Mechanical Engineering BSc and Mechatronics Engineering BSc Laboratories

Contents

Air and Noise Protection Laboratory

Purpose of the laboratory

The Air and Noise Protection Laboratory provides the practical background for different courses such as Noise and Vibration Protection, Air Quality Protection, and Unit Operations. Numerous different specific software are introduced to students in the lab, which is also the place for result processing of field measurements.

Competence of the laboratory

The laboratory is suitable for carrying out and post-processing acoustic and vibration diagnostic tests. In addition, modeling noise and air pollution propagation and noise mapping are also important tasks of the lab, just like mathematical modeling of dynamical systems in the field of chemical and environmental methods. Numerous software are used for the determination of optimal operation of chemical and environmental systems.

Our partners

- DKV Debrecen Transportation Services Ltd., Plánum 97 Ltd., TIKTVF (Green Authority)

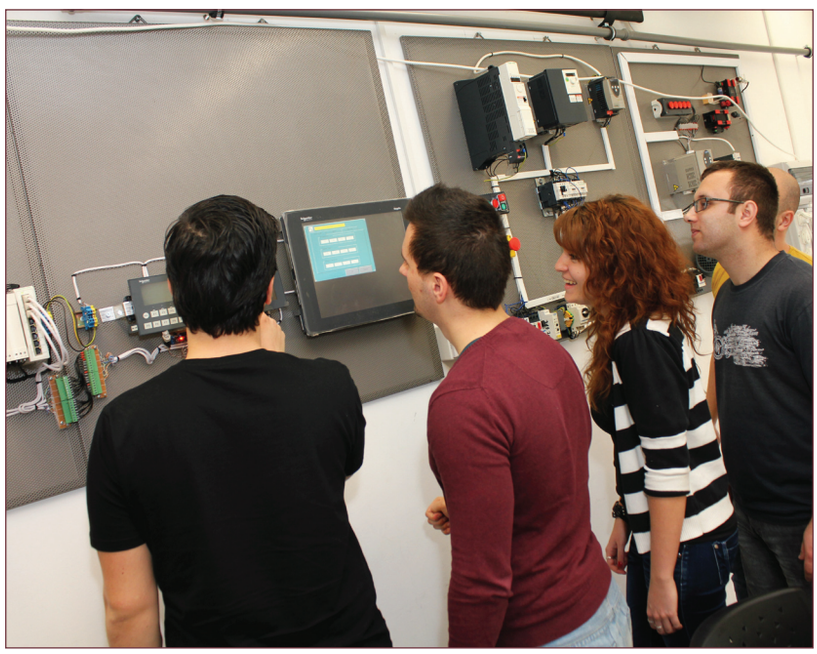
Equipment in the laboratory

The laboratory boasts 20 personal computer with software for modeling noise and vibration measurements (IMMI, SAMURAI) and environmental processes (MATLAB, Control System Toolbox, Simulink Toolbox). The laboratory is also equipped with measurement systems and devices for in situ tests, such as a Soundbook universal multi-channel acoustic measuring system, four channel analyzers with Samurai software for vibration and noise measurements, a PDV 100 portable digital vibrometer, SINUS 3D seismometer and a Larson Davis 831 sound level meter. Additionally, other sound level meters are available for student measurements.

Building Mechatronics Research Laboratory

Purpose of the laboratory

The goal of the laboratory is the elaboration of methods for carrying out intelligent evaluation of measurements, intervention and planning. The international research carried out in the laboratory promotes the activity of practicing planners, operators and builders so that they can use more efficient building engineering and building supervision systems from an energetic aspect and for buildings to meet the comfort feeling of residents, especially their special requirements in case environmental conditions differ from normal circumstances.



Competence of the laboratory

The competence of the laboratory includes the integrated parts of building automation, building supervision and security techniques, including the operation of necessary sensors, regulators and interveners, which is defined as building mechatronics.

Our researchers have a wide-ranging theoretical and practical experience in automation of building engineering systems of intelligent grounds, elaboration of their support by means of building information technology as well as elaboration of objectives relating to the cost-saving intelligent automation of systems.

Our partners

The laboratory was established thanks to the EU-funded project "HURO/0802/155_AFA Hungarian-Rumanian Research and Development Platform for supporting the building of Intelligent Buildings" and with the co-operation of the European Regional Development Fund. Apparatus utilizing renewable energy were built with the co-operation of ENERGOTEST Ltd, while the measuring and automations objectives have been realized by means of instruments and software of National Instruments.

Equipment in the laboratory

- The construction and embodiment of the apparatus manufactured individually and installed into the laboratory promotes the access for teaching, research, presentation and measurement.
- Hot water supply system
- Vacuum-tube solar collector (1000W).
- Flat solar collectors:
- Buffer stores
- 6 pcs solar cells (PV) to be used for research.
- Rotating stand

Cutting and CNC Workshop

Purpose of the laboratory

The laboratory is based on the common and latest production technologies, thanks to which students have the opportunity to see the material removal processes on the production machine in real time. The machinery and equipment used in the lab provide the scientific and technical background to education. The available technologies are identical with the latest technologies used in industry.

Competence of the laboratory

Students learn about the basic manufacturing procedures (lathe machining, milling, planning, sawing, grinding gear-tooth forming), the main parts of the equipment and their operation by working on the machines in small groups. They also have the opportunity to study the cutting edge geometry of the different tools.

Our partners

- Optimum Hungary Ltd

Equipment in the laboratory

The workshop is equipped with five universal lathe machines, a universal milling machine with two planer machines each, a Fellow Gear machine, two saw machines, two grinding machines used to sharpen tools.
A type of OPTI M2 CNC milling machine, a CNC lathe L28 Opti and Opti D280x700 a type universal lathe.
CNC programming and simulation software are available for ten students.

Diagnostics Lab

Purpose of the laboratory

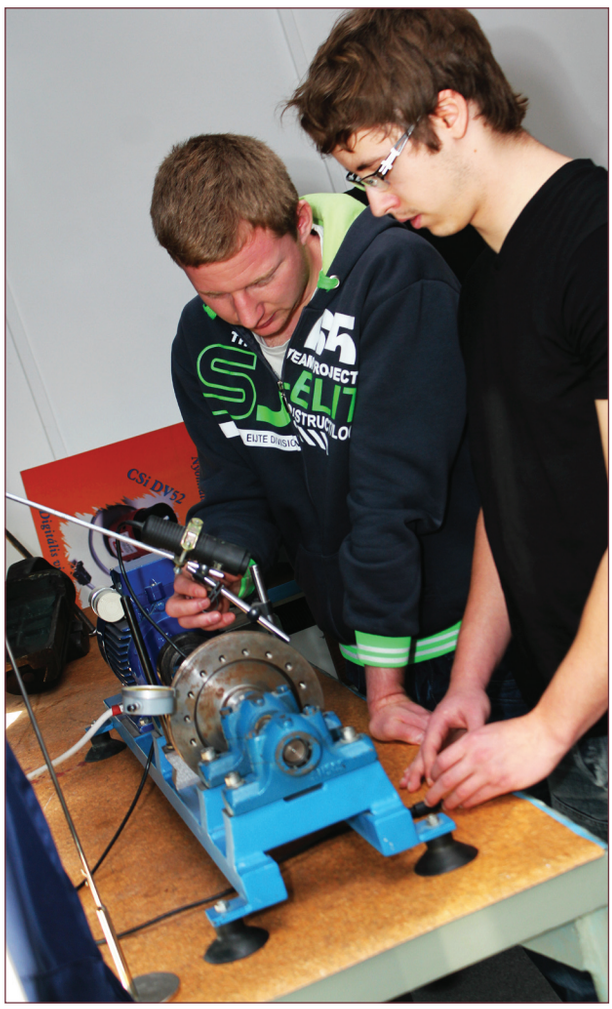
The purpose of the lab is to provide the technical background to different diagnostic tests and measurements applied in general mechanical engineering. Studying the application of measuring systems and special diagnostic devices is also emphasized in the lab. Students can practise how to set up and carry out measurements and draw the conclusion about technical problems.

Competence of the laboratory

Acquiring the basics of measurement techniques of machine fault diagnostics applied in machine repairing and maintenance engineering fields. With the up-to-date equipment and measuring systems students carry out different testing and structural analysis of structures and machine elements as research and scientific activities. Our lab also provides the scientific and technical background for PhD students.

Our partners

- SKF Group, FAG Schaeffler Technologies AG & Co. KG • Deutschland,



- GRIMAS Hungary Ltd., SPM Instrument Budapest Ltd., KE-TECH Ltd.

Equipment in the laboratory

The following measurement devices are available:

- Oilcheck oil tester
- CMVP 10 vibration tester
- CMVP 30 SEE tester
- SPM analysator with PRO32-2 and PRO46-2 software's
- VIB 10 vibrometer
- Testo 816 noise meter
- Center 320 noise meter
- Infrared thermal meter
- SPM Leonova Infinity universal vibration tester
- SPM Vibchecker
- SPM Bearingchecker
- Flir (ThermaCAM E45)
- Labview software
- Audacity acoustic software

Heat Treatment Lab

Purpose of the laboratory

Heat treating is a group of industrial and metalworking processes used to alter the physical, and sometimes chemical, properties of a material. The following basic heat treatment techniques take place in the laboratory: annealing, case hardening, precipitation strengthening, tempering and quenching processes for small groups (8-10 students).

Competence of the laboratory

The lab supports the teaching of the Materials Sciences and Manufacturing Engineering practice course, and presents the main heat treatment processes for small groups (8-10 people). With the up-to-date equipment and heat treatment techniques different heat treatment methods of different materials can be carried out as research and scientific activities.

Equipment in the laboratory

- Heat treatment furnaces: RE-60, KO-14, ET-2
- Quenching vessels: water, oil, salt
- Hardness testers
- Temperature measurement & management equipment

Personal protection & safety equipment

Hydraulics laboratory

Purpose of the laboratory

Presentation of most modern hydraulic systems and research in the field of hydraulics.

Competence of the laboratory

Teaching of hydraulic systems of different courses by means of software developed by FESTO Didactic Ltd, resp. BOSCH-Rexroth.

Our partners

The laboratory is sponsored by BOSCH-Rexroth Ltd and FESTO Didactic Ltd.

Equipment in the laboratory

- Two-side stand system with hydraulic power-supply unit, slave cylinder, hose storage, oil tray, hydro-battery, cog-wheel motor, pressure limiter, stuffing-one-way valves, electronically controlled root changers, manometers,
- error locating system: electro-hydraulic elements operating defectively, manually controlled valves operating defectively,
- a set of mobile hydraulic elements, including the control block necessary for mobile hydraulic research,
- axial-piston hydro-motor, pre-controlling apparatus and loading simulator.

Laboratory of Biomechanics

Purpose of the laboratory

The main purpose of the lab is the determination of mechanical properties of polymer structural materials and biomaterials in contrast with stress. The Laboratory of Biomechanics participates in material testing, particularly in tests of human bones. The Laboratory supports the following courses: Biomechanics, Material Testing Methods of Plastics and CAD-CAM, Rapid Prototyping. It is also used for various research activities.

Competence of the laboratory

The Biomechanical Material Testing Laboratory was founded in 2005 for accredited material testing activities with its quality management system. The main activity of the Material Testing Laboratory is research: various biomechanical nature experiments, measurements and tests. In accordance with the accredited activity orders from external companies are executed as well.

Our partner

- DEKK (University of Debrecen, Clinical Center)

Equipment in the laboratory

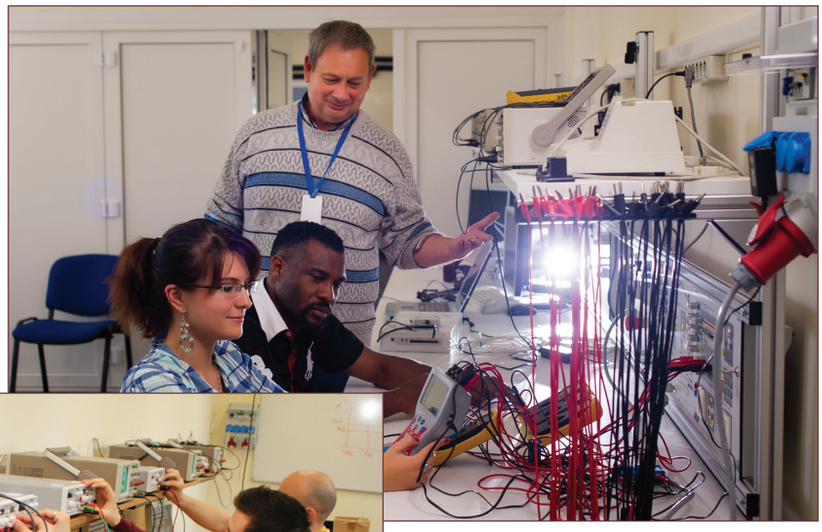
The most important devices of the laboratory:

- Instron 8874 biaxial material testing machine,
- Instron AVE advanced video extensometer,
- Instron 51 portable digital durometer,
- Mitutoyo measuring devices,
- Torque meters,
- Connex three dimensional printer,
- Zprinter 310 three dimensional printer,
- Cobra Fastscan three dimensional scanner.

Laboratory of Electronic Engineering and Electronics

Purpose of the laboratory

In the laboratory students obtain experience in the field of electronic and electronic engineering in the framework of the following courses: electrical engineering and electronics, technique and electronics and chemical science of mechanics.



Competence of the laboratory

Students measure electric quantities by means of digital and analogue circuits composed by the students themselves, which enables them to extend their experience. The examination of passive and active elements for understanding the operation of digital and analogue circuits is also possible, just as well as practising the search of electric errors. The laboratory takes part in the development of electric cars through activities such as the energy supply of vehicles, charging batteries, planning and building dashboard panels.

Equipment in the laboratory

There are 10 measuring stations in the laboratory, where 20 students can carry out measurements at the same time. The equipment of the stations includes 2-channel and 35-MHz oscilloscopes, 2-MHz function, direct-current double power-supply units, 3,5-digit multimeters, and measuring bags.

Machine Elements Lab

Purpose of the laboratory

The machine elements lab practice is part of the Machine Elements course, which introduces machine elements and machine constructions built up of them to students, familiarizing them with the material taught at lectures. Machines and equipment in the lab are designed in the framework of the four designing tasks: Welded Machinery Base; Hydraulic Cylinder; External Double-Shoe Thruster Released Drum Brake; Counter drive, which may be dismantled and assembled with the guidance of the instructor.

Competence of the laboratory

Students have the opportunity to gain hands-on experience with machine elements and parts and to study their construction and operation methods. The lab provides the background for the technical knowledge and hands-on skills required by the educational and outcome requirements of the training program. Students have the opportunity to design the four designing tasks, operate and maintain mechanical systems. The lab is equipped with test-benches instrumented with an up-to-date measuring system comprising an amplifier and evaluating software, which is suitable for the fast, electrical measurement of mechanical parameters changing with time.

Our partner

- Hottinger Baldwin Messtechnic Ltd. (HBM)

Equipment in the laboratory

Test benches for testing drive train vibration, bolted joints, spring operation, endurance limit of composite materials and friction phenomenon between surfaces, and so on.
The lab is instrumented with Spider 8 amplifier and CATMAN Easy software from HBM for acquisition and evaluation of the measurement signals provided by transducers for the measurement of force, pressure, acceleration, torque, and displacement. The Catman software package running under MS-Windows is applied for experimental stress analysis with strain gauges and an on-line measurement system.

The applied transducers and gauges:

- force transducers: measure static and dynamic tensile and compressive loads,
- torque transducers: in rotating and non-rotating version,
- pressure transducers: for absolute and differential pressure measurements,
- displacement transducers,
- strain gauges for determining the strain on the surface of components,
- piezoelectric accelerometer.

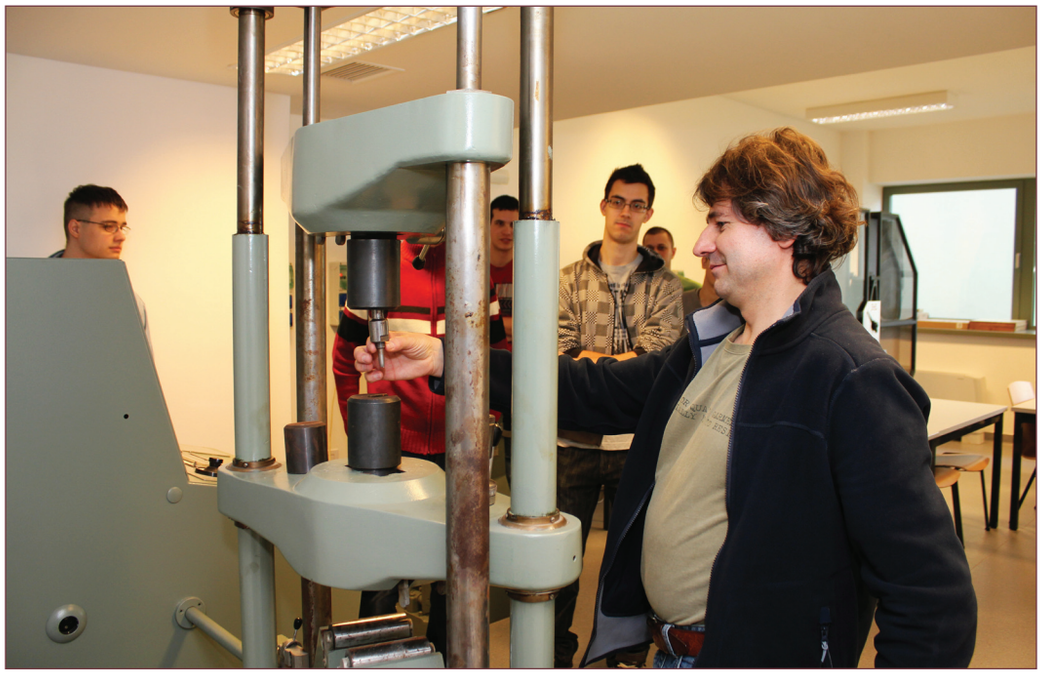
Mechanical Lab

Purpose of the laboratory

The laboratory is based on common testing methods of raw materials, technological materials and structures like welded joints. The devices in the lab follow the order of an ordinary material testing method. There are several devices for test sample preparation (cutting, grinding). Comprehensive analysis of materials is rendered possible by the tensile test machine and the Charpy impact testers.

Competence of the laboratory

Transferring the basic knowledge of lectures of material testing, technology of structural materials, fracture mechanics courses, representing the testing processes by specialized test machines. Our lab is a scientific and technical background for PhD students providing the facilities to carry out experimental tests for research and scientific activities.



Equipment in the laboratory

- Tensile test machine (with computer managed closed loop data storage & handling)
- Charpy impact tester machines (computer controlled from 0 to 450J impac5t range)
- Hardness tester (computer managed)
- Furnace up to 1300°C (computer managed heating & cooling curve)
- Personal protection & safety equipment

MPS Manufacturing Line Laboratory

Purpose of the laboratory

- Teaching and research of industrial discrete processes,
- study and research of the control of closed and opened systems.

Competence of the laboratory

Teaching of pneumatics on the basis of the program developed by FESTO Didactic Ltd. in the field of pneumatics, electro-pneumatics, hydraulics, electro-hydraulics, PLC technique, driving technique, mechatronics and sensor technique. The laboratory carries out research on the basis of contracts signed with FESTO Didactic Ltd.

Our partners

- The laboratory is sponsored by FESTO Didactic Ltd.

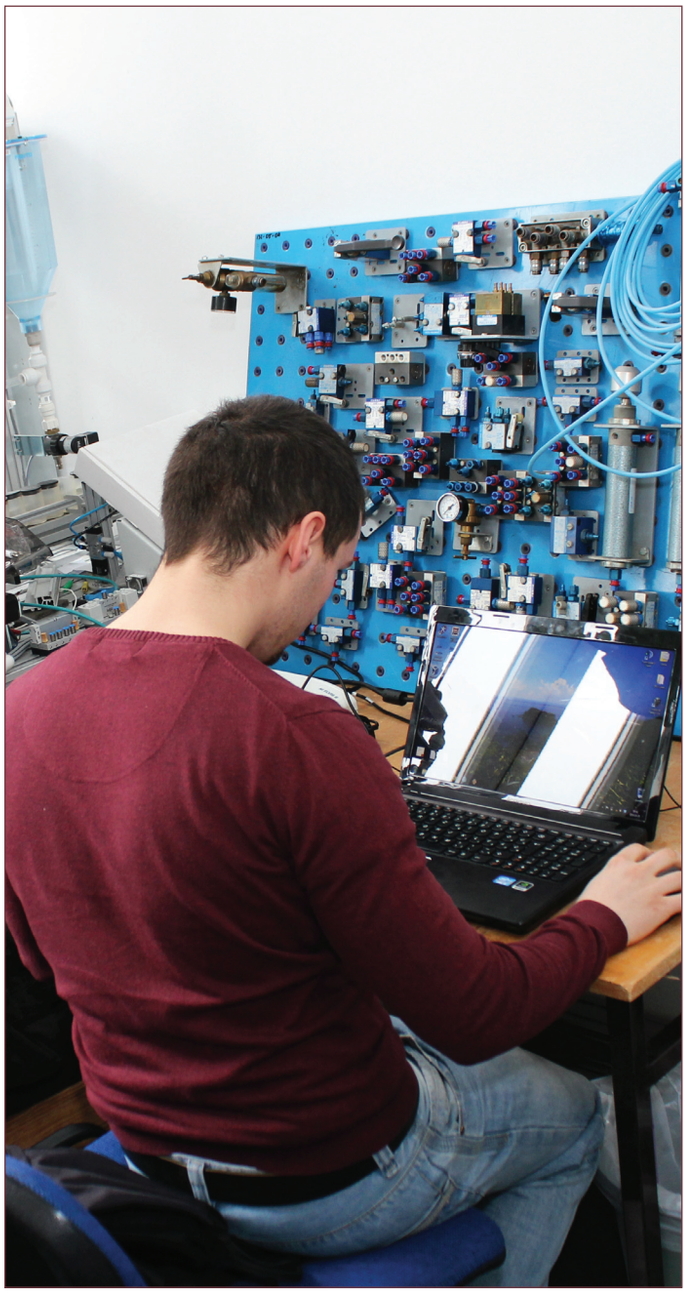
Equipment in the laboratory

- a 5-cation manufacturing line built by FESTO Didactic Ltd.
- software programming of the production schedule, examination of the advance and automated quality monitoring between actions of the manufacturing

MPS PA laboratory

Purpose of the laboratory

- Presentation and research processes based on the flow of industrial liquids,
- study and research of the control of closed and open systems,
- FESTO Didactic's Learning System for process automation and technology is orientated towards different training and educational requirements.



Competence of the laboratory

Teaching of pneumatics on the basis of didactic programs by FESTO Ltd. in the fields of pneumatics, electro-pneumatics, hydraulics, electro-hydraulics, PLC technique, driving technique, mechatronics and sensor technique. The systems and stations of the modular Production System for Process Automation (MPS® PA) facilitate vocational and further training in line with industrial practice. The actual project phases can be taught in training projects which include: planning, assembly, programming, commissioning, operation, optimisation of control parameters, maintenance and fault finding.

Our partners

- The laboratory was established within the framework of the project TÁMOP-4.1.1/A-10/1-KONV-2010-0016 and supported by FESTO Ltd Didactic.

Equipment in the laboratory

- instrumentation for measuring and evaluation of quality and technological data of filtering, mixing, reactor, charging (bottling), thermo and hydrodynamic measurements, control with opened and closed cycle,
- filtration, mixing, reactor station and bottling station.

NDT (Metallographic) Lab

Purpose of the laboratory

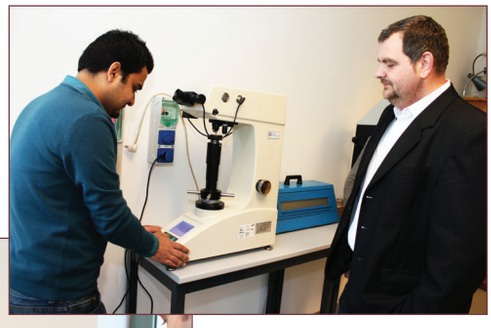
The laboratory is based on NDT testing of raw materials, technological materials and structures like welded joints. The devices in the lab follow the order of an ordinary material testing method. There are several devices for test sample preparation (cutting, grinding, polishing and chemical conservation). Metallographic analysis of the prepared sample is rendered possible by a microscope. Besides, there are several NDT (metallographic) inspection equipment to create a comprehensive analysis of the material.

Competence of the laboratory

The lab supports the education of basic lectures like material science, technology of structural materials, manufacturing technologies I-III. and student's measuring for scientific contests. With the up-to-date equipment and measuring techniques we are able to do different testing and structural analysis of special technological materials as research and scientific activities. Our lab is also a scientific and technical background for PhD students.

Equipment in the laboratory

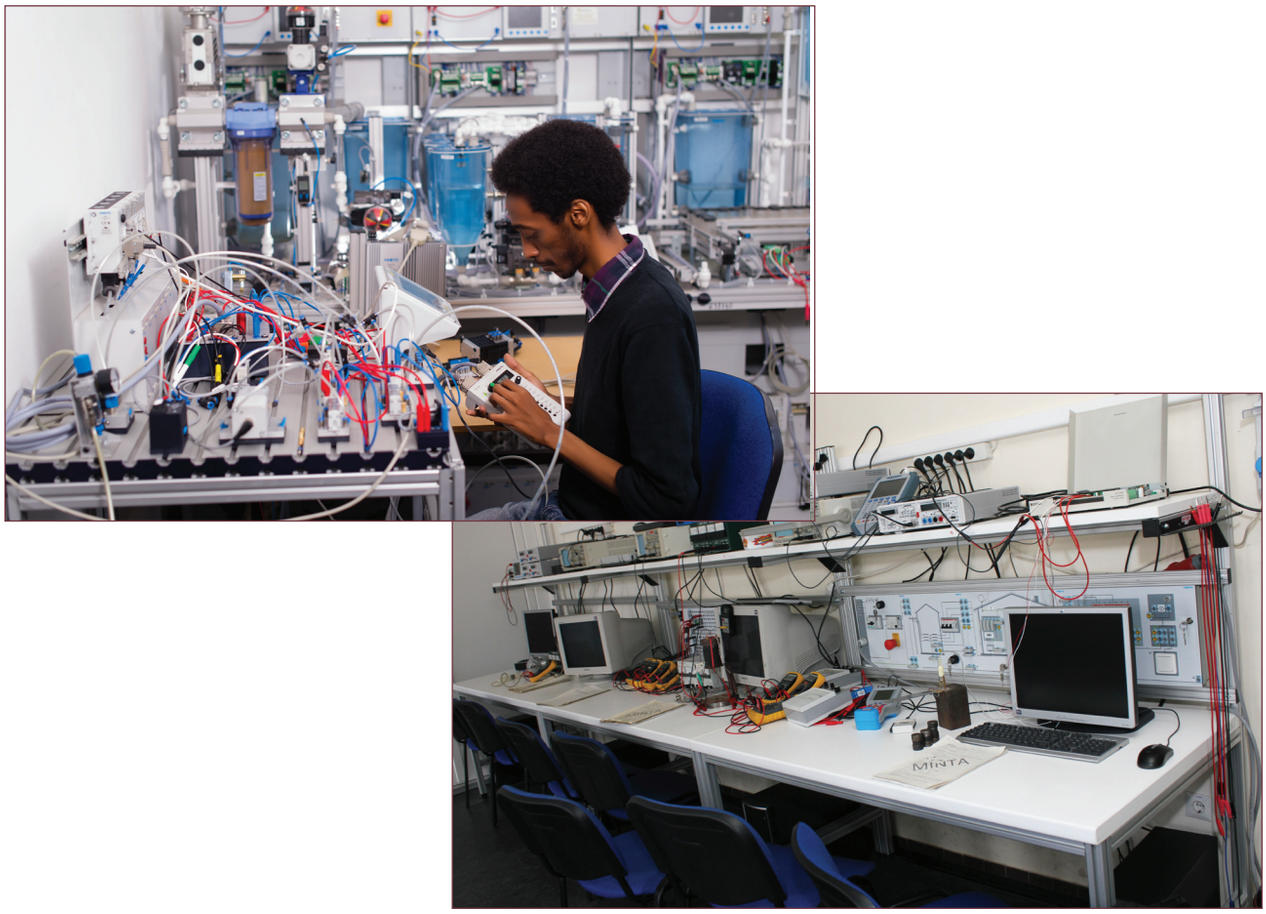
- Cutting, grinding and polishing machines to create samples
- Hardness testers (computer managed HB, HRC, HV)
- Ultrasonic wall thickness measurement equipment
- Ultrasonic hardness tester
- Microscopes (Neophot with CCD & Olympus with CCD up to M=250x digital imaging)
- Image analysis software
- Furnace up to 1300°C (computer managed heating & cooling curve)
- Qualified measuring tools (callipers, gauges, micrometers)



NI ELVIS Laboratory

Purpose of the laboratory

The aim is to provide practical courses in basic electrotechnics and electronics, and to grant specialized knowledge and experience to mechatronics students in special areas like data acquisition, Labview programming and research on the system of NI ELVIS (Teaching Laboratory Virtual Instrumentation Suite).



Competence of the laboratory

Based on NI LabVIEW graphical system design software, NI ELVIS, with USB plug-and-play capabilities, offers the flexibility of virtual instrumentation and allows for quick and easy measurement acquisition and display in the field of control, telecommunication, fiber optics, embedded design, bioinstrumentation, digital electronics, and field-programmable gate arrays (FPGAs). Besides our teaching duties, these NI tools enable us to conduct research and software development in different fields of sciences.

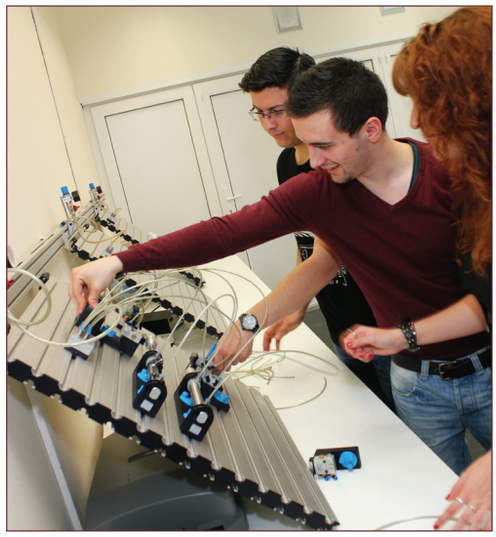
Our partners

- The laboratory is maintained by National Instruments Hungary Ltd and financed by the project HURO-0901/028/ 2.3.1. ”E-Laboratory Practical Teaching for Applied Engineering Sciences”.

Equipment in the laboratory

The NI Educational Laboratory Virtual Instrumentation Suite (NI ELVIS) features an integrated suite of 12 of the most commonly used instruments in the lab (including the oscilloscope, digital multimeter, function generator, variable power supply, and Bode analyser) in a compact form factor for the lab or classroom demonstrations.

Pneumatics laboratory



Purpose of the laboratory

Presentation of the most modern pneumatic systems used in industry and research in the field of pneumatics.

Competence of the laboratory

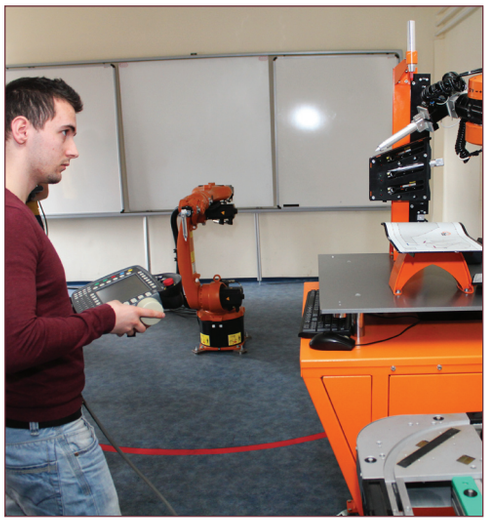
Teaching of pneumatics on the basis of didactic programs of FESTO Ltd in the field of pneumatics, electro-pneumatics, hydraulics, electro-hydraulics, PLC technique, driving technique, mechatronics and sensor technique.

Our partners

- The laboratory is sponsored by FESTO Didactic Ltd.

Equipment in the laboratory

- FESTO teaching package (PLC, VEEP emulator, wires, tools, specifications…).,
- two-side pneumatic stand system: pneumatic power-supply unit, hose storage,
- basic and electro-pneumatics, proportional pneumatic stock.



Robotics Laboratory

Purpose of the laboratory

Teaching of robotics and research processes concerning the robotizing of industrial processes. Presentation of CIM systems and research of the possibilities of integration

Competence of the laboratory

- Use and programming of recycle bin robots, carrying out of examination concerning the operation of robots,
- examination of human-machine communication on intelligent grounds, where robots and humans are present at the same time and perhaps co-operate with each other in space.

Our partners

- The laboratory is supported by KUKA Robotics Hungary Ltd,
- Robot-X Hungary Ltd,
- Flexlink Systems Ltd.

Equipment in the laboratory

- 3-axe TTT Q-robot multitasking robot, a KR5arc KUKA industrial robot, a KR5Sxx KUKA teaching robot and a SONY SCARA SRX-611 robot connected with a delivery track incorporated into a manufacturing cell,
- 8 pcs LEGO MINDSTORM robot and a sample manufacturing line consisting of 16 Fischertechnik elements developed by the university as well as a FESTO Robotino robot,
- KUKA.Sim Pro software developed for programming offline KUKA robots and their simulation.

Roller Power Test Bench and Diagnostics Lab for Passenger Cars

Purpose of the laboratory

The roller power test bench is appropriate for measuring and diagnosing the vehicle performance and its condition. The installed test bench makes wild range power measurements possible in different speed range in a safe environment.

Students can carry out a series of measurements in the laboratory about internal combustion engine performance, exhaust gas analysis and on-board diagnostic (OBD) systems. These measurements may support the degree theses of students.

Competence of the laboratory

The installed measuring equipment of Vehicle Engine Performance Measurement and Diagnostic Laboratory have official calibration and authentication, therefore performance measurements, exhaust gas analyses, emission measurement and diagnostic tests carried out in this laboratory are all certified.

Our partners

- Energotest Ltd

Equipment in the laboratory

- Rolling road dynamometer (TMP-350) with CAN bus based measurement data logger unit. The equipment is suitable for performance measurement of two-wheel-drive passenger cars and light duty vans up to 350 kW. Our lab is able to provide scientific and technical background for PhD students.
- Exhaust gas analyser instrument (AVL DiGas 480) which is capable of measuring the composition of exhaust gas. The measuring system is also equipped with Diagnostic Trouble Codes scanner, diagnostic software and an Autodata emission database.
- The laboratory is equipped with more wind generators and exhaust gas extractors.

Schneider Electric Knowledge Center

Purpose of the laboratory

The knowledge center established by Schneider Electric Ltd offers complete solutions in the field of energy management, electric energy distribution, control engineering and automation of processes of industry, building automation and security, energy supply and cooling as well as installation and the control of installation systems. The knowledge center is instrumented for the presentation of these systems as well as for carrying out research of building supervision systems.

Competence of the laboratory

The laboratory is suitable for the following activities:

- Teaching of industrial controls by means of small and medium PCs and realization of real industrial processes on twido demonstration tables built with PLCs of type M340.
- Regulation of driving technical models by programming frequency changers (ATV11, ATV31 and ATV71).
- Complex engineering duties by connecting operating models into the network.

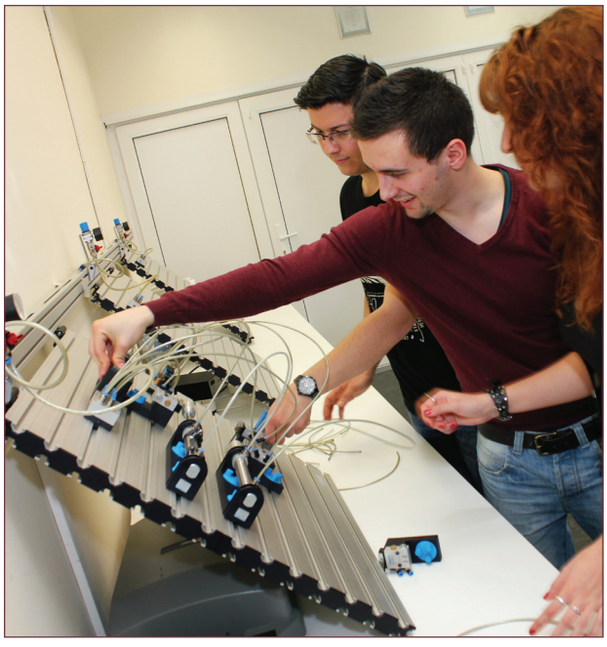
Our partners

- Schneider Electric Hungary Ltd

Equipment in the laboratory

- TAC system for realizing a complete building supervision A (TAC 302, 422, 731, 100, 452, 511 OPC panel) and terrain tools,
- let-in/let-out and camera system controlled by an Andover system,
- the laboratory is officially informed about any development carried out by Schneider Electric and given a sample of its products.

Pneumatic laboratory



Purpose of the laboratory

Presentation of most modern pneumatic systems used in industry and researches in the field of pneumatics.

Competence of the laboratory

Teaching of pneumatics on the basis of didactic programs of FESTO Ltd in the field of pneumatics, electro-pneumatics, hydraulics, electro-hydraulics, PLC technique, driving technique, mechatronics and sensor technique.

Our partners

- The laboratory is sponsored by FESTO Ltd Didactic.

Equipment in the laboratory

- FESTO teaching package (PLC, VEEP emulator, wires, tools, specifications…).
- two-side pneumatic stand system: pneumatic power-supply unit, hose storage
- basic and electro-pneumatics, proportional pneumatic stock

Water Quality Protection Laboratory

Purpose of the laboratory

The laboratory has all basic tools applied in environmental engineering to ensure a strong practical analytic background for field and laboratory measurements. Several research topics are also connected to the equipment of the laboratory (such as investigation of rain water or greywater reuse in households; thermal water final placement and the environmental effect of thermal water utilization; surface water analysis and environmental status assessment of watercourses surrounding Debrecen).

Competence of the laboratory

Environmental engineers get a good experience and knowledge on the prevention of environmental hazards, the abolition of environmental problems, the utilization of natural resources, cleaner technologies, analytical and monitoring methods. The lab is equipped with modern and efficient instrumental analytical devices to get reliable and fast results for water or sludge samples.

Our partners

- TIKTVF (Green Authority), Debrecen Waterworks Ltd., Hajdú-Bihar County Municipalities Water Works Co., Ltd. Analab Ltd., Scharlab Hungary Ltd., NNK Environmental Management, Information Technology, Sales and Service Ltd.

Equipment in the laboratory

Classical and instrumental analytical techniques for investigation of different water or sludge samples:

- DIONEX ICS 3000 ion chromatographic system,
- Shimadzu Vcpn TOC instrument,
- Zetasizer Nano Z zeta potential analyser,
- WTW MultilineP4 electro-analytical set,
- BOD OXITOP IS 12 measurement, Thermostat cabinet,
- Nanocolor Linus spectrophotometer with thermoblock,
- TURB-555 IR Turbidimeter,
- Millipore Milli-Q Integral 3 water purification unit,
- Classical analytical methods (gravimetry and titrimetry).

Welding Lab

Purpose of the laboratory

Instruction, presentation and practice of advanced welding procedures used in industry all over the world, to ensure the proper technological environment for the construction of racing cars driven by compressed air or electric motors for student's competitions.

Competence of the laboratory

The lab introduces basic welding processes on welding joints of test specimens. The lab supports the Materials Sciences and Manufacturing Engineering courses.
The laboratory is equipped with eight welding dry boxes for electric arc-welding and one for gas-welding and metal cutting.

Students learn and practise four different welding procedures:

- Manual metal arc welding (MMA)
- MIG-MAG gas-shielded arc welding (MIG -MAG)
- Wolfram electrode welding with argon shielding gas (GTAW -TIG, WIG)
- Gas welding, flame cutting and plasma cutting.

Equipment in the laboratory

- MILLER Powcon-300 type welding machines for MMA welding,
- MILLER Synchrowave-250 type welding machines for TIG welding,
- MILLER MIGBLU-300 type welding machines for gas-shielded metal-arc welding,
- WELDI TIG-200i DC type welding machines for TIG and MMA welding,
- WELDI AMIGO-250, WELDI MIG-320 Plus, WELDI MIG-420 type welding machines for gas-shielded metal-arc welding.

ZF Lenksysteme Hungária Automotive Lab

Purpose of the laboratory

The ZF Lenksysteme Hungária Automotive Laboratory was established by ZF Lenksysteme Hungária Ltd. in 2014. The Laboratory is suitable for performing activities like electric vehicle construction and assembly for student competitions and for company related projects. Thanks to its modern equipment and top class steering systems, the lab ensures the appropriate background for related research.

Competence of the laboratory

The Laboratory is suitable for implementing modern engineering projects. The laboratory is equipped with the products of ZF Lenksysteme Hungária Ltd., mountable steering systems and steering columns. Students have the opportunity to investigate real steering systems in the lab, which is also a scientific and technical background for PhD students.

Our partners

- ZF Lenksysteme Hungária Ltd

Equipment in the laboratory

- Turning lathe (OPTI TU 2807 – D280x700mm, 125-1200 f/p, 850W/400V),
- Welding machine (AC/DC AWI),
- Drillers, Cutters,
- Hand tools,
- Tool trolleys,
- Measuring instruments.

Debreceni Egyetem MK
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