostics 1. | | | | | Code | DUEN(L)-MUG-157 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-153<br>IMA-110 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 1 | per week | 0 | E | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 5 | per term | 0 | | | | |
| Teacher responsible for the subject | | | | Name | | Gábor Pór, PhD | | | schedule | Professor emeritus | |

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|---|---|---|
| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The aim of the training is to acquire the basics of vibration diagnostics of rotating machinery, theoretical and practical knowledge of vibration measurement, which is the basis for modern maintenance. | |
| Typical delivery methods | Presentation | For all students, in a large lecture, using a whiteboard, projector or overhead projector, computer network |
| | Practice | Tabletop exercise, use of a projector or overhead projector |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used. | |
| | **Ability**<br>Performs the job according to his/her qualifications.<br>Ability to plan, organise and carry out independent learning.<br>Ability to diagnose mechanical failures, select troubleshooting operations, solve repair tasks | |
| | **Attitude**<br>He/she is open to learning and absorbing knowledge related to engineering technology related to his/her qualification and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | In this course, students will learn the essence of the different maintenance strategies (operation until failure, TMK, condition-based, predictive). They will learn the basic concepts of vibration theory, the description of single-freedom harmonics and forced vibration without and with damping. In the course of this subject, you will learn about the additivity of vibration, complex vibrations, the amplitude and frequency scales of vibration, the phase, the relationship between the time and frequency domains, and the Fourier transform. Students will learn the basics of measuring and processing vibration signals, the laws and problems of analog-to-digital signal conversion. They will acquire the theoretical and practical knowledge to use a correct vibration analyser, to deal with the phenomenon of aliasing, to use the windowing technique. Students will become familiar with the use of methods of vibration measurement such as the use of the axis orbit curve, the use of Orbit, the time synchronous sampling, the Crest Factor test. In addition to the study of forced vibrations, time will be devoted to the analysis of natural frequency vibrations, the study of resonance phenomena, and the study of critical axis velocities. In addition to the study of failure frequencies to detect bearing failures, we will learn the basics of one of the most effective methods, cepstrum analysis. Students will also learn the theoretical and practical foundations for the application of state-of-the-art rule-based expert systems for vibration diagnostics. | |
| Types of student activities | Processing a text you have heard by taking notes. Task-guided organisation of information. Independent processing of tasks | |
| Required literature and contact details | • Dr. István Nagy: Technical Diagnostics I. Főiskolai Kiadó, Dunaújváros, 2010.<br>• Materials on MOODLE | |
| Recommended literature and contact details | • Dr. István Nagy: Condition Based Maintenance, Technical Diagnostics I., Vibration Diagnostics, ISBN 963 06 0807 3, Publisher: Delta-3N Kft., 2006.<br>• Dr. Tibor Kégl- Zoltán József Szabó: T. Tolgi, T. Vibration, T. Tolgi, T. György, T. György, T. György. Dunaújváros, 1995. | |

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

## Maintenance technologies 2.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Gépüzemfenntartási technológiák 2. | | | | | | | Level | BSc | |
| | in English | Maintenance technologies 2. | | | | | | | Code | DUEN(L)-MGT-253 | |
| Responsible educational unit | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | MGT-113 | | | | | | | | | |
| 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**<br>The students should be able to design the recovery technologies and to control the implementation of the recovery technologies. The students should be able to calculate the recovery expenses. He should be able to select the recovery technology, which would be the appropriate in accordance with the situation and the goal on the basis of the technical and economic aspects. | | | | | | | | | |
| Typical delivery methods | | Presentation | projector, ppt presentations | | | | | | | | |
| | | Practice | projector, ppt presentations | | | | | | | | |
| | | Laboratory | | | | | | | | | |
| | | Other | | | | | | | | | |
| Requirements (expressed in terms of learning outcomes) | | **Knowledge**<br>Able to analytically examine the damage processes of machines and equipment, uncover causes of errors and professionally eliminate them. | | | | | | | | | |
| | | **Ability**<br>Performs a job corresponding to his qualifications.<br>Able to plan, organize and carry out independent study.<br>Able to diagnose mechanical failures, select remedial actions, solve repair technology tasks | | | | | | | | | |
| | | **Attitude**<br>He is open to learning about and receiving knowledge related to machine maintenance related to his qualification and field of expertise. Interested in new methods and tools related to the field. | | | | | | | | | |
| | | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of your peers. | | | | | | | | | |
| Short description of the subject content | | The technological methods of recovery. Recovery: - with mechanical methods; - by welding; -with soft and hard soldering; - with thermal scattering; - gluing and plasticizing. High energy density technologies and surface strengthening processes modifying surface integrity. Economy and organization of machine maintenance. Indicators of the economy of machine maintenance. | | | | | | | | | |
| Types of student activities | | Processing theoretical course material with guidance: 60 %<br>Independent processing of theoretical course material: 40 %<br>Task solution with guidance 15 %<br>Processing tasks independently 85% | | | | | | | | | |
| Required literature and contact details | | • Lech Pawlowski, The Science and Engineering of Thermal Spray Coatings, John Wiley & Sons, 2008<br>• Maintenance manual - methods and tools for managing maintenance. [professional editor Zoltán Gaál]. Budapest: RAABE Tanácsadó és Kiadó Kft., 2004.<br>• Materials on MOODLE | | | | | | | | | |
| Recommended literature and contact details | | • William A. Bowditch; Kevin E. Bowditch; Mark A. Bowditch, Welding Technology Fundamentals Goodheart-Willcox, 2009 | | | | | | | | | |
| Description of tasks to be submitted/measurement reports | | Completion of 2 homework assignments during the semester | | | | | | | | | |
| Description and timetable of the workshops | | 2 tests during the semester | | | | | | | | | |

## Maintenance strategy

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="6">Karbantartásmenedzsment</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="6">Maintenance strategy</td><td>Code</td><td>DUEN(L)-MGT-254</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="8">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="8">MGT-113</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="2">Teacher responsible for the subject</td><td colspan="4">Name</td><td colspan="3">Szabó Attila, PhD</td><td>schedule</td><td>College associate professor</td></tr>
<tr><td colspan="2">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="9">Goals, development objectives<br>The student should be able to plan the maintenance strategy based on reliable operation.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="8">projector, ppt presentations</td></tr>
<tr><td>Practice</td><td colspan="8">projector, ppt presentations</td></tr>
<tr><td>Laboratory</td><td colspan="8"></td></tr>
<tr><td>Other</td><td colspan="8"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="9">Knowledge<br>Get to know and apply the most common maintenance philosophies in companies. Able to review a company's maintenance philosophy, identify gaps and modernize it.</td></tr>
<tr><td colspan="9">Ability<br>Performs a job corresponding to his qualifications.<br>Able to plan, organize and carry out independent study.<br>Able to design a maintenance strategy that meets the needs of companies.</td></tr>
<tr><td colspan="9">Attitude<br>He is open to learning about and receiving knowledge related to machine maintenance related to his qualification and field of expertise. Interested in new methods and tools related to the field.</td></tr>
<tr><td colspan="9">Autonomy and responsibility<br>Taking responsibility for your own work and the work of your peers.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="9">The modern interpretation of the definition of „maintenance". Maintenance and terotechnology. The connection between production and maintenance. The double-circled model of the machine life-time. Effects that can damage the machine parts. Appearance forms of damages. Deterioration reserve and its wearing out. Breakdowns and operational errors. Weak-point analysis. The probabilistic examination of operational processes. The calculation method of maintenance cycle-time. Risk analysis in maintenance. The process of root-reason-analysis. Fault-tree analysis. Maintenance strategies and philosophies. The development of maintenance. Faliure Based Corective Maintenance (FBCM). Planned Preventive Maintenance. Parameter Condition Based Maintenance (PCBM). Reliability Centred Maintenance (RCM). Risk Based Maintenance (RBM); Risk Based Inspection and Maintenance (RBIM). Total Productive Maintenance (TPM). Automatic Maintenance (AM).</td></tr>
<tr><td colspan="2">Types of student activities</td><td colspan="9">Processing theoretical course material with guidance: 60 %<br>Independent processing of theoretical course material: 40 %<br>Task solution with guidance 15 %<br>Processing tasks independently 85%</td></tr>
<tr><td colspan="2">Required literature and contact details</td><td colspan="9">• David J Smith: Reliability, Maintainability and Risk, Elsevier, 2013.<br>• Machine Maintenance I. Edited by Dr. Janik József, Dunaújváros, 2001.<br>• Maintenance manual - methods and tools for managing maintenance. [professional editor Zoltán Gaál]. Budapest: RAABE Tanácsadó és Kiadó Kft., 2004</td></tr>
<tr><td colspan="2">Recommended literature and contact details</td><td colspan="9">• Machine Maintenance II. Edited by Dr. Janik József, Főiskolai Kiadó, Dunaújváros, 2001.</td></tr>
<tr><td colspan="2">Description of tasks to be submitted/measurement reports</td><td colspan="9">Completion of 1 homework assignments during the semester</td></tr>
<tr><td colspan="2">Description and timetable of the workshops</td><td colspan="9">2 tests during the semester</td></tr>
</table>

## Complex Machine Designing

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Komplex gépészeti tervezés | | | | | Level | BSc | |
| | | in English | | Complex Machine Designing | | | | | Code | DUEN(L)-MUG-216 | |
| 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 | 150/26 | per week | 0 | per week | 0 | per week | 2 | M | 5 | English | |
| Part time | 150/10 | per term | 0 | per term | 0 | per term | 10 | | | | |
| Teacher responsible for the subject | | | | Name | | Gábor Vizi, PhD | | | schedule | Associate professor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The student should be able to perform tasks in mechanical engineering, computer aided design (CAD), finite element strength calculation (VEM) and manufacturing engineering (CAM). Be able to explore and sketch solution variations of mechanical design problems, establish selection criteria, select and develop the optimal variant. Be able to document the design process and present design results. | |
| Typical delivery methods | Presentation | |
| | Practice | |
| | Laboratory | For all students in classroom, blackboard class, lab.<br>Use of a projector (100% of all lessons). |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Get to know and apply the most common maintenance philosophies in companies. Able to review a company's maintenance philosophy, identify gaps and modernize it. | |
| | **Ability**<br>Performs a job corresponding to his qualifications.<br>Able to plan, organize and carry out independent study.<br>Able to design a maintenance strategy that meets the needs of companies. | |
| | **Attitude**<br>He is open to learning about and receiving knowledge related to machine maintenance related to his qualification and field of expertise. Interested in new methods and tools related to the field. | |
| | Taking responsibility for your own work and the work of your peers. | |
| Short description of the subject content | Practise parametric 3D modelling and drawing on simple machine parts, then assemblies, part pick-up. Development of model variants. Basics of finite element method. Structure of program systems, interpretation of INPUT / OUTPUT data. Solid state applications, shape optimisation. Preparation of technical documentation. Development of component manufacturing technology. Selection of machining cycles. Generation of CNC program. | |
| Types of student activities | Task solving with guidance 15 %<br>Independent processing of tasks 85 % | |
| Required literature and contact details | • SolidWorks design system description<br>• Béla Csizmadia - Ernő Nándori:Mechanics for engineers. Nándor M. Mechanical engineers. National Textbook Publishing House, 1998. 435-480 p.<br>• Materials on MOODLE | |
| Recommended literature and contact details | • SolidWorks VEM module software description<br>• EdgeCAM technology software description | |
| Description of tasks to be submitted/measurement reports | Continuously produce 3D models and improved parts drawings from parts and assembly drawings issued during the semester. VEM testing of a simple machine part for a specific load case. | |
| Description and timetable of the workshops | Create a 3D model of a specific part per student and produce a drawing of the part in accordance with the specifications of the technical drawing within a given time.<br>1. Positive evaluation of progress monitoring and homework.<br>2. Create and perform finite element analysis of a 3D model of a simple workpiece.<br>3. exploring and evaluating alternative solutions to the technical problem posed, based on given selection criteria, and then selecting the viable alternative(s). | |

## Technical Diagnostics 2.

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Műszaki diagnosztika 2. | | | | | Level | BSc | |
| | | in English | | Technical Diagnostics 2. | | | | | Code | DUEN(L)-MUG-219 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUG-157 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 0 | per week | 1 | M | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 0 | per term | 5 | | | | |
| Teacher responsible for the subject | | | | Name | | Gábor Pór, PhD | | | schedule | Professor emeritus | |

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|---|---|---|
| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Understanding the mathematical theory, mathematics and practice of signals and signal processing in modern diagnostic systems. Thorough knowledge of the mathematical derivations of the functions and procedures taught. Confident handling of time and frequency domain transformations, interpretation of signals and functions obtained from signals by signal processing and quantitative knowledge of measurement and diagnostic procedures based on them, mathematical foundations of modern methods and their usefulness for diagnostics. The aim of the training is to acquire the theoretical and practical basics of diagnostic techniques and methods (vibration diagnostics, infrared thermography, ferrography, ultrasonic fault and leakage detection), and to gain a deeper understanding of the more complex procedures of vibration measurement and evaluation, in order to provide a basis for modern maintenance. | |
| Typical delivery methods | Presentation | For all students, in a large lecture, using a whiteboard, projector or overhead projector, computer network |
| | Practice | |
| | Laboratory | Measurements with laboratory instruments. |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used. | |
| | **Ability**<br>Performs the job according to his/her qualifications.<br>Ability to plan, organise and carry out independent learning.<br>Ability to diagnose mechanical failures, select troubleshooting operations, solve repair tasks | |
| | **Attitude**<br>He/she is open to learning and absorbing knowledge related to engineering technology related to his/her qualification and area of expertise. Interested in new methods and tools related to the field. | |
| | **Autonomy and responsibility**<br>Taking responsibility for your own work and the work of others. | |
| Short description of the subject content | In the field of balancing rotating machinery, students will learn the theoretical basics and practice balancing rotating machinery in a state-of-the-art laboratory. Students will learn the steps of modern laser shaft alignment. Students will master the steps of data and knowledge base building, measurement preparation and measurement evaluation using the expert system. Students will be able to carry out full system development and operation using the vibration diagnostics expert system, which will lay the foundation for the organisation of condition-based maintenance in production companies. The design and functions of machine vibration protection systems, shaft motion monitoring and orbit testing will be discussed in the course. The students will learn the theoretical basics of infrared image analysis, the use of infrared cameras in laboratory exercises and the computer processing of thermal images in machine condition diagnostics, fault location of electrical equipment and control cabinet joints and the identification of insulation defects in buildings. Students will learn about the application of ultrasonic leak detection and the wide variety of ultrasonic flaw detection techniques. | |
| Types of student activities | Processing a text you have heard by taking notes. Task-guided organisation of information. Independent processing of tasks. | |
| Required literature and contact details | • Dr. István Nagy: Technical Diagnostics I. Note, Főiskolai Kiadó, Dunaújváros, 2010.<br>• Dr. István Nagy: Technical Diagnostics II. Note, Főiskolai Kiadó, Dunaújváros, 2010. | |

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|---|---|
| Recommended literature and contact details | • Dr. István Nagy: Condition-based Maintenance, Technical Diagnostics I., Vibration Diagnostics,ISBN96306 0807 3, Publisher: Delta-3N Kft., 2006.<br>• Dr. István Nagy, Gábor Baksai and Károly Sólyomvári: Condition-based Maintenance, Technical Diagnostics II. Edited by Dr. Ferenc Dömötör College Publishing House. Dunaújváros, 2003. |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

# GREEN TRANSFORMATION

## Energy management

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="8">Energiamenedzsment</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="8">Energy management</td><td>Code</td><td>DUEN(L)-MGT-114</td></tr>
<tr><td colspan="3">Responsible educational unit</td><td colspan="9">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="3">Name of compulsory prior learning<br>DUEN(L)-</td><td colspan="9"></td></tr>
<tr><td colspan="2">Type</td><td colspan="2">Presentation</td><td colspan="2">Practice</td><td colspan="2">Laboratory</td><td>Requirement</td><td>Credit</td><td>Language of education</td></tr>
<tr><td>Full time</td><td>150/39</td><td>per week</td><td>2</td><td>per week</td><td>1</td><td>per week</td><td>0</td><td rowspan="2">M</td><td rowspan="2">5</td><td rowspan="2">english</td></tr>
<tr><td>Part time</td><td>150/15</td><td>per term</td><td>10</td><td>per term</td><td>5</td><td>per term</td><td>0</td></tr>
<tr><td colspan="3">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">Éva Kovács-Bokor, PhD</td><td>schedule</td><td>College assosiate professor</td></tr>
<tr><td colspan="3">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="9">Goals, development objectives<br>The aim of the course is to familiarise students with the specific management and economic knowledge of the energy sector. Accordingly, students will be familiarised with the basic economic processes, management and economic evaluation principles and methods across the entire energy sector. By applying a systems approach, students will acquire a combined technical and economic optimisation methodology. In the context of sustainability and responsibility for future generations, the course will focus on basic environmental management principles, simple methods for describing and evaluating the externalities of energy on an economic basis</td></tr>
<tr><td colspan="3" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="8">For all students, in a large lecture, presentation on a whiteboard, projector or on-line using MS Teams, using a computer network.</td></tr>
<tr><td>Practice</td><td colspan="8">Group work presentations</td></tr>
<tr><td>Laboratory</td><td colspan="8"></td></tr>
<tr><td>Other</td><td colspan="8"></td></tr>
<tr><td colspan="3" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="9">Knowledge<br>He has a comprehensive knowledge of the different forms of project management and their classification. He has an accurate knowledge of the role of those involved in the project and the possible organizational forms. Knows the theoretical background and practical implementation criteria of process groups and knowledge areas. Informed in the context of designing and managing procurement contract strategies. He knows the advantages and disadvantages of different financial accounting solutions, the limits of their application. It distinguishes between different forms of project scope management. He has comprehensive knowledge of project scheduling management. Knows the permitting and additional phases of projects. It provides an overview of possible forms and management options for project financing. Is aware of the potential risks that can be identified and addressed.</td></tr>
<tr><td colspan="9">Ability<br>Explores the different forms of project management and their classification. Defines the role of those involved in the project and the possible organizational forms. Applies the theoretical background and practical implementation criteria of process groups and knowledge areas. Prioritizes the circumstances in which procurement contract strategies are developed and managed. Selects the advantages and disadvantages of different financial settlement solutions, the limits of their application. Evaluates different forms of project scope management. Evaluates the possibilities of project scheduling management and the operation of the implemented solutions. Evaluates the permitting and further phases of projects as well as management options. Explores the possible forms and management possibilities of project financing. Solves the identification of potential risks and treatment options.</td></tr>
<tr><td colspan="9">Attitude<br>Constantly monitors his work, results, and conclusions. Expands your knowledge of energy management and sustainability through continuous learning. Open to the use of information technology tools. It strives to get to know and routinely use the tools needed for energy management and economic problem-solving. Develops your ability to provide accurate and error-free problem solving, engineering precision, and accuracy. Applies the principles of energy efficiency, sustainability, and environmental awareness in solving energy management tasks. Monitors changes in the social, economic, and political system. He publishes his results following his profession's rules. It publishes its opinions and views without offending others</td></tr>
<tr><td colspan="9">Autonomy and responsibility</td></tr>
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|---|---|
| | Collaborates with the instructor and fellow students to expand knowledge. Accepts well-founded professional and other critical remarks. In some situations, as part of a team, he/she works with his/her fellow students to solve tasks. With his/her knowledge, he/she makes a responsible, informed decision based on his/her analysis. He/She feels responsible for energy, energy management problems, the sustainable use of the environment, and present and future generations. He/She is committed to the principles and methods of systems thinking and problem-solving. |
| Short description of the subject content | Energy market situation. Changes in the energy mix; Energy use and the energy intensity - sectoral comparison between Hungary and EU countries. Liberalisation in the energy sector. Pro and con of liberalisation; Political, economic, social, environmental and corporate challenges of the global energy crisis. Process and resource requirements of corporate management. Concept of corporate resources, main categories; Key challenges and problem areas of corporate energy management; Investment. The main methods of calculating investment economics; Methodological specificities of evaluating energy investments; Cost and capital efficiency of resources. Cost management. Classification of costs, cost functions; Calculation of margins - the turning point of profitability and profitability. |
| Types of student activities | Processing heard text with notes 60% Task-based organisation of information 10% Independent processing of tasks 30%. |
| Required literature and contact details | • Materials on MOODLE<br>• Guide to Energy Management, Eighth Edition 8th Edition by Barney L. Capehart Ph.D. CEM, Wayne C. Turner Ph.D. PE CEM, River Publishers, 2016, ISBN-13 978-1498759335 |
| Recommended literature and contact details | • Wayne C. Turner, Steve Doty, Energy management, handbook, sixth edition, Distributed by Taylor & Francis Ltd., 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487, USA<br>• Craig B. Smith, Kelly E. Parmenter, Energy Management Principles - Applications, Benefits, Savings, Published 2016 Elsevier, ISBN 978-0-12-802506-2 |
| Description of tasks to be submitted/measurement reports | 1 essay to be submitted on a topic of your choice |
| Description and timetable of the workshops | |

## Renewable energy

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| Name of the subject | | in Hungarian | | Megújuló energiaforrások | | | | | Level | BSc | |
| | | in English | | Renewable energy | | | | | Code | DUEN(L)-MGT-115 | |
| Responsible educational unit | | | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | MUT-250 | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 1 | per week | 0 | M | 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 | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The aim of the course is to introduce the students to the building level renewable energy utilization (passive solar, solar collector, PV, heat pump, biomass boiler), their indicators, operation and system integration to the buildings' energy systems. The aim of the course is also to describe the different system designs and the possible interconnection of different energy utilization devices. | |
| Typical delivery methods | Presentation | For all students, in a large lecture, presentation on a whiteboard, projector or on-line using MS Teams, using a computer network. |
| | Practice | Group work presentations |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>The student knows the conceptual background, properties and possibilities of renewable energy sources integration in buling energy systems. The student is aware of the relevant meteorological conditions. The student knows the physical background of the operation of each equipment utilizing renewable energy sources, the necessary principles. The student knows the structure of solar collectors, PV systems, heat pump, different types of biomass based heat generation and geothermal systems. Understands the operation of solar collectors, PV systems, heat pump, different types of biomass based heat generation and geothermal systems. The student is aware of the distributor licensing process for building level PV systems in Hungary. The student was informed about the possibilities of passive solar energy utilization. The student is aware of the possibilities and limitations of integrating certain renewable energy equipment into the building's energy system. Summarizes the application limits, selection criteria, necessary safety equipments and installation requirements of each system utilizing renewable energy sources. Distinguishes between the efficiency indicators of different renewable energy based systems | |
| | **Ability**<br>Able to evaluate the possibilities of the application of renewable energy sources. Selects the best renewable energy source for the given meteorological conditions. Able to distinguish between each system that uses renewable energy sources. Able to develop a conceptual plan for the appropriate system design. Able to evaluate each system using renewable energy sources from their operational characteristics. Able to use the knowledge gained to enable solar systems. Able to distinguish between passive solar energy utilization possibilities. Able to propose the optimal system design, taking into consideration the characteristics of the building. Able to determine the limitations of different renewable based systems. Able to perform energy assessment of renewable energy systems. | |
| | **Attitude**<br>Constantly monitors his work, results and conclusions. Strives to put the acquired knowledge into practice, to use problem-solving techniques. Susceptible to the use of new professional and scientific results. Open to formulating appropriate response for criticism or opinions and able to make decisions and to draw conclusions. Develops accurate and error-free problem solving, engineering precision and accuracy. Seeks to apply the principles of energy efficiency and environmental awareness in providing building energy supply concepts. | |
| | **Autonomy and responsibility**<br>Collaborates with the instructor and fellow students to expand knowledge. Accepts well-founded professional and other critical remarks. In some situations, as part of a team, works with fellow students to solve tasks. With his knowledge, he makes a responsible, informed decision based on his analyzes. The student is committed to enriching the building engineering field with new knowledge and scientific results. The student is committed to the principles and methods of systematic thinking and problem solving. | |

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| Short description of the subject content | The aim of the course is to introduce the students to the technologies utilizing renewable energy sources (solar, water, wind, biomass, geothermal) and converting them into secondary energy carriers (fuel, heat, electricity), their possibilities and application limitations. In addition to the technical solutions, the students will get acquainted with the optimal selection and design process of renewable energy supply systems, as well as their operational aspects. In addition to energy production, the issues of integration into the system and energy storage will also be emphasized. |
| Types of student activities | Processing heard text with notes 60% Task-based organisation of information 10% Independent processing of tasks 30%. |
| Required literature and contact details | • Planning and Installing Solar Thermal Systems: A Guide for Installers, Architects and Engineers. Deutsche Gesellschaft für Sonnenenergie, Earthscan, 2008, ISBN-13: 978-1844077601<br>• Planning and Installing Photovoltaic Systems: A Guide for Installers, Architects and Engineers, Deutsche Gesellschaft für Sonnenenergie, Earthscan, 2005, ISBN: 978-1-84407-442-6<br>• Materials on MOODLE |
| Recommended literature and contact details | • Duffie- Beckman: Solar Engineering of Thermal Processes, 4th edition, John Whiley and Sons Inc., New Jersey, 2013, ISBN: 978-0-470-87366-3 |
| Description of tasks to be submitted/measurement reports | 2 essays to be submitted on a topic of your choice |
| Description and timetable of the workshops | |

## Basics of energy saving and conservation

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="6">Gazdaságos energiafelhasználás alapjai</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="6">Basics of energy saving and conservation</td><td>Code</td><td>DUEN(L)-MGT-153</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="8">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="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>150/39</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="2">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">Endre Kiss, 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="8">Goals, development objectives<br>To introduce students to the field of energy management and to familiarise them with the operation, use and development of the necessary high-efficiency and safe equipment.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7">For all students in a large lecture hall with a blackboard presentation.<br>Use of projector.</td></tr>
<tr><td>Practice</td><td colspan="7">Supervised and independent solution of numerical examples and case studies in the form of small-scale exercises.</td></tr>
<tr><td>Laboratory</td><td colspan="7"></td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific rules, contexts and procedures necessary for the operation of the field of engineering.<br>Knowledge of the terminology, key concepts and theories related to the field.<br>Comprehensive knowledge of the main theories in the field of knowledge acquisition and problem solving<br>methods of problem solving.<br>Basic knowledge of machine design principles and methods, control procedures and operational processes.<br>Has an applied knowledge of measurement procedures, their tools, instruments and measuring equipment used in mechanical engineering.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used.</td></tr>
<tr><td colspan="8">Ability<br>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.<br>Ability to apply the most important terminologies, theories and procedures of the technical discipline in the performance of related tasks.<br>Ability to plan, organise and conduct independent learning.<br>Ability to identify routine technical problems and to apply the principles and techniques needed to solve them<br>to identify, formulate and implement (standard operations in practice)<br>(using standard procedures).</td></tr>
<tr><td colspan="8">Attitude<br>It assumes and authentically represents the social role of its profession and its fundamental relationship with the world.<br>Open to learning about, accepting and authentically communicating professional and technological developments and innovations in the field of engineering.<br>Seeks to solve problems, preferably in cooperation with others.<br>Have the stamina and tolerance of monotony to carry out practical activities<br>has the ability to<br>Applies his/her acquired technical knowledge to gain a thorough understanding of observable phenomena, to describe and explain their laws.<br>In his/her work, he/she observes and complies with the relevant safety, health, environmental, quality assurance and control requirements.</td></tr>
<tr><td colspan="8">Autonomy and responsibility<br>In unexpected decision situations, he/she independently thinks through and develops comprehensive, substantiating professional questions on the basis of given sources.<br>In the performance of his/her professional duties, he/she will also cooperate with qualified professionals from other disciplines (primarily technical, economic and legal).</td></tr>
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|---|---|
| | He/she will share his/her experience with his/her colleagues in order to support their development.<br>Assumes responsibility for the consequences of his/her technical analyses, the resulting proposals and the decisions taken. |
| Short description of the subject content | Introduction to energy management. Areas of energy and energy management. Overview of the world energy economy, main trends and macro-relationships. Overview of national energy management in Hungary. National energy structure and energy balance. Main energy needs of each economic sector. Energy demand and energy use of the population.<br>Energy carriers and sources I:<br>Energy carriers and energy sources of our planet. Exhaustible, renewable and renewable resources. Physical and chemical properties of different energy carriers. Extraction, transport and storage of energy carriers. Fossil fuels. Coal, oil, natural gas.<br>Energy carriers and resources II:<br>Exhaustible energy sources: nuclear energy.<br>Renewable energy sources: solar, wind, hydro and geothermal, biomass, biogas. Waste-to-energy options. Conversion processes of energy carriers: combustion, combustion products.<br>Energy conversion l. Thermal energy: stove, convector, hot water boiler, steam boiler. Electricity: thermal power plants, gas engines, gas and steam turbines, steam cycles, condensing power plants, combined cycle power plants.<br>Treatment, storage, disposal and use of pollutants. Remediation, maintenance. Energy transport. Storage facilities. Water, gas, hot water, steam and electricity networks. Energy use I. Meeting heat demand, heating and hot water supply.<br>Energy use in industrial processes. Electricity and heat consumption. Energy requirements of agriculture, transport and services. Ways of meeting demand. Legal environment, strategic approach. Legal environment of energy supply, laws and regulations. Corporate energy management. Tasks of the energy manager.<br>Strategic approach. Energy management. Systematic description of energy use. Understanding of system and system boundary. Mass and energy balances. Effectiveness and efficiency.<br>Energy use lI . Nature of use, performance and duration diagram. Estimation of expected consumption. Optimal control, monitoring of consumption, equipment operating in parallel. Energy storage options, storage. Energy use in residential, government, industry and agriculture. The energy mix.<br>Energy use llI Transport of energy carriers. Transport planning. Optimal means and routes of transport. Recovery of losses. Safety considerations. Environmental constraints, emissions of pollutants during energy use<br>Energy use lV . Description of energy conversion and consumption processes. Balance equations: mass, energy and waste balance. Identification of losses. |
| Types of student activities | Presentation: Processing of lectures with notes 40%, independent processing of theoretical material 20%, preparation of a seminar presentation 40% |
| Required literature and contact details | • Endre Kiss: The Basics of Economical Energy Use, Electronic handbook, 2023, Moodle system |
| Recommended literature and contact details | • Y. Mizuta: Energy Saving Technology kézikönyv, JICA-DEED kiadásában, 2003 |
| Description of tasks to be submitted/measurement reports | Full-time: student seminar presentations<br>Part-time: student seminar presentations |
| Description and timetable of the workshops | During the semester, for correspondence students in the 2nd and 4th consultation, and for day students in the 6th and 13th week, five theoretical questions from the lectures. The papers are 100-100 marks, with a maximum of 20 marks for each question. The |

## Sustainable Finance and Bigtech Companies in Finance

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | | in Hungarian | | Fenntartható pénzügyek és a FinTech cégek | | | | | Level | BSc | |
| | | in English | | Sustainable Finance and Bigtech Companies in Finance | | | | | Code | DUEN(L)-TGT-252 | |
| Responsible educational unit | | | | Institute of Social Sciences, Department of Economics | | | | | | | |
| 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 | | Andrea Keszi-Szeremlei, PhD | | | schedule | College professor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Through the development of financial instruments, the aim is to understand the financial instruments, options and solutions that support ESG goals for sustainable development. To learn about financial investments. To understand the importance of FinTech companies and their development path. | |
| Typical delivery methods | Presentation | For all students in a large lecture hall with a blackboard presentation. Use of projector. |
| | Practice | Supervised and independent solution of numerical examples and case studies in the form of small-scale exercises. |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Knowledge of sustainable financial instruments; can apply sustainable financial instruments in private and workplace decisions | |
| | **Ability**<br>Ability to distinguish between sustainable financial instruments<br>Ability to propose and develop alternatives for private and workplace financial decisions.<br>Ability to plan, organise and carry out independent learning.<br>Ability to apply the knowledge acquired in solving problems in his/her field of specialisation. | |
| | **Attitude**<br>Open to learn about, adopt and authentically communicate developments and innovations in the financial field<br>Interested in new methods and tools in the field.<br>Applying his/her acquired knowledge of finance, he/she seeks to gain a better understanding of observable phenomena, to describe and explain their laws. | |
| | **Autonomy and responsibility**<br>In the performance of his/her professional duties, he/she collaborates with qualified professionals in other fields (primarily economic and legal)<br>assumes responsibility for the consequences of his/her financial analyses, the proposals based on them and the decisions taken. | |
| Short description of the subject content | Types of financial instruments<br>Financial aspects of sustainable development<br>Characteristics of sustainable financial instruments in our country and abroad<br>Possible future financial instruments<br>Definition, characteristics and operation of FinTech companies | |
| Types of student activities | Presentation: Processing of heard text with notes 60%, independent processing of theoretical material 30%, independent research 10%.<br>Lab. | |
| Required literature and contact details | • Dirk Schoenmaker – Williem Schramade: Principles of Sustainable Finance, Libristo, Oxford University Press, 2018. könyvtári példány | |
| Recommended literature and contact details | • Paiki -Sironi: FinTEch Innovation, Wiley Finance Series, Libristo, 2016. | |
| Description of tasks to be submitted/measurement reports | | |
| Description and timetable of the workshops | During the semester, 2 essays with five theoretical questions from the lectures. | |

## Practical application of renewable energy sources

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| Name of the subject | in Hungarian | Megújuló energiaforrások projektfeladat | | | | | | | Level | BSc | |
| | in English | Practical application of renewable energy sources | | | | | | | Code | DUEN(L)-MGT-215 | |
| 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 | 0 | per week | 0 | per week | 3 | E | 5 | English | |
| Part time | 150/15 | per term | 0 | per term | 0 | per term | 15 | | | | |
| Teacher responsible for the subject | | Name | | Éva Kovács-Bokor, PhD | | | | | schedule | College assosicate professor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The objective of the course is to familiarise the student with the different types of renewable energy sources and the basic design and measurement procedures related to them. | |
| Typical delivery methods | Presentation | For all students in a lecture room with projector or on-line using MS Teams. |
| | Practice | |
| | Laboratory | Laboratory exercises with renewable energy modelling |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>The student will learn about fossil and renewable energy sources; The student will understand what it means to balance needs and environmental opportunities; The student will recognise the links between natural resources and the economy-society. | |
| | **Ability**<br>The student is able to consider environmental or social, economic energy choices and their consequences through examples. The student will be able to explore the systemic links between nature, his/her own life and that of his/her environment. | |
| | **Attitude**<br>By the end of the course, the student will be committed to using greener energy sources, to preserving environmental values and to using energy in an environmentally responsible way. The student will take responsibility for the preservation of his/her own activities and the natural environment, and for cooperating with his/her social environment | |
| | **Autonomy and responsibility**<br>Decides independently. You take responsibility for. | |
| Short description of the subject content | Grouping of energy sources, Hungary's and the EU's energy strategy, presentation of energy mixes. Solar energy - solar panels, Solar energy - solar collectors. Wind energy on land and at sea. Marine and river hydropower. Use of geothermal energy. Biomass - biofuels. Biomass fuels. Nuclear and fusion energy utilisation. Hydrogen as a new fuel, fuel cells. New propulsion methods in the automotive industry. Passive house design. | |
| Types of student activities | Presentation: Processing of lectures with notes 40%, independent processing of theoretical material 20%, Practical: Preparation of laboratory measurements, preparation of measurement report 40%. | |
| Required literature and contact details | • The Renewable Energy Sources in the Service of Green Energy note, Moodle,<br>• Dr. Éva Kovács-Bokor Kovács: Renewable Energy Sources note, Moodle,<br>• Károly Reményi: Renewable Energies, Akadémiai Kiadó, Budapest, 2007 | |
| Recommended literature and contact details | • Reményi Károly:Energetics, CO2 warming, - The carbon cycle is life, Akadémiai Kiadó, Budapest, 2010 | |
| Description of tasks to be submitted/measurement reports | Full-time students: there are 6 2-hour assessment exercises during the semester. Students will take a report of each measurement exercise and will be graded on the basis of the measurement results. Part time students: During the semester, there is a total | |
| Description and timetable of the workshops | During the semester period, in weeks 7 and 13, a total of 2 independent project papers/ case studies on topics of your choice related to renewable energy sources, 8-15 pages in length, illustrated with diagrams, charts and photos of the material presented | |

## Novel techniques of environmental protection

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="5">Új környezetvédelmi technikák</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="5">Novel techniques of environmental protection</td><td>Code</td><td>DUEN(L)-MGT-216</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td 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="2">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">Endre Kiss, 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="8">Goals, development objectives<br>Introduce students to the latest environmental techniques and their application, recycling of used lithium batteries.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7">For all students in a large lecture hall with a blackboard presentation.<br>Use of projector.</td></tr>
<tr><td>Practice</td><td colspan="7"></td></tr>
<tr><td>Laboratory</td><td colspan="7">Measurements in laboratories</td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge<br>Knowledge of the general and specific rules, contexts and procedures for the operation of the technical field.<br>Familiarity with the terminology, the main contexts and theories related to the field.<br>Comprehensive knowledge of the main theories of the field in terms of knowledge acquisition and problem solving<br>methods of problem solving.<br>Basic knowledge of machine design principles and methods, control procedures and operational processes.<br>Has an applied knowledge of measurement procedures, their tools, instruments and measuring equipment used in mechanical engineering.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used.</td></tr>
<tr><td colspan="8">Ability<br>Ability to apply the most important terminology, theories and procedures of the technical field in the performance of related tasks.<br>Ability to plan, organise and conduct independent learning.<br>Ability to identify routine technical problems and to apply the necessary principles and techniques to solve them<br>to identify, formulate and implement (standard operations in practice)<br>(using standard procedures).</td></tr>
<tr><td colspan="8">Attitude<br>It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering.<br>Seeks to solve problems, preferably in cooperation with others.<br>Have the stamina and tolerance of monotony to carry out practical activities<br>has the ability to<br>Applies his/her acquired technical knowledge to gain a thorough understanding of observable phenomena, to describe and explain their laws.<br>In his/her work, he/she observes and complies with the relevant safety, health, environmental, quality assurance and control requirements.</td></tr>
<tr><td colspan="8">Autonomy and responsibility<br>In carrying out his/her professional duties, he/she will also cooperate with qualified professionals in other fields (primarily technical, economic and legal).<br>He/she shares his/her experience with his/her colleagues, thus contributing to their development.<br>He/she is responsible for the consequences of his/her technical analyses, the proposals he/she makes and the decisions he/she takes.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="8">The expected construction of new types of equipment in line with Chinese emission reduction plans (aimed at developing emission reduction processes and equipment that meet a tenth of the EU limit). Possibilities to improve the efficiency of conventional electrostatic precipitators in coal and other fossil-fired power plants. Electrostatic precipitators with increased efficiency, Bag filters with improved electrostatic charge. Electrostatic cyclones. Venturi high efficiency filters. Design principles for separators using a combination of the above options. Design guidelines. New trends in water</td></tr>
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| | treatment. Newer principles and options for biological water purification. Theory and practice of endocrine disruptor removal from water. New noise reduction techniques (interference, new types of attenuation. New methods of odour control, modern methods of odour measurement. Dioxin and PCB abatement. New radioactivity reduction techniques. Processing of red mud, extraction of rare earths and scandium. |
| Types of student activities | Presentation: Processing of lectures with notes 40%, independent processing of theoretical material 20%, preparation of lab notes 40% |
| Required literature and contact details | • Endre Kiss: New environmental techniques, Electronic note, 2023, Moodle system |
| Recommended literature and contact details | • Y. Mizuta: Energy New Environmental Technologies Technology Handbook, JICA-DEED publication, 2003 Proceeding Publication of the Wroclaw International World Conference on Electrostatic Discharge Elimination |
| Description of tasks to be submitted/measurement reports | Full-time: preparation of 5 measurement reports<br>Part-time: 3 measurement reports |
| Description and timetable of the workshops | During the semester, for correspondence students in the 2nd and 4th consultation, and for day students in the 6th and 13th week, five theoretical questions from the lectures. The papers are 100-100 marks, with a maximum of 20 marks for each question. |

## Basic Principles of Hydrogen Technology

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="4">Hidrogéntechnológia kémiai alapjai</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="4">Basic Principles of Hydrogen Technology</td><td>Code</td><td>DUEN(L)-MGT-257</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">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 10</td><td>per term 5</td><td>per term 0</td></tr>
<tr><td colspan="2">Teacher responsible for the subject</td><td>Name</td><td colspan="3">Imre Kovács, PhD</td><td>schedule</td><td>Associate 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<br>Students will learn about the chemical and physical properties of hydrogen, its compounds, the production of hydrogen in laboratory and industrial settings, and the production of high-purity hydrogen. Students will also learn about elementary adsorption processes at the solid-gas interface, diffusion through solids (metals) and membranes, and electrochemical processes in materials containing active hydrogen.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="5">For all students in a large lecture hall with a blackboard presentation. Use of projector.</td></tr>
<tr><td>Practice</td><td colspan="5">For all students in a large lecture hall with a blackboard presentation. Use of projector.</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="3">Requirements (expressed in terms of learning outcomes)</td><td colspan="6">Knowledge<br>The student will learn about the elements of knowledge related to hydrogen;<br>The student will understand the knowledge required to work with this energy storage material;<br>The student will recognise the links between the resources associated with such a chemical and the economy-society.</td></tr>
<tr><td colspan="6">Ability<br>The student is able to consider social, economic and energy choices and their consequences through examples;<br>The student will be able to explore the systemic links between energy, economics and the environment.</td></tr>
<tr><td colspan="6">Attitude<br>At the end of the course, the student will be committed to the use of greener energy sources, including hydrogen, to protect the environment and to use energy in an environmentally responsible way.<br>The student will assume responsibility for his/her own activities and for the preservation of the natural environment, and for cooperating with the social environment.<br>Autonomy and responsibility<br>decides independently,<br>takes responsibility</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="6">This course aims to introduce the basics of inorganic and physical chemistry in relation to hydrogen. Its production, physical and chemical properties, and future uses.</td></tr>
<tr><td colspan="2">Types of student activities</td><td colspan="6">Presentation: Processing of lectures with notes 40%, independent processing of theoretical material 20%, preparation of lab notes 40%</td></tr>
<tr><td colspan="2">Required literature and contact details</td><td colspan="6">• Csepeli-Kovács: Chemistry and Materials Science notebook<br>• Materials on MOODLE<br>• Viktor Hacker, Shigenori Mitsushima, Fuel Cells and Hydrogen: From Fundamentals to Applied Research 1st Edition, publisher Elsevier, ISBN-13 978-0128114599<br>• Handbook of Hydrogen Energy 1st Edition,Edited By S.A. Sherif, D. Yogi Goswami, E.K. (Lee) Stefanakos, Aldo Steinfeld, ISBN 9781420054477, 1058 Pages 375 B/W Illustrations , Published September 3, 2014 by CRC Press.</td></tr>
<tr><td colspan="2">Recommended literature and contact details</td><td colspan="6">• Introductory Chapter: Hydrogen Energy, Written By Ahmed Albahnasawi and Murat Eyvaz, Published: 07 December 2022, DOI: 10.5772/intechopen.108635</td></tr>
<tr><td colspan="2">Description of tasks to be submitted/measurement reports</td><td colspan="6">Full-time:<br>A total of 3 assignments to be submitted during the semester.</td></tr>
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| | By correspondence:<br>A total of 2 papers to be written during the semester. |
| Description and timetable of the workshops | At the end of the semester, in the 13th week of the semester, a 100-point essay. |

## Basics of the circular economy

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| Name of the subject | in Hungarian | Körforgásos gazdaság alapjai | | | | | | | Level | BSc | |
| | in English | Basics of the circular economy | | | | | | | Code | DUEN(L)-MGT-258 | |
| 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 | | | | Éva Kovács-Bokor, PhD | | | schedule | Senior lecturer | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The aim of the course is to familiarize the student with the problems of environmental protection related to waste management, international and national solutions, technical and development opportunities; to learn the specific design tasks of waste recovery and disposal; to learn the methods of recycling waste (e.g. spent solar cells, batteries), by-products. | |
| Typical delivery methods | Presentation | For all students in a large lecture hall with a blackboard presentation. Use of projector or overhead projector |
| | Practice | For all students in a lecture room with projector. |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>The student will learn about waste management and recycling; The student will understand what it means to balance needs and environmental opportunities; The student will recognise the links between natural resources and the economy-society. | |
| | **Ability**<br>The student is able to consider environmental or social, economic energy choices and their consequences through examples; The student is able to explore the systemic relationships between nature, his/her own life and the environment. | |
| | **Attitude**<br>By the end of the course, students should be committed to the preservation of environmental values and the environmentally responsible use of energy. The student will take responsibility for the preservation of his/her own activities and the natural environment, and for cooperation with the social environment. | |
| | **Autonomy and responsibility**<br>The student can make independent decisions; take responsibility. | |
| Short description of the subject content | The current state of waste management in Hungary and Europe. Basic concepts of waste management. Waste management. Legislation on waste management. Waste Management Plans. Waste collection, treatment, transport, storage. Landfills: design, processes, monitoring, recultivation Energy recovery from waste. Methods and policies for waste prevention and minimisation (IPPC, LCA) Processes and technologies for industrial composting Recycling of spent solar cells and Li-batteries. Management of nuclear industrial waste. Radioactive waste disposal processes and methods. | |
| Types of student activities | Presentation: Processing of heard text with notes 40%, independent processing of theoretical material 20%, Exercise: 40% | |
| Required literature and contact details | • Éva Kovács-Bokor: Lecture notes: Moodle system; | |
| Recommended literature and contact details | • Maria-Beatrice Coltelli, Pierfrancesco Morganti: An Introduction to the Circular Economy; Nova Science Publishers, 2021., ISBN 9781536192339 | |
| Description of tasks to be submitted/measurement reports | | |
| Description and timetable of the workshops | During the semester, in weeks 7 and 14, five theoretical questions from the lectures are presented.<br>The tests are both 100-100 marks, with a maximum of 20 marks per 5 essay questions. The mark for the essay will be calculated according to the mark limits | |

# NUCLEAR ENERGY

## Basics of nuclear safety

<table>
<tr><td colspan="2" rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="3">Nukleáris biztonság alapjai</td><td colspan="2">Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="3">Basics of nuclear safety</td><td colspan="2">Code</td><td>DUEN(L)-MGT-117</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="2">Name of compulsory prior learning<br>DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td colspan="2">Type</td><td>Presentation</td><td>Practice</td><td>Laboratory</td><td>Requirement</td><td>Credit</td><td colspan="2">Language of education</td></tr>
<tr><td>Full time</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 colspan="2" 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 colspan="2">Name</td><td colspan="3">Miklós Horváth, 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="7">Goals, development objectives<br>A series of introductory lectures to give the student an overview of the history of nuclear energy, the types of nuclear power plants currently in operation and planned for the future, the journey of uranium ore from mining to burial, and trends, and to anticipate what they will learn in more detail in each subject.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="6">For all students in a large lecture hall with a blackboard presentation.</td></tr>
<tr><td>Practice</td><td colspan="6">For all students in a lecture room with projector.</td></tr>
<tr><td>Laboratory</td><td colspan="6"></td></tr>
<tr><td>Other</td><td colspan="6"></td></tr>
<tr><td colspan="2" rowspan="2">Requirements (expressed in terms of learning outcomes)</td><td colspan="7">Knowledge<br>Have a comprehensive knowledge of the basic facts, trends and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field.<br>Comprehensive knowledge of basic economic, business and legal rules and tools.<br>He has a thorough knowledge of the structural materials used in the field of mechanical engineering, the methods of their manufacture and the conditions of their application.<br>Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes.<br>Comprehensive knowledge of the operating principles and structural units of the machinery, power tools, mechanical equipment and tools used.<br>He/she knows the measuring procedures used in mechanical engineering, their instruments, instruments and measuring equipment.<br>He/she knows the expectations and requirements of the occupational safety, fire protection, safety and occupational health areas related to his/her field of specialisation, as well as the relevant environmental protection regulations.<br>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.<br>In-depth knowledge of learning, knowledge acquisition, data collection methods, their ethical limitations and problem-solving techniques in mechanical engineering.<br>Knowledge of the methods and tools of business economics and cost-benefit analysis based on technical principles.<br>Understand, characterise and model the structure and operation of the structural units and elements of mechanical systems, the design and interrelationship of the system components used.<br>Apply the related computational and modelling principles and methods of engineering product, process and technology design.</td></tr>
<tr><td colspan="7">Ability<br>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.<br>Ability to apply the most important terminology, theories and procedures of the technical field in the performance of related tasks.<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.</td></tr>
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| | Ability to understand and use literature, computer and library resources specific to their field.<br>The acquired IT knowledge can be applied to the solution of tasks in the field.<br>Ability to build basic models of technical systems and processes.<br>The ability to use their knowledge in a creative way to manage their workplace resources effectively.<br>In the course of his/her work, he/she is able to apply and enforce safety, fire safety and hygiene rules and regulations.<br>Ability to communicate in a professionally appropriate manner, orally and in writing, in your mother tongue and at least one foreign language.<br>Ability to apply the technical specifications related to the operation of mechanical systems, the principles and economic context of setting up and operating machinery and mechanical equipment.<br>The ability to manage and control the production processes of specialised technology, with a view to quality assurance and quality control.<br>Ability to diagnose mechanical failures, select troubleshooting operations, solve repair tasks |
| | **Attitude**<br>It assumes and authentically represents the social role of its profession and its fundamental relationship with the world.<br>It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering.<br>You strive to make your self-training a means to achieve your professional goals.<br>Make decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards.<br>It tries to solve problems in cooperation with others, where possible.<br>Strive to keep their self-training in mechanical engineering continuous and in line with their professional goals.<br>It strives to solve its tasks and make management decisions by listening to the opinions of the colleagues it manages, preferably in cooperation.<br>You have the stamina and tolerance for monotony needed to carry out practical activities.<br>You are open to the use of IT tools, you strive to learn and use software in the field of mechanical engineering, and you know and use at least one of these programs to a proficient level.<br>Open and receptive to new, modern and innovative practices and methods related to organic farming and health awareness.<br>Using his/her technical knowledge, he/she strives to understand the observable phenomena as thoroughly as possible, to describe and explain their laws.<br>In the course of his/her work, he/she observes and complies with the relevant safety, health, environmental, quality assurance and control requirements. |
| | **Autonomy and responsibility** |
| Short description of the subject content | The evolution of security philosophy. The basics of modern security philosophy. Risk and security. Technical aspects of security philosophy, implementing defence in depth. International security requirements. IAEA and EU security standards. Domestic regulatory requirements, Nuclear Safety Regulations. Safety functions. Safe heat removal from the reactor active zone. Safe heat removal from the spent fuel pool. Safety systems. Reliability and safety. Verification of design safety, safety reports and safety analyses. Safety management during the operating period, Operating Conditions and Limits. |
| Types of student activities | Processing of heard text by note-taking and recording of material using own notes and electronically available notes 80% Development of test questions 20% |
| Required literature and contact details | • Fundamentals of Nuclear Safety (electronic note, rapporteur's note)<br>• Elter J., Gadó J., Holló E., Lux I. (eds.): Safety of Nuclear Reactors, ELTE Eötvös Kiadó, ISBN 978-963-312-180-1, Budapest, 2013<br>• Materials on MOODLE |
| Recommended literature and contact details | • Nuclear Safety Regulations Volumes 1-10 and Guides (OAH website)<br>• IAEA Safety Standards (Safety Fundamentals, Safety Standards, Safety Guides) (IAEA website) |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | Week 7: I final examination<br>Week 12: II final examination<br>Week 13: any paper can be substituted |

## Basics of Atomenergetics

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="6">Atomenergetikai alapismeretek</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="6">Basics of Atomenergetics</td><td>Code</td><td>DUEN(L)-MGT-118</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="8">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="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>150/39</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="2">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">Miklós Horváth, 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="8">Goals, development objectives<br>A series of introductory lectures to give the student an overview of the history of nuclear energy, the types of nuclear power plants currently in operation and planned for the future, the journey of uranium ore from mining to burial, and trends, and to anticipate what they will learn in more detail in each subject.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7">For all students in a large lecture hall with a blackboard presentation.<br>Use of projector or overhead projector.</td></tr>
<tr><td>Practice</td><td colspan="7">Practice, example</td></tr>
<tr><td>Laboratory</td><td colspan="7"></td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge<br>Have a comprehensive knowledge of the basic facts, trends and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field.</td></tr>
<tr><td colspan="8">Ability<br>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.<br>Ability to apply the most important terminology, theories and procedures of the technical field in the performance of related tasks.<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.<br>Ability to understand and use literature, computer and library resources specific to their field.<br>The acquired IT knowledge can be applied to the solution of tasks in the field.<br>Ability to build basic models of technical systems and processes.<br>The ability to use their knowledge in a creative way to manage their workplace resources effectively.<br>In the course of his/her work, he/she is able to apply and enforce safety, fire safety and hygiene rules and regulations.</td></tr>
<tr><td colspan="8">Attitude<br>It assumes and authentically represents the social role of its profession and its fundamental relationship with the world.<br>It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering.<br>You strive to make your self-training a means to achieve your professional goals.<br>Make decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards.<br>It tries to solve problems in cooperation with others, where possible.<br>Strive to keep their self-training in mechanical engineering continuous and in line with their professional goals.</td></tr>
<tr><td colspan="8">Autonomy and responsibility<br>In unexpected decision situations, he/she independently thinks through and develops comprehensive, substantiating professional questions on the basis of given sources.<br>Responsibly uphold and represent the values of the engineering profession, and be open to professionally informed critical comments.<br>In carrying out his/her professional duties, he/she will also cooperate with qualified professionals from other fields (primarily technical, economic and legal).</td></tr>
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| | Identify the shortcomings of the technologies used, the risks of the processes and initiate measures to reduce them.<br>Monitor legislative, technical, technological and administrative changes in the field.<br>Directs the work of the personnel assigned to him/her, supervises the operation of machinery and equipment, based on the instructions of the workplace manager. |
| Short description of the subject content | The history of nuclear reactors. The Bomb 1939-1945,-47; The first atomic bomb. Accidents Nuclear power plant generations.<br>From the uranium vein to the graveyard. The safety principles. The entire uranium life cycle Uranium ore mining. Fuel cell production. Nuclear power plant use (source: npp.hu). Temporary storage. Reprocessing. Waste management. Final disposal. Reactor physics. Fundamentals of nuclear physics. Criticality (four and six factor formulae). Point kinetics. Building blocks of reactors. Reactor calculations. From transport equation to point kinetics backwards. Reactor kinetics equations with late neutrons Solutions to the transport equation, critical reactor state. Multiplication factor, concept of reactivity. Diffusion approximation. Space dependence calculations. Treatment of reactor ores in reactor physics.<br>Mechanical engineering. .The main components of the primary circuit. Other main equipment of the primary circuit. Elements of the primary circuit safety protection system. The secondary circuit heat cycle processes. Thermohydraulics of the reactor plant. Main factors to increase the safety of nuclear power plants.<br>Fission nuclear power generation of the future. .Fusion power generation |
| Types of student activities | Taking notes on what you have heard and recording the material using your own notes and those available electronically 80% Developing test questions 20% |
| Required literature and contact details | • Gábor Pór:Nuclear Energy Basics textbook<br>• Materials on MOODLE<br>• International Atomic Energy Agency textbook, https://www-pub.iaea.org/MTCD/Publications/PDF/P082_scr.pdf<br>• Gyula Csom:Nuclear Power Plant Operation I. - Fundamentals of Reactor Physics and Technology (Technical University of Budapest, 1997)<br>• Gyula Csom:Nuclear Power Plants Operation II/1 - Operation of Energetic Nuclear Reactors (Műegyetemi Kiadó, Budapest, 2005) By: Operational knowledge (University of Dunaújváros, university note, in progress) |
| Recommended literature and contact details | • Zoltán Szatmáry: Introduction to Reactor Physics, (Akadémiai Kiadó, Budapest, 2000)<br>• Duderstadt, J and Hamilton, L.: Nuclear Reactor Analyses (Wiley, New York, 1976)<br>• Bell, G. I., and Glasstone, S.: Nuclear Reactor Theory (American Nuclear Society, 1970)<br>• Dénes Bódizs:Measurement Techniques for Nuclear Radiation (Typotex, Budapest, 2009)<br>• G. F. Knoll, Radiation Detection and Measurement, 3rd Edition (John Wiley & Sons, Inc., 2000.) |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Ensuring the integrity of equipment

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| Name of the subject | in Hungarian | Berendezések integritásának biztosítása | | | | | | | Level | BSc | |
| | in English | Ensuring the integrity of equipment | | | | | | | Code | DUEN(L)-MGT-119 | |
| 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 | M | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 5 | per term | 0 | | | | |
| Teacher responsible for the subject | | Name | | | | Péter Trampus, PhD | | | schedule | Professor emeritus | |

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

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

## Equipments of Nuclear Power Plants

<table>
<tr><td rowspan="2">Name of the subject</td><td>in Hungarian</td><td colspan="5">Atomerőművek berendezései</td><td>Level</td><td>BSc</td></tr>
<tr><td>in English</td><td colspan="5">Equipments of Nuclear Power Plants</td><td>Code</td><td>DUEN(L)-MGT-152</td></tr>
<tr><td colspan="2">Responsible educational unit</td><td colspan="7">Institute of Technology, Department of Mechanical Engineering and Energy</td></tr>
<tr><td colspan="2">Name of compulsory prior learning DUEN(L)-</td><td colspan="7"></td></tr>
<tr><td 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="2">Teacher responsible for the subject</td><td colspan="3">Name</td><td colspan="3">Péter Trampus, PhD</td><td>schedule</td><td>Professor emeritus</td></tr>
<tr><td colspan="2">Training objective and justification of the course (content, output, location in the curriculum)</td><td colspan="8">Goals, development objectives<br>After completing the subject, the student should know the engineering technology systems and equipment of the pressurized water nuclear power plant, the task, structure and operation of the main equipment. In possession of this knowledge, he should be able to perform independent engineering or management and coordination work in the design, operation, maintenance and inspection of equipment.</td></tr>
<tr><td colspan="2" rowspan="4">Typical delivery methods</td><td>Presentation</td><td colspan="7">Lectures with blackboard and projector.</td></tr>
<tr><td>Practice</td><td colspan="7"></td></tr>
<tr><td>Laboratory</td><td colspan="7">Carrying out experiments and calculation.</td></tr>
<tr><td>Other</td><td colspan="7"></td></tr>
<tr><td colspan="2" rowspan="4">Requirements (expressed in terms of learning outcomes)</td><td colspan="8">Knowledge<br>has extensive theoretical and practical preparation, methodological and practical knowledge for the planning and operation of complex energy conversion, supply and user systems and processes</td></tr>
<tr><td colspan="8">Ability<br>In solving a problem, it is able to organise cooperation with experts in related fields.<br>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.<br>It is able to use information and communication technologies and methods to solve technical problems.<br>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="8">Attitude<br>Constantly monitors his work, results, and conclusions. Expands your knowledge of energy management and sustainability through continuous learning. The student is open to the use of information technology tools. Strives to get to know and routinely use the tools needed for energy management and economic problem-solving. Develops your ability to provide accurate and error-free problem solving, engineering precision, and accuracy. Applies the principles of energy efficiency, sustainability, and environmental awareness in solving energy management tasks. Monitors changes in power plant technologies. Publishes his/her results following his/her professional rules. Publishes his/her opinions and views without offending others.</td></tr>
<tr><td colspan="8">Autonomy and responsibility<br>Collaborates with the instructor and fellow students to expand knowledge. Accepts well-founded professional and other critical remarks. As part of a team, you work with his/her fellow students to solve tasks in some situations. With his knowledge, he makes a responsible, well-founded decision based on his analysis. Feels responsible for energy, the problems of energy management, and the sustainable use of the environment, as well as present and future generations. The student is committed to the principles and methods of systematic thinking and problem-solving.</td></tr>
<tr><td colspan="2">Short description of the subject content</td><td colspan="8">The main technological systems of the pressurized water nuclear power plant (primary and secondary circuits).<br>Primary circuit equipment: reactor equipment (reactor tank, reactor cover, internal structures), reactor cooling circuit equipment (main circulation line, main circulation pump), pressure control system equipment (volume compensation tank), steam generator, zone failure cooling system equipment, other safety system equipment, primary circuit auxiliary system equipment.<br>Secondary circuit equipment: feed water preheating system equipment, turbine, generator. Condensate system equipment (turbine condenser).<br>Heating element transfer, spent heating element treatment equipment</td></tr>
<tr><td colspan="2">Types of student activities</td><td colspan="8">Understanding and assimilation of the topics of presentations 50%<br>Testing of materials 30%<br>Laboratory exercises 20%</td></tr>
<tr><td colspan="2">Required literature and contact details</td><td colspan="8">• Materials on MOODLE</td></tr>
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| | • Atomerőművek üzemtana, II. kötet, Az energetikai reaktorok üzemtana, Budapest, 2012.<br>• Zoltán Szatmáry: Introduction to Reactor Physics, (Akadémiai Kiadó, Budapest, 2000)<br>• Duderstadt, J and Hamilton, L.: Nuclear Reactor Analyses (Wiley, New York, 1976) |
| Recommended literature and contact details | • Bell, G. I., and Glasstone, S.: Nuclear Reactor Theory (American Nuclear Society, 1970)<br>• Csom Gyula, Atomerőművek üzemtana, Műegyetemi Kiadó, Budapest 2005 |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | |

## Industrial knowledge

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Name of the subject | in Hungarian | Üzemtani ismeretek | | | | | | | Level | BSc | |
| | in English | Industrial knowledge | | | | | | | Code | DUEN(L)-MGT-213 | |
| Responsible educational unit | | Institute of Technology, Department of Mechanical Engineering and Energy | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 0 | per week | 1 | M | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 0 | per term | 5 | | | | |
| Teacher responsible for the subject | | Name | | Gábor Ladányi | | | | | schedule | Master instructor | |

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

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| | Ability to apply the acquired knowledge in the field of information technology to the solution of problems in the field apply the knowledge and skills acquired in the field<br>Ability to construct basic models of technical systems and processes.<br>Ability to use knowledge in a creative way, using the resources of the workplace effectively manage their workplace effectively. Ability to apply and comply with safety, fire safety and hygiene rules and regulations in the course of his/her work.<br>Ability to apply, orally and in writing, in a professionally appropriate manner, in accordance with the area of competence communicate in his/her mother tongue and at least one foreign language.<br>Ability to apply the technical specifications relating to the operation of mechanical systems, the the principles of setting up and operating machinery and mechanical equipment, and the principles of economic efficiency<br>the economic context. Ability to manage and control technical production processes, taking into account the elements of quality assurance and quality control.<br>Ability to diagnose mechanical breakdowns and to select remedial actions, solve repair technology problems. |
| | **Attitude**<br>It assumes and authentically represents the social role of its profession and its fundamental relationship with the world.<br>Open to professional, technological development and innovation in the field of engineering and innovation in the technical field.<br>strives to make self-learning a means of achieving professional goals.<br>Takes decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards.<br>Seek to solve problems, preferably in cooperation with others.<br>He/she shall endeavour to pursue continuous and professional development in the field of mechanical engineering.<br>in line with his professional goals.<br>He/she strives to solve problems and make management decisions by listening to the opinion of his/her supervisor, preferably in cooperation.<br>Possesses sufficient stamina and tolerance of monotony to carry out practical activities have the ability to perform tasks with.<br>Open to the use of information technology tools and has a good knowledge and application of software in the field of engineering, with at least one such program at a proficiency level.<br>Open and receptive to the application of new, modern and innovative practices and methods related to organic farming and health awareness.<br>Applies his/her acquired technical knowledge to gain a better understanding of observable phenomena and to describe and explain their laws.<br>In the course of his/her work, he/she shall apply the relevant safety, health, environmental and quality assurance and control requirements. |
| | **Autonomy and responsibility** |
| Short description of the subject content | Beam decay, NAA. Basic concepts in reactor physics: transport equation, diffusion approximation, cross section, neutron spectrum, reactivity coefficients. Moderation. Inherent safety. Reactor physics framework parameters and their derivation. Charge design. Zone thermohydraulics: heat conduction from fuel to moderator, DNBR. RIA analyses flow. Fuel behaviour. Relationship between framework parameters-safety analyses-technical design. Manoeuvring: reactor control modes, rod, boric acid, steam generator, Xe process. In-core, ex-core measurements. |
| Types of student activities | Laboratory and simulator exercises |
| Required literature and contact details | • Gábor Pór:Nuclear Energy Basics textbook<br>• Materials on MOODLE<br>• International Atomic Energy Agency textbook, https://www-pub.iaea.org/MTCD/Publications/PDF/P082_scr.pdf<br>• Gyula Csom:Nuclear Power Plant Operation I. - Fundamentals of Reactor Physics and Technology (Technical University of Budapest, 1997)<br>• Gyula Csom:Nuclear Power Plants Operation II/1 - Operation of Energetic Nuclear Reactors (Műegyetemi Kiadó, Budapest, 2005) By: Operational knowledge (University of Dunaújváros, university note, in progress) |
| Recommended literature and contact details | • Zoltán Szatmáry: Introduction to Reactor Physics, (Akadémiai Kiadó, Budapest, 2000)<br>• Duderstadt, J and Hamilton, L.: Nuclear Reactor Analyses (Wiley, New York, 1976)<br>• Bell, G. I., and Glasstone, S.: Nuclear Reactor Theory (American Nuclear Society, 1970) |

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| | • Dénes Bódizs:Measurement Techniques for Nuclear Radiation (Typotex, Budapest, 2009)<br>G. F. Knoll, Radiation Detection and Measurement, 3rd Edition (John Wiley & Sons, Inc., 2000.) |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | As announced in the first session |

## Operation and maintenance practice

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| Name of the subject | in Hungarian | Üzemviteli és karbantartási gyakorlat | | | | | | | Level | BSc | |
| | in English | Operation and maintenance practice | | | | | | | Code | DUEN(L)-MGT-214 | |
| 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 | 0 | per week | 0 | per week | 3 | M | 5 | english | |
| Part time | 150/15 | per term | 0 | per term | 0 | per term | 15 | | | | |
| Teacher responsible for the subject | | Name | | | | János Kuti | | | schedule | Master instructor | |
| Training objective and justification of the course (content, output, location in the curriculum) | | **Goals, development objectives**<br>After completing the exercise, the student will have a deeper and practical understanding of the structure, design and operation of a nuclear power plant. | | | | | | | | | |
| Typical delivery methods | | Presentation | Lectures with blackboard and projector. | | | | | | | | |
| | | Practice | | | | | | | | | |
| | | Laboratory | Carrying out experiments and calculation. | | | | | | | | |
| | | Other | | | | | | | | | |
| Requirements (expressed in terms of learning outcomes) | | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, directions and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematics required to operate in the field of engineering, principles, rules, contexts and procedures of natural and social sciences.<br>Knowledge of the terminology, the most important relationships and theories related to the field.<br>Comprehensive knowledge of the main theories in the field of knowledge acquisition and problem solving and problem-solving methods. Comprehensive knowledge of basic economic, business and legal rules and tools. Thorough knowledge of structural materials used in engineering, their production methods and conditions of use.<br>Has a basic knowledge of the principles and methods of machine design, machine construction technology, control procedures and operating processes.<br>Comprehensive knowledge of the operating principles and structural units of the machinery, power tools, mechanical equipment and tools used. Knowledge of measuring procedures, their tools, instruments and measuring equipment used in mechanical engineering.<br>Has an working knowledge of occupational health and safety and fire prevention related to his/her area of specialisation, safety, health and safety at work and environmental protection requirements in the field of the activity.<br>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.<br>In-depth knowledge of the learning, knowledge acquisition, data collection and management of the mechanical engineering discipline.<br>methods of learning, learning, research and data collection, their ethical limitations and problem-solving techniques.<br>Knowledge of the methods and tools of business economics and engineering-based cost-benefit analysis.<br>Understand, characterise and model the structure and operation of the components and elements of engineering systems, the design and interrelationship of the system components used. Apply the related computational and modelling principles and methods of mechanical product, process and process design. | | | | | | | | | |
| | | **Ability**<br>Ability to carry out a basic analysis of the disciplines that make up the knowledge system of the technical field, to synthesising and evaluating contexts.<br>Ability to understand the main terminologies, theories and procedures of the technical discipline in the performance of related tasks. Ability to plan, organise and conduct independent learning. Ability to identify routine technical problems and to identify, formulate and solve (by the practical application of standard operations) the theoretical and practical background required to solve them.<br>Ability to understand and use literature specific to his/her field of specialisation, computing, library resources.<br>Ability to apply the acquired knowledge in the field of information technology to the solution of problems in the field apply the knowledge and skills acquired in the field<br>Ability to construct basic models of technical systems and processes. | | | | | | | | | |

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| | Ability to use knowledge in a creative way, using the resources of the workplace effectively manage their workplace effectively. Ability to apply and comply with safety, fire safety and hygiene rules and regulations in the course of his/her work.<br>Ability to apply, orally and in writing, in a professionally appropriate manner, in accordance with the area of competence communicate in his/her mother tongue and at least one foreign language.<br>Ability to apply the technical specifications relating to the operation of mechanical systems, the the principles of setting up and operating machinery and mechanical equipment, and the principles of economic efficiency<br>the economic context. Ability to manage and control technical production processes, taking into account the elements of quality assurance and quality control.<br>Ability to diagnose mechanical breakdowns and to select remedial actions, solve repair technology problems. |
| | **Attitude**<br>It assumes and authentically represents the social role of its profession and its fundamental relationship with the world.<br>Open to professional, technological development and innovation in the field of engineering and innovation in the technical field.<br>strives to make self-learning a means of achieving professional goals.<br>Takes decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards.<br>Seek to solve problems, preferably in cooperation with others.<br>He/she shall endeavour to pursue continuous and professional development in the field of mechanical engineering.<br>in line with his professional goals.<br>He/she strives to solve problems and make management decisions by listening to the opinion of his/her supervisor, preferably in cooperation.<br>Possesses sufficient stamina and tolerance of monotony to carry out practical activities have the ability to perform tasks with.<br>Open to the use of information technology tools and has a good knowledge and application of software in the field of engineering, with at least one such program at a proficiency level.<br>Open and receptive to the application of new, modern and innovative practices and methods related to organic farming and health awareness.<br>Applies his/her acquired technical knowledge to gain a better understanding of observable phenomena and to describe and explain their laws.<br>In the course of his/her work, he/she shall apply the relevant safety, health, environmental and quality assurance and control requirements. |
| | **Autonomy and responsibility**<br>In unexpected decision-making situations, independently answer comprehensive, fundamental professional questions and develop them on the basis of given sources.<br>Responsibly upholds and represents the values of the engineering profession, is open to open to professionally informed critical comment.<br>In the performance of his/her professional duties, he/she collaborates with other professionals (primarily technical and economic and legal).<br>Identify the shortcomings of the technologies used, the risks of the processes and the initiate mitigating measures.<br>Monitors the development of legislation, technical, technological and regulatory developments in the field administrative changes.<br>Under the guidance of his/her line manager, manages the assigned staff supervises the operation of machinery and equipment.<br>Assesses the efficiency, effectiveness and effectiveness of the work of subordinates safety.<br>He/she takes care to promote the professional development of his/her subordinates and to manage their efforts in this direction and assisting them in their efforts, and applying the principle of equal access.<br>Sharing his/her experience with his/her colleagues in order to support their development.<br>Taking responsibility for the technical analysis, proposals and results of his/her work the consequences of its decisions. |
| Short description of the subject content | Familiarisation with the normal operational and design basis processes at Paks.<br>Nuclear Power Plant (Paks 1) full-scale simulator and exercise on the analytical simulator.<br>Familiarisation with the main equipment of the VVER-440 pressurised water nuclear power plant and and study of the equipment at the Paks Maintenance Training Centre (Paks 1) |
| Types of student activities | Laboratory and simulator exercises |

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| Required literature and contact details | • Gyula Csom:Nuclear Power Plant Operation I. - Fundamentals of Reactor Physics and Technology (Technical University of Budapest, 1997)<br>• Gyula Csom:Nuclear Power Plants Operation II/1 - Operation of Energetic Nuclear Reactors (Műegyetemi Kiadó, Budapest, 2005)<br>• By: Operational knowledge (University of Dunaújváros, university note, in progress) |
| Recommended literature and contact details | • Gyula Csom:Nuclear Power Plant Operation I. - Fundamentals of Reactor Physics and Technology (Technical University of Budapest, 1997)<br>• Gyula Csom:Nuclear Power Plants Operation II/1-3 - Operation of Energetic Nuclear Reactors (Műegyetemi Kiadó, Budapest, 2005)<br>• Gyula Csom:Operation of Nuclear Power Plants II/4 - Operation of Energetic Nuclear Reactors (Műegyetemi Kiadó, Budapest, 2012)<br>• Zoltán Szatmáry: Introduction to Reactor Physics, (Akadémiai Kiadó, Budapest, 2000)<br>• Duderstadt, J and Hamilton, L.: Nuclear Reactor Analyses (Wiley, New York, 1976)<br>• Bell, G. I., and Glasstone, S.: Nuclear Reactor Theory (American Nuclear Society, 1970)<br>• Dénes Bódizs:Measurement Techniques for Nuclear Radiation (Typotex, Budapest, 2009)<br>• G. F. Knoll, Radiation Detection and Measurement, 3rd Edition (John Wiley & Sons, Inc., 2000.) |
| Description of tasks to be submitted/measurement reports | As announced in the first session |
| Description and timetable of the workshops | As announced in the first session |

## Radiation protection and environmental policy

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| Name of the subject | in Hungarian | Sugárvédelem és környezetpolitika | | | | | | | Level | BSc | |
| | in English | Radiation protection and environmental policy | | | | | | | Code | DUEN(L)-MGT-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 | | Endre Kiss, PhD | | | | | schedule | College professor | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>The goal of radiation protection and environmental policy is to achieve a balance between utilizing radiation for beneficial purposes, such as medical diagnosis and treatment, industrial applications, and energy generation, while minimizing its potential adverse impacts on human health and the environment. | |
| Typical delivery methods | Presentation | Lectures with blackboard and projector. |
| | Practice | |
| | Laboratory | Carrying out experiments and calculation. |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Have a comprehensive knowledge of the basic facts, trends and limits of the subject area of engineering.<br>Knowledge of the general and specific mathematical, scientific and social principles, rules, contexts and procedures necessary for the operation of the technical field.<br>You know the terminology, key concepts and theories related to your field.<br>You have a comprehensive knowledge of the main theories and problem-solving methods in your field.<br>Comprehensive knowledge of basic economic, business and legal rules and tools.<br>He/she has a thorough knowledge of the structural materials used in the field of mechanical engineering, the methods of their manufacture and the conditions of their application.<br>Basic knowledge of machine design principles and methods, machine manufacturing technology, control procedures and operating processes.<br>Comprehensive knowledge of the operating principles and structural units of the machinery, power tools, mechanical equipment and tools used.<br>He/she knows the measuring procedures used in mechanical engineering, their instruments, instruments and measuring equipment.<br>He/she knows the expectations and requirements of the occupational safety, fire protection, safety and occupational health areas related to his/her field of specialisation, as well as the relevant environmental protection regulations.<br>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.<br>In-depth knowledge of learning, knowledge acquisition, data collection methods, their ethical limitations and problem-solving techniques in mechanical engineering.<br>Knowledge of the methods and tools of business economics and cost-benefit analysis based on technical principles. | |
| | **Ability**<br>Ability to analyse at a basic level the disciplines that make up the knowledge base of the technical field, to formulate synthetically the interrelationships and to make adequate evaluations.<br>Ability to apply the most important terminology, theories and procedures of the technical field in the performance of related tasks.<br>Ability to plan, organise and carry out independent learning.<br>Ability to identify routine professional problems, to identify, formulate and solve them (using standard operations in practice) against a theoretical and practical background.<br>Ability to understand and use literature, computer and library resources specific to their field.<br>The acquired IT knowledge can be applied to the solution of tasks in the field.<br>Ability to build basic models of technical systems and processes. | |
| | **Attitude** | |

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| | It assumes and authentically represents the social role of its profession and its fundamental relationship with the world.<br>It is open to learning about, embracing and authentically communicating professional, technological development and innovation in engineering.<br>You strive to make your self-training a means to achieve your professional goals.<br>Make decisions in complex or unexpected decision-making situations, taking full account of legal and ethical standards.<br>It tries to solve problems in cooperation with others, where possible.<br>Strive to keep their self-training in mechanical engineering continuous and in line with their professional goals.<br>It strives to solve its tasks and make management decisions by listening to the opinions of the colleagues it manages, preferably in cooperation.<br>You have the stamina and tolerance for monotony needed to carry out practical activities.<br>You are open to the use of IT tools, you strive to learn and use software in the field of mechanical engineering, and you know and use at least one of these programs to a proficient level.<br>Open and receptive to new, modern and innovative practices and methods related to organic farming and health awareness.<br>Using his/her technical knowledge, he/she strives to understand the observable phenomena as thoroughly as possible, to describe and explain their laws.<br>In the course of his/her work, he/she observes and complies with the relevant safety, health, environmental, quality assurance and control requirements. |
| | **Autonomy and responsibility**<br>In unexpected decision situations, he/she independently thinks through and develops comprehensive, substantiating professional questions on the basis of given sources.<br>Responsibly uphold and represent the values of the engineering profession, and be open to professionally informed critical comments.<br>In carrying out his/her professional duties, he/she will also cooperate with qualified professionals from other fields (primarily technical, economic and legal).<br>Identify the shortcomings of the technologies used, the risks of the processes and initiate measures to reduce them.<br>Monitor legislative, technical, technological and administrative changes in the field.<br>Directs the work of the staff assigned to him/her, supervises the operation of machinery and equipment, based on the instructions of the workplace manager.<br>Assesses the efficiency, effectiveness and safety of the work of subordinates.<br>He/she is attentive to promoting the professional development of his/her subordinates, to managing and supporting their efforts in this direction, and to applying the principle of equal access.<br>He shares his experience with his colleagues, helping them to develop.<br>It takes responsibility for the consequences of its technical analyses, its proposals and its decisions. |
| Short description of the subject content | The main environmental issues of the moment are global warming, carbon dioxide emissions and sequestration, the impact of human activity on global warming, carbon dioxide emissions and ways to reduce global warming. The 3 E harmonisation. Life expectancy and polluting emissions of fossil fuels and nuclear feedstocks. Accounting for renewable energy sources and the significance of their environmental emissions. Energy production options, combined fossil, nuclear and renewable energies, basics of environmental management, environmental policy. Radioactivity and the interaction of different materials, absorption of radiation. Reduction of radiation intensity by different walls, thin film walls. Effects of radiation on the human body, decontamination procedures |
| Types of student activities | Processing of heard text by note-taking and recording of material using own notes and electronically available notes 80% Development of test questions 20% |
| Required literature and contact details | • Endre Kiss: Environmental protection and energy management (electronic note)<br>• Sándor Bisztray-Balku, László Bozóki, László Koblinger:The Development of Radiation Protection in Hungary, Akadémiai Kiadó, 1982 |
| Recommended literature and contact details | • Martin James E: Physics for radioactivity, Wiley-VCM Verlag GMBH, 2013<br>• Nikjoo Mooshang: Interaction of radiation with Matter , Taylor and Francis 2019 |
| Description of tasks to be submitted/measurement reports | |
| Description and timetable of the workshops | Week 7: I final examination<br>Week 12: II final examination<br>Week 13: any paper can be substituted |

## NPP measurements and NDT

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| Name of the subject | in Hungarian | Üzemi mérések és anyagvizsgálatok | | | | | | | Level | BSc | |
| | in English | NPP measurements and NDT | | | | | | | Code | DUEN(L)-MGT-256 | |
| Responsible educational unit | | Institute of Technology, Department of Structural Integrity | | | | | | | | | |
| Name of compulsory prior learning DUEN(L)- | | | | | | | | | | | |
| Type | | Presentation | | Practice | | Laboratory | | Requirement | Credit | Language of education | |
| Full time | 150/39 | per week | 2 | per week | 1 | per week | 0 | E | 5 | english | |
| Part time | 150/15 | per term | 10 | per term | 5 | per term | 0 | | | | |
| Teacher responsible for the subject | | Name | | | | Gábor Pór, PhD | | | schedule | Professor emeritus | |

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| Training objective and justification of the course (content, output, location in the curriculum) | **Goals, development objectives**<br>Students learn the modern model-based measurement philosophy, which enables the measurement of reactor parameters that cannot be measured directly, learn about the most important nuclear power plant-specific, primarily primary circuit measurement chains, and get an overview of material testing techniques used in destructive and non-destructive nuclear power plants. | |
| Typical delivery methods | Presentation | Projector, ppt presentation materials |
| | Practice | |
| | Laboratory | |
| | Other | |
| Requirements (expressed in terms of learning outcomes) | **Knowledge**<br>Students get to know the primary circuit measurement methods and typical data collection and evaluation systems of nuclear power plants. He knows the measuring tools and methods used in the primary circuit of nuclear power plants. | |
| | **Ability**<br>Students are able to set up a suitable measuring device in a nuclear power plant environment, think through its consequences and proper operation, develop the measurement procedure and measurement evaluation | |
| | **Attitude**<br>Forms cooperation with his/her group mates and the instructor during the expansion of knowledge. | |
| | **Autonomy and responsibility**<br>Able to independently learn nuclear power plant measurement procedures and prepare a study based on international literature, with risk analysis | |
| Short description of the subject content | Neutron flux measurements; Temperature measurements; In-zone neutron detectors, DPZ transmitters (KNI chains); Pressure measurements; Traffic measurements; Vibration measurements. Reactivity coefficients, heating element temperature: Measurement philosophy model-based measurements. Nuclear power plant data collection systems. Hungarian data collector VERONA. Human-machine communication. Built-in reactor physics calculations in the new Verona. ALPS (Advanced Loose Part. System) is the modern acoustic system for searching for loose parts. Destructive and non-destructive tests: the six most important non-destructive methods and their role in nuclear power plants. | |
| Types of student activities | Participation in lectures, preparation of an independent study based on literature | |
| Required literature and contact details | • IAEA relating materials from internet or on Moodle | |
| Recommended literature and contact details | • IAEA relating materials from internet or on Moodle<br>• Xavier E. Gros, Applications of NDT Data Fusion, Publisher Springer New York, Ny, 978-0-7923-7412-1Published: 31 July 2001, Number of PagesXIV, 277 | |
| Description of tasks to be submitted/measurement reports | Presentation and study of nuclear power plant systems based on pre-agreed literature: 1 ppt presentation approx. 20 slides and an essay describing it | |
| Description and timetable of the workshops | | |