



# The University of Dunaújváros industrial, research and development services

- Research, Development, Innovation
- Our services
- Our equipment





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DUNAÚJVÁROSI EGYETEM  
UNIVERSITY OF DUNAÚJVÁROS

# The University of Dunaújváros industrial, research and development services



NEMZETI KUTATÁSI, FEJLESZTÉSI  
ÉS INNOVÁCIÓS HIVATAL

AZ NKFI ALAPBÓL  
MEGVALÓSULÓ PROJEKT





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## INTRODUCTION

The industrial role of higher education institutions has been significantly re-evaluated in the recent period. It has become the goal of the universities, including the University of Dunaújváros, to broaden and deepen their relations with economic actors and entrepreneurs and to further increase the applied research, innovation and production support activities in addition to the previous basic research activities.

This expectation towards our institution, which has been operating autonomously since 2000, has only been further strengthened by becoming a university in 2016. Building on its decades of experience, our university, in addition to the Ecotech Nonprofit Zrt. established to meet industrial needs quickly and flexibly, utilizing the results of the Dunaújváros Regional Materials Science Center (DURATT) focused on revitalizing relations and strengthening cooperation with the industry.

In recent years, our university has been significantly open to key industrial players in the region and the country. As a result, following the implementation of joint research and educational activities with MVM Paks Nuclear Power Plant Zrt. and Paks II Zrt., The University of Dunaújváros recently established a Nuclear Power Plant Training Base as part of the Paks Competence and Research Center. As a university of applied sciences, the emphasis on the practice-oriented training model is also a priority in education and research. The University of Dunaújváros has developed a nationally recognized system of industrial relations.

In response to the changing requirements and operation of higher education, the University of Dunaújváros established the Industrial Development Center already in 2018, the aim of which is to establish knowledge transfer between university and industrial activities, to harmonize higher education and industrial needs.

The main task of the Industrial Development Center is to find industrial players and bring university competencies to the market. Our mission is to use our knowledge and tools to support the research and development activities of our partners in ensuring their efficiency and long-term sustainability.

Industrial Development Center  
University of Dunaújváros



## TECHNICAL SCIENCES

### Mechatronics Research Group

- *Human-computer interfaces research (EFOP 3.6.1.)*  
*Laboratories involved:*
  - *Electronics Manufacturing Technology Laboratory*

### Materials Science Research Group

- *Development of amorphous iron core and cage material for electric motors (EFOP 3.6.2.)*  
*Laboratories involved:*
  - *Metallographic laboratory*
- *Development of aluminum alloys (GINOP Arconic)*  
*Laboratories involved:*
  - *Gleeble3800 Thermomechanical laboratory*
  - *Metallographic laboratory*

### Acoustics and Industrial Diagnostics Research Group

- *Development of a scanning acoustic and eddy-current emission microscope*  
*Gleeble Lab Research Group*
  - *Hungarian Acoustic and Industrial Diagnostic Laboratory*
- *Magneto-acoustic examination of metals (EFOP 3.6.1., but research was carried out earlier regardless of the application)*  
*Gleeble Lab Research Group*
  - *Hungarian Acoustic and Industrial Diagnostic Laboratory*

### Gleeble Lab Research Group

- *Modeling of crystal regeneration processes of steel and aluminum alloys during hot rolling, optimization of thermo-mechanical parameters of hot rolling.*
- *Fracture mechanical testing of steels with three-point bending testing.*
- *Research of ultrafine and nanoparticulate bulk metal alloys.*
- *Research on short-cycle fatigue of steels, investigation of the life of reactor steels.*
- *Projects involving the Gleeble3800 Thermomechanical Laboratory.*
  - *Thematic Program of Excellence 2019*
  - *Thematic Program of Excellence 2020 (2020-4.1.1-TKP2020)*
  - *GINOP-2.2.1-15-2016-00018*
  - *TÁMOP-4.2.2.A-11/1/KONV-2012-0027*

### Welding Center Research Group

- Weldability testing of newly developed aluminum alloys (GINOP Arconic)  
Laboratories involved:
  - Metallographic laboratory

### Science and Environment Research Group

- Decomposition of smoke and exhaust gases with fast electrical discharges ( $\text{NO}_x$ ,  $\text{SO}_2$ , decomposition of freons and other contaminants)
- Development of ozone generators
- Development of ozone measurement
- Research on the extraction of useful metal content from industrial sludges (utilization of converter sludge, zinc sludge, red sludge - in the case of the latter extraction of rare earth metals, ytterbium and especially scandium)
- Analysis and mobilization of heavy metal content in natural and artificial sludges
- Reduction of wastewater pollution by electrical impulses
- Improving the paintability, adhesiveness and solderability of metal and plastic surfaces by irradiation with silent electrical discharges
- Investigation of the separability of gases with electric field
- Investigation of the production of carbon-rich pellets
- Investigation of electrostatic spraying systems

## INFORMATION SCIENCES

### Institute of Informatics Student Research Group (NEW)

- Research on the mechanical and thermal conductivity properties of end products of different 3D printing technologies
- Research on the connectivity of GIS systems and 3D printing  
Laboratories involved:
  - Student research laboratory
  - Surface physics and surface chemistry laboratory
  - Mechanical engineering and structure measurement laboratory

# OUR FIELDS OF RESEARCH

## SOCIAL SCIENCE

### Key Research Topics

- Development of playful learning environments and examination of their effectiveness;  
Examining the “soft skills” of video players in light of labor market expectations  
Researchers of the Department of Management and Entrepreneurship
- Social science aspects of e-mobility  
Researchers of the Department of Management and Entrepreneurship
- Society 5.0. Sustainable development in organizations - employer branding,  
workforce retention program  
Researchers of the Department of Communication and Media Studies

The priority research area includes the application of organizational development processes and tools, such as the preparation of organizational diagnostics, organizational culture analysis, commitment analysis, organizational communication analysis, etc. Based on the organizational results, the research group undertakes to develop and hold trainings, and to formulate proposals for development and measures. In order to start research, we need partner organizations where preliminary analyzes can take place. Instead of financial support, we would primarily need contact capital, provision of the test site(s).

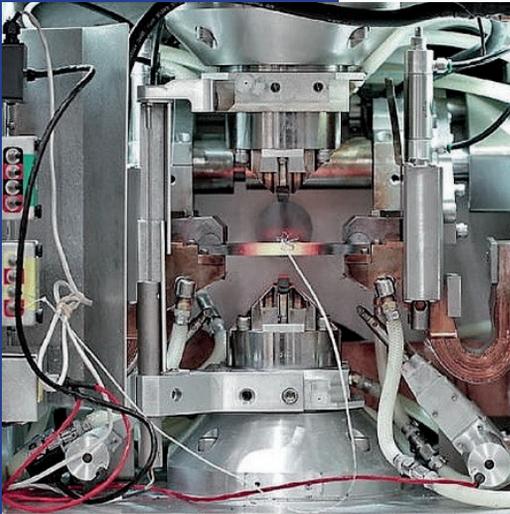
### Research at the Teacher Training Center

- Portfolio building training for educators
- Sample class pilot project in the 9th grade of a vocational high school
- Involving, motivating and retaining Generation Z employees

## OUR SERVICES

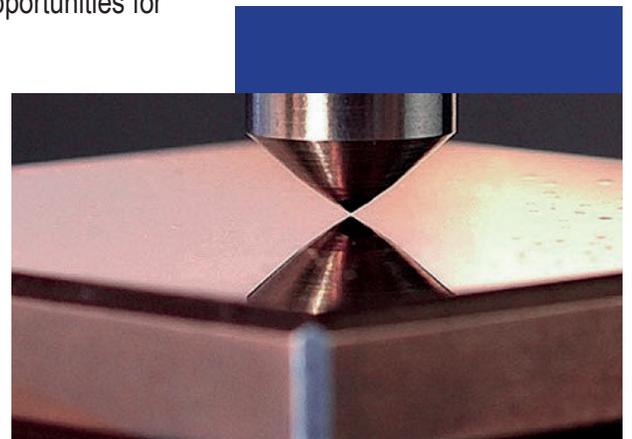
### Technical Services

- Simulation of metal technology processes on the Gleeble3800 physical simulator::
  - Forming technology processes
  - Welding processes
  - Low cycle thermomechanical fatigue
  - Production of nanoparticulate materials
- Simulation of foundry processes and small sample experiments in an arc jet furnace (NEW)
  - Production of high precision alloys
  - Production of intermetallic phase alloys
- Development of welding technologies
  - Coated electrode manual arc welding, consumable – electrode shield gas arc welding, AWI – welding, covered arc welding with wire electrode or tape electrode.
  - Build-up and repair welding with the use of industrial robots.
  - Conventional arc welding, plasma dispersion welding, tape electrode covered arc welding.
  - Friction welding.
  - Welding of special materials.
  - Process application of resistance welding.
  - Resistance butt welding, resistance spot welding and button welding.
  - Completion of welding procedure tests, approval of technologies.



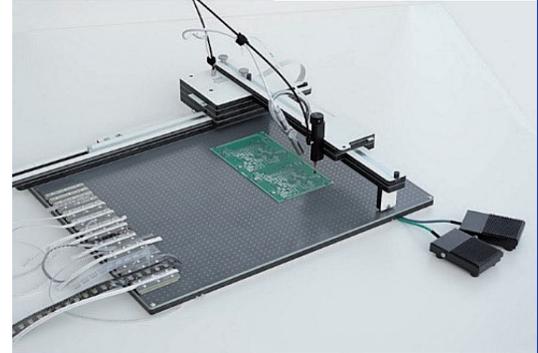
Simulations can significantly reduce the number of experiments required to determine technological parameters, thus helping to reduce costs and provide opportunities for rapid market access.

- Material tests:
  - Non-destructive testing of materials and equipment: ultrasonic, Barchausen noise, acoustic emission tests.
  - Mechanical material tests: tensile tests, hardness measurement.
  - Metallographic and electron microscopic examinations.



- Design, custom and small series production of electronic circuits (NEW).
- Environmental impact tests of electronic devices.
  - Vibration, thermal aging tests.
  - Stress and heat shock tests.
  - Corrosion and salt spray tests.

In addition to multinational companies, we can improve lab utilization if we manage to reach the small-sized electronics industry. SMEs are generally unable to develop a fleet of equipment similar to ours. As a result, we may benefit if they are outsourcing the implantation and soldering of microelectronic components to improve their efficiency.



- Industrial diagnostics:
  - vibration measurement with acceleration and velocity measurement, by contact and non-contact methods;
  - video-endoscopic recordings;
  - heat source and heat bridge detection using infrared camera;
  - video recording of high-speed processes using a high-speed camera;
  - crack detection by ultrasonic, eddy current, magnetic powder and liquid penetration methods.

The direct application of diagnostic procedures by industrial actors is usually possible on their own. Our services may be of interest primarily in connection with the detection of unusual phenomena.

For any company that uses mechanical equipment, it is inevitable the destruction of the machinery and equipment. To prevent or predict this, we use technical diagnostic tools.



- Mechanical design and support:
  - Fault analysis and development of service life extension proposals,
  - Computer simulation: strength, dynamic, thermal and fluid dynamics studies
  - Experiment and measurement design and implementation
  - Design and adaptation of individual mechanical, assembly and test equipment to existing production lines
  - Existing equipment with inclusion and production of fast-wearing parts (reverse engineering)
  - Design and prototyping of individual components (3D printing)
  - Digitization of traditional paper-based technical documentation.



# OUR SERVICES



## Our references

- Examination of the sealing material of the turbine housing dividing plane
- Coke treatment equipment damage analysis and redesign
- Flow simulation and redesign of the tempering tub oil circuit
- Flow simulation and design of tempering tub oil vapor extraction equipment
- On-site dimensional inspection of welded parts with a joint arm measuring machine
- Geometrical design, material testing and documentation of gear brake drum and emergency brake drum
- Laboratory press sample preparation and color comparison for raw material change - for Valeo Autoelectric Kft.
- Tests performed in an aging chamber with xenon lamp: Public lighting (LED) project - aging of plexiglass sheets for Wemont Kft..
- Forensic expert material testing: tensile testing, impact testing, texture testing and particle size determination
- Development of a knee joint prosthesis providing three-dimensional movement and its manufacturing technology: impact testing, hardness measurement, microhardness measurement, electropolishing
- Tensile testing of steel sheets for Kingspan Kereskedelmi Kft
- Development of satellite thermal components, optical shields and ground service units
- Optimization of the fabric structure of 1050A aluminum alloy with physical simulation of hot rolling technology - for Alcoa Köfém Kft.
- Determination of X80 molybdenum alloy strength level steel tube raw material pre-stretching and finished line rolling technology with thermomechanical simulation - for Dunafer Zrt.
- Simulation of the thermal load of a nuclear power plant pressure equalization line - for MVM Paks Zrt.
- Investigation of rolling technology parameters of aluminum alloys – Arconic Kft.
- Chemical etching testing of chips in generator control units to verify compliance of manufacturing technology.
- Testing the corrosion load of battery terminals and voltage control units.
- Investigation of causes of the surface defects of a sandwich panel.
- Simulation of corrosion stress of steel profiles and steel sheets.
- Salt spray load testing of differently coated movement skid frames.

Our customers include e.g.:



*Our media and communication services*

- Compilation of methodological materials
- Online training consulting
- Customization, installation and hosting of e-learning frameworks (Moodle)
- Testing of e-learning and M-learning materials
- Development of online study materials. Production of polymedia recordings
- Cameraman, video production in a “green-box” studio or on-site
- Online curriculum development according to the SCORM standard and individual needs
- Drone recordings
- GIS surveys and 3D modeling based on drone recordings and measurements (NEW)
- Organizing and conducting trainings
- Organizing and conducting conferences, workshops, corporate events
- Production of video clips, reference films, documentaries and interviews
- Recording of quiz and show programs
- Production of news materials and news programs
- Control of television broadcasts
- Shooting location



**Laboratories involved**

- Methodological laboratory
- TV studio

**Our references**

- More than 900 recordings so far, a total of nearly 100 hours of edited video.
- Creating, publishing and operating of more than 100 e-learning materials.

**Our customers include:**



# OUR COURSES

## OUR COURSES

- Communication trainings:
  - Communication and assertiveness.
  - Presentation techniques.
- Team-building.
- Leadership trainings:
  - Management trainings.
  - Middle-level and group leadership training.
  - Project manager training.
  - Leadership based on emotional intelligence.
- Stress management and lifestyle training.
- Conflict management training.
- Corporate training:
  - MS Excel professional.
  - MS Excel VBA.
  - MS Project.
  - LEAN-SIX SIGMA GREEN BELT.
  - Vibration diagnostics course.
  - Higher education tutor.
  - Text editing.
- Portfolio designing training for educators.
- Language courses:
  - seven levels of knowledge,
  - in English, German and Russian.
- Organization of language exams at levels B1, B2 and C2.
- Vocational training:
  - The range of professional trainings is constantly updated, more information on which they can be found at <https://ecotech.hu/>



## OUR COURSES

### Laboratories involved

- FESTO Pneumatics and FESTO PLC laboratories
- SKF laboratory
- Welding Training and Research Base
- Methodological laboratory
- TV studio

### Our references

More than 1,500 people have completed our courses.



## OUR EQUIPMENT

### Low, medium and high temperature material testing laboratory

The laboratory was established to study the physical and mechanical properties of steels, other metals and non-metallic materials and fluids, in particular to determine their room temperature and medium temperature (700-1000 °C) parameters, including various phase transitions, state changes, and thermal stability. Heat treatments and precision alloying (NEW) can also be performed in the laboratory using various sets of parameters (temperature, heating / cooling rate, application of shielding gas, etc.) up to 3500 °C.

#### Equipment:

● Setaram Instrumentation DSC 131 EVO:  
It is used for the characterization and quality control of polymers and plastics as well as metals / metal alloys. This includes the determination of the polymorphism, purity and thermal stability of the constituents / compounds used in the manufacture of organic chemicals and pharmaceuticals, and the detection of dehydration, transformation or degradation in inorganic samples. In addition, in the case of metals, it is possible to study phase changes (fusion, crystallization, evaporation), transformations (glass transition, crystalline-amorphous structure), reaction kinetics (polymerization, decomposition) and heat capacity on the principle of thermodynamics.



● CEAST HDT  
3 VICAT (code nr.: 6911.000) softening  
measuring device:

The equipment can be used to determine the Heat Deflection Temperature (HDT) and Vicat Softening Temperature (VST) of various thermoplastics according to the following international standards:

- ASTM D 648 and ASTM D 1525.
- DIN 53461.
- ISO 75-1/-2 and ISO 306.
- UNI 5641 and UNI 5642.



Dimensions of samples to perform measurement:

- length (l):  $80 \pm 2$  mm.
- width (b):  $10 \pm 0,2$  mm.
- thickness (h):  $4 \pm 0,2$  mm.

- 809/809A cylindrical core bending tester:  
With this device it is possible to determine the resistance of painted, varnished surfaces or products to bending stress, ie whether the painted surface chips and / or detaches due to various deformation conditions. This procedure helps to evaluate and classify materials according to their ability to retain paint under tensile deformation. This can be used to evaluate the bendability of materials and to qualify bendable surfaces to be painted.

- TESTO 230 device:  
The TESTO 230 is used to measure the pH, Redox potential and temperature of aqueous solutions and semi-solid to solid state medium.

Measuring range:

- pH: 0–14.
- Redox-potential:  $\pm 1999$  mV.
- Temperature range: -50–150°C.

- TESTO 240 conductivity measuring device:  
A device for determining the conductance, temperature and salinity of various chemical solutions.

Measuring range:

- Conductance: 0–2000 mS/cm.
- Temperature range: -50–150°C.
- Salinity measurement (NaCl): 1mg/L–200 g/L.

Resolution:

- Conductance: 0,1  $\mu$  S/cm.
- Temperature range: 0,1°C.
- Salinity measurement (NaCl): 0,1mg/L.

Accuracy:

- Conductance: 1% of the measured value.
- Temperature range:
  - $\pm 0,4^\circ\text{C}$  (-50–25°C) .
  - $\pm 0,2^\circ\text{C}$  (-25–75°C).
  - $\pm 0,4^\circ\text{C}$  (75–100°C).
  - a mért érték  $\pm 0,5\%$  (100–150°C).
- Sótartalomérés (NaCl): a mért érték 1,2%-a.

- Carbolite AAF / 1100 annealing furnace (temperature controller type: 201):  
Annealing furnace heatable to 1100° C for heat treatment operations to improve / degrade the mechanical properties of metals and metal alloys (depending on the application).

Key parameters:

- Maximum temperature: 1100°C.
- Constant air circulation.
- Furnace capacity: 7 L.

- Conductivity meter for metals (type: PCE-COM 20):  
Suitable for measuring the effect of alloying metals on electrical resistance in non-ferrous alloys.

- Manual cutting machine (type: Labotom-5):  
Manual cutting machine with 3.0 / 3.2 kW (41/43 hp) motor for Ø250 mm cutting discs. 10 mm T-slot cutting table with external washing tube and recirculation unit.

- Electron beam melting furnace (type: Bühler Arc Melter AM/0.5):  
Intensive water cooling.

Key parameters:

- Maximum filling weight: 500 g.
- Maximum temperature: 3500 °C.
- Argon shielding gas or vacuum casting.
- Alloy option.



## Lifetime Research Laboratory

The laboratory was established to study aging caused by heat changes and vibrations in a DURATT research collaboration. Its main sponsor is Robert Bosch Elektronika Kft (Hatvan), but we also perform vibration and heat aging torments and tests for many other companies. For now, the laboratory became industrial. It is also ISO-9001 and ISO 17025 certified, allowing us to perform high-demand vibration tests required by the space industry. Under the leadership of Admatis Kft, we achieved a successful GOP tender, where these investigations take place. We have previously performed self-vibration studies aimed primarily at determining the natural frequencies of vibration traps, which we presented at conferences. These measurements are supported by finite element modeling. Studies have been conducted to develop an industrial grade drop testing machine. Vibration diagnostic measurements were performed on vehicles, during which we tested the car parts placed on the shaker with vibration signals recorded under real travel conditions.

Special mention should be made of the technical-scientific solution of the surface and structural integrity issues of work surfaces, volume elements and special-purpose functional units exposed to extreme stress and boundary loads. In the assembly of the various functional elements, the application of the applied bonding technology, maintenance and component production, implant material selection, as well as answering material technology and technical questions are very important issues. In addition to the economic issues of these aspects, the requirements set by them must be met, which are vibration, stress and heat shock, aging, wear, fatigue and crack stability.

The aim of the research, as well as the ongoing R&D work, is to create and apply shaking and thermal algorithms that approximate the actual load well, or which “torment” effect can be related to the failures caused by everyday vehicle use. With regard to vehicle electronic components, the first step in the lifecycle research was the development and implementation of an eigenvalue procedure and measurement system that “tracks” the use of certain components of the pieces to be installed during shaking and verifies the results of related modal analyzes. The identification, characterization and R&D oriented analysis of information on typical and individual failures can be based on the test results of standard loads and the evaluation of customer complaints. The artificial aging of the installation elements is realized by the practice of the professional field by shaking or heat loading. The implementation of shaking and thermal algorithms requires appropriate equipment, heat chambers, and shakers.

The complex test system must meet the relevant directives of the ESD (electrostatic discharge) standard.

The Bosch laboratory has three main test units - two Vötsch thermal chambers, two shakers (one TIRA and one LDS) - which can work in one system, and there is also a WEISS thermal shock chamber.

The test room was designed and furnished according to the regulations and quality assurance system of Robert Bosch Elektronika Kft.

### *Equipment:*

#### ● TIRA shaker:

To investigate the relationship between the surface integrity of machine parts and tools, and to verify damage processes and predictions using analytical models. Can be used in aging processes together with air conditioning chamber.

#### Parameters:

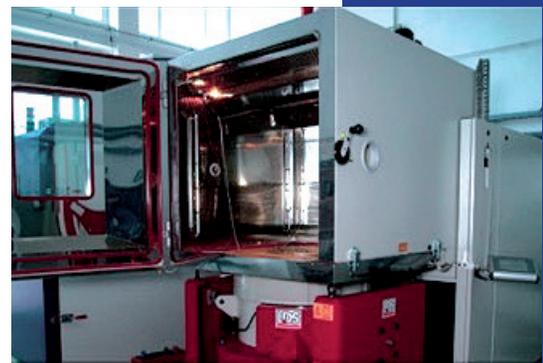
- 120 G load capacity,
- 50 mm max. displacement,
- 10 Hz–3 kHz frequency range,
- 78 kg maximum weight,
- number of measuring and control channels 8.

#### ● Vötsch climate chamber:

Electronic equipment testing, durability and climatic tests. It is also suitable for aging materials and devices with additional equipment.

#### Parameters:

- 1100-liter sample space,
- -90 and +180°C,
- 10– 95% humidification,
- cooling-heating speed 15 degrees/min.



# TECHNICAL SERVICES AND RESEARCH



- LDS shaker:  
To investigate the relationship between the surface integrity of machine parts and tools, and to verify damage processes and predictions using analytical models. Can be used in aging processes together with a climate chamber.

#### Parameters:

- 160 G load capacity,
- 50 mm max. displacement,
- 10 Hz-3 kHz frequency range,
- 600 kg maximum weight,
- number of measuring and control channels 16.

- WEISS thermal shock chamber:  
Lifetime research, artificial aging, automotive industry, space research, testing for all electronic devices.

We deal with the study, analysis, evaluation and management of damage, failure, fault formation processes and phenomena, with special regard to the integrity of products (e.g., mechanical, electronic components, subassemblies, etc.) and substrates, to the complex relationship between technological factors and stressful loads and to the prediction of damage behavior. We have already had the task of examining the systems and system components (ABS, airbag control, etc.) of products operating under critical conditions.

## CAD-CAM Laboratory

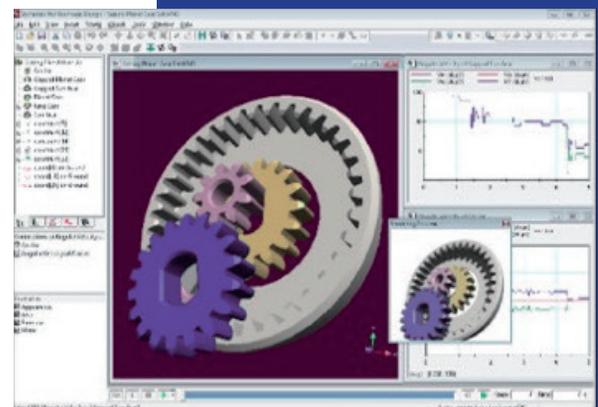
The laboratory serves the purposes of education and research development using state-of-the-art CAM and CAD software. It is primarily a stage for courses and further trainings in the following areas:

#### Parameters:

- Computerized technical representations.
- Engineering and steel structural CAD.
- Finite element analysis.
- CAM.

#### Equipment:

- 20 PCs.
- Most recent programs used in engineering design (SolidWorks, Cosmos, Ansys v12, SolidCAM, EdgeCAM).



### CNC Laboratory

The inventory of the laboratory allows training in CNC technology both at intermediate and advanced level, at the same time small series of production can also be accomplished, mainly for research and development purposes. Educational objectives can be implemented using student computers.

#### Main equipment:

- FCM-22 Tomill 270 NCT four axial CNC milling and machining center.
- S280 NCT CNC lathe station.
- Z Corporation Z Printer 310 Plus RPT 3D printer.
- FESTO manufacturing cell with Mitsubishi robot.
- Proxxon BFW 40/E engraving machine.
- Denford CNC milling machine.
- EMCO Compact 5 CNC lathe.
- 13 PCs with Keller SymPlus 4 software.



### Surface physics and surface chemistry laboratory

#### Equipment:

- C+W corrosion/salt spray chamber (type: SF/450CCT):  
Salt chamber tests can be used to determine the degree of corrosion resistance of coatings applied to the surface of metals and plastics, i.e. the service life of the coating, its non-porosity, its suitability for different media and its applicability in certain conditions.
- Q-lab aging chamber with xenon lamp  
(type: Q-Sun Ce-1B/S) :

The Q-SUN xenon test chamber is a laboratory device for the damaging effects of weather. It can be used to determine the relative life of materials. The chamber is able to bring about changes in a few days or weeks that would naturally take months or years.

The examined damage processes:

- fading,
- molder,
- cracking,
- breaking,
- turbidity,
- blistering,
- loss of glossy surface brightness,
- loss of solidity,
- embrittlement.



- Elcometer 407 gloss meter:

It is able to determine the light reflected from the surface of the test sample and the permanent luminous intensity of the surface, which makes it usable for all areas of application, e.g. polished metal and plastic surfaces, ceramics, matt surfaces. It can measure brightness at three angles at 20°, 60° and 85°. It operates according to the ISO 2813 standard in three-geometry design with 200 data memory, USB output for downloading analyzes and results, complete statistical analysis using Novo-Soft software.

Measurement range:

- 0-1000 GU (60°) to be used on general gloss surfaces;
- 0-2000 GU (20°) provides appropriate measurement on glossy surfaces;
- 0-200 GU (85°) ideal for mat surfaces;
- compatible with all important standards;
- reproduction accuracy:  $\pm 0,5$  GU,
- resolution: 0.1 GU.

An accessory to the device is the calibrating brightness with a calibration certificate.



- Elcometer SP 60 type diffuse geometry color measuring instrument according to ISO 7724:

An instrument for measuring the light emission strength of materials and the concentration of solutions with the help of spectroscopic analysis.

The standard device contains the following:

- 1 SP60 spectrophotometer,
- 1 calibration etalon,
- + accessories.
- Accuracy (CIE Lab): means among devices  $E_{ab}=0,4$ ; max.  $E_{ab}=0,6$ .

Key parameters:

- light source: gas filled tungsten lamp,
- measurement range: 400-700 nm,
- measuring time: 2 sec,
- Motor driven scratch testing machine.

An instrument for testing the adhesion of surface coatings, in particular painted or galvanized surfaces. During the test, after fixing the plate-like parts, a 1 mm hemispherical needle draws a scratch on the sample with a maximum length of 60 mm, as required by the standard, and the nature of the resulting coating can be inferred from the nature of the resulting scratch.

- ISO 1518 and EN 15523-12,
- 0-2000 g load,
- 1 mm diameter tungsten-carbide scratching head.

- Elcometer 1620 manually controlled digital deep drawing device:

The device is used to test the deep-drawing properties of coatings with a maximum thickness of 1.2 mm. By placing the metal plate in a device, a cup-shaped indentation is created with a 20 mm diameter ball. By observing the coated surface, deep drawing can be stopped at the point where the cracks appear.

- works according to ISO 1520,
- equipped with resetting plate and magnifying glass.



### Key parameters:

- maximum width of the sample metal plate: 100 mm,
- maximum thickness of the sample metal plate: 1,2 mm,
- Elcometer 106 adhesion measuring instrument.

### ● Elcometer 106 adhesion measuring instrument :

The Elcometer 106 adhesion tester is used to test the bond strength of the coatings used. A wide variety of coatings can be tested, including paint, plastic, atomized metal, epoxy, wood, veneer, and plywood on metal or plastic. The device uses the tear-off method to measure the force required to tear off a small piece to be torn from the raw material with a 20 mm diameter test pin, thus confirming / refuting compliance with the quality standards.

- Including tearing discs,
- circle cutter,
- adhesive,
- magnetic cut-off.

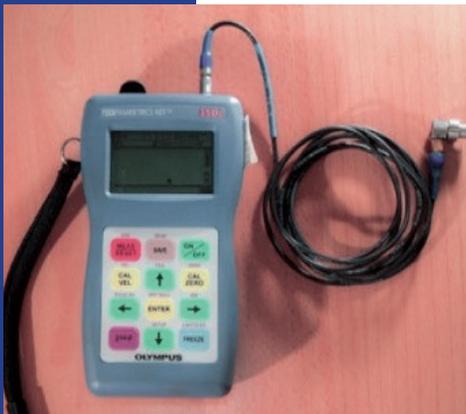
Measuring range: 0-35 kg/cm<sup>2</sup> and 0-500 lb/in<sup>2</sup> (0-3,45 MPa)

Accuracy: reading  $\pm$  10%.

### ● Olympus 35 DL Ultrasonic thickness meter:

The thickness tester uses pulse reflection technology to measure the thickness of the material when access to both sides of the material is limited. The 35DL is a thickness meter with a file-based, alphanumeric data storage that uses 2.25-30 MHz frequency converters. It can also be used for most material families in cases when the other side of the surface to be measured is not accessible.

- for plastics the measurement range is 0,08 - 635 mm,
- for metals the measurement range is 0,1 - 635 mm,
- maximum resolution: 0,001 mm,
- frequency range: 2,25 - 50 MHz,
- 0,001 mm resolution, measurements in inches and millimeters.



Suitable for measuring the thickness of plastic products, machine parts, turbines, glass, ceramics, fiber-reinforced materials, rubber, curved surfaces (bent plates with a small radius).

### ● TESTO 206 pH— and temperature measuring instrument:

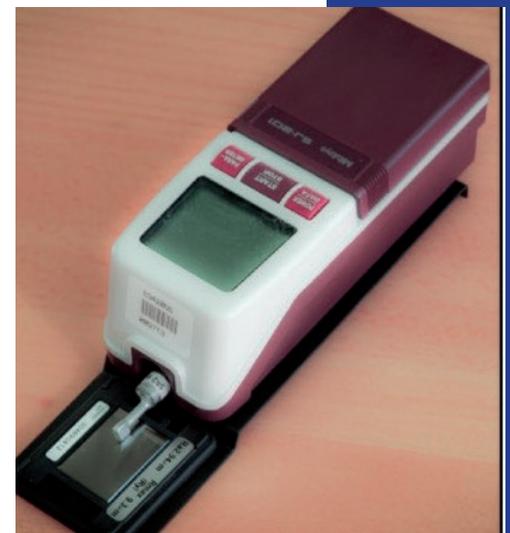
The TESTO 206 is a hand-held instrument for measuring pH and temperature with a Testo 206 pH1 immersion probe - for measuring liquid media e.g., refrigerant, galvanizing liquid, chip production, paints and varnishes, printed matter, drinking and sewage water.

### ● Mitutoyo SJ-201 surface roughness measuring instrument:

Device for determining the surface roughness of machined (turned, milled metallic) surfaces with different surface qualities, of metallic or non-metallic coated components.

### ● NSTRON 3366L1092 tensile-testing machine:

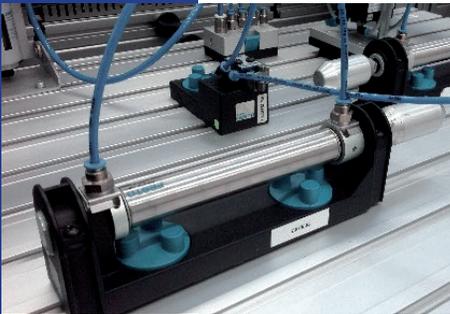
The two-column, table-mounted test equipment is suitable for tensile and/or pressure testing under a load requirement of 50 kN, i.e. mainly plastics and tires can be tested with it.



- Elcometer456 coating thickness meter:  
Determination of layer thickness for coatings, paints, varnishes:
  - on materials with a magnetizable content in accordance with ISO 2178, ISO 2808, DIN 50981,
  - on non-magnetizable materials according to ISO 2360, ISO 2808, DIN 50984 standards.

## FESTO Pneumatics and FESTO PLC Laboratory

At the workstations of the laboratory, modern knowledge of control technology and pneumatic systems can be acquired within the framework of theoretical and practical classes. During the practical sessions, students can get acquainted with the elements of control engineering and pneumatics and their application. We have MPS stations to meet the requirements dictated by the industry, with the help of which our students can study and program the structure and operation of a complex production system.



### Equipment:

- 4 workstation fleet of pneumatic equipment (with PLC control),
- 5-module MPS station + industrial robot,
- 3 workstation fleet of hydraulic equipment (with PLC control).

## Mechanical engineering and structural measurement laboratory

The purpose of the laboratory is to perform technical measurements, length measurements, markings, structural tests, test loads, vibration tests, and optical tension tests. The laboratory equipment is also suitable for elongation measurement, force measurement, welding deformation and stress measurement, and measurement data processing..



### Equipment:

- Olympus Measuring Microscope STM6.
- Romer Stinger II articulated joint arm measuring machine.
- Microlaser2000 3D scanning head.
- Micro-Hite 3D coordinates measuring machine.
- Hottinger Baldwin Messtechnik Spider8 measuring amplifier and data storage.

## Gleeble 3800 Thermo-mechanic Simulator

The Gleeble 3800 is a fully integrated thermomechanical simulator with digital, closed-loop control systems, suitable for real-time physical simulation of various manufacturing processes, thermomechanical treatment of metals and material testing. The two main parts of the equipment are the thermal system and the mechanical system, which consist of a combination of the main unit and the MCU (Mobile Conversion Unit), which is appropriately selected for the required test.

## TECHNICAL PARAMETERS OF THE THERMAL SYSTEM

- Type of the heating system: direct resistance heating (Joule-heat).
- Temperature control: digital, closed-loop control with 16-bit A/D converter and 16/32-bit DSP.
- Heat element thermocouple (E, K, R, S, B) or infrared pyrometer.
- Temperature range: from room temperature up to 3000°C.
- Maximum heating speed: 10.000°C/s.
- Resolution: 1°C.
- Control accuracy: 1°C (in steady state).

## TECHNICAL PARAMETERS OF THE MECHANIC SYSTEM

- Test frame: horizontal, with 2  $\varnothing$  99mm columns.
- Mechanic system: closed loop hydraulic servo regulation + pneumatic system.
- Maximum static pressing / pulling load: 20t / 10t.
- Formation speed range: 0,01–2000 mm/s.
- Accuracy of force measurement:  $\pm 1\%$  (for the entire scale).
- Resolution of force measurement:  $\pm 1$ kg (for the entire scale).

## MATERIAL TESTS:

- investigation of deformation-induced crack propagation in multilayer welds (SICO test),
- elevated temperature, uniaxial pressure tests,
- phase transition test with a dilatometer,
- crystallization from melt state,
- thermal cycles / heat treatment,
- stress relaxation test,
- creep tests,
- thermomechanical fatigue tests,
- crack susceptibility testing,
- tensile test at elevated temperature.

## TECHNOLOGY SIMULATIONS:

- modeling the thermal impact zone of welded joints,
- simultaneous modeling of several technological processes, compressive test creating a plane deformation (Ford test),
- forging, multi axial forging,
- extrusion,
- continuous cast,
- resistance welding simulation,
- continuous strip annealing,
- simulation of heat treatment technologies,
- powder metallurgy, sintering,
- multi-stage hot rolling.

## Welder Training and Research Base

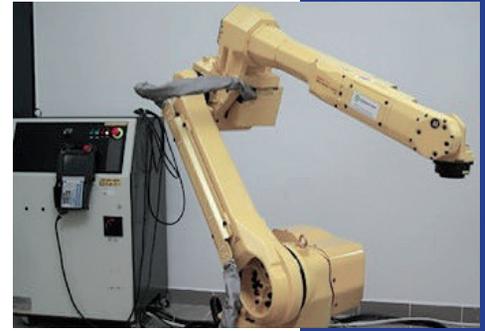
The training base and the laboratory are a welding training center that allows the training of professionals at different levels, so

- trained welder workers,
- skilled welders,
- welding machine operators,
- welding masters,
- welding technicians,
- welding specialists,
- welding process technicians,
- welding engineers.

A 2 x 8 work stations workshop is available for the purposes of the basic fusion welding procedures:

- coated electrode manual arc welding and AWI-welding,
- consumable-electrode shield gas arc welding.

The Welding Base is connected to preparatory workshops and post-treatment workshops, where welding preparation works and seam cleaning can also be performed.



## Fully automated welding laboratory

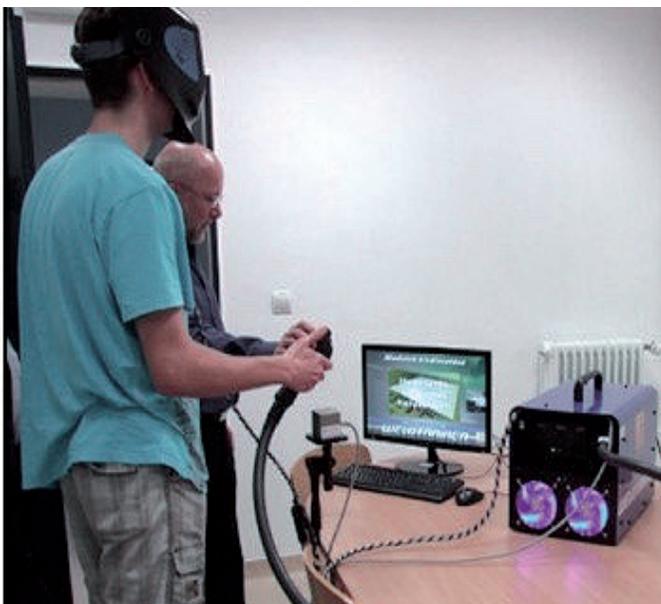
There is a technological robot station, a covered arc welding machine in the laboratory. It is possible to perform build up welds and other technological experiments.

## Pressing weld laboratory

There are spot and bulge resistance welding machines, butt welding machines, friction welding machines in the laboratory.

The laboratory presents a segment of welding processes that creates opportunities for bonding sheet metal parts and allows for a multitude of design simplifications. Friction welding machines are few places in the country. The universal machine located in the laboratory is suitable for performing a multitude of welding tasks.

With the tensile machine located in the laboratory, the completed joints can be quickly checked, a multitude of welding technologies can be developed and the optimal welding parameters can be determined.



### Environmental, Chemical, Heat & Fluid engineering Laboratory

The aim of the laboratory is to serve the education of the departments of Engineering Physics, Heat and Fluid Science, Environmental Protection and Energy Management, Environmental Economics and Environmental Protection, as well as to support the environmental research of the departments.

#### Equipment:

- Atomic absorption spectrometer with 10 lamps, a gift from the Japanese government
- Clean water producing equipment using distillation and/or ion exchange
- Gas chromatograph with electron capture, flame ionization and heat conduction measurement detectors
- Mass spectrometer gas chromatograph (GCMS)
- Jar tester
- Full organic carbon content determination
- Device to test frequency converter pumps
- Ultrasonic washing equipment
- Water testing spectrophotometer
- Drying oven 800 °C
- RION noise emission meter
- KOI measuring instrument
- Dust concentration meter
- pH meter, water meter
- Experimental waste water treatment plant (mainly for testing biological waste water treatment processes)
- FTIR device (designed mainly to determine the concentration of gases consisting of two different atoms and multi atomic gases, the length of the route for the measuring vial is changeable between 0.8 and 8 m, equipped with a library consisting of the spectrum of 30000 molecules)



### Hungarian Acoustics and Industrial Diagnostics (MAID) laboratory

Nondestructive, no intervention material and equipment testing laboratory.

#### Equipment:

- Acoustic emission measuring device (produced by Geréb and Partner - Sensophone): Industrial, robust measuring machine capable of detecting, recording and processing acoustic noises created in the materials in the ultrasonic range under load.
- Manual ultrasonic fault detector: OLYMPUS -Epoch 1000.
  - For conventional and phase-controlled measurements.
  - With different testing probes.



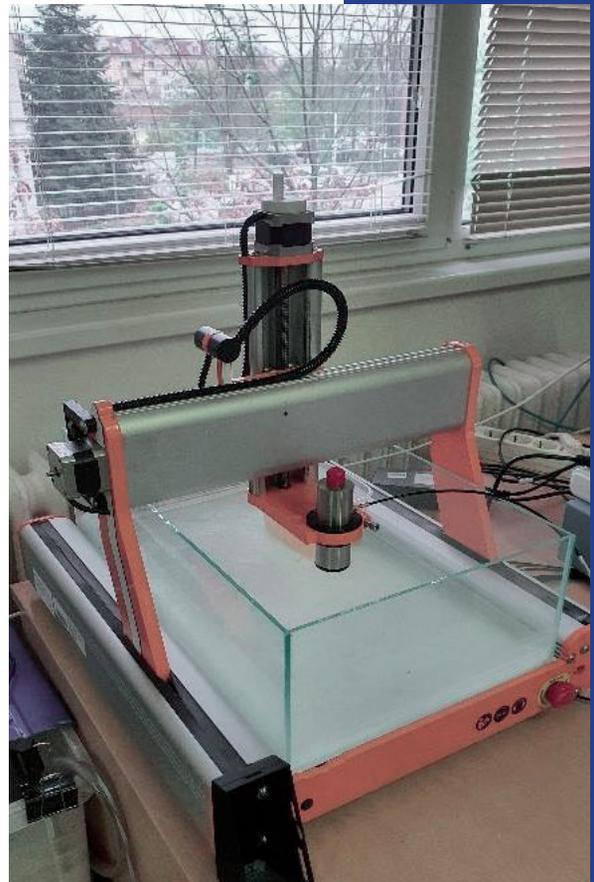


- Manual ultrasonic fault detector:  
OLYMPUS - Epoch LTC:
  - Digital operation:
    - numerically adjustable measuring range, amplification, alarm gate,
    - display of sound route distance and trigonometric parameters,
    - saveable calibration parameters.
  - Built in DAC and AVG methods.

- Thermal camera: Thermo -PRO TP8S :

Typical parameters:

- Detectors: non cooling Vanadium Oxide Microbolometer
- Infrared spectrum: long wavelength (8  $\mu\text{m}$ –14  $\mu\text{m}$ )
- Image resolution: 384 x 288
- Temperature measuring range: -20–800 °C (optionally up to 2000 °C)
- Geometric resolution: 1.5 mrad
- Thermal sensitivity: 0.08 °C (=80mK)
- Absolute accuracy:  $\pm 2$  °C
- High speed camera: Olympus i-SPEED 3
- Image recording speed: 1–150 000 frame per second (1280x1024 image resolution is guaranteed up to maximum 2000 fps)
- Exposition time: up to 1  $\mu\text{s}$
- Video tube length: 3.5m, 4 and 6 mm diameters
- Eddy current fault detector: OLYMPUS–OmniScan MX
- Non-contact vibration meter: Brüel & Kjaers – Ometron VH-1000-D
- 3-axis probe actuator
- High performance ultrasonic pulzer
- Digital oscilloscope
- DC power supplies
- Laboratory power supply



## Metallographic Laboratory

With the equipment of the metallographic laboratory, destructive material testing and sample preparation can be performed according to the customer's wishes. The laboratory has automatic wet and dry grinding and polishing equipment, which allows scratch-free sample preparation, and light microscopes with Zeiss optics can be used to characterize the texture of the test sample (metals and various metal alloys). In addition, the hardness (micro-hardness) can be determined from the solidity characteristics of the test sample.



### Tools for sample preparation:

- Simplimet 1000 automatic hot embedding machine.
- Buehler Ecomet 250 Pro grinder polisher.

It allows the preparation of test specimens for the texture examination of metals and metal alloys before testing. Single-disc machine used to grind and polish 6 sample specimens at the same time; automatic Primet Pro polishing suspension feeder included.

- Buehler Alfa & Beta manual two discs grinding polishing tool.
- Struers LaboPol-5 manual wet grinder.

### Tools for texture testing:

- Zeiss Axio Imager.A2m optical microscope.
- Zeiss Axio Observer.Z1m optical microscope.

Used to examine the texture of dense – lightproof – materials, mainly metals and metal alloys, but coating thickness measurement can also be accomplished on cross sectional grindings of parts with surface coating.



Texture images can be made:

- in 25X, 50X, 100X, 200X, 500X and 1000X magnification
- bright field of vision, dark field of vision imaging
- texture images in polarized light
- interference contrast can be applied
- the following measurements can be made: particle size and distribution determination, coating thickness measurement (on cross-sectional grindings of parts with surface coating)

- **Wolpert 401 MVD micro-scleroscope equipment:**

The equipment is able to measure the hardness of metals, metal alloys, and their minor structural units, texture elements, phases. It has a 136° diamond pyramid lancing tool, thus allowing Vickers-hardness testing by micro and macro loads (applicable loads: 0.01 - 1 kN).

- **Optilia OP-019 158 portable video-microscope:**

Portable microscope for testing the solder bonding of electronic components (BGA) (detection of cracks, impurities), which, thanks to its good resolution, takes sharp images of the test areas even for components smaller than 50 µm.

## Microbiology laboratory

The aim of the laboratory is to test the quantitative and qualitative occurrence of microorganisms (bacteria and microscopic fungi) in various environmental samples (air, water, soil, waste, production materials, by-products, etc.) by classical microbiological methods.

It is suitable for studying the effects of pollutants (e.g. de-icers, heavy metals, propellants and carriers) on living organisms using standardized methods. It is also suitable for searching for correlations between the degree of air pollution and ground(water) pollution in the short and long term.

Our task is the area-dependent monitoring of the environmental condition of Dunaújváros, the maintenance of a database on the development of air and soil pollution from 2005 to the present.



### Equipment:

- UV-Vis spectrometer: it is designed to test optical permeability of biological and other samples in the visible and near ultraviolet region of the spectrum.
- Thermostat, incubator: suitable for growing environmental samples and the microorganisms detected from them in a wide temperature range (-10 to +60 °C) from air, water, surface and depth soils.
- Sterile chamber: equipment used for the treatment of various biological processes and materials under sterile conditions, for the spreading of bacteria and fungi waiting for various spreads, a laminar cabin. Suitable for safe work with even pathogenic (plant, animal, human) agents.
- Steam Sterilizer: for the sterilization of biological objects, materials and devices used for treatment by sterilizing them with water vapor at a pressure higher than air. Suitable for the production of microbial-free sterile controls of environmental samples, as well as for the production of selective media and devices for cultivation and sterile microbiological work.
- Shaker: facilitates the suspending of biological samples. Suited to incubate environmental samples digested with different methods and to propagate isolated micro-organisms in liquid media by shaking.
- Centrifuge: separates various biological mixtures by density.

### SKF laboratory

Operations to be conducted in the laboratory:

- Bearings assembly (mechanic, hydraulic, thermal).
- Vibration measurements.

### Equipment:

- hydraulic and hand operated bearings assembly toolbox.
- bearings pre-heating equipment.
- lubricant testing equipment.

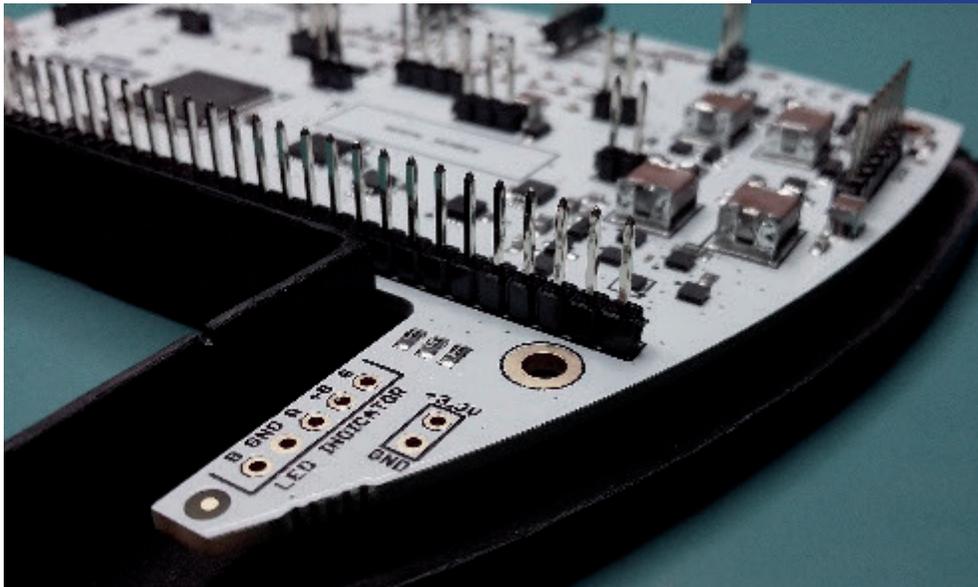


## Electronics Manufacturing Technology Laboratory (NEW)

The equipment of the laboratory allows the production of electronic panels using surface-mounted technology, from 0603 component and 0.5mm IC size. The lab is also fitted to limited BGA implantation. ESD protection consists of dissipative table tops, storage and personal protection solutions.

### Equipment:

- IR reflow oven: eC-Reflow mate v4.
- Manual stencil printer: eC-Stencil mate.
- Manual pick and place implanter: eC-placer.
- Manual soldering and de-soldering station:
- Desktop multimeter: GW Instek GDM-8341.
- ESD protected environment.

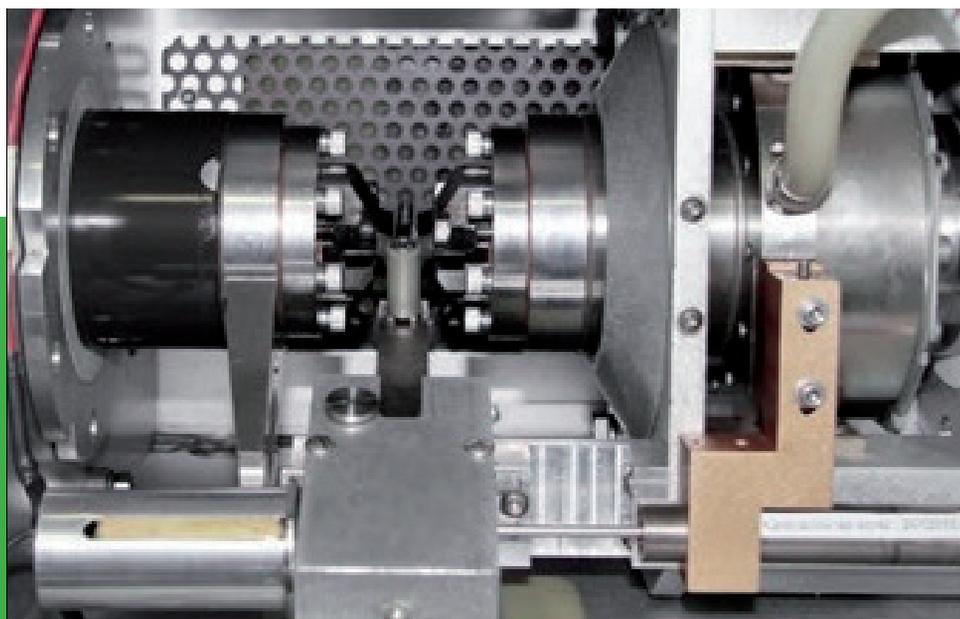


## IT SERVICES AND RESEARCH

### Student Research Laboratory (NEW)

By acquiring the following 4 tools, the Institute of Informatics can appear with new demonstrations and participate in some external locations of the “enrollment campaign” as well as in public events held at the University of Dunaújváros (eg Career Choice Day, Researchers’ Night). We expect that using these tools we will be able to hold new, spectacular presentations that will highlight our university compared to other higher education institutions, as well as effectively orient secondary school students by marking a degree at the University of Dunaújváros and seeking admission to the university. Target age group: high school students or parents.

- 3D scanner, Sense 3D.
- Virtual Reality goggles, Oculus GO.
- Drone, Dji Mavic2 + Fly more kit.
- 3D scanner: Wanhao Duplicator i3.



## MEDIA AND COMMUNICATION SERVICES AND RESEARCH

### Methodological laboratory

The purpose of designing the laboratory is to present and evaluate the finished materials. A wide range of presentation tools are available, from an interactive whiteboard projected from the back, from touchscreen computers to a 'smartphone'. The mobile furniture and equipment system allows us to conduct any presentation or training, even in several venues (video conferencing).

### TV studio

The main field of use of the television studio is education, the high-quality practical training of students. It provides an excellent opportunity and professional location primarily for the studies and works of students participating in higher education vocational training - Television Programming and Communication and Media - as well as BA in Communication and Media Studies. In the TV studio, they can learn the tricks of television and short film making, their work processes, and the rules of operating the equipment. In the case of television productions, the recording in the studio can be controlled from the control room, the imposing size of which can be said to be quite exceptional.

The studio with a floor area of about 200 m<sup>2</sup> and a high ceiling has a professional technical background:

- four-camera recording system with digital video mixer desk and teleprompter.
- professional lighting system with 30 adjustable and controllable luminaires..
- large green box screen and a projection screen, teleprompter.



The materials can be recorded on two high-performance workstations with the help of the world-famous AVID Media Composer editing software, which of course also satisfies the needs for post-production. The studio is suitable for recording many types of television programs as well as short films, especially video clips, reference films, weather reports, newscasts, commercials and interviews. Thanks to its floor space, it can accommodate an audience of 60-80 people, and its gallery, which is located in the studio space, can also accommodate 80 people. It also has a dressing room, a technical room and a soundproofing room.



### *Key equipment:*

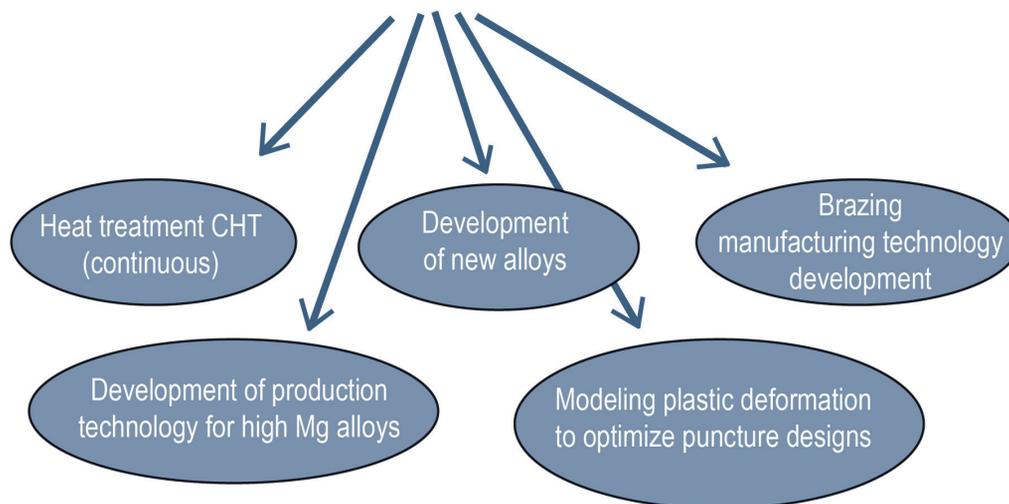
- studio cameras: 3 Blackmagic Studio Camera (talkback, tally, 10" color viewfinder, HD broadcast)
- reporter cameras:  
SONY PMW300, SONY PXW 400
- teleprompter + software
- studio lighting equipment:  
DeSisti, Balogh luminaires, Smartfade light desk
- sound desk: 32 channel Yamaha
- microphones: AKG, Electrovoice, Sennheiser (wired and wireless)
- recording devices: AVID Media Composer, ATEM Production Studio – Blackmagic Design
- post-processing tools: AVID Media Composer
- ATEM Production Studio 4K - Blackmagic Design system (video switch, videohub)
- Manfrotto and Sachtler tripods + dolly
- 2 Panasonic Viera 126 cm LED TV

The materials produced in the television studio of the University of Dunaújváros represent broadcast quality and can be converted directly to any media. That is, they are input for Internet videos, DVDs and Blu-ray Discs, multimedia materials, and can also serve mobile technology devices. They are suitable for task-specific, safe, loss-free work.

## OUR OUTSTANDING COMPETENCIES AND NEWLY ACQUIRED ASSETS

### Our competencies related to hot rolling and heat treatment:

- physical simulation of preheating immediately before plastic forming.
- physical simulation of multi-step, elevated temperature plastic forming: up to  $\bar{\epsilon}=(2-2,3)$  equivalent plastic deformation can be achieved with wedge impression test.
- controlled temperature control according to the desired heat conduct, ensuring the required degree of deformation per puncture, speed and intermediate times,.
- physical simulation of cooling strategies immediately after punctures.
- simulation and study of precipitation processes.

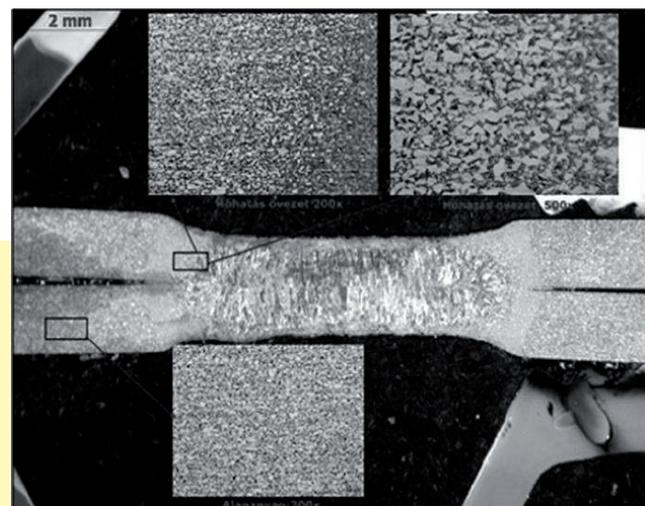


### Our competencies related to multi-axial forging:

- Physical simulation of preheating immediately before plastic forming;
- Multi-step, bi-directional, intensive plastic forming, even at elevated temperatures:
- up to  $\bar{\epsilon} \approx 20-25$  cumulative equivalent plastic deformation can be achieved, controlled temperature conduction according to the desired heat profile,
- developed mechanical model for the calculation of flow curves → cyclic change of forming strength → stabilizing tool load,
- UFG structure, grain size below  $1\mu\text{m}$  → increasing strength, “good” formability.

### Casting - related crystallization tests:

- melting and crystallization under “instrumented” conditions.
- formability tests during the solidification process (e.g. determination of NDT or NST temperature).

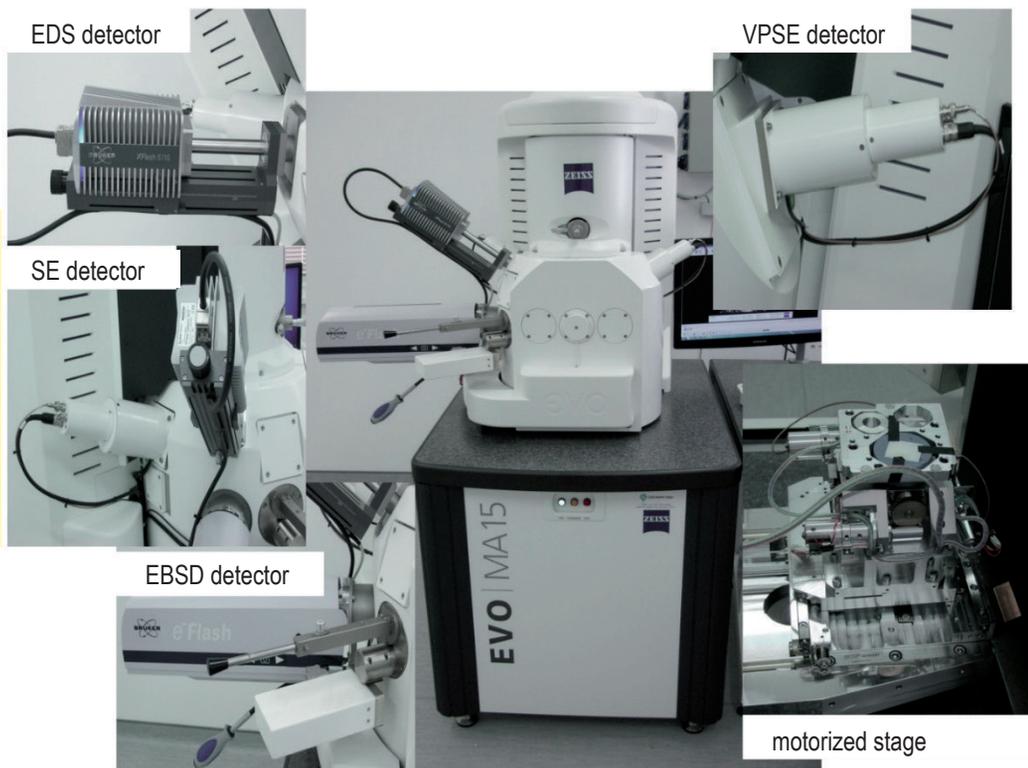


**Material damage, service life estimation**

- Thermomechanical fatigue: tool, valuation method.
- Fatigue kinetics (change in dislocation structure).
  
- EVO MA 15 scanning electron microscope:

**It is used to determine the texture of metals, polymers, ceramics:** It has 5 detectors, which allow the determination of complete composition, crystallographic orientation and phase.

- Secondary electron detector (SE) - topography,
- Backscattered Electron Detector (BSE) – atomic number sensitive recording,
- Variable pressure mode SE detector, Examination of plastics, ceramics (VPSE),
- Electron backscattered diffraction (EBSD),
- Determination of grain structure and orientation, recrystallization, directed structure, pole diagrams, grain orientation mapping,
- Energy dispersive microprobe (EDS) - determination of element composition in weight or atom%.



## TOOLS OF THE PAKS COMPETENCE AND RESEARCH CENTER

### Welding [workshop] Laboratory

- Orbital welding machine:

Output amperage	5–180 A (range)
Supply voltage	110 - 230 V (range)
Degree of protection	IP11 – IP12
Programming option	4 aspects, manual, 99 sectors
Connection option	min. 4 USB connection, keyboard, external printer, HDMI
Switch-on time	at 60% min. 150 A
Compatibility	Possibility to connect devices recommended in Part 1 of this procedure
Control	One button
Language	Hungarian
Shielding gas	digital, programmable volume, flow monitoring,
Regulation option	cold wire
Printing option	Yes
Display, screen	colorful, touchscreen
Rotor supervision	torque monitoring
Current change rate	can be varied between sectors
Data storage	min. 4000 welding programs
Cooling	water cooling, cooling water monitoring
User's Guide	Hungarian



OUR OUTSTANDING COMPETENCIES AND NEWLY ACQUIRED ASSETS

● Plasma cutting equipment:



Cutting thickness	min. 20 mm
Cutting speed	0-300 mm/min
Output amperage	50–100 A (range)
Gas consumption	air
Gas pressure	4–10 bar (range)
Work cable	min. 4 m
Cutting gun	machine, min. 5 m
accessory flame cutting head	

● Cutting Secator:

Speed	10–2400 mm/min (range)
Engine	24 V DC, encoder with electronic control
Applicability	flame and plasma
Track driving	rail, min. 1,8 m
Display, screen	digital display
Waiting time for arc ignition	0,0–10,0 s (range)

**Destructive Materials Testing Laboratory**

- INSTRON 450 MPX pendulum impactor (450 J capacity):



<b>For instrumented tests</b>	Instron MPX series 450MPX Pendulum impact tester, capacity max 450J Suitable for Charpy and Izod impact tests. Automatic hammer return with motor drive at the end of the test.
	Electromagnetic brake and clutch control. Suitable for performing tests according to ASTM E23, ISO 148-2, GOST 10708-82 and GOST 9454-78 standards.
	Dual safety mechanism to lock the hammer in the start position, which prevents accidental test start and accidental release of the hammer.
	The entire test area is closed with a cover and the doors (3 pcs.) are equipped with interlock switches: this prevents the hammer from being started accidentally and the hammer from moving when any door is open. Its design allows the use of any Dynatup Impulse hardware.
	PC-based digital display that is via connected USB port – Main voltage: 208 / 230V\$1096, 1Ph, 50/60 Hz, 15 Amps Equipment dimensions: (width x depth x height) 2200x1117 x2090 mm Net weight: 821 kg
	European power cord: CE and 230V
	Hungarian language option
<b>Software for non-instrumented tests</b>	Bluehill Impact software for PC-based impact display. Its use is mandatory on all new MPX series percussion instruments. Automate Charpy / Izod testing with the INSTRON Bluehill platform. The main functions of the display: – Analog and digital display of percussion work via a modern- looking display. – Pre-written test method ASTM E23 files and 150 148 according to the standard. A professional look is guaranteed with Bluehill's unique protocol generation feature, which provides exceptional flexibility for editing protocol templates to meet individual expectations. Protocol templates for testing can be attached to methods that allow the program to export test results in a professional-looking manner and transmit them by e-mail. Minutes can also be saved in HTML, Word or Pdf format.
	Hardware accessories for .MPX Series for Fracta PC-based percussion display. Includes: high-precision angle encoders that encodes hammer to accurately measure the angle.
<b>Computer</b>	Dell computer with Intel Core i7 Processor
<b>Instrumented impact edge that can be used for non-instrumented tests</b>	Instrumented Charpy impact edge, 2 mm radius, for testing according to ISO 148 SI-1, SI-1M and MPX series of pendulum impact tester. Scaled version for increased use. Includes indirect and direct calibration. 89 kN capacity.

● Macro Hardness Testing Machine and Micro Hardness Testing Machine:



**Buehler Wilson UH4750S Universal hardness tester**

	Universal hardness tester UH4750 - load range between 3 and 750kgf
	Suitable for Vickers, Knoop, Rockwell, Super Rockwell and Brinell measurement methods based on ISO and ASTM hardness measurement standards
	ISO 6506-1, ISO 6507-1, ISO 6508-1, ISO 4545-1, ASTM E10, ASTM E18, ASTM E92, ASTM E384
	Plastic testing according to ISO 2039-1 & ISO 2039-2
	Rockwell Carbon Testing to DIN 51917
	Brinell Depth Testing (non- standardized) HBW-T
	DiaMet™ Hardness Control Workstation PC accessory
	DiaMet Software: Fast autofocus and auto evaluation
	The DIAM software constantly monitors the regularity of inspections by ISO and ASTM
	24" monitor
	8-position motorized turret
	Large sample table with T-slots.
	Motor and manual pattern movement in the Z direction
	Dimensions (L x W x H): 704 mm (28 in) x 534 mm (21 in) x 995 mm (39.2 in)
	Weight. 300kgf
	Power supply 110-240V / 50-60Hz
	80mm dia. anvil is a standard accessory.
<b>Indenters</b>	Brinell 2.5mm indenter
	Vickers indenter
	Rockwell diamond indenter
	10X Long Working Distance optics

OUR OUTSTANDING COMPETENCIES AND NEWLY ACQUIRED ASSETS

● Micro Hardness Testing Machine:

The equipment is CE certified, complies with the relevant European Union regulations and guidelines.



**Buehler Wilson VH3100S Automatic Vickers Hardness Tester - Basic**

**DiaMet full automatic software package with PC.**

	Meets the requirements of ISO 6507, 9385, 4546 and ASTM E384, E92 standards.
	Load range: HV0.01 - HV0.05 - HV0.1 - HV0.2 - HV0.3 - HV0.5 - HV1 - HV2 - HV3 - HV5 - HV10 HK 0.01 - HK0.05 - HK0.1 HK0.2 - HK0.3 - HK0.5 - HK1 HBW 1/1; HBW 1 / 1.25; HBW 1 / 2.5; HBW 1/5; HBW 1/10.
	Closed loop load cell model
	Motor load transfer
	1 intruder body location
	2 objective locations
	Integrated 5MP camera with digital zoom
	Motorized hardness tester with impact protection
	LED lighting with a lifespan of 11 years
	Power supply 220 / 230V, 50Hz - Dimensions 340mm x 600mm x 832mm (W x D x H) - Weight 37.5kg
	Automatic focus and lighting control
	Impression analysis is automated
	Imprint pattern editor
	Automatic load switching even within a series
	Batch measurement, save batch pattern - provides fast test parameterization
	Run multiple measurement sequences in a row
	Create reports even with built-in templates and save measurement data
	K1C fracture toughness module for measuring fracture toughness of ceramics – Scanning module – Conversion – Automatic surface roughness correction – Possibility to set tolerances – Statistics function
<b>24" FullHD monitor</b>	
<b>High speed automatic motorized XY sample table</b>	Maximum sample weight: 120kg
	Working space depth: 347 mm
	Test space height: 155mm

OUR OUTSTANDING COMPETENCIES AND NEWLY ACQUIRED ASSETS

- Proceq Equotip 550 portable hardness tester:



<b>Proceq Equotip 550 portable hardness tester</b>	<p>Modular design: Flexible configuration for various industrial applications, with wide range of probes and accessories.</p> <p>Automatic on-site correlation from Leeb scale to Rockwell scale.</p> <p>Step-by-step inspection in accordance with ISO 16859 and ASTM A956.</p> <p>Conversion curves can be created and modified according to the user's needs.</p> <p>It is possible to create individual measurement reports.</p>
	<p>Automatic conversion from all common hardness scales (HV, HB, HRC, HRB, HRA, HS, Rm).</p> <p>Extremely accurate <math>\pm 4</math> HL (0.5%, 800 HL), automatic correction in the direction of penetration.</p> <p>Wide measuring range, several types of measuring probes and support rings.</p> <p>A wide range of hardness test standards are available.</p>
	7" diameter color display
	Size: 250 x 162 x 62 mm
	Operating time: > 8 hours

- Tensile tester:

<b>Mechanical design</b>	2 playless recirculation ball screws.	
	AC servo motor.	
	Fmax.	100 kN
	stiffness.	minimum 100kN/mm
	test space width:	min. 400 mm
	maximum working height without tools, adapters and load measuring cell:	min. 1000 mm
<b>Speed range</b>	Crosshead speed range (full load).	min. 0,0005–400 mm/min
	return rate.	min. 400 mm/min
<b>Compliance with testing standards</b>	ISO, ASTM, DIN standards.	

OUR OUTSTANDING COMPETENCIES AND NEWLY ACQUIRED ASSETS

Calibration	calibration certificate / calibration check during start/up.	
Power measure cell	Type R load cell.	
	Measuring range.	minimum 100 kN pulling / pressing.
	max. operating force.	130%.
	static lateral force limit.	MAXIMUM 50%.
	Class accuracy according to DIN EN ISO 7500-1.	at least grade 1 accuracy or better.
	IP security code.	at least IP 65.
	Force measuring range.	0.2 to 100% of the rated force.
Wedge clamping head 100 kN and associated clamping jaw	Nature of investigation.	Universal.
	Capacity / load direction.	maximum 100 kN / tension.
	Temperature range.	Room temperature.
	Sample dimensions/characteristics.	Flat sample thickness 0–35 mm, cylindrical sample diameter 5–35 mm.
		width up to 60 mm.
	Sample material.	Metallic and non-metallic materials, plastic.
	Sample geometry.	lamina, rods, profiles, tapes.
	Clamping jaw for wedge clamping head.	flat samples: minimum 1.5 mm profile, circular clamping surface: minimum Ø 50 mm, sample thickness 0-15 mm.
Long working distance extensometer with centralized stand		Adjusting the initial position (lower joint arm position), recording the signal distance and opening / closing the joint arms is done manually by the operator.
	Class accuracy.	Class 1 after a working distance of 10 mm according to DIN EN ISO 9513.
	Range of motion.	Min. 1000 mm.
	Resolution.	Min. 10 µm.
	Signal range.	10/20/25/50/75/80/100 mm (manual adjustment).
	Cylindrical sample.	0–9 mm.
	Plane sample thickness.	0–9 mm.
	flat sample width.	0–30 mm.

Manual contraction measuring extensometer for flat / cylindrical samples	Class accuracy.	according to 1 EN ISO 9513.
	Measuring range.	Min. 4 mm.
	Display error limit (reading).	Min. 0.2 %.
	Full scale margin of error.	Max. 0.05 %
	Display error.	Max. 0.6 $\mu\text{m}$ .
	Operating force.	Minimum 4 N.
	Sample diameter (cylindrical sample).	4–25 mm.
	Sample thickness (flat sample).	0.4–20 mm.
	Sample width (flat sample).	4–25 mm.

● 250 kN servo-hydraulic fatigue machine:

Description	Suitable for swinging strains (tensile and compressive in one cycle) over the entire capacity range.
	It is equipped with a control panel mounted on the load frame, quick positioning and fine positioning buttons for easy gripping of the sample.
	sized for endless fatigue life span with a minimum capacity of $\pm 250$ kN.
Load frame	Can be moved with hydraulic cylinders and with hydraulically fixed upper crosshead.
Move	min. 500 kN/mm.
Axial stiffness of the load frame	meet the requirements of the ASTM E1012-14 standard.
Uniaxiality of the load frame	min. 660 mm.
Distance between columns	min. 1900 mm.
Vertical dimension of the test cell (without load cell and clamps)	$\pm 0.25$ mm.
System displacement at 125 kN elastic load and 30 Hz frequency	min. $\pm 0.05\%$ or $\pm 0.01$ mm, or $\pm 0.2\%$ of full scale, whichever is larger.



OUR OUTSTANDING COMPETENCIES AND NEWLY ACQUIRED ASSETS

Accuracy of elongation measurement	0.5 class accuracy according to ISO 9513, ASTM E 83 Class B1, B2, C, D, EN 10002-4 Class 0.5, 1, 2 and JIS7741 Grade 0.5, 1, 2 or better.
	The accuracy shall be better than $\pm 0.25\%$ of the measured deformation + the accuracy of the extensometer, or $\pm 0.005\%$ of the measuring range of the extensometer, whichever is greater.
<b>Work cylinder</b>	
Description	Axial cylinder with hydrostatic bearing, with LVDT odometer.
Capacity	min. $\pm 250$ kN.
stroke length of the piston	min. 150 mm ( $\pm 75$ mm).
cylinder placement	movable upper crosshead.
<b>Power Measure Cell</b>	
Capacity	Construction with a capacity of $\pm 250$ kN, designed for fatigue and infinite fatigue life.
Placement	load cell shall be attached to the lower crosshead of the equipment.
ACCURACY	$\pm 0,5\%$ of reading or $\pm 0,002\%$ of final deviation, whichever is greater, to be guaranteed in the range of at least 1 to 100% of the rated capacity of the load cell.
Calibration	In accordance with the requirements of class accuracy of ISO 7500-1 0.5.
Automatic compensation for dynamic effects	using an accelerometer built into the load cell.

**Nondestructive Materials Testing Laboratory**

- 1 X-ray generator:



Nature and type of construction.	industrial design, portable.
Depth of penetration.	65 mm in steel or larger.
Voltage range.	10-300 kV.
Current range.	0.5-6 mA or greater.
Nominal focus point size.	max. 1 mm (EN 12543).
Radiation angle range.	min. 30° x 60°.
Cooling.	air cooling.
Protection.	IP65.
Control unit.	digital.
Power supply.	160 V - 253 V AC, 50/60 Hz.
360° rotatable stand.	Yes.

- Flat panel:



Pixel size.	140 microns or less.
Detector active area size.	14 x 17 "(350 x 420 mm).
Protection.	min. IP57.
Operating temperature range.	-20°C to + 50°C.
Shockproof design.	Yes.
Communication.	wireless (Wi-Fi connection) max. up to 100 m.
Certificates.	compliance with applicable ISO and ASTM standards.

## OUR OUTSTANDING COMPETENCIES AND NEWLY ACQUIRED ASSETS

### Penetration testing equipment

#### Ultrasonic examination devices

- Phase controlled ultrasonic equipment.
- Radiation dosimeters.



### Machining work shop



- 5 AXIS CNC MILLING MACHINE



- DRIVEN TOOLS SLANTED BED CNC LATHE

- CNC SURFACE GRINDING MACHINE

### PROTH



# Online Studium

## PROFESSIONAL PRODUCTION OF ELECTRONIC TEACHING MATERIALS FOR EDUCATIONAL PURPOSES AT THE UNIVERSITY OF DUNAÚJVÁROS

A smaller organizational unit operates in the “P” building of the University of Dunaújváros, the participants of which have been supplying the University and the University’s business relations with the more spectacular e-learning materials for almost 10 years.

The management of the University is committed to serving students as professionally as possible; therefore, it considers it important to continuously improve the online tools of education. Nothing proves this better than providing constant renewal at a high level of online learning opportunities. This endeavor paid off many times during the period of distant education, as the possibility of continuous learning and teaching could be ensured by the practical application of the available online study materials.

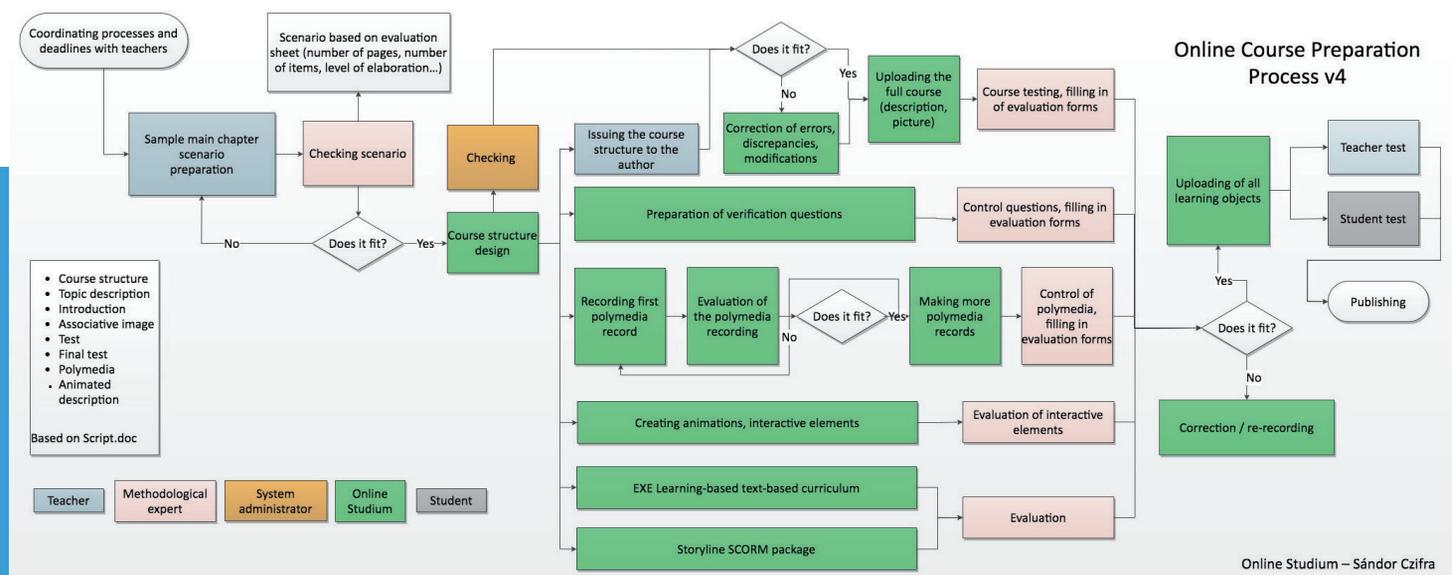
The employees of Online Studium also have experience in the Hungarian business environment and in Hungarian higher education. Based on their experience and the available infrastructure, we offer the following services to our partners:

- Online training advisement.
- Customization, installation and hosting of e-learning frameworks (Moodle).
- Development of online study materials. Production of polymedia recordings.
- Professional video recording in a “green-box” studio or on-site.

In order to implement effective online education, we have developed a system that complements and supports both teacher and student processes in the higher education system. Key features:

- Second generation, special Moodle framework.
- Use of video-based online educational content in university education.
- Unique functionality tailored to higher education needs.
- Communication and contact option integrated into the system.

In order to ensure the smooth implementation of the courses, we have developed a curriculum development procedure that is transparent to all participants. The process shown in the figure is supported by several of our unique, self-designed applications.



## Curriculum development

In the preparation of our courses, we place great emphasis on the quality of the scenario as a basic development document, and on the adherence to the basic information specified in the scenario during the development.

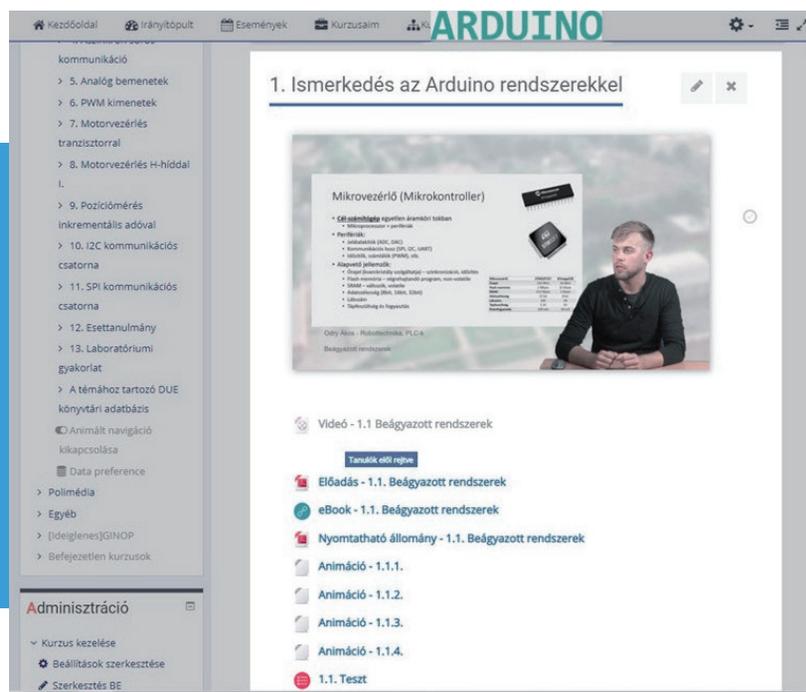
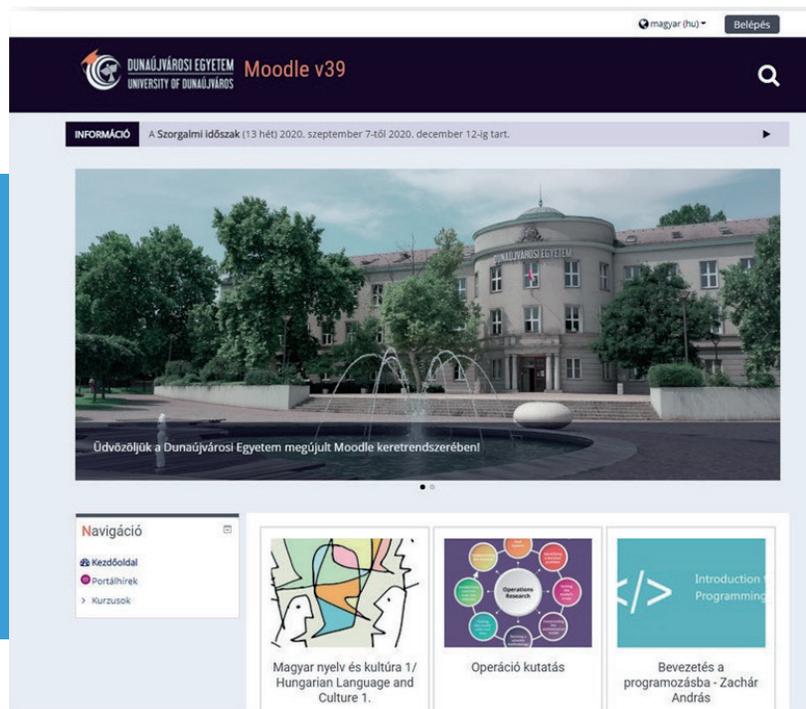
Our university courses are basically built on two levels, in which the second (subchapter) level contains the individual learning objects. When passing on information, we strive to maintain the SHOW-PRACTICE-REQUEST principle, so our courses consist of a video-based presentation, a downloadable, printable presentation outline, practice animations, and test questions.

We recommend the following formats for the preparation of study materials and courses:

- Video-guided, lecture-based course. Components: edited video presentation, self-test questions, PDF presentations, assignments, assessed test questions, and custom animations
- SCORM learning materials: multimedia learning materials with simulation tasks. It is primarily a curriculum that supports the presentation of software and the practice of its functions.
- e-book type, text-based curriculum.

In the courses prepared for the framework of the University of Dunaújváros, the student can use other useful online tools, thus enhancing the efficiency of online education (chat, forum, video consultation). In addition to the above, the framework includes a number of additional options, which we are constantly developing based on the needs and feedback of faculty and students.

Screenshots of the design of the university framework:



## Our higher education references

In addition to our own university courses, we have collaborated with several Hungarian higher education institutions on various online content development projects. As part of a successful collaboration, we have closed several large-scale projects. Some examples from the implemented projects:

### 1. Hungarian Online University:

Under the leadership of Széchenyi István University, a consortium was established between the Alba Regia Center of the University of Óbuda, the University of Dunaújváros, the Károly Eszterházy College and Universitas-Győr Nonprofit Kft. The main goal of the consortium is to jointly set up the Hungarian Online University (HUNline), by which they will establish a cooperation in the applied IT sector, and under whose coordination they will appear together in the education market of Europe and the world. In the project, we developed 10 online courses.



**2. MeMOOC:** Commissioned by the University of Miskolc, we managed to produce 20 different curricula on 5 topics in an extremely short time at an exceptionally high level. Its appearance is MeMOOC, i.e. the online training center.

The special feature of the project is that the curriculum had to be produced in English and Hungarian with the EDX content development tool. All the curricula produced by us in the field of informatics were prepared by the lecturers of the University of Dunaújváros.



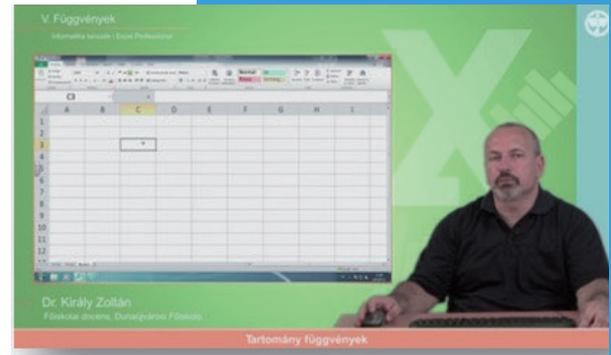
**3. Within the framework of the project "Joint improvement of the quality and accessibility of higher education at the University of Dunaújváros and the King Sigismund University"** we participated in the development of 10 online curricula, which we operate on a common platform in cooperation with the partner university and make available to students of the two universities every six months. The success of the project was also supported by distance education ordered during the pandemic period.



### Our content developments used by our business partners

In addition to university content development, we also serve requests from the private sector. Without wishing to be exhaustive, here are some examples of successful on-line courses:

- Railway English online audio curriculum.
- Railway German.
- Occupational safety and health.
- Conducting.
- IT basics.
- Excel Professiona.I
- Digital competency development program.

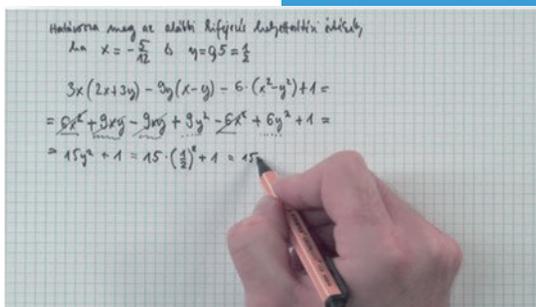


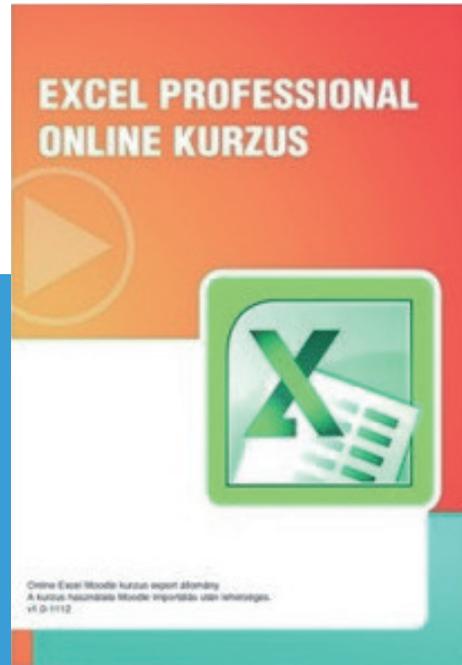
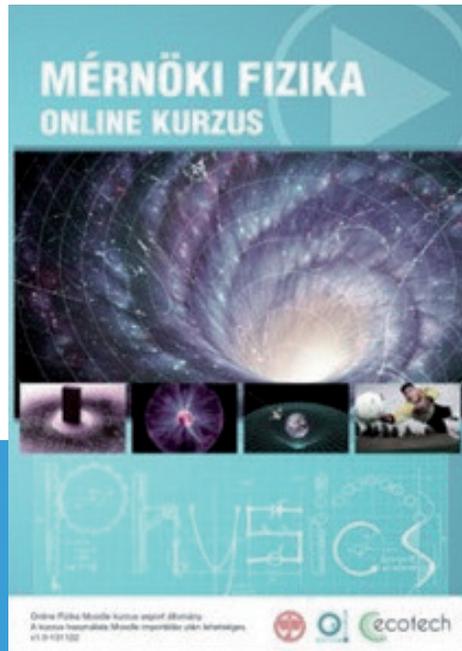
Our partners who are the direct customers of the University of Dunaújváros or in cooperation with the On-line Studium in connection with the University:

If you are interested, please contact Sándor Czifra, Head of Online Studium, at [czifras@uniduna.hu](mailto:czifras@uniduna.hu)!



### Samples from our completed university courses







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