UNIVERSITY OF EAST SARAJEVO

Scientific and research potentials
of the University of East Sarajevo

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RECTOR'S ADDRESS

Dear students, teachers, associates, partners,

This publication, entitled „Scientific-research potentials of the University of East Sarajevo", is intended to introduce you to the laboratories and technical capabilities of the University of East Sarajevo.

The development of society is unthinkable without the development of science and art, that is, scientific research. Public universities in Republic of Srpska play a very important role in this development. A modern university, ready to adapt to changes and meet the demands of the community, is the driver of all social development. The University of East Sarajevo, with the vision of a developed, modern, successful and internationally distinguished and respected University, constantly works on raising the quality of scientific research and artistic work.

The involvement in the European research and education area, as well as the connection and cooperation with the real sector are challenges faced by a strong community of professors, students and all employees at the University of East Sarajevo every day.

Part of the teaching and research process takes place in laboratories equipped with high-tech modern equipment that serves for the realization of scientific and research tasks. In addition to improving the knowledge and skills of university students and teachers, this equipment can significantly contribute to a better integration of universities in the field of research. It also contributes to the greater opportunities for inclusion in international research projects and the development of cooperation with the real sector.

Contemporary equipped laboratories, as well as teaching staff at the University of East Sarajevo, whose educational structure and work experience provide a high level of knowledge, are an exceptional opportunity for our students, of all three study cycles, to master the modern methods and techniques necessary to become responsible professionals and leaders in the performance and work after graduation.

Sincerely,

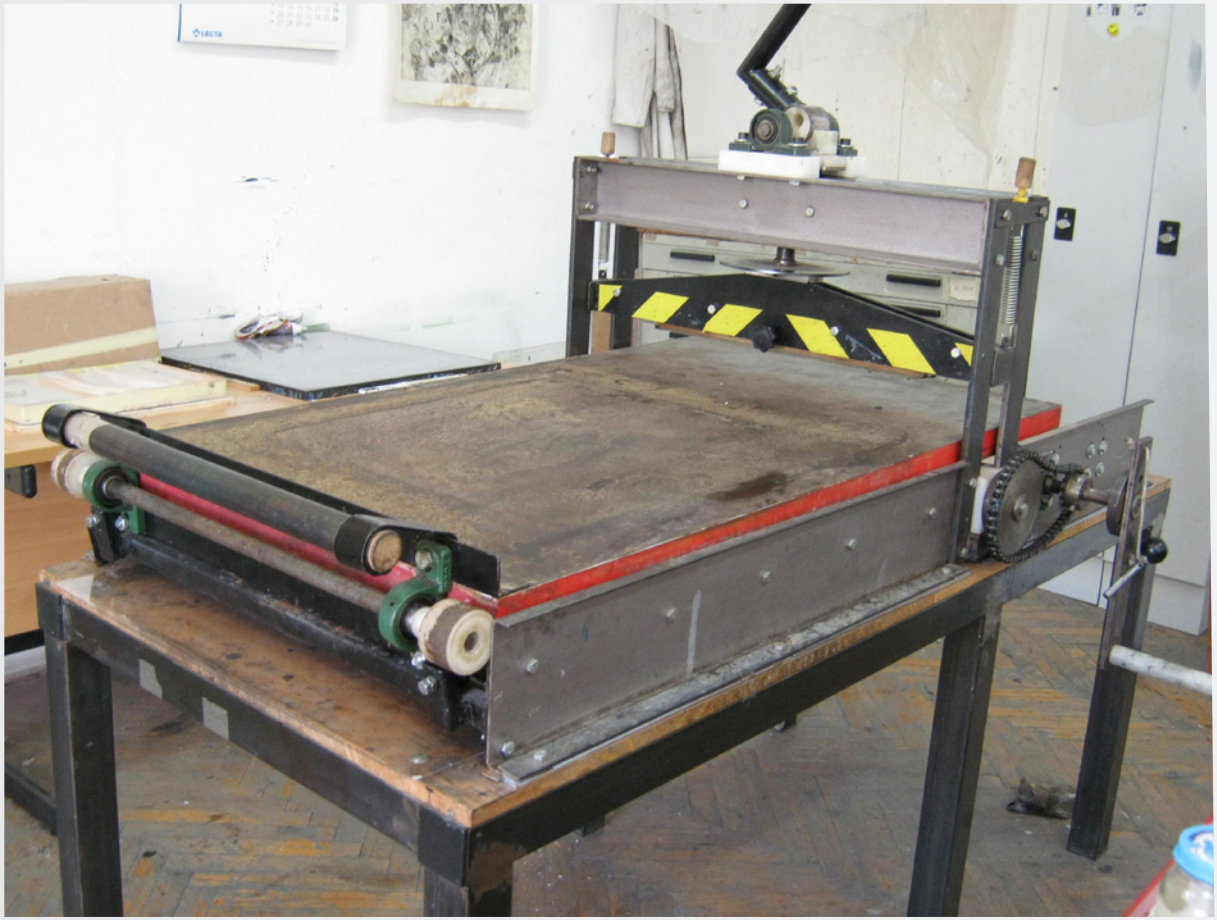
Rector

Prof. Dr. Stevo Pasalic

ACADEMY OF FINE ARTS – DEPARTMENT OF GRAPHICS

Lithographic press

Printing of lithographs



Lithographic press

DEPARTMENT OF SCULPTURE – ACADEMY OF FINE ARTS

„Fronius“ *Plasma Cutting machine*

Creation of sculptures in metal and processing of metal materials.

Plasma Cutter aspirator

Creation of sculptures in metal and processing of metal materials.

„Fronius“ Plasma Cutting machine

Plasma Cutter aspirator

„Hofman Kiln B300 “ – High Temperature Furnace

Baking sculptures from clay. The furnace reaches a temperature of 1200°C. In 8-12 hours of baking, the clay becomes ceramic.

„Hofman Kiln B300 “

„Hofman HT1500.72“ – (Electric kiln)

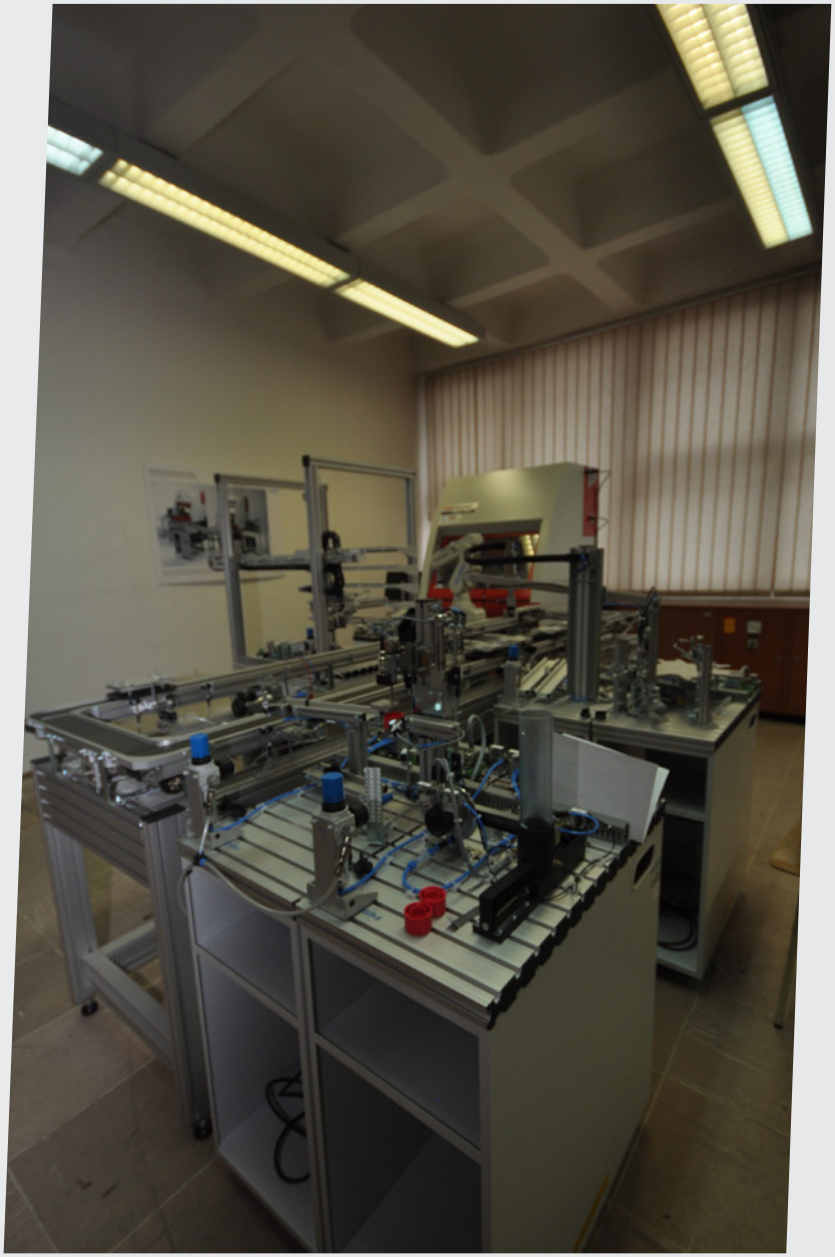
Baking and drying of terracotta.

„Hofman HT1500.72“ – (Electric kiln)

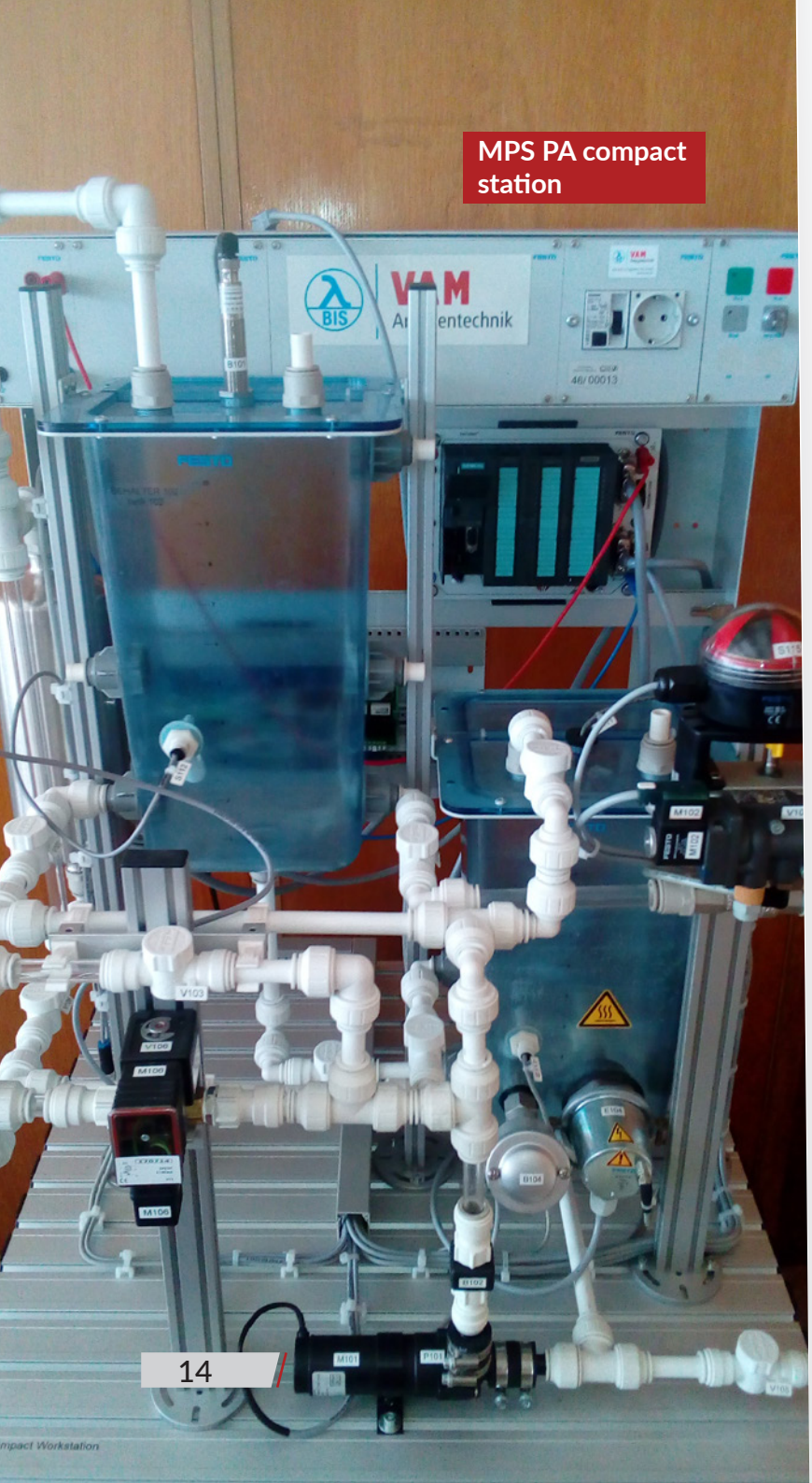
FACULTY OF ELECTRICAL ENGINEERING – AUTOMATION LABORATORY

Workstations of the company FESTO

Workstations are connected by a production line. The control is realized through programmable logic controllers, Siemens S7-300. The cells communicate with each other over a conveyor belt, making one whole that performs certain tasks. Within the laboratory there is a Mitsubishi robotic manipulator that communicates with the EMCO Concept Mill 105 machine.



Workstations FESTO



MPS PA compact station

> *It serves for measurement and control of fluids in open and closed-loop in the minimum installed space. Valve management is via Siemens S7-300 programmable logic controllers. Within the station there is a heater which also allows temperature control).*

The laboratory can be used to maintain courses in process automation in the industry for training personnel for machine operation.

LABORATORY FOR ELECTRICAL MACHINES – FACULTY OF ELECTRICAL ENGINEERING

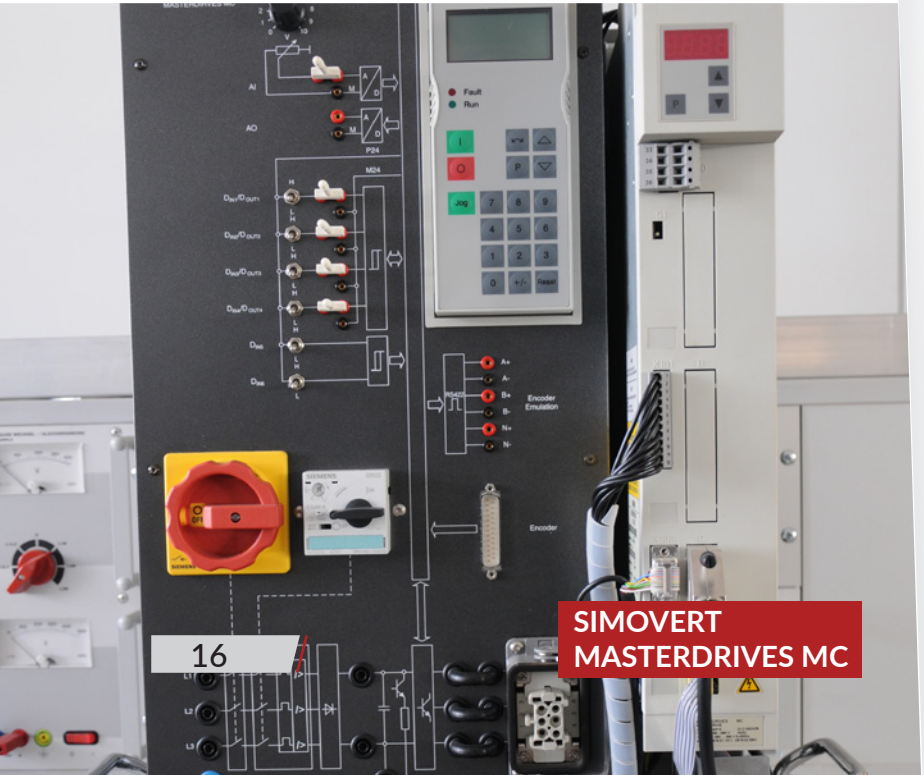
The Laboratory has the following modules for controlling asynchronous, synchronous and one-way motors:

SIMOREG 6RA70

> *One-way motors control -Distant inputs 3x400V, 13A, 50 / 60Hz, Output: DC voltage 420V, Conducted as a three-phase thyristor bridge with input overcurrent protection.*

SINAMICS S120 Frequency inverter

> *High-performance servo drive for managing synchronous motors with permanent magnets. Control mode is possible with a panel or computer. Characteristics: 3AC 380-480V 4.8A 50/60Hz.*



Micromaster 440

> *Frequency controller for general purpose in asynchronous motors. It is made as a three-phase inverter bridge with IGBT transistors. Characteristics: 3AC 380-480V 50/60Hz.*

SIMOVERT MASTERDRIVES MC

> *High performance servo drive designed to operate an asynchronous motor. Possible parametrization and startup by panel or by computer. Characteristics: Vin = 380-480V, Vout = 380-480V, Iout = 5A, 0-400Hz.*

The laboratory is used in the teaching for laboratory practical work, and can be used for training and work on frequency regulators.

LABORATORY FOR EMBEDDED SYSTEMS – FACULTY OF ELECTRICAL ENGINEERING

The laboratory consists of LPKF equipment for the production of prototype printed circuit boards:

ProtoMat S63

> *Milling machine to produce printed circuit boards with vacuum table and additional materials*

ProtoFlow

> *Soldering oven for curing of paints and similar processes in the process of making printed boards*

ProtoPlace

> *Semi-automatic machine for installing components on printed circuit boards with associated parts*

Field of application: creation of prototype printed circuit boards, it is not in serial production because it is consumable material.

ProtoMat S63

ProtoFlow

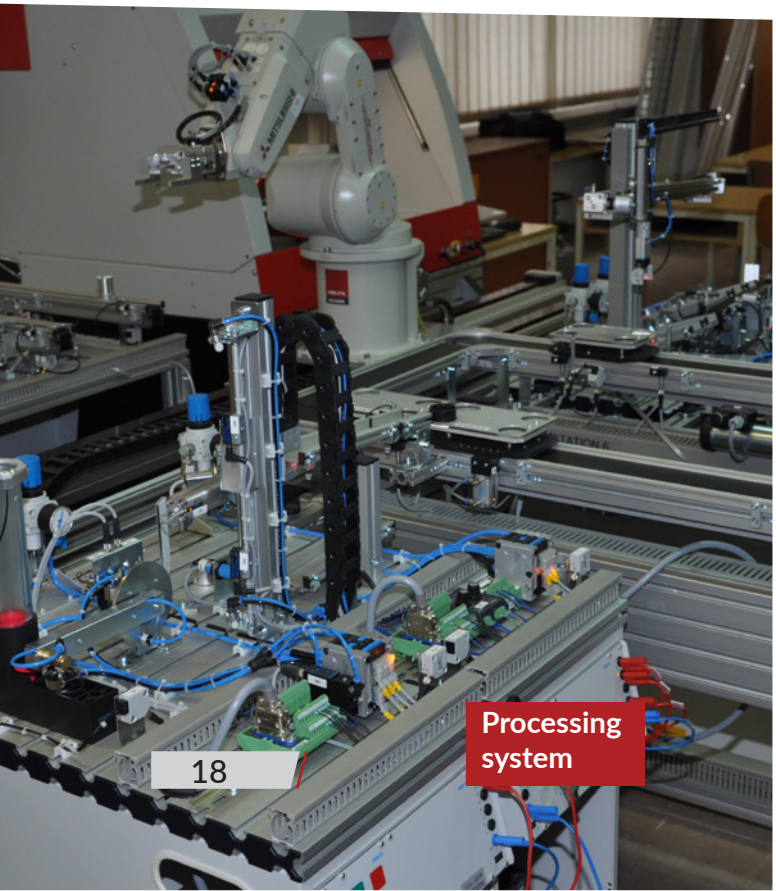

ProtoPlace

MECHATRONICS LABORATORY – FACULTY OF ELECTRICAL ENGINEERING

Processing system

Consists of two CNC machines: Turn 105 and Mill 105 with belonging robot Mitsubishi RV 3SDDB. The control of the specified system is performed by the robot controller, while the programming of the tasks is performed using the WinCC SCADA system.

Assembly system for pneumatic cylinders

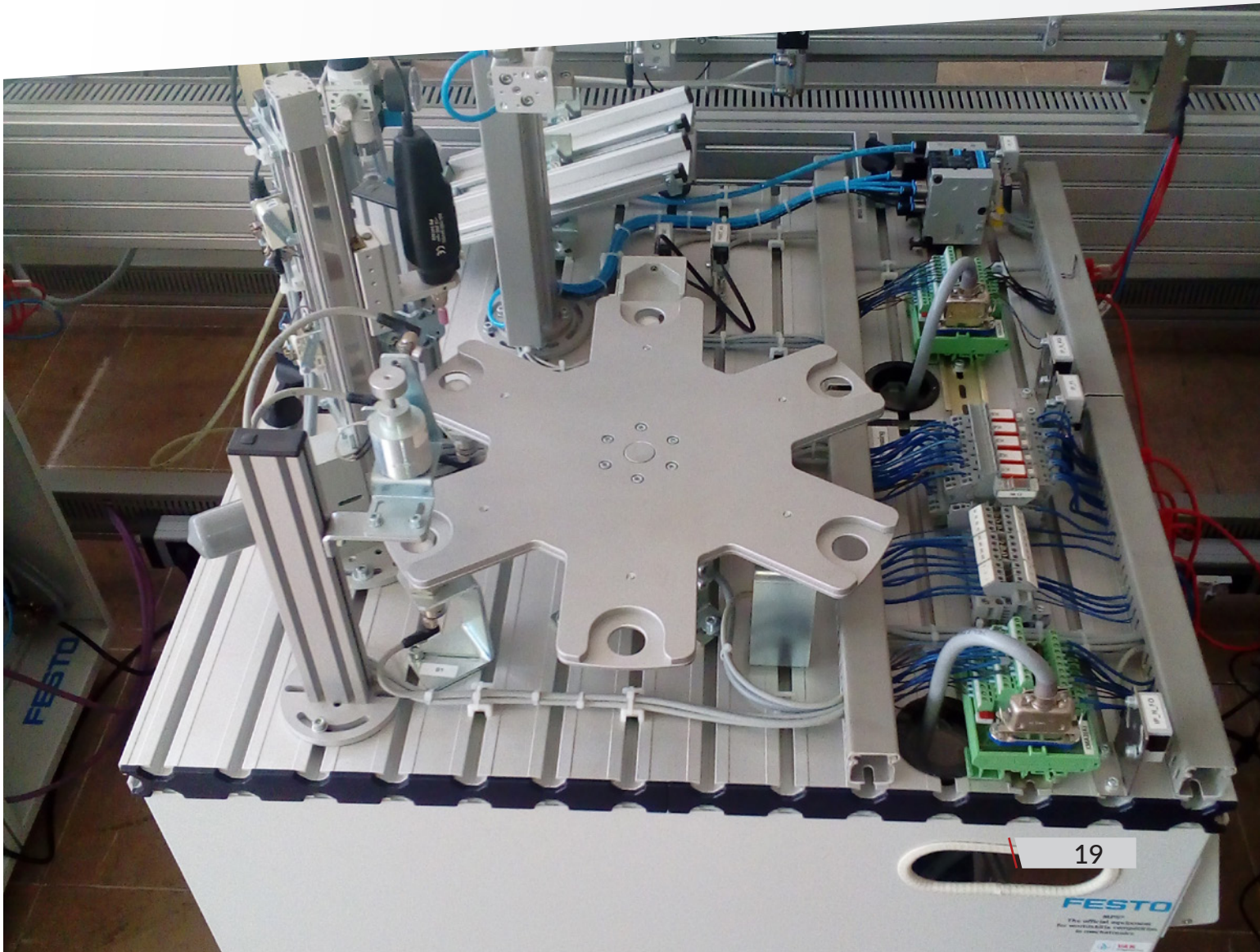


Processing system

Assembly system for pneumatic cylinders

The assembling system is equipped with workstations that are connected to the production line. The cells are operated using programmable logic controllers.

The laboratory can be used for the courses in automation of processes in the industry, as well as for training of personnel for work on machines.



LABORATORY FOR PROGRAMMABLE LOGIC CONTROLLERS – FACULTY OF ELECTRICAL ENGINEERING

Laboratory is equipped with PLK controllers S7-200, S7-300, WUEKRO and the corresponding models:

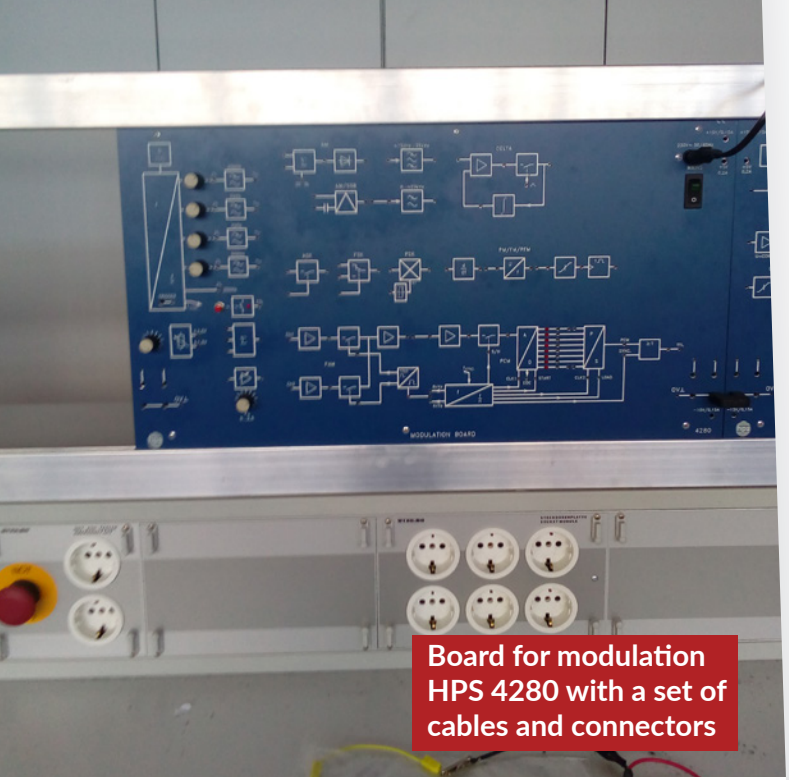
S7-200

> *Technical characteristics: compact design, RS-485 communication, CPU (32 bit, timers, counters) excellent for applications in real-time applications, memory card for data storage, analog and digital input and output modules.*

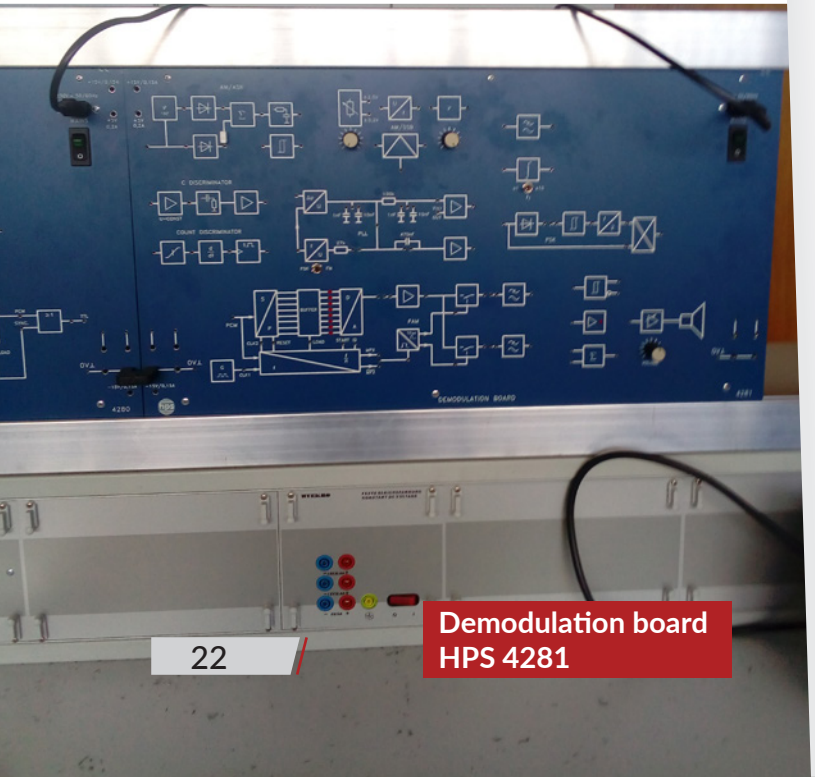
S7-300

Modular PLK system with “user friendly” solutions. It is applied in process automation, energy, textile industry, building management. Technical characteristics: it consists of the CPU central processing unit, signal modules for digital and analog inputs and outputs. The power supply is 230V AC, 24V DC.

The laboratory can be used to maintain courses from programmable logic controllers for training and working on them.



Board for modulation HPS 4280 with a set of cables and connectors



Demodulation board HPS 4281

LABORATORY FOR TELECOMMUNICATIONS – FACULTY OF ELECTRICAL ENGINEERING

Laboratory consists of models where laboratory exercises can be performed:

Board for modulation HPS 4280 with a set of cables and connectors

> *Modulation methods that can be performed on this board: amplitude modulations, frequency modulation, phase modulation, pulse amplitude modulation, pulse code modulation, delta modulation. Power supply 230V, 50Hz, Output DC voltage ±15V,+5V*

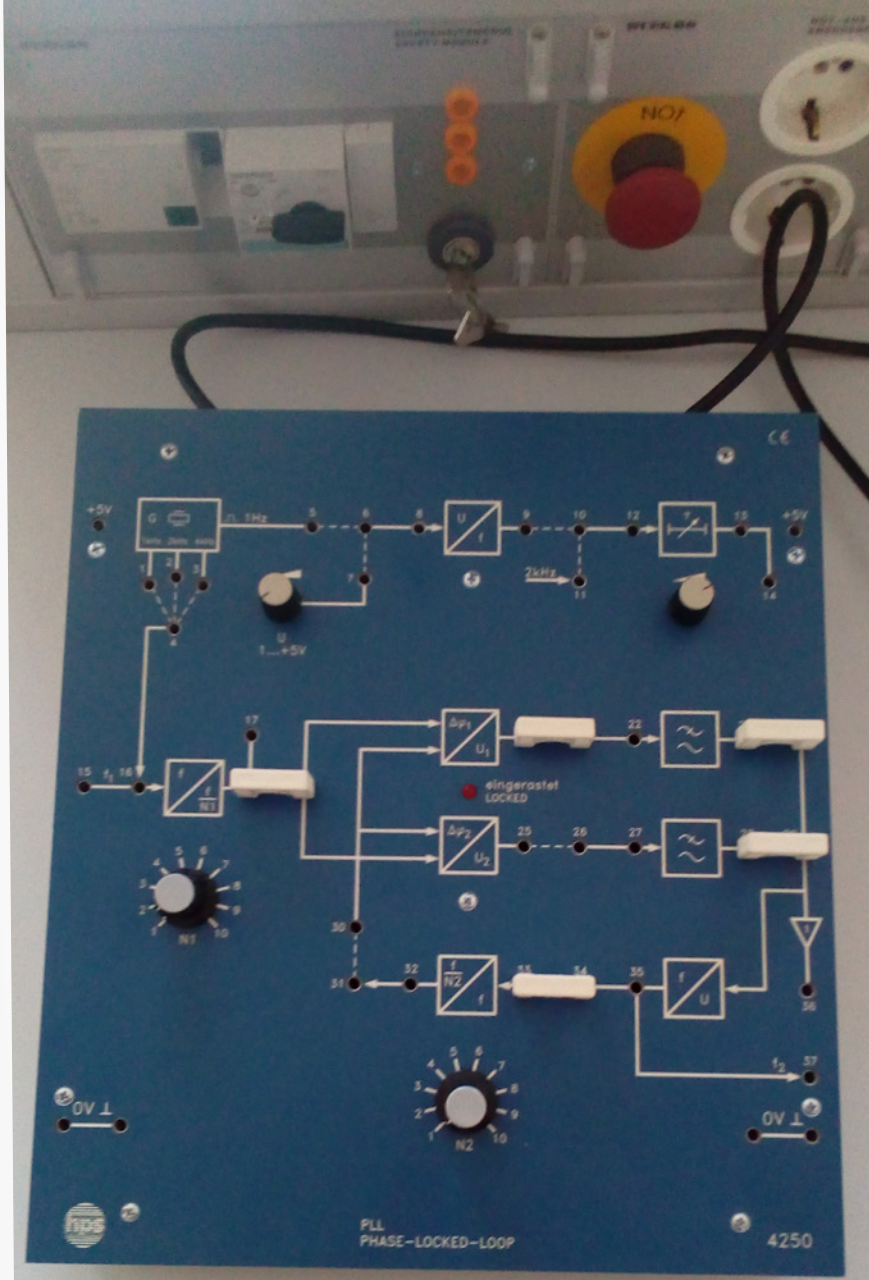
Demodulation board HPS 4281

> *It is used for the following demodulation techniques: amplitude demodulation,*

phase demodulation with PLL, impulse amplitude demodulation, pulse code demodulation. Power supply 230V, 50Hz, output DC voltage ±15V,+5V

Board for phase locked loops PLL HPS 4250

Characteristics: square voltage source, DC voltage source, amplifiers, voltage controlled oscillator, low pass filter, phase shifter, frequency divider. It is used for modulation and demodulation, phase shifting, frequency generator.



Board for phase locked loops PLL HPS 4250

Digitial TV training system ET-893 Promax, TECHNIMAGEN

Satellite antenna training system WUEKRO

Digitial TV training system ET-893 Promax, TECHNIMAGEN

> *It is used for learning TV technology with TFT-LCD and plasma technology. The model is also used to receive the earth signal. The module also has a training center for initiating errors and removing them.*

Satellite antenna training system WUEKRO

> *The receiving satellite antenna receiver is a demonstration model that is used for the following: reception with 2 satellites, TV signal processing, external signal from the camera, central antenna and multiple reception, decoding terminal.*

ISDN and network training system WUEKRO with an optional patch part

Communication ISDN server for telephone calls as well as for receiving fax and data transmission and Internet access. The training unit can also be used without an ISDN connection to public telephone systems (isolated work).

The laboratory can be used for training courses and work in the field of telecommunications.

ISDN and network training system WUEKRO with an optional patch part

FACULTY OF PRODUCTION AND MANAGEMENT – CNC LABORATORY

EMCO Concept Turn 250 (PC-controlled 2-axis CNC- turning machine for chuck- and bar-machining)

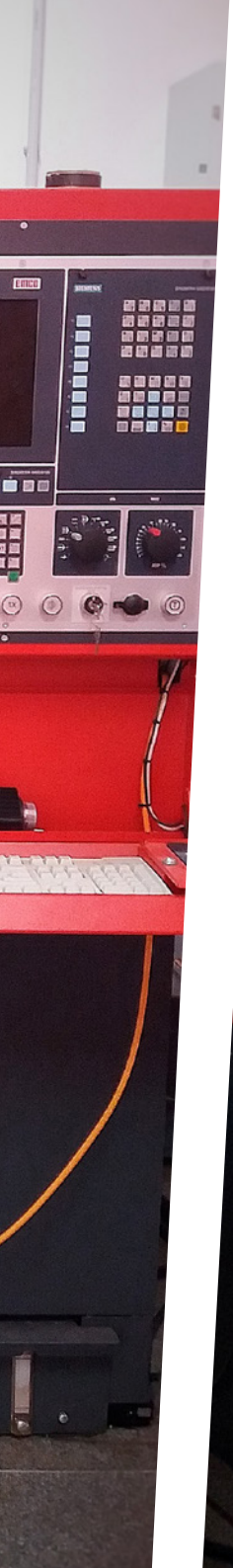
Production of elements from non-ferrous metals and their alloys, plastics, LG and thermally unprocessed parts made of steel.

EMCO Concept Mill 250

Designed to work with elements of non-ferrous metals, plastic and small steel elements.

EMCO CONCEPT TURN 250

CNC lathes with two-way revolver carrier for processing the maximum diameter Φ250 mm and length up to 350mm



EMCO CONCEPT MILL 250

CNC milling machine for working with dimension elements max 350/250/300mm.

ZScanner 700

HELIX 8000 24x12

LABORATORY FOR CONTEMPORARY PRODUCTION – FACULTY OF PRODUCTION AND MANAGEMENT

3D mobile scanner *ZScanner 700*

with laptop HP Elitebook 8560p. The maximum precision of the scan is 0,2mm.

By using the device, it is possible to create a computer model according to the actual object, it is possible to scan objects of different sizes (from a few centimeters to, for example, the size of a car). Large-scale scanning is complex and computer-intensive. The scanned model can be software-modified (change dimensions and shape) and print it using a 3D printer with precision, which is satisfactory in the process of prototype and reverse engineering.

Laser cutter *HELIX 8000 24x12*

with the computer DELL Optiplex 790 and monitor DELL E1705C

Engraving is possible on all materials of flat and cylindrical surfaces up to a maximum of 60 h 40 cm. Cutting is limited to softer materials (wood up to 3mm, acrylate up to 8mm, cardboard, etc.) - laser tube power.

3D printer *Z Printer 450*

with computer HP Compaq 8200 Elite CMT PC and HP 2211x 21.5/In LED LCD monitor.

Proto-prototype is possible according to the computer 3D model of maximum dimensions 20x20x30cm. The material is a cured powder which by infiltration with the cyanoacrylate hardener gets the strength enough to be further processed on the CNC machine. Possible production of prototype products in color.

Engraving and cutting various materials (wood, acrylic panels, aluminum, brass, stone, glass, etc.).

Z Printer 450

CNC CLASSROOM – FACULTY OF PRODUCTION AND MANAGEMENT

CNC classroom

Eight external program stations (SIEMENS) for sixteen students. Each station is connected to a computer HP Compaq 8200 Elite CMT PC with Microsoft Office 2010 - Standard (021-09685), HP 2211x21.5 / In LED LCD monitor and corresponding software for CNC classroom.

For the courses in the field of programming and management of machine tools with numerical control.

CNC classroom

ZEISS Contura G2

3D measuring machine *ZEISS Contura G2*

with integrated computer HP Z400 Workstation 32764 Bit G4 and HP ZR2240W monitor.

Spatial measurement of geometric shapes in the measuring area 700/700/600mm and measurement accuracy is (1,8 + L/300) µm.

3D measurements of geometric lengths and angles, deviations from shape and position.

MEASURING LABORATORY – FACULTY OF PRODUCTION AND MANAGEMENT

Profile-projector *Mitutoyo PJ-A3000*

Screen diameter 315 mm, table movement 180/150mm. Measurement area is 300/240mm, height 105mm. Enlargement of the projector is 10x; angle resolution is 0.01 °, and the X / Y displacement resolution is 0.001 mm.

It is used to examine the shape and dimensions of complicated curves and profiles.

Mitutoyo PJ-A3000

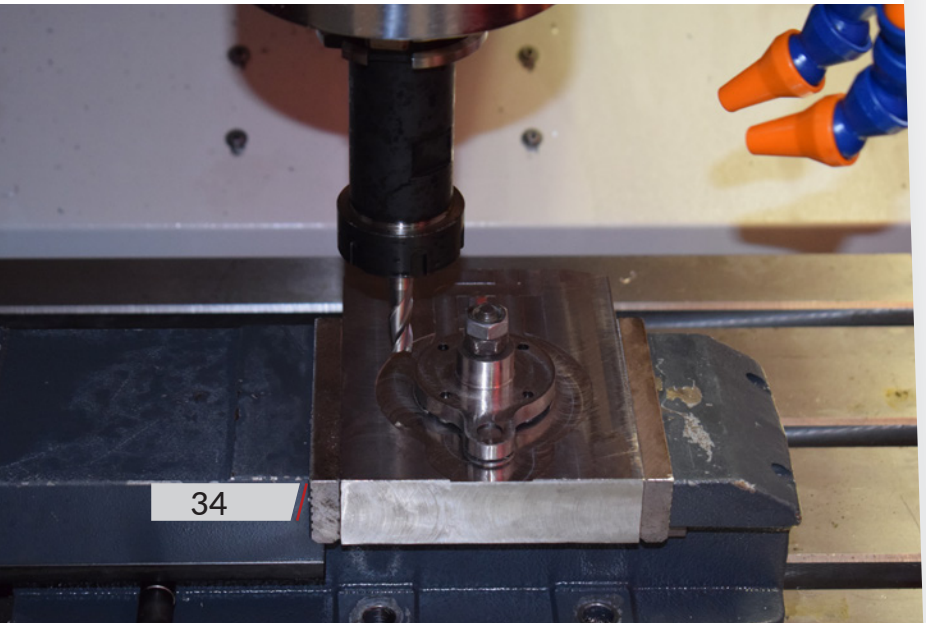
Mitutoyo LH-600

Digital altimeter *Mitutoyo LH-600*

Measuring dimensions of height, diameter and angle. Measuring height 0-600 (972) mm, resolution 0.0001mm.

Measuring height, angle, diameter and centricity of machine elements.

EMCO Concept Mill 450



FACULTY OF MECHANICAL ENGINEERING – LABORATORY FOR CNC MACHINES, TOOLS AND CIM SYSTEMS

Vertical processing center EMCO Concept Mill 450

Movement by axes (X, Y, Z) 600x500x500 mm. Speed of rotation 50-10000 rpm. Maximum tool diameter 80 mm. Maximum tool length 250 mm. The number of tools in the tool store 20. The maximum weight of the workpiece is 500 kg.

Used for scientific-research work in the field of conventional cutting technology, new cutting technology. Research and simulation of cutting processes (using dedicated

computer software). Teaching process, lectures and laboratory exercises.

Vertical processing center EMCO Concept Mill 250

> *Movement by axes (X, Y, Z) 350x250x300 mm. Number of tools in tool store 20. Maximum weight weight of the workpiece 100 kg.*

Field of application: Scientific-research work in the field of conventional cutting technology, new cutting technology, research and simulation of cutting processes (using dedicated computer software), teaching process, lectures and laboratory exercises.

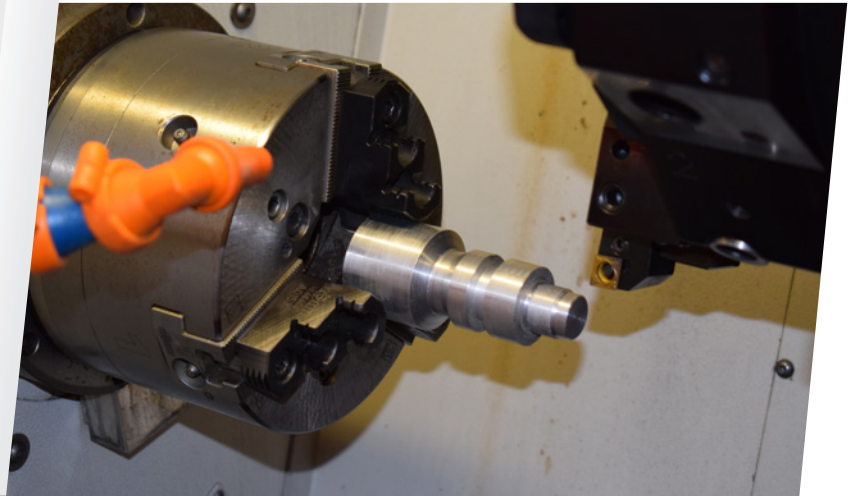
EMCO Concept Mill 250

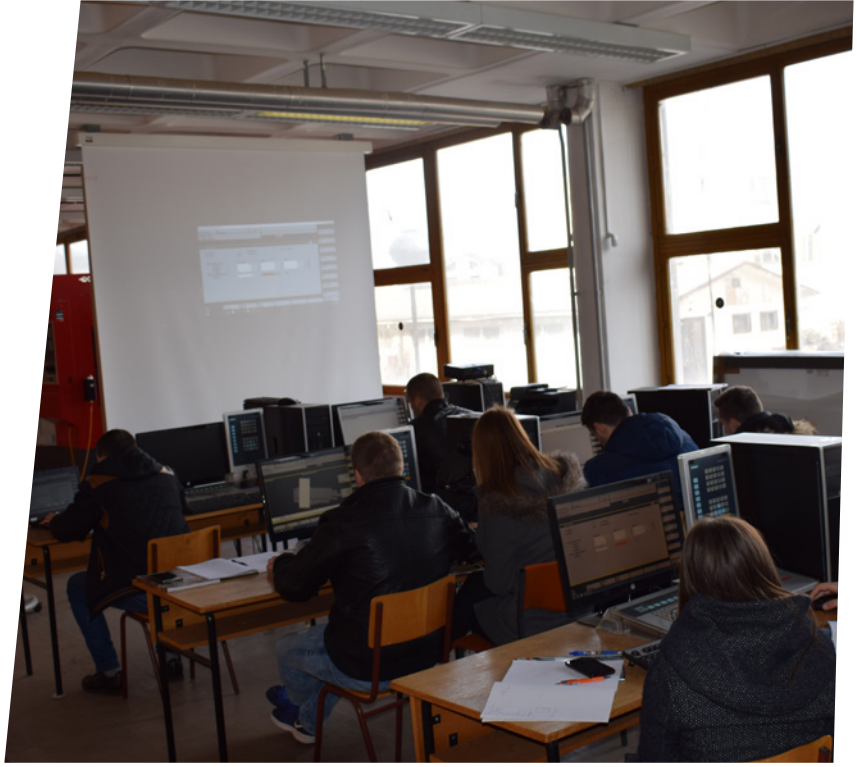
CNC lathe *Concept Turn 450*

Maximum processing diameter is 210 mm. Movements on X and Z axes 160x310 mm. Maximum diameter through the clamping head 45 mm. Number of tools in tool store 6 + 6 (driven).

Field of application: Scientific-research work in the field of conventional cutting technology, new cutting technology, research and simulation of cutting processes (using dedicated computer software), teaching process, lectures and laboratory exercises.

Concept Turn 450





Computer laboratory for carrying out training for manual and automated programming of numerically controlled machine tools.

*Nine workstations with installed software **EMCO WinNC** and simulation panels for control units **SIMENS 810/840 i FANUC 21.***

The laboratory has software for simulation **EMCO WIN NC** that enables students to develop creative abilities in the field of modeling and simulation of the processing work.

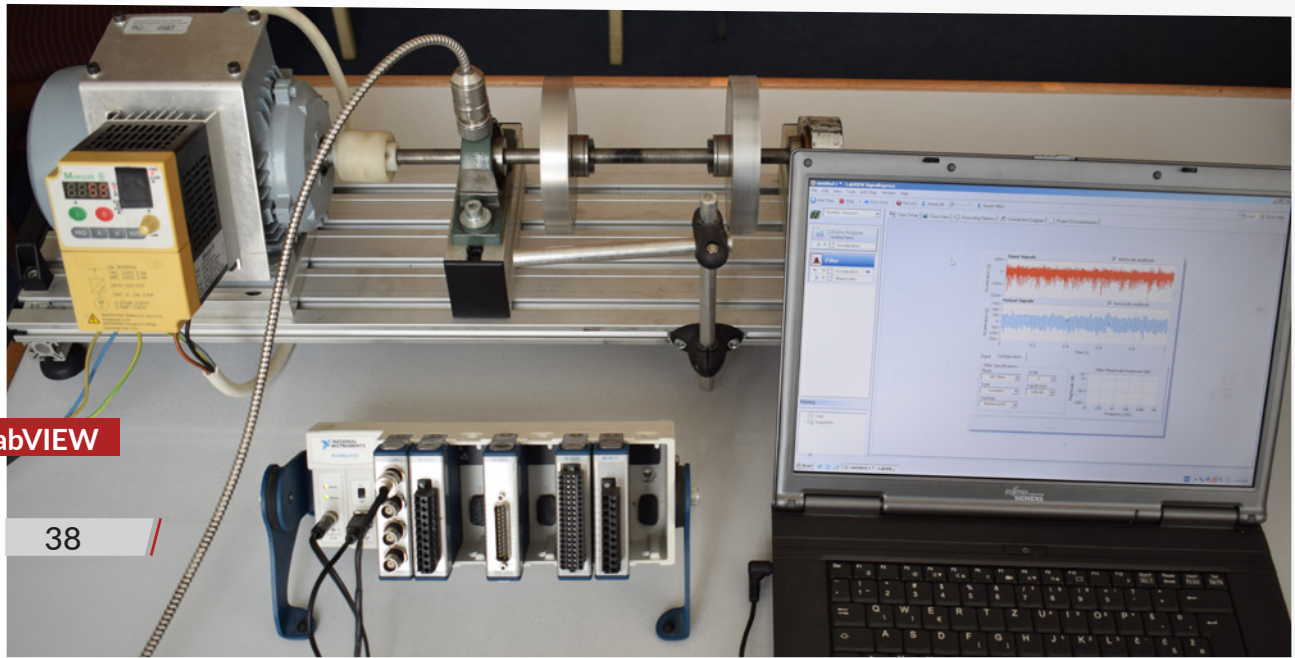
LABORATORY FOR APPLIED MECHANICS AND MECHANICAL CONSTRUCTIONS – FACULTY OF MECHANICAL ENGINEERING

Modular measuring-acquisition system with test bench for dynamic testing, and software package *LabVIEW*

The Modular measuring-acquisition System consists of the NI cDAQ-9172 chassis and the following modules: NI 9233 with four analog inputs, NI 9263 module with 4 analog outputs in the range of ±10 V, module NI 9401 with „High Speed" (fast) digital inputs, 32-channel analog input module NI9205, and analog input temperature module NI 9211, 14 S/s, ±80 mV C Series.

The test bench consists of an electric motor, a frequency regulator and a shaft. The shaft is supported via roller bearing type SKF YAR 203/12-2F, with an electric motor connected with a claw coupling.

The instrumentation is intended for measuring a wide range of analog and digital U/I signals in the teaching - scientific and research process, as well as the development of virtual instrumentation and mechatronic systems, dynamic analysis of mechanical systems, experimental testing of dynamic behavior of rotary machines, development of control and monitoring measurement systems, diagnostic systems, training and seminars in the field of diagnostics of rotary machines.



LabVIEW

Modular portable vibration analyzer CMXA 75

> *Four-channel, simultaneous 3-way input with separate input for tachometer enables faster and more comprehensive data collection in teaching - scientific and research process.*

The instrumentation is intended for: measurement and analysis of vibration in time and frequency domain, vector vibration analysis and determination of residual imbalance, dynamic balancing of rotor in one and two levels, vibrations of rotary machines.

Sound level meter, *Bruel & Kjaer 2250*

> *Measurement of terrestrial and octave spectra, gathering data with time logging, recording of sound signal of measured signal, reverberation, building acoustics, FFT analysis, etc.*

The instrumentation is intended for: environmental protection (noise monitoring in cities), protection of health and safety (noise monitoring in plants and workplaces), measurement of building acoustics, measurements for noise analysis in the industry.

Device for measuring residual voltage *DynaLog Strain Meter*, with dynamometer *AXIS FB10K*

> *It serves for the static voltage measurement with eight channel outputs. With the help of the device, it is possible to measure different static loads, as well as the guesses.*

The instrumentation is intended for: static testing and structural analysis, deformation measurements and analysis of residual stresses in machine constructions, numerical analysis and determination of the degree of safety of constructions, measurement of force and angle, stability analysis of structures, examination of the construction life.

DynaLog Strain Meter

Thermo-vision camera *FLIR E4*

IR resolution 80x60. MSX resolution 320x240. Thermal sensitivity 0,15°C. Monitor3.0 in. 320 × 240 color LCD. View field 45° × 34°. Temperature range –20°C to 250°C. Accuracy ±2% or 2°C. Measurement modes - Point (center). Emissivity from 0.1 to 1.0

It is intended for: analysis of the temperature field of mechanical systems, testing of insulation and removal of the weak spots of mechanical structures and construction objects, thermovision analysis and diagnostic testing of the machines.

Dynamometer *AXIS FB10K*

It measures the value of the force up to 10 kN based on the change of electrical resistance, or on the basis of measuring strips placed in the measuring cell of the device. Supports ambient temperature in values from -10°C to 40°C.

Application in teaching - scientific and research process.

FLIR E4

AXIS FB10K

3D scanner *NextEngine 2020i*

It consists of a camera, a laser, a connection cable, a flash light, a clamp and a MultiDrive or AutoDrive platform.

t is intended for: 3D scanning of mechanical systems and obtaining a computer compatible object, the development of mechanical systems and products.

Thermo-vision camera *SKF TKTI 31*

Heat detector (FPA) - 384 x 288. Measurable spatial resolution IFOV - 3.46 mrad. Thermal sensitivity - NETD ≤60 mK (0.06 °C) at 23 °C (73 °F). Monitor 3.5 inch color LCD. View field 25 x 19°. Temperature range –20 to +180 °C standard measurements, 100 do 600 °C high temperature measurements. Accuracy ±2% or 2°C.

NextEngine 2020i

SKF TKTI 31

Measuring modes, up to four moving points. Up to three moving areas and two moving lines (maximum, minimum and average temperatures). Automatic temperature difference. Hot and cold spots. Visual and audible alarms. Emissivity from 0.1 to 1.0.

It is intended for: analysis of the temperature field of mechanical systems, testing of insulation and removal of the weak spots of mechanical structures and construction objects, thermovision analysis and diagnostic testing of the machines.

Device *HARTIP 1000* to test the hardness of materials by Leeb

Measures the hardness of the tested material on the Leeb scale in the range of 170 to 960, wherein the hardness is determined by the ratio of the velocity by which the penetrant strikes the substrate of the tested material and the return speed. Temperature conditions for the undisturbed operation of the device range from -10°C to 45°C.

Application in teaching - scientific and research process.

LABORATORY FOR WELDING AND MATERIAL TESTING – FACULTY OF MECHANICAL ENGINEERING

Industrial AC/DC machine for TIG and REL welding process – model *MagicWave Comfort 3000*

Two work stations. Mains voltage 50-60 Hz, 3 x 400 V. Tolerance of network voltage +/- 15%. 3 x 400 V protection circuit breakers 16 A. Welding current three-phase TIG 3-300. Welding current three-phase REL 10-300 A. Single-phase welding current TIG 3-220 A. Single-phase welding current REL 10-180 A. Welding current in 10 min/40°C, 35% DC at 300 A, 100% DC at 190 A Standard operating voltage TIG 10.1 - 22.0 V. Standard operating voltage REL 20,4 - 32,0 V.

The instrument is used for the needs of the teaching-scientific and research process, as well as in the construction of

MagicWave Comfort 3000

TransPuls 3200
Synergic

containers, engineering, for industrial plants and pipeline construction, maintenance, reparation and assembly. It is also used in the construction of chemical plants, automotive industry, construction of railway vehicles, airline industry, shipbuilding and robotic welding.

Industrial machine for MIG and MAG welding process -model *TransPuls 3200 Synergic*

Two work stations. Mains voltage 3 x 200-240 V. Mains voltage 3 x 380-460 V. Tolerance of network voltage +/- 10%. Network frequency 50/60 Hz. Network fuse protection 35 A. Efficiency grade, 91%. Welding current MIG / MAG 3-320 A. Welding current, electrode 10-320 A. Operating voltage MIG / MAG 14.2 - 30.0 V. Working voltage of electrodes 20.4 - 32.8 V. Protection IP 23. Type cooling AF. Insulation class F. safety S.

Devices located in the Laboratory for Welding and Material Testing (Welding Department) can be used in the scientific-research process, in the air industry, in the automotive industry, as well as in industrial plants for the construction and installation of pipelines, maintenance and reparation, then for the production of special vehicles and construction machinery, construction of plants, containers, engineering, construction of railway wagons, construction of agricultural machines, robotic welding and shipbuilding.

Portable MMA & TIG welding machine– model *TransPocket 1500 TIG*

> *One working station. Microprocessor control of the device with resonant intelligence. "HOT START" function - adjusting the starting current for easier starting of the electric arc / REL/.*

“ANTI-STICK” function - preventing the “bonding” of the electrode / REL /. “Arc Force Control” - automatic dynamic port density control / REL /. Possibility of connection to a power generator / with voltage compensation +/- 15% /. Built-in special protective filter. Overload protection with indicator on the control panel. Built-in thermostatically controlled fan. The possibility of connecting remote control. Gas-test, gas flow control. TIG Comfort Stop / TCS / end-effect function with one operator movement / TIG /. Continuous adjustment of the welding current directly from the TIG burner. TIG-DC selection of standard or pulsating current.

TIG-DC welding with microprocessor contact ignition control and special end-effect function - TIG Comfort Stop / TCS / with welding current regulation on the TIG burner itself. TIG-DC welding by PULSING CURRENT with microprocessor control of ignition and special end-effect function - TIG Comfort Stop / TCS / with welding current regulation on TIG burner itself, REL welding of all types of coated electrodes up to ∅ 4,0 mm REL welding with cellulose electrodes, vertically down, to ∅ 4,0 mm.

TransPocket 1500 TIG

Plasma cutting device – model *PowerMax 45*

One working station. Electrical connection 3x400VAC. Frequency 50Hz. Current range 20-45 A. Air ionization. Manual guidance.

The instrument is used for the needs of the teaching-scientific and research process.

Gas welding and cutting equipment

One working station. Bottles of oxygen and acetylene. Set for gas welding and cutting.

The instrument is used for the teaching-scientific and research processes.

PowerMax 45


Gas welding and cutting equipmente

Equipment for testing the mechanical properties of materials – *SHIMADZU AGS-20kNXD + 500mm*

Universal machine with associated modules.

Tensile Testing. Testing the material by blending. Bending test at three points. Examination of tribological properties of the material. Trials in quasi dynamic conditions.

Plastinated human body

FACULTY OF MEDICINE – ANATOMIC ROOM

Plastinated human body

> *Human body made by the plastination method (not plasticised)*

Water and fat are removed from the displayed body and replaced by acetone, natural and other substances. This is a constant teaching tool with preserved and clearly visible tissues, skeletal parts and muscles. It is superior compared to previously used cadavers kept in formalin solution (very unsuitable for use, potentially carcinogenic, expensive for maintenance, limited use span). This model is considered as very modern teaching-scientific tool, indispensable in anatomy teaching and permanent specialization in surgery.

OPERATION THEATRE – FACULTY OF MEDICINE

Laparoscopic column

Laparoscopic column consists of: endoscopic camera, cold light, equipment carrier with optics, CO2 reservoir, insufflator with an outflow and a pyramidal three-stroke set.

Used in practical teaching in surgery.

CENTER FOR BIOMEDICAL SCIENCES – FACULTY OF MEDICINE

Two chamber bath Ugo Basile for *isolated organs*

Bath for isolated organs (two chambers).

Possible parallel examination of two organs. Along with the device, there are accompanying components: two glass spirals, silicone hoses, two metal holders for organs and two micrometers.

Used in scientific research. Investigations of contraction/relaxation of isolated organs of animal/human origin, in a system with a transducer and a circular channel.

Isolated organ for two chamber Bath Ugo Basile

MasterFlex L/S peristaltic pump

Flow measuring devices.

It consists of two parts (drive part - pump driver and pump head). It is used in scientific research to measure blood flow through the blood vessels.

MasterFlex L/S

Circular channel UNIRECORD with the Acquisition Software Package *Ugo Basile*

A four-channel software-hardware system that transmits a signal from a transducer to a computer.

Currently, two such identical devices are used in scientific research, enabling software monitoring of In vivo and In vitro pharmacological experiments.

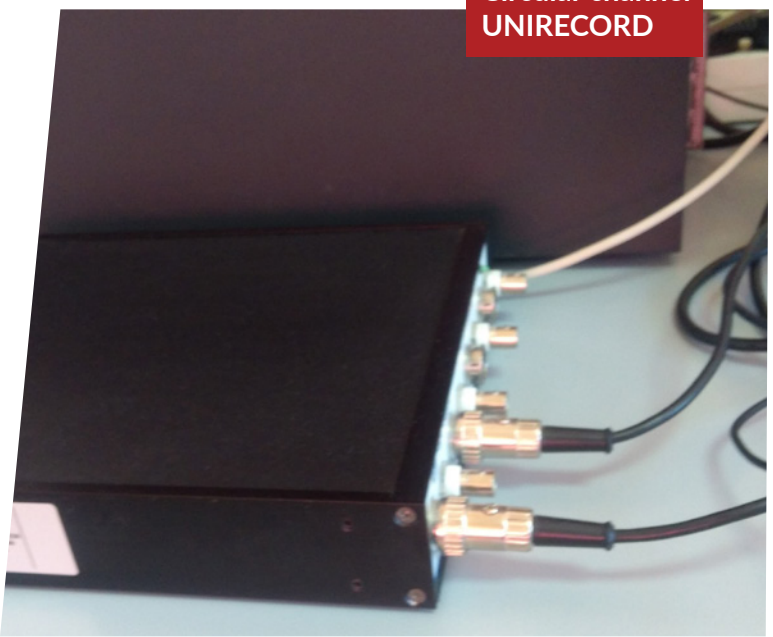
Isolated organ *Bath one chamber Ugo Basile*

Bath for isolated organs (one chamber)

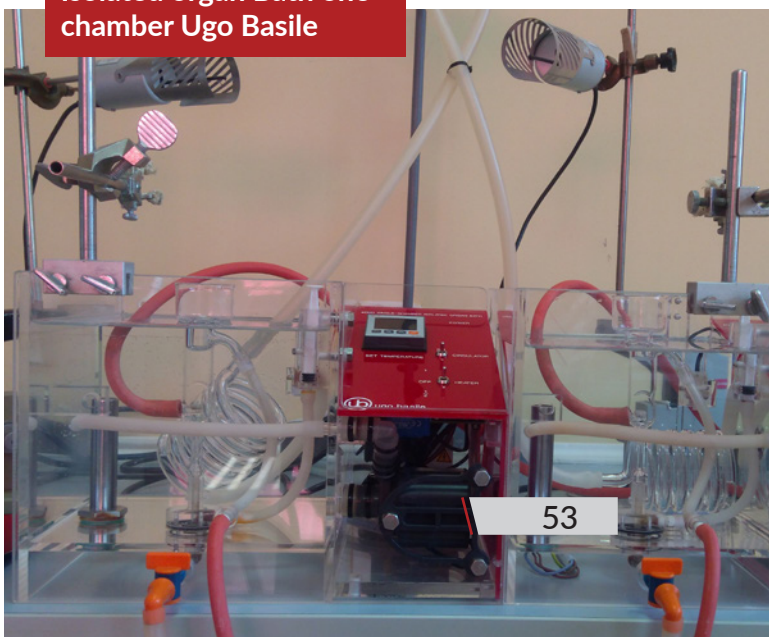
Designed for testing only one isolated organ. Along with the device, there are accompanying components: glass spiral, silicone hose, metal body holder and micrometer lift.

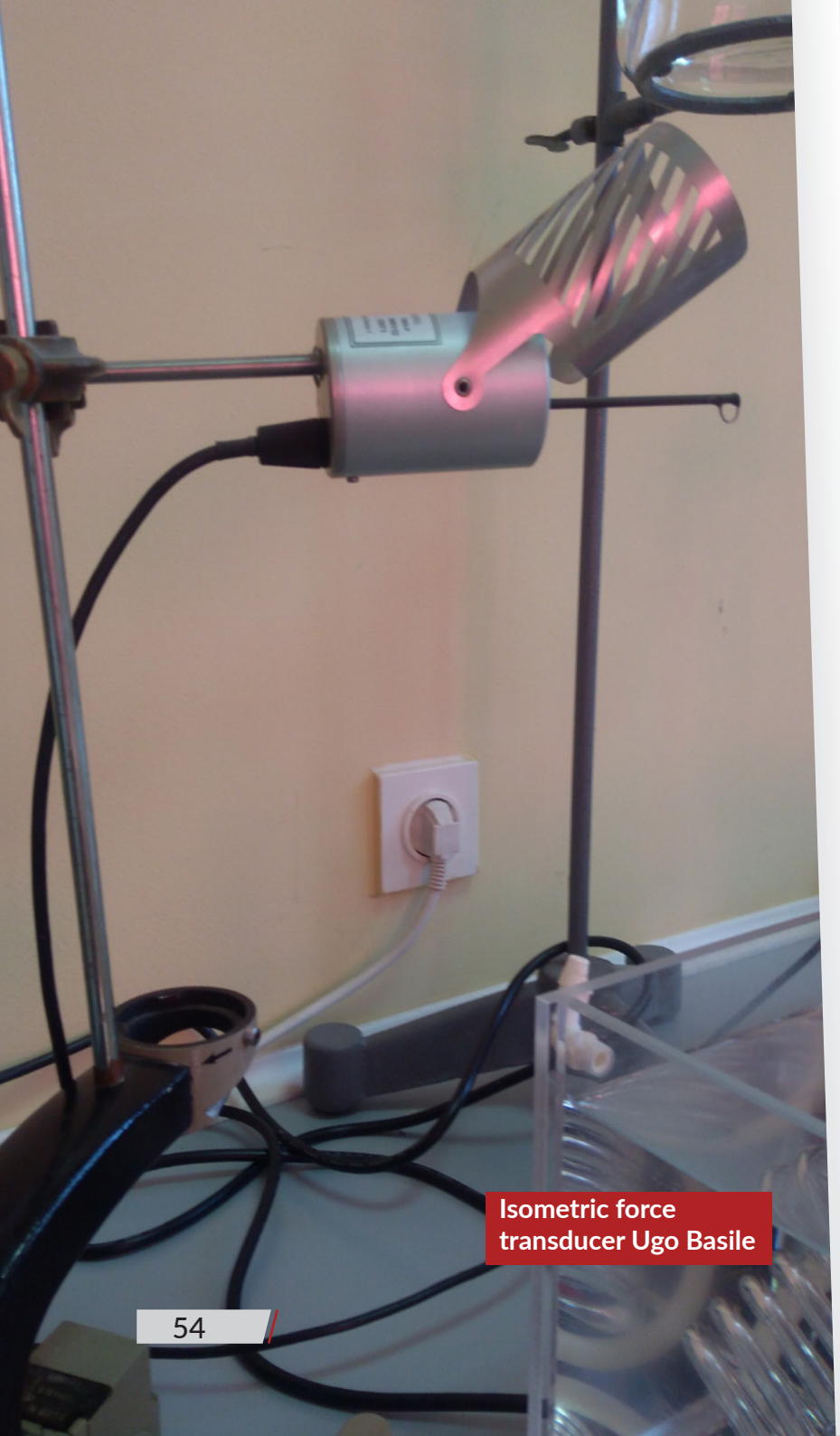
It is used in scientific research, examination of contraction/relaxation of isolated organs of animal/human origin in a system with a transducer and a circular channel. There are two devices in the Center.

Circular channel UNIRECORD



Isolated organ Bath one chamber Ugo Basile





Isometric force transducer Ugo Basile

Isometric force transducer Ugo Basile

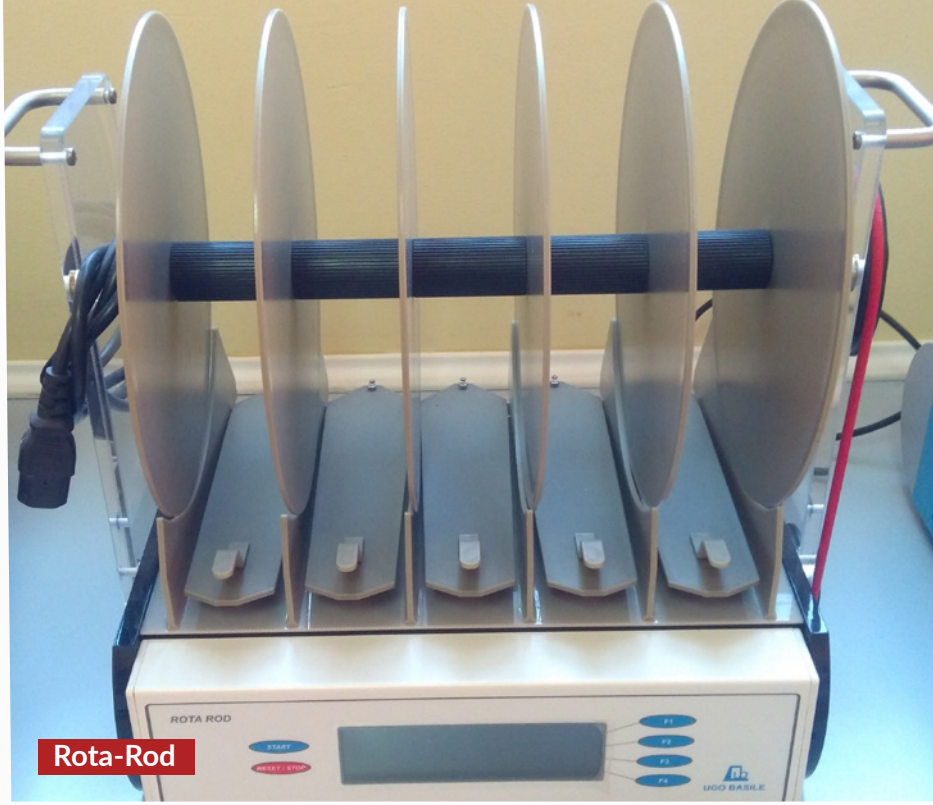
> *Transducer - a device that converts a mechanical signal (the change in the length of an isolated organ turns into an electrical signal).*

Eight identical devices used in scientific research and teaching process, in the testing of contraction/relaxation of isolated organs of animal/human origin in a bonded system with a bath for isolated organs and a circular channel.

Rota-Rod mice machine

The machine consists of a rotating lever on which the test animals are placed.

It is used in scientific research and teaching process, for testing the influence of drugs on motor coordination of examining animals.



Rota-Rod

Centrifuge

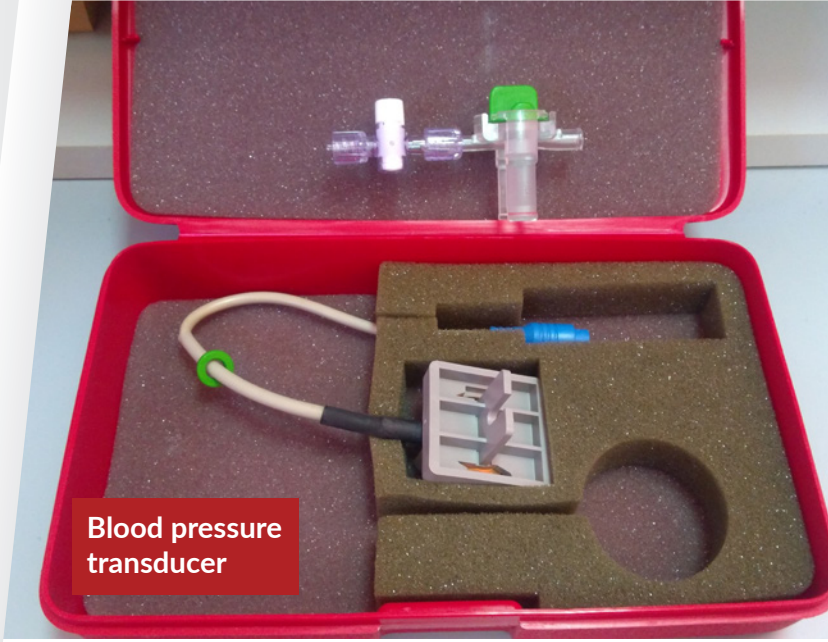
Centrifuging of samples

Centrifuge

Blood pressure transducer

> *Pressure transducer, direct monitoring of mean arterial blood pressure.*

The device is used for research purposes. When directly binds to the blood vessel, it records the height of the blood pressure and the measured value turns into an electrical signal.



Blood pressure transducer

Small animal decapitator

> *Decapitator, guillotine.*

It is used for research purposes, when performing invasive experiments on small laboratory animals for fast, minimal stress decapitation.

Small animal decapitator

Automatic reflex transducer

Liquid nitrogen tank CRYO Vessel Locator 8 Plus

Automatic reflex transducer

Device composed of two cages with visual and acoustic stimulators.

The device serves to perform avoidance experiments, designed for rats as experimental animals.

Liquid nitrogen tank CRYO Vessel Locator 8 Plus

Liquid nitrogen container.

The device is used for storing liquid nitrogen. Liquid nitrogen is needed for rapid freezing of the preparations used in the scientific-research process.

Freezer -80 C

Freezer -80 C

> *The freezer serves to store samples on -83 C.*

Inner volume 550 L. The equipment is used for research in the field of immunology and genetics.

Liquid nitrogen tank CRYO Vessel Locator 8 Plus

Liquid nitrogen tank CRYO Vessel Locator 8 Plus

> *It serves to store samples at low temperatures.*

The equipment is used for research in the field of immunology, genetics and clinical pharmacology.

Vortex genie II

> *Used to vortexing.*

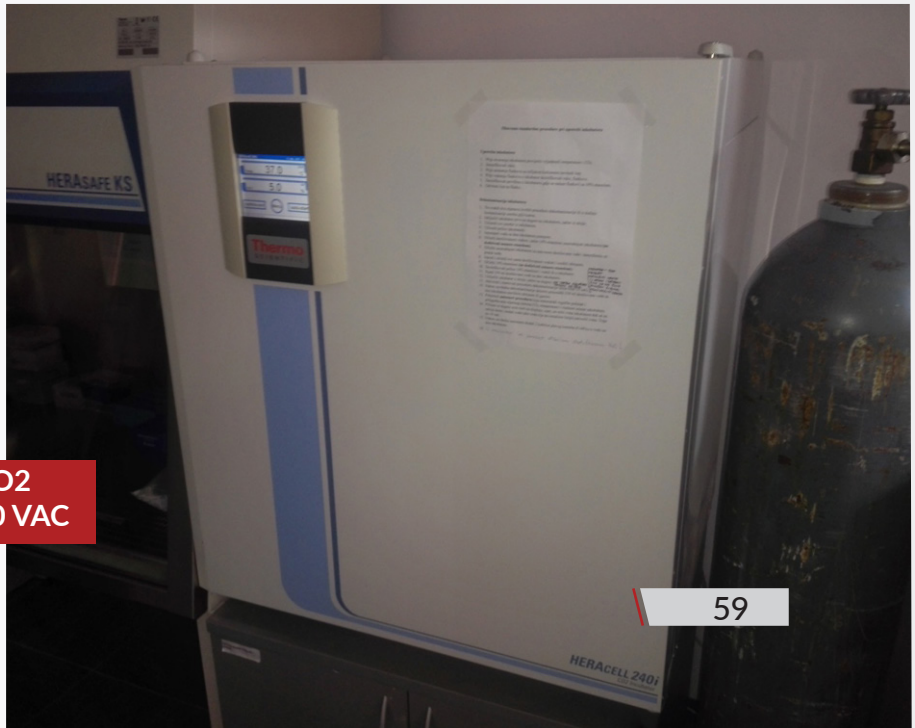
The equipment is used for research in the field of immunology and genetics.

Heracell 240L CO2 incubator SS 230 VAC

> *It serves to maintain cell culture.*

The equipment is used for research in the field of immunology.

Vortex genie II



Heracell 240L CO2 incubator SS 230 VAC

Herasafe 12 230V

Digital Camera OLYMPUS

Herasafe 12 230V

Serves in sterile conditions.

The equipment is used for research in the field of immunology.

Digital Camera OLYMPUS

It serves for imaging and observation of histological preparations.

The equipment is used for research in the field of immunology.

Labofuge 400 set, *Centrifuge with rotor eppendorf*

> *Includes a flexible 4 x 180 ml rotor (centrifuge with rotor). It serves to centrifuge samples.*

The equipment is used for research in the field of human genetics.

Set of Pipets (epResearch) eppendorf

> *Pipetting of samples*

The equipment is used for research in the field of human genetics.

Centrifuge with rotor eppendorf

Set of Pipets (epResearch) eppendorf

Microwave Oven MWP 1050-30M

> *It serves to heat the samples.*

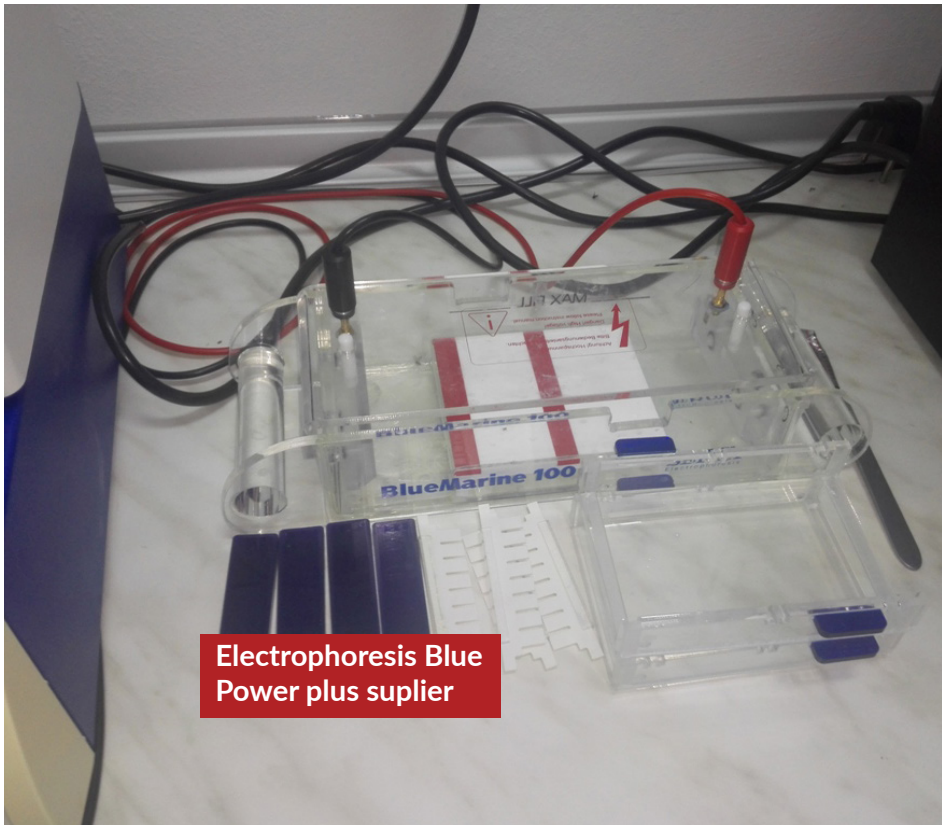
The equipment is used for research in the field of Humane genetics.

Microwave Oven MWP 1050-30M

Electrophoresis Blue Power plus suplier

> *Electrophoresis, 2 combs.*

The equipment is used for research in the field of Humane genetics.



Electrophoresis Blue Power plus suplier

Centrifuge 5702 eppendorf

> *It serves to centrifuge samples.*

The equipment is used for research in the field of Humane genetics.

Ice Machine SIMAG

> *It is used for storage of samples on ice.*

The equipment is used for research in the field of Humane genetics.

Centrifuge 5702 eppendorf

Ice Machine SIMAG

QUANTUM ST4

PCR Mastercycler personal eppendorf

Documentation system , *QUANTUM ST4*

Gel electrophoresis visualization system.

Desktop computer, Terra PC system with monitor, Mulisys+ software.

The equipment is used for research in the field of Humane genetics.

PCR Mastercycler personal eppendorf

The equipment is used for research in the field of Humane genetics.

BioPhotometer Plus eppendorf

> *A device designed for spectrophotometry.*

The equipment is used for research in the field of Humane genetics.

Analytical balance *„Scale Mettler“, Mettler TOLEDO*

The equipment is used for research in the field of Humane genetics.

BioPhotometer Plus eppendorf

„Scale Mettler“, Mettler TOLEDO

Biophotometer plus EPHENDORF

Scale „Mettler Toledo“

BIOCHEMISTRY LABORATORY – FACULTY OF MEDICINE

Biophotometer plus EPHENDORF

Spectrophotometer - a light intensity measuring device that can measure intensity as a function of the wavelength of the light source.

The important features of this device are the spectral range and the linear range of absorption or measurements of reflection. It is used to measure airiness or the reflection of solutions, transparent or opaque materials, the presence of different substances in the sample.

Scale „Mettler Toledo“, 1 mg

Analytical high-precision digital scale.

It is used for different types of measurements.

Vortex Genie 2

Samples vortexing

Hot/Cold Plate

The device's panel can be heated, but also cooled to the set temperature.

The device is used to examine the effect of analgesics on experimental animals, i.e. the reaction time of the animal to the application of warm/cold irritation.

Vortex Genie 2

Hot/Cold Plate

FACULTY OF AGRICULTURE – *LABORATORIES*

Atomic Absorption Spectrophotometer, *Model 200 Series AA, Agilent Technologies*, USA

The device has three analysis techniques: flame, hydride, and graphite. In addition, the device also has a computer with specialized software.

Determination of the content of elements in different materials at very low concentrations. There is the possibility of using devices for educational, scientific and professional (commercial) purposes.

Model 200 Series AA, Agilent Technologies

Portable fluorescence microscope *„Leica“ DM6000B*

Fluorescent tube with lens, portable light, eyepiece 10x20, lens: 5x, 10x, 20x, 40x, 40x PH, 50x.

A device equipped with accessories for observation of preparations with a light and fluorescence microscopy. The device has a camera, as well as a computer with specialized software.

There is a possibility to use devices for scientific and research and educational purposes from various fields of agriculture and related fields of science.

„Leica“ DM6000B

Protein Determination System

Velp Scientifica (Model of digestion units – DK 20, Model of distillation unit – UDK 159)

Protein Determination System - Kjeldahl Method, *Velp Scientifica (Model of digestion units – DK 20, Model of distillation unit – UDK 159)*

> *The system consists of: Digestion unit containing 20 places for hobs. The system also has all the accompanying equipment for manipulating with the hobs. Distillation unit is automatic and allows for the selection of different distillation time and steam flow. Allows automatic titration. The system owns Pump and Scrubber.*

Using the system, it is possible to determine the content of nitrogen (proteins) in different types of samples. The system can be used in educational, scientific and professional activities from several fields of agriculture, as well as related fields.

Gerhardt /
840450 SX 414

Automatic system for quick extraction of grease - SOXTHERM, *Gerhardt / 840450 SX 414*

The automatic system serves for quick extraction. The device has four places for baking. The device has a computer with a specialized system management software. Cooling water consumption approx. 3l / min. Maximum temperature 300°C

t is used to determine fat in different samples. The system can be used in educational, scientific and professional activities from several fields of agriculture, as well as related fields.

Air-condition chambers for growth, *Binder/KBW 240 E5.1, M.R.C./LE-539*

Equipped with systems for regulation of meteorological and light conditions, possess own programmers. For Binder/KBW 240 E5.1: Temperature range from 0 to 70°C, Nominal power 1,4 KW, adjustable fan. It has a digital programmer. For M.R.C./LE-539: Volume 487 liters, Temperature range from 0 to 60°C, Illumination: 9 lamps x 20 W, Adjustment of lighting time: from 10 min to 24 hours.

Possibility to be used for various experiments in educational, scientific and professional purposes from several fields of plant production. It is used for exercises in the physiology of plants, crop, vegetable, fodder and the like (examination of germination of grass, grains and other plants).

Binder/KBW 240 E5.1, M.R.C./LE-539

Stereo microscopes and magnifiers, *Leica/EZ4/EZ4 HD*

Devices can be used for educational purposes in several areas of agriculture. They are suitable for observing biological, entomological, phytopathological and other preparations. They can be used, for example, for observing temporary and permanent entomological preparations, direct recording of insect species of smaller dimensions, observation of temporary and permanent phytopathological preparations, and so on.

POLARIMETER - Device for starch determining by Evers, *Nahita/ ZUZI 404 Y 404-LED*

> *The device consists of four parts: adjustable eyepieces, two side fourfold glasses for easier reading of the scale, a slanted stand for a tube up to 220 mm in diameter and long-lasting energy-saving diode wavelengths of 589.3 nanometers.*

The polarimeter serves to measure the polarization of light in optically active samples. The device is used to determine starch in plant material and has wide application in agriculture and food industry.

LEICA/EZ4/ EZ4 HD

Zoom 4,4:1, eyepiece 10x / 20, magnification range 8x to 35x. Devices are with and without a digital camera. Digital camera devices have a memory card port, as well as other ports for connecting to a monitor.

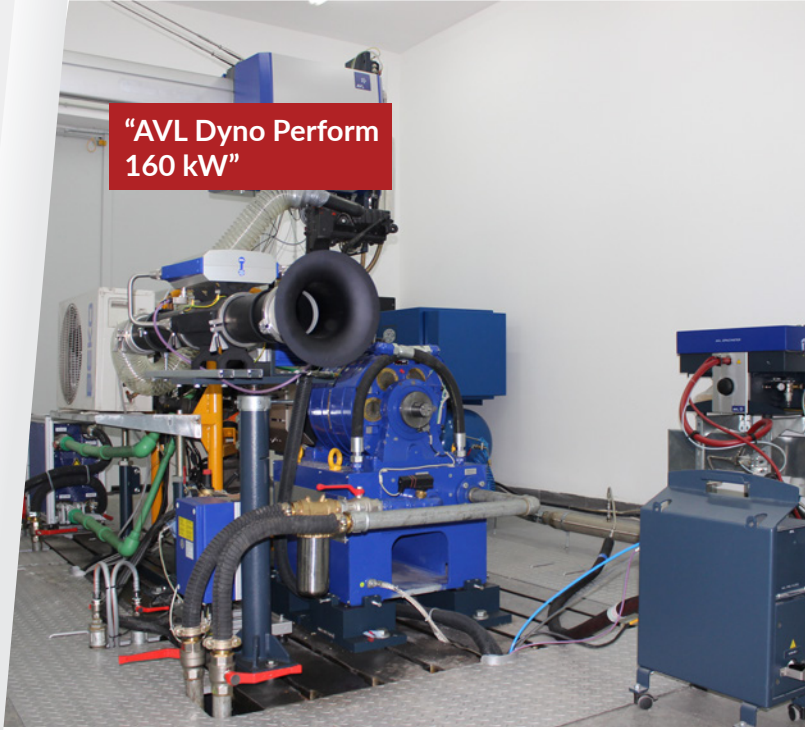
NAHITA/ ZUZI 404 Y 404-LED

FACULTY OF TRAFFIC ENGINEERING – LABORATORY FOR MOTOR TESTING

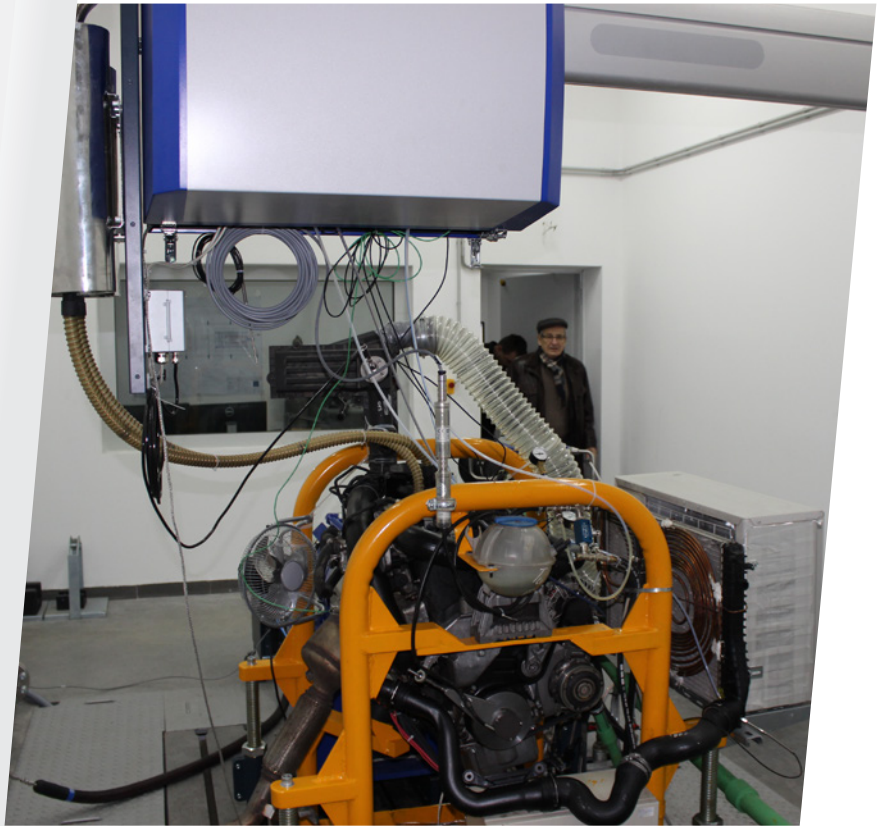
Dynamometer "*AVL Dyno Perform 160 kW*", Austria

The laboratory performs motor endurance tests up to a maximum power of 85% and performs the test of durability in fast and repeated loading variants up to 75% of the maximum power.

The tests are carried out in the static and dynamic mode of operation of petrol, diesel and hybrid motors of the following parameters: engine power, engine torque, piston wear measurement and cylinder wear in the engine at the stage of development, engines entering the production process, as well as existing engines, gas passing through piston rings, compression pressure in cylinders, pressure in the suction branch of air



"AVL Dyno Perform 160 kW"



from -1 to 2.5 bar, exhaust emission pressure in the exhaust system, oil pressure in the engine up to 10 bar, pressure and fuel consumption measurement in various operating modes engine oil temperature in the crankcase, air intake air temperature, engine cylinder temperature, engine coolant temperature, intercooler inlet and outlet temperature, fuel tube temperature, volume flow of sucked air, opacities of the engine exhaust gas at prototype production, reconditioned and new engines, testing the exhaust emissions of various exhaust component gases in unmanufactured engine exhaust gases, encoder angle measurement on crankshaft, engine speed, etc.

Licensed software is used to manage and visualize the data examined „AVL Puma“, „AVL Indicom“ and we also have licensed software „AVL Concerto“.

The laboratory examines engines in the development phase, new and generally refined petrol, diesel and hybrid motors up to 160 kW power and torque up to 400 Nm.

Spectrometric exhaust emission analyzer *"AVL SESAM IFT 60"*, Austria

The laboratory is equipped with a high-precision "AVL Sesam iFT 60" spectrometer that measures the concentration of 32 components of the exhaust gas at the molecular level. In order to obtain a high metering repeatability of the exhaust gas analysis, the spectrometer is equipped with a system for the cleaning of measuring probes with liquid nitrogen. In order to obtain precise measurement results between the spectrometer and the measuring point, "AVL Prefilter" is connected, which has the function of purifying the particle emission of the exhaust gases and heating the measurement probes.

The "AVL Sesam iFT 60" spectrometer measures the concentration of the following components in exhaust gases: carbon monoxide CO, carbon dioxide CO2, water H2O, nitrogen monoxide NO, nitrogen dioxide NO2, total nitrogen oxide NOx, nitrogen suboxide N2O, ammonia NH3, methane CH4, acetylene C2H2, ethylene C2H4, ethane C2H6, propane C3H8, propylene C3H6, butadiene C4H6, ethanol C2H5OH, methanol CH3OH, acetaldehyde CH3CHO, formaldehyde HCHO, formic acid HCOOH, sulfur dioxide SO2, iso-pentane IC5, n-pentane NC5, n-octane NC8, isocyanic acid HNCO, hydrogen cyanide HCN, carbonyl sulfide COS, aromatic hydrocarbons AHC, hydrocarbons diesel HCD, hydrocarbon gasoline HCG, hydrocarbon ethanol HCE, non-methane hydrocarbons NM.

AVL SESAM IFT 60

It is used to determine the concentration of chemical compounds in the exhaust emission of a motor vehicle.

Two-stage crane *„Maha ECON III 4t”*, Austria

A two-stage crane with two 3 kW motors with an electronic connection between the pillars and an asymmetrically mounted shoulder and a thermally processed screwdriver is used in the preparation of test units in laboratories for testing motor vehicles and internal combustion engines.

Load capacity 4000 kg, lifting height 2 m, lifting /lowering time 40 s, vehicle angle of rotation 180°, carrier length short/long telescopic 660-1260 mm, high safety lock in a given position, width of the vehicle passage 2,46 m, power 2x3 KW.

Maha ECON III 4t

LABORATORY FOR TESTING MOTOR VEHICLES – FACULTY OF TRAFFIC ENGINEERING

Chassis dynamometer "*AVL Chassis Dyno 160 kW 4WD MiM*", Austria

Chassis dynamometer system (motor vehicle testing platform) is used in the following modes of operation: road load simulation, speed control, motor vehicle traction, acceleration mode.

The device is specifically designed and intended for testing motor vehicles in various road conditions at different speeds (from 0 to 200 km/h). It precisely measures: speed and acceleration of the vehicle, vehicle pulling force, engine power, exhaust emission, vehicle handling, fuel consumption, vehicle depreciation, rolling resistance of the vehicle.

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AVL Chassis Dyno 160 kW 4WD MiM

The principle of measurement is based on the acceleration of the inertial mass of the rollers. By determining the change in the angular velocity of the rollers, the power of the engines on the drive wheels is determined equally.

The calculation includes a correction factor which takes into account the air temperature and air pressure, so that accurate data of the tests are considered physically relevant regardless of the weather conditions.

In order to obtain the exact results of measuring the traction characteristics of the vehicle, the "coastdown" test function is integrated into the measurement system, which serves to obtain the most accurate approximation of the vehicle's dynamic parameters and determination of the rolling resistance of the vehicle.

In addition to rolling resistance, the system also measures power transmission losses in order to measure the exact power on the engine flywheel.

The chassis dynamometer is equipped with an automatic centering device for vehicle wheels and a device for automatic change of wheelbase. To allow cooling the test vehicle's engine to the chassis dynamometer „AVL Chassis Dyno 160 kW 4WD MiM" an integrated fan is provided with the volume flow 26500 m3/h.

Licensed software is used to set chassis dynamometer test parameters „AVL Veacon“, and software for visualizing measurement results „AVL Power Measurement“ is used.

The chassis dynamometer is used to measure the traction characteristics of the front and rear axle and all-wheel drive vehicles, and is intended for legislative procedures for quality control in vehicle exploitation and vehicle design research.

TOC-L ca TN-L,
Shimadzu Corporation

FACULTY OF TECHNOLOGY – LABORATORY FOR CHEMICAL PROCESS ENGINEERING

Device for determination of total organic carbon and total nitrogen – *TOC-L ca TN-L, Shimadzu Corporation*, Japan

The device consists of a main unit for determining the total organic carbon and an additional unit to determine total nitrogen. The main and additional units are connected directly and operate using a software package that is an integral part of the main unit. All the parameters of the analysis can be adjusted directly through the software package, and also the device can be connected to the computer, so that the whole process of analysis can be controlled through a computer.

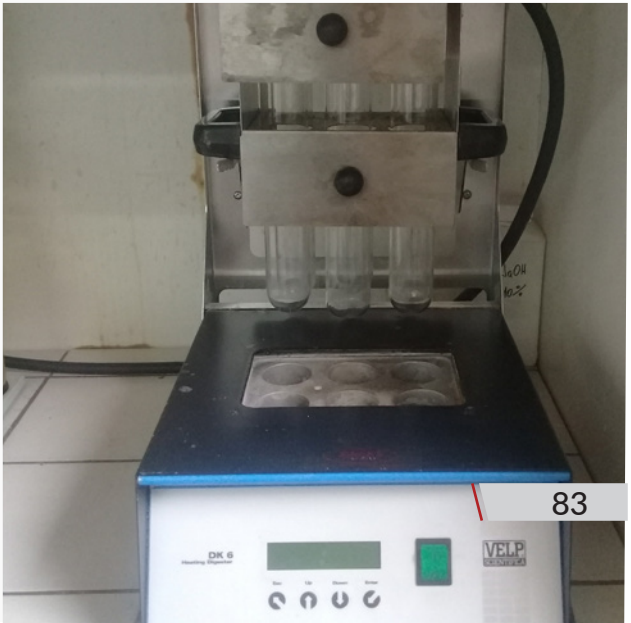
The device is used to determine the total organic, total inorganic and total carbon, as well as to determine the total nitrogen. It is used in analyzes of water, minerals, in food analyzes, as well as in analyzes of raw materials used in food preparation.

Nitrogen Detector by Kjeldal *DK-6*, *VELP SCIENTIFICA*, Italy

The device consists of four units: The burner unit (thermoreactor), cleaning purifier, the evaporator aspirator and the distillation unit. The incineration unit consists of a box of six 300-ml cuvettes and a gas extraction system, the operating temperature of the unit is within an interval 100 °C - 300 °C. Determination of nitrogen may range 0.1-200 mg/l.

t is used to determine the content of total nitrogen, or protein in samples of water, soil, foods of plant and animal origin, animal feed, chemicals.

DK-6, VELP SCIENTIFICA



Spectrophotometer, *UV-1800 SHIMADZU, Shimadzu Corporation*, Japan

UV-1800 the spectrophotometer has an LCD display for displaying photometric results, it is operated very easily and works in the interval of wavelengths from 190 nm to 1100 nm. It can work directly with entering input data directly on the camera. It can also connect to the computer to manage the operation of this device via a computer with the corresponding software package it owns. This instrument is ideal for measurements in the visible and ultraviolet range of the wavelengths of the electromagnetic spectrum.

UV-1800 spectrophotometer is a two-way general purpose spectrophotometer designed to meet the needs of various tests. It is ideal for various applications, such as: chemical, biochemical, petrochemical, and in the laboratory for the protection of the environment, in the analysis of food and beverages, water and wastewater, as well as other areas of quality control and research.

UV-1800 SHIMADZU, Shimadzu Corporation

Cyclic chamber for corrosion testing, *SF-960-CCT*

SILVERFOG corrosion test chambers are designed to meet the requirements of all major international tests of standard corrosion testing. The chamber is made using high quality materials that provide a highly reliable and robust system. An integral part of this chamber is a software that performs parameter setting directly on the device.

It is mainly used for determining the corrosion resistance of the tested materials and determining the parameters essential for corrosion, and this also entails the large application of this apparatus in scientific research and industrial tests.

Ambient air sampler (dust, aerosol), *Echo PM 2 line, TCR TEGORA* Italy

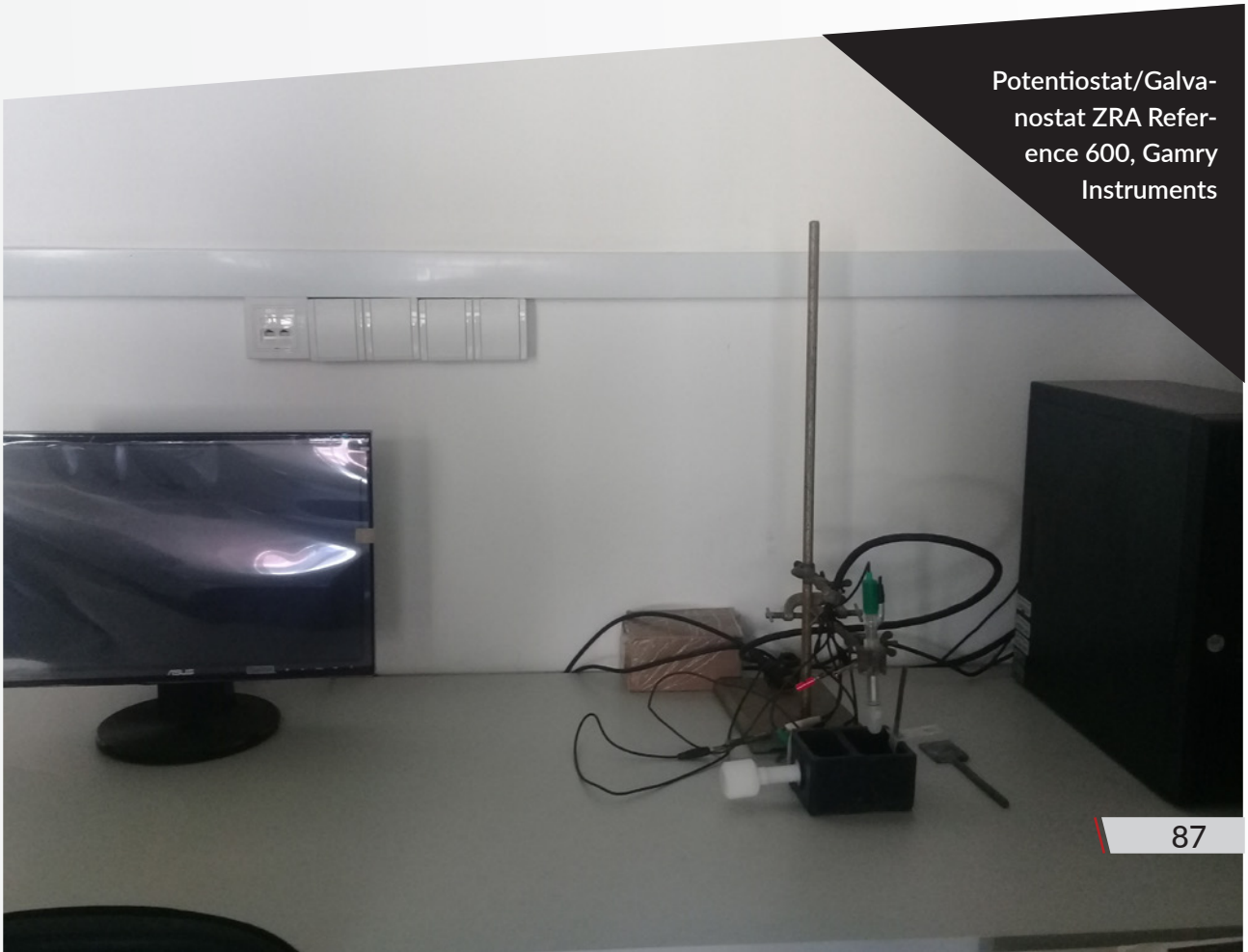
An ambient air sampler has two channels for simultaneous sampling, so that at the same time a concentration of total floating particles (TFP) can be measured at a diameter smaller than 10 µm and 5 µm, PM 10 and PM 5. It also monitors and stores 5 key parameters necessary for further measurements in determining air quality.

t is mainly used to determine PM10 and PM5 as well as temperature, pressure, flow, air humidity and filter loads. Based on the above, it has found great application in air quality studies, i.e. quality of the environment, as well as in the conditions in the working environment.

Potentiostat/Galvanostat with software, *Potentiostat/Galvanostat ZRA Reference 600, Gamry Instruments*, USA

The device of the most up-to-date features, which in addition to the work unit, contains the best software package in the areas defined by the operation of this appliance. It also contains a set of electrodes (working, auxiliary and contraelectroda) that serve to perform tests.

The device is used in the most advanced physical-chemical tests as well as in the most modern corrosion tests, and as such is very widely applied both in scientific research work and in industrial research, in the protection of materials.



Potentiostat/Galvanostat ZRA Reference 600, Gamry Instruments

LABORATORY FOR FOOD TECHNOLOGY – FACULTY OF TECHNOLOGY

High pressure liquid chromatograph, *Agilent 1260 Infinity Quaternary LC Agilent Technologies*, USA

The device consists of several working subunits: quaternary pumps with a degasser, systems with the possibility of mixing 4 solvents, autosemplers with 100 sampling points, thermostats, UV-VIS spectrophotometric detectors and spectrofluorometric detector. All subunits are connected to a computer with the ChemStation software package, through which all parameters of the analysis can be adjusted.

The device is used for separation, identification and quantification of non-volatile components which presence can be recorded by using UV-VIS or FLD detectors. It is applied in the analysis of proteins, organic acids, flavonoids, polyphenols, sugars, vitamins, and mycotoxins in food and feed samples used in food preparation.

Capillary Electrophoresis with UV-VIS and mass detector *Agilent 7100 CE/MS System Agilent Technologies, Capillatory Elektropharesis System*, USA

The system consists of an electrophoretic separation unit, a UV-VIS detector, an auto-sampler with 50 vials, an atomizer generator, a vacuum pump and a mass detector. The temperature of the capillary cassette can be set from 15 to 60 °C. Flushing pressure as well as pressure in the vials may be up 12 Bar.

Agilent 1260 Infinity Quaternary LC Agilent Technologies

The electrodes voltage may vary from -30 to +30 kV. Through ChemStation and MassHunter softwares it is possible to control the analysis parameters as well as to process the received data.

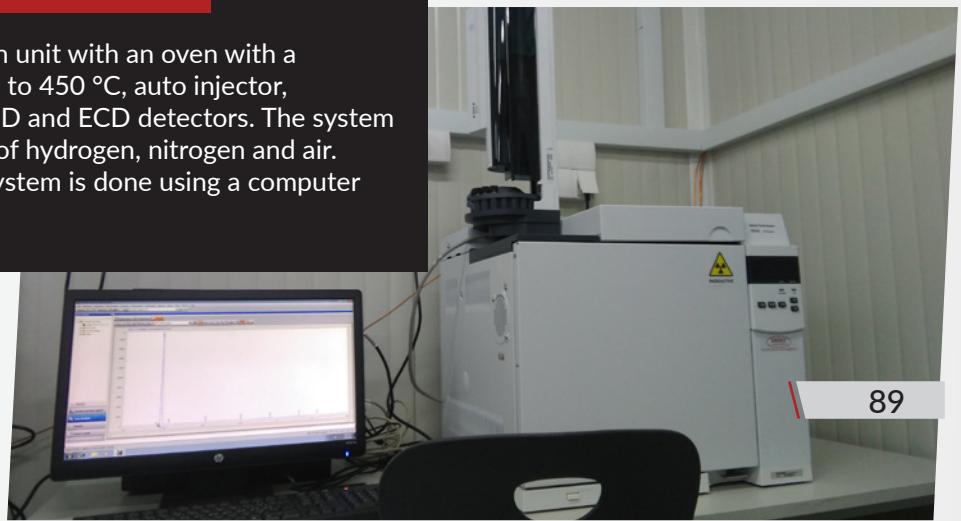
The device can be used to determine the different compounds in the complex matrix of the sample. It is most commonly used to separate proteins, different DNA and nucleic acid fragments separations.

Gas Chromatograph with FID and ECD detectors, *Gas Chromatograph Agilent 7820 GC System, Agilent Technologies*, USA

Agilent 7100 CE/MS System Agilent Technologies, Capillatory Elektropharesis System

GAS CHROMATOGRAPH AGILENT 7820 GC SYSTEM

The device consists of a main unit with an oven with a temperature range from +30 to 450 °C, auto injector, autosampler with 16 vials, FID and ECD detectors. The system is connected to the sources of hydrogen, nitrogen and air. Management of the entire system is done using a computer through a special program.



The device is used for separation, identification and quantification of organic compounds which presence can be recorded using FID or ECD detectors. It is mostly used for the determination of pesticides in food.

Gas chromatograph with mass detector *Agilent 5977 GC/MSD System, Agilent Technologies*, USA

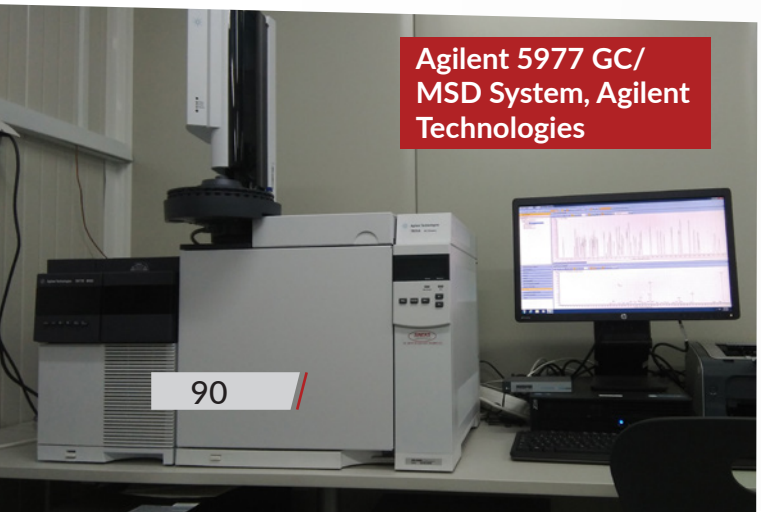
> *The device consists of a furnace with a temperature range of +30 to 450°C, auto injectors, autosamplers with 50 places for vials, vacuum pumps and mass detector. Quadrupole has the possibility of heating up to 200°C without reducing the accuracy. Management of the entire system is done with the computer through the program MSD ChemStation.*

The gas mass chromatograph is used for separation and detection of a large number of easily volatile organic compounds, which can be converted to a gaseous state without degradation.

IR spectrometer with Fourier transformations *Agilent Cary 630 FTIR Spectrometer, Agilent Technologies*, USA

> *The device has an ATR accessory with a diamond-reflective surface of 1 mm in diameter, with which it is possible to analyze solid, liquid, powder and gel samples. Samples with pH between 1 and 14 can be analyzed. No sample preparation is required, and the analysis itself is very rapid.*

It is used to qualitatively analyze a large number of different samples.



Agilent 5977 GC/ MSD System, Agilent Technologies

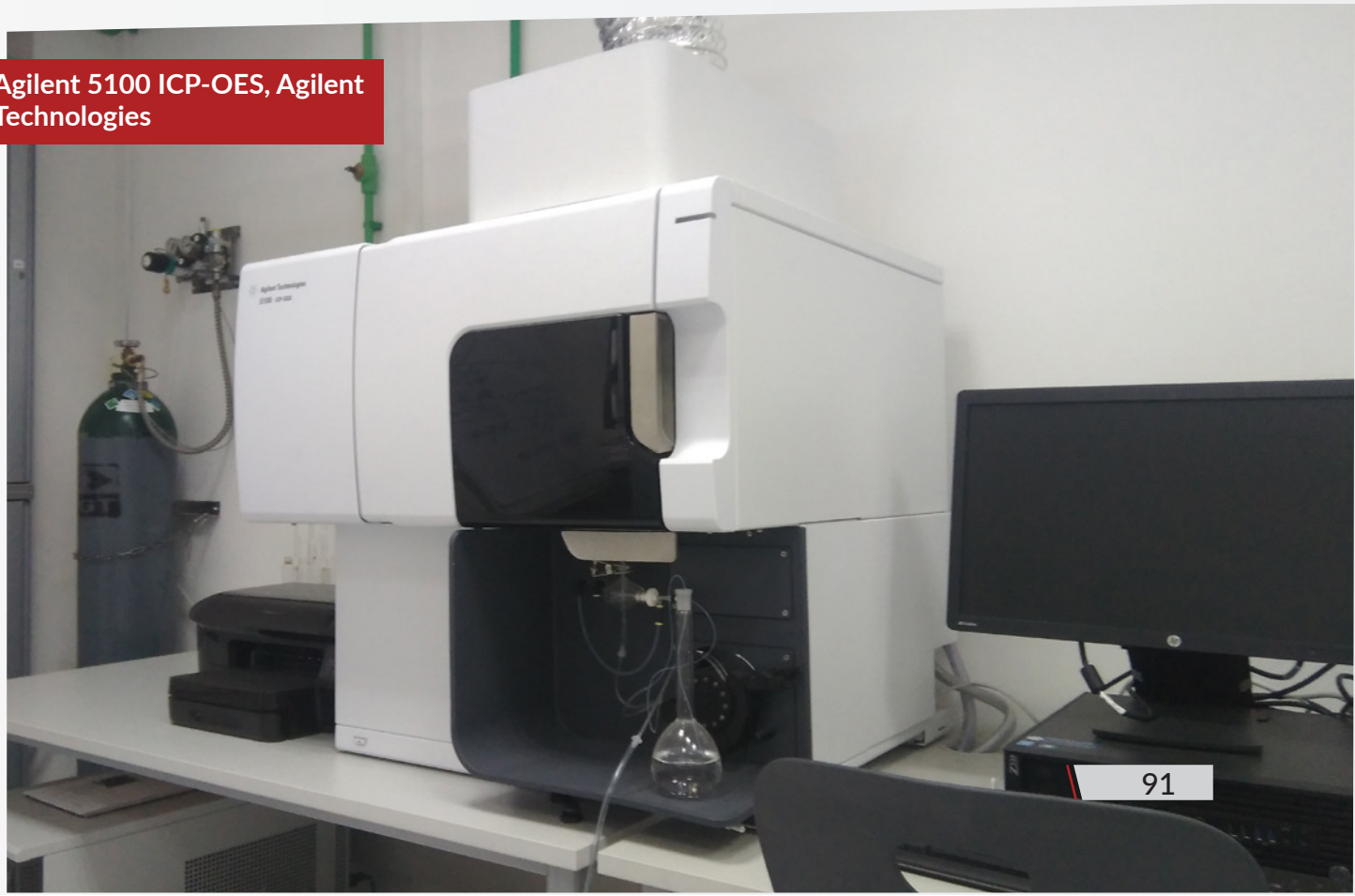
Agilent Cary 630 FTIR Spectrometer, Agilent Technologies

Inductively coupled plasma *Agilent 5100 ICP-OES, Agilent Technologies*, USA

The device through inductively coupled plasma excites atoms of the sample, which emit electromagnetic radiation with wavelengths specific to the individual elements. The detector can register the spectrum in the radial and axial directions relative to the plasma jet. The device has low detection limits and very high precision measurement with a very short analysis time. The advantage of this method is that the effect of the matrix in it is very small, so it is suitable for the analysis of complex matrix samples.

The device has a wide application in the analysis of various water, soil, biological samples, food and beverage samples. In the same sample, up to 70 elements can be determined, including heavy metals.

Agilent 5100 ICP-OES, Agilent Technologies



Texturometer, *TA.XT plus*, *Stable Micro Systems*, Great Britain

The maximum force with which the device can operate is 50 kg, while the sensing force is 0.1 g. The device includes a work platform and the following accessories: Kramer shear cell HDP/KS5, Blade set, Revolution Shear Blade, Meullenet-Ovens Razor Shear Blade, Spaghetti Flexure Rig, Fracture Wedge Set, Backward Extrusion Rig, Multiple Penetration Probe, Bread Squeeze Rig, compression plates SMS P / 36R, cylindrical probes P/25, P/2N, P/0,5R and P/5.

The device is used to measure the texture parameters of various food products. Different parameters can be determined, such as: hardness, cohesiveness, elasticity, adhesiveness, etc..

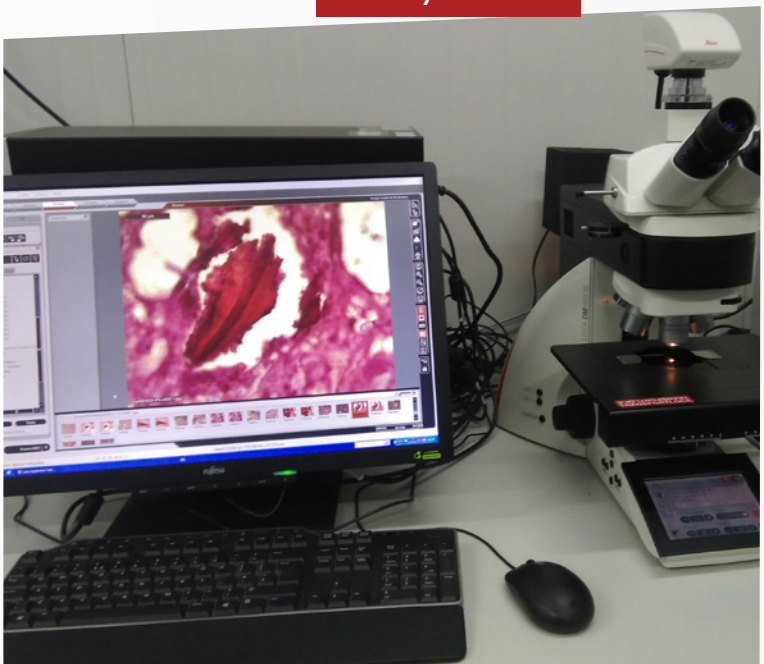
Light microscope *DM 6000 M*, *Leica Microsystems*, Germany

The device has the magnifying ability up to 1000 times, motorized focusing and software adjustment of the brightness, contrast and color intensity. The microscope has a digital camera for taking high quality photos.

It is used for microscopy of biological and food preparations.

TA.XT plus, Stable Micro Systems

DM 6000 M, Leica Microsystems



Farinograph, *Farinograf E, Brabender*, Germany

The device consists of the main unit in which the dynamometer, measuring mixer, thermostat and water-based burette are located. The dynamometer allows adjusting the speed of the mixer from 0 to 200 rpm. The device is connected to a computer, through which all parameters of analysis can be adjusted via Farinograph software and calculate parameters from the diagram obtained.

Farinograph is most often used to measure flavor characteristics during mixing. The rheological properties of various types of flour, as well as other products such as cheese, chocolate, fats can be examined.

Farinograf E, Brabender

Extensograph *Ekstenzograf E, Brabender*, Germany

The device consists of an envelope, a roller for shaping a loaf, three repose chambers, a stretch unit and a thermostat. At the same time, analysis can be done for three samples. The force required to stretch the dough is recorded on the computer through the Extensograph program.

t is used to determine the resistance to stretching of dough characterized by the quality of flour, that is, dough properties during processing and baking.

Amylograph *Amilograf E, Brabender*, Germany

The device consists of a measuring vessel, a measuring head with a temperature sensor and motor housing. The device heats the flour and water suspension, at a rate of 0.1 to 3°C/min, with a constant rotational speed of 75 rpm.

Ekstenzograf E, Brabender

Amilograf E, Brabender

The amylograph assesses the quality of flour and the benefits of flour for various applications, data on pasty characteristics of flour (starch gelatinization and enzyme activity), evaluation of special flour types, and provides assistance in controlling the enzyme addition in the process of producing bakery products.

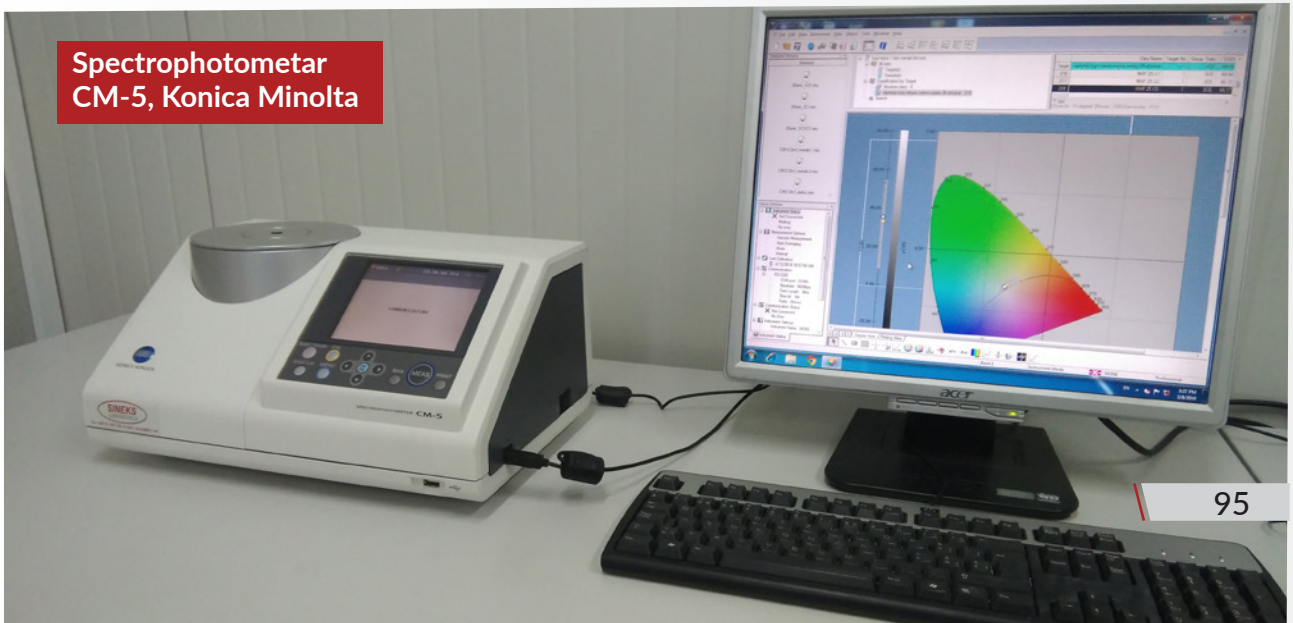
Spectrophotometer for color determination *Spectrophotometar CM-5, Konica Minolta*, Japan

The device can record samples in a solid, liquid and powder state. It has two light sources with the ability to dial between thirteen different modes. The detector can record at angles of 2° and 10°. The spectrophotometer is connected to the computer, so through the SpectraMagic NX program, it is possible to process the obtained results.

It is used to capture the color of all kinds of food products, raw materials and other types of samples.

Semi-industrial meat processing plant

In the semi-industrial meat processing plant it is possible to perform most of the technological operations characteristic for modern industrial processing capacities. Starting from the operations of cutting, molding and sousing of meat, the plant also has suitable small capacity for grinding, mixing, injection of souse and filling sausages and cans.



The plant enables high-quality teaching through practical work of students of the first cycle, as well as modern scientific research in the field of meat technology.

Semi-industrial plant for food, heat treatment

The plant contains cooling, freezing and deep-freezing appliances. In addition to the cold block in the plant there are gas and electric ovens, barbecue, deep fryer, baking chamber and smokers, chambers for meat products, autoclaves and dryers. In addition to heat treatment equipment, the plant has two machines for vacuum food packaging.

The plant is used for teaching through the practical work of students of the first cycle, as well as scientific research in the field of food preservation.

Semi-industrial meat processing plant

Semi-industrial plant for food, heat treatment

Semi-industrial plant for the processing of cereals and flour

In the semi-industrial plant for the processing of cereals and flour it is possible to perform most of the technological operations characteristic for modern processing capacities. The plant has appropriate grain sorting devices, grain grinding, dough swab, dough processing, dough shaping, fermentation and baking.

The plant enables high-quality teaching through practical work of students of the first cycle, as well as modern scientific research in the field of cereals and flour technology.

Semi-industrial plant for the processing of cereals and flour

LABORATORY FOR PROCESS ENGINEERING – FACULTY OF TECHNOLOGY

A particle size analyzer using laser diffraction, *Mastersizer 3000E, Malvern Panalytical Ltd.*, Great Britain

The device is used to determine the particle size distribution using laser diffraction. The basic elements of the device are: hydro unit (Hydro EV) equipped with a mixer to achieve a good dispersion of the analyzed particles in the appropriate dispersant, a set of focal lenses and a laser generator. The device's operation is supported by the appropriate Malvern software. The size of the particles that the device analyzes is 0,1-1000 µm.

The device is used for granulometric analysis of various samples of organic and inorganic origin.

Hydraulic bench F1-10, Armfield Limited, Bridge House, England

The hydraulic bench is the basis for working with all the modules relating to Armfield's fluid mechanics equipment. The bench reservoir volume is 1.5 m3, its height is 1 m, length 1.13 m and width 0.73 m. It contains a centrifugal pump with a maximum flow rate of 1.35 l / s.

Hydraulic bench is used as the basis for the operation of all Armfield's fluid mechanics modules.

Mastersizer 3000E, Malvern Panalytical Ltd

***Bernoulli's Theorem Demonstration F1-15, Armfield Limited, Bridge House,* England**

The test section of this device consists of a classic Venturi tube made of pure acrylic. The piezometers located above the Venturi tubes are connected by silicon tubes with individual points on the tube and serve to determine static pressure. The total pressure in the system is determined by the probe located on the right side of the Venturi tube.

Hydraulic bench F1-10, Armfield Limited, Bridge House

Bernoulli's Theorem Demonstration F1-15, Armfield Limited, Bridge House

The water in the device comes with a hose connector and the flow of water is controlled by the valve at the exit of the analysis section. The height of the device is 0.60 m, width 0.55 m.

The demonstrator (F1-15) is used for direct measurement of static and total pressure along the Venturi tube for different fluid flows.

Nozzle Detector Demonstrator and Nozzle Profile Demonstrator (F1-17), *Orrifice and Free Jet Flow (F1-17), Armfield Limited, Bridge House*, England

The F1-17 apparatus consists of a reservoir supplied with water from a hydraulic bench. The tank has a specially profiled opening that allows adjusting the nozzle. On the right side of the reservoir there is a panel with markers on which the millimeter paper is adjusted, by which the distances of the individual parts of the jets from the reference point are marked.

It is used to determine the velocity coefficient for small openings, the discharge coefficient through small openings in the case of different fluid flows and to compare the obtained jet trajectory with another theoretically known.

Orrifice and Free Jet Flow (F1-17), Armfield Limited, Bridge House

The apparatus for determining losses in the pipes (F1-18), *Energy Losses in Pipes F1-18, Armfield Limited, Bridge House*, England

This apparatus consists of a test tube positioned vertically next to the device through which water can flow directly from the hydraulic bench or from the reservoir equipped with the appliance. Water sources allow high and low flow rates of water that can be controlled by the valve at the outlet from the test tube. The apparatus is also equipped with mercury and water manometers whose role is to measure the total pressure.

The apparatus is used to determine the frictional friction losses in the pipeline system.

Energy Losses in Pipes F1-18, Armfield Limited, Bridge House

Osborne Reynolds Demonstrations F1-20, Armfield Limited, Bridge House, England

The apparatus consists of a tank that is connected to a test tube of 700 mm long. The apparatus is connected to a hydraulic bench by means of which the reservoir is supplied with water, and the discharge of the tank is carried out by the outlet valve on the apparatus. Above the reservoir there is a reservoir for dosing a marker of liquids whose role is to indicate in the test tube the fluid flow regime.

The apparatus is used to determine the fluid flow regime for different flow conditions.

Osborne Reynolds Demonstrations F1-20, Armfield Limited, Bridge House

Flow Meter Demonstration F1-21, Armfield Limited, Bridge House

Flow Meter Demonstration F1-21, Armfield Limited, Bridge House, England

> *The apparatus consists of three types of flow meters (gauges with a damp plate, Venturi tubes and rotameters). It is supplied with water from the hydraulic bench, on which the valve is adjusted and flow.*

The apparatus is used to compare flow values obtained using different types of gauges.

Energy Losses in Bends F1-22, Armfield Limited, Bridge House

Energy Losses in Bends F1-22, Armfield Limited, Bridge House, England

> *The apparatus is designed to analyze the separate energy losses in the basic pipe infrastructure, in places of sudden narrowing and sudden expansion, at the site of the knee and branch. The second part of the device is intended for the determination of losses in the water pipe on which the valve is located.*

The apparatus is equipped with piezometer tubes and differential manometers. The diameter of the base pipe is 19.48 mm, and at the site it extends 26.2 mm.

The apparatus is used to determine the coefficient of losses in the pipeline at local resistance sites.

Cavitation Demonstration F1-28, Armfield Limited, Bridge House, England

The apparatus consists of a circular Venturi tube, three Burdon pressure gauge, which measures the static pressure, the control valve on the apparatus.

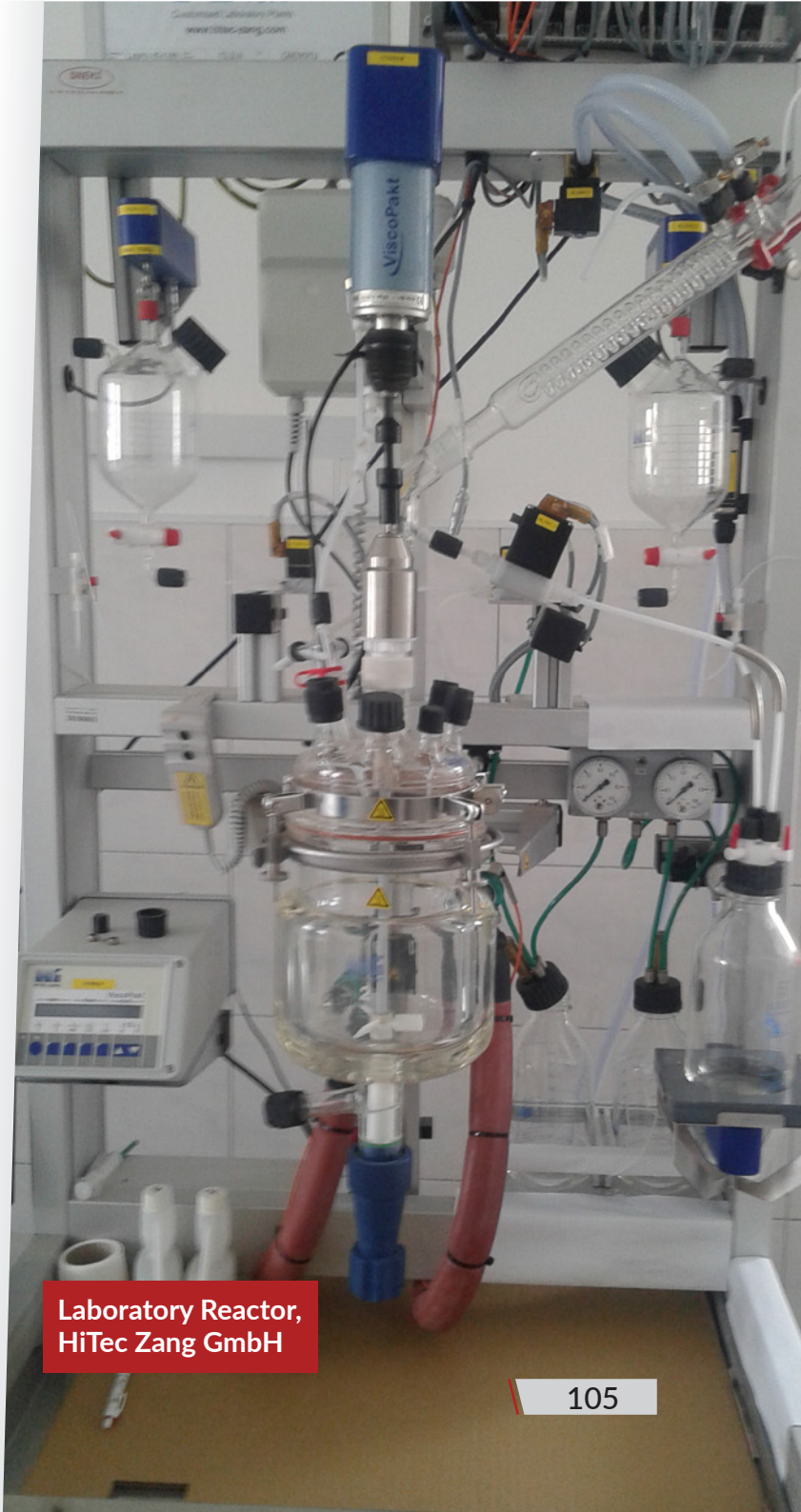
The apparatus is used to demonstrate the phenomenon of cavitation, which is due to sudden changes in fluid flow velocity and pressure in the tube water. Due to the increase in the flow velocity, according to Bernoulli's equation, the pressure falls until a boundary corresponds to the voltage of the steam of the flowing fluid. At this pressure, water vapor bubbles forming strongly affect the elements in the system (propellers, impellers, etc.) and thus destroy them.

Cavitation Demonstration F1-28, Armfield Limited, Bridge House

Laboratory Reactor, HiTec Zang GmbH, Germany

The laboratory reactor is a semi-automated system. It consists of a heating and cooling system for Huber. The reactor vessel is equipped with double heating and cooling coats, temperature gauges and pH values. Also, in the reactor there is a propeller mixer. It is connected with two dosing vessels, as well as for the distillation system. The reactor operation is managed by the software. The maximum operating pressure of the reactor is 1.1 bar and the temperature is 170 °C.

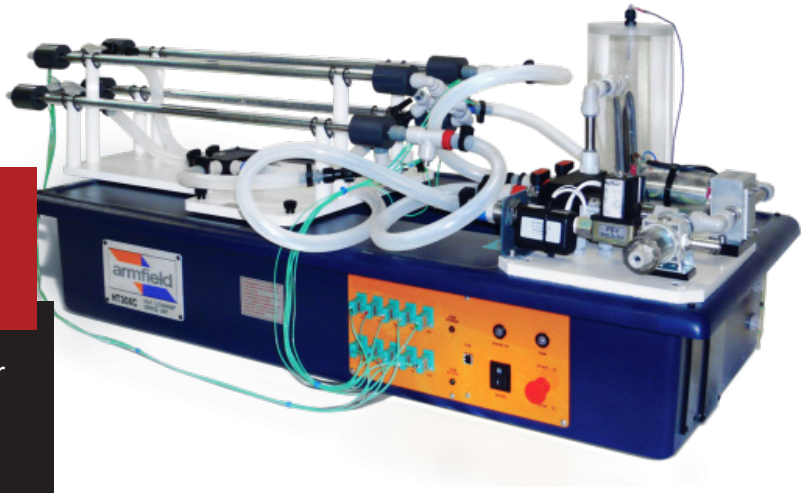
The reactor is used to perform basic non-catalytic and catalytic chemical reactions, as well as the reactions of the synthesis of new products. It is suitable for the testing kinetics of a large number of reactions.

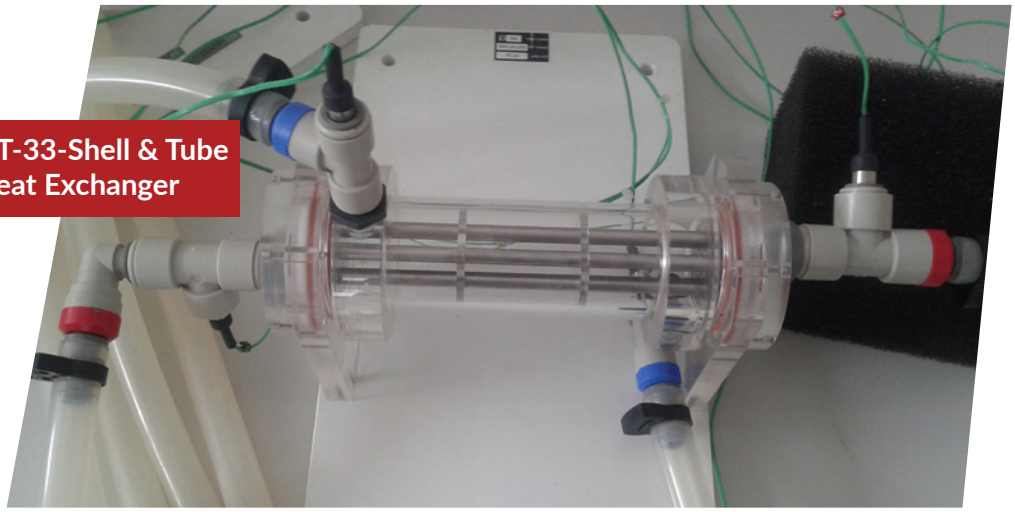


Laboratory Reactor, HiTec Zang GmbH

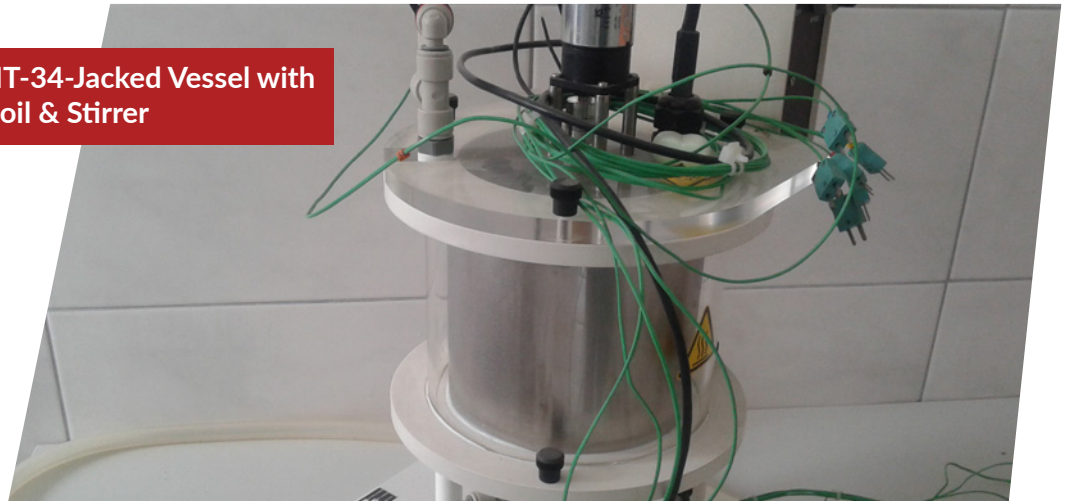
HEAT EXCHANGER, ARMFIELD LIMITED, BRIDGE HOUSE, ENGLAND

The heat exchanger, is the heat transfer analysis section, consists of several subunits:

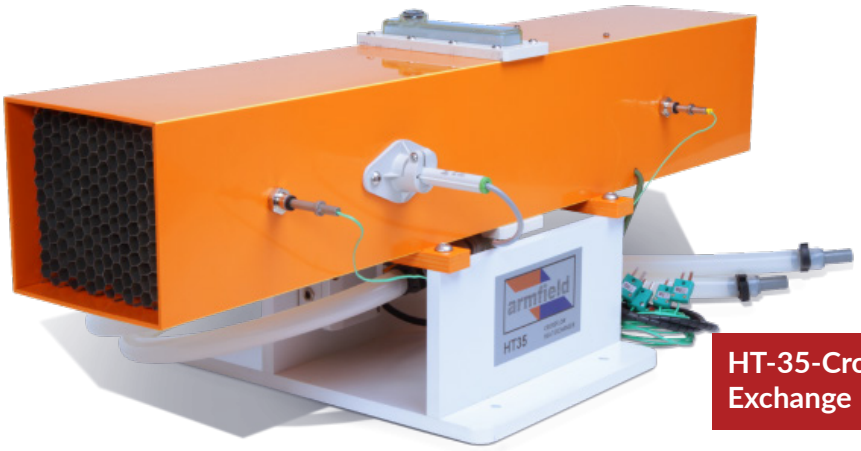




HT-33-Shell & Tube Heat Exchanger



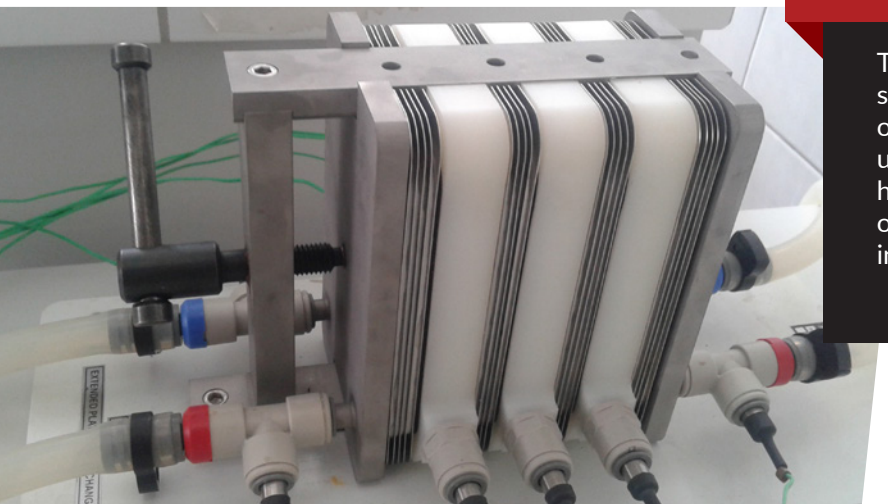
HT-34-Jacked Vessel with Coil & Stirrer



HT-35-Cross Flow Heat Exchange

HT-36-Tubular Heat Exchanger

HT-37-PLATE HEAT EXCHANGER



The system is equipped with educational software for monitoring and managing the operation of all heat exchangers. They are used to determine the basic parameters in heat transfer, as well as comparing this type of device with devices that are used in real industrial conditions.

Extraction unit liquid - liquid (UOP5MkII), *Heat Exchanger, Armfield Limited, Bridge House*, England

Liquid - liquid extraction unit consists of a column of height 1.6 m, diameter 50 mm and made of glass. The column is filled with Raschig rings with a diameter of 15 mm. The aqueous phase through the system circulates from a 25-liter power supply and return tank. The liquid is transported by pumps whose flow is in the range 50 - 250 ml/min.

The column is used to perform the extraction operation in the liquid - liquid system.

Heat Exchanger, Armfield Limited, Bridge House

Gas Absorption Column, Armfield Limited, Bridge House, England

The absorption unit consists of a column of height 1.4 m, diameter 80 mm and divided into two sections. The column is filled with Raschig rings of 15 mm in diameter. The electrical pressure sensor measures the pressure drop along the column. The liquid transport pump allows flow in the range of 1-10 l/min. Temperature sensors measure the temperature of the gas and liquid. Operation of the equipment is monitored by educational software.

The column is used to perform the gas absorption operation in the gas - liquid system.

Gas Absorption Column, Armfield Limited, Bridge House

UNIVERSITY COMPUTER CENTER

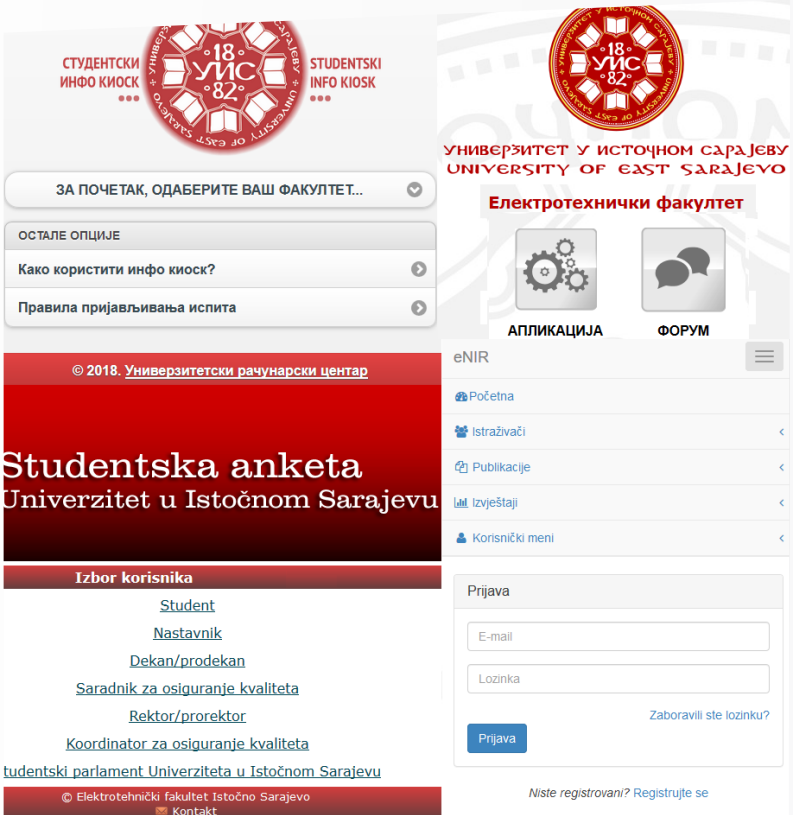
(support to scientific - research work)

Software platform (services, application)

Information technologies - setting up information systems, developing software applications. It is based on the information system of the University and is intended for integration of data from faculties and academies, centralized issuing of diplomas and various types of certificates, as well as analysis of the work of higher education institutions, as well as support to the management processes at the University. Still, some of the software solutions are student services Info-kiosk, records of student payments, student survey, records of scientific-research work (eNIR).

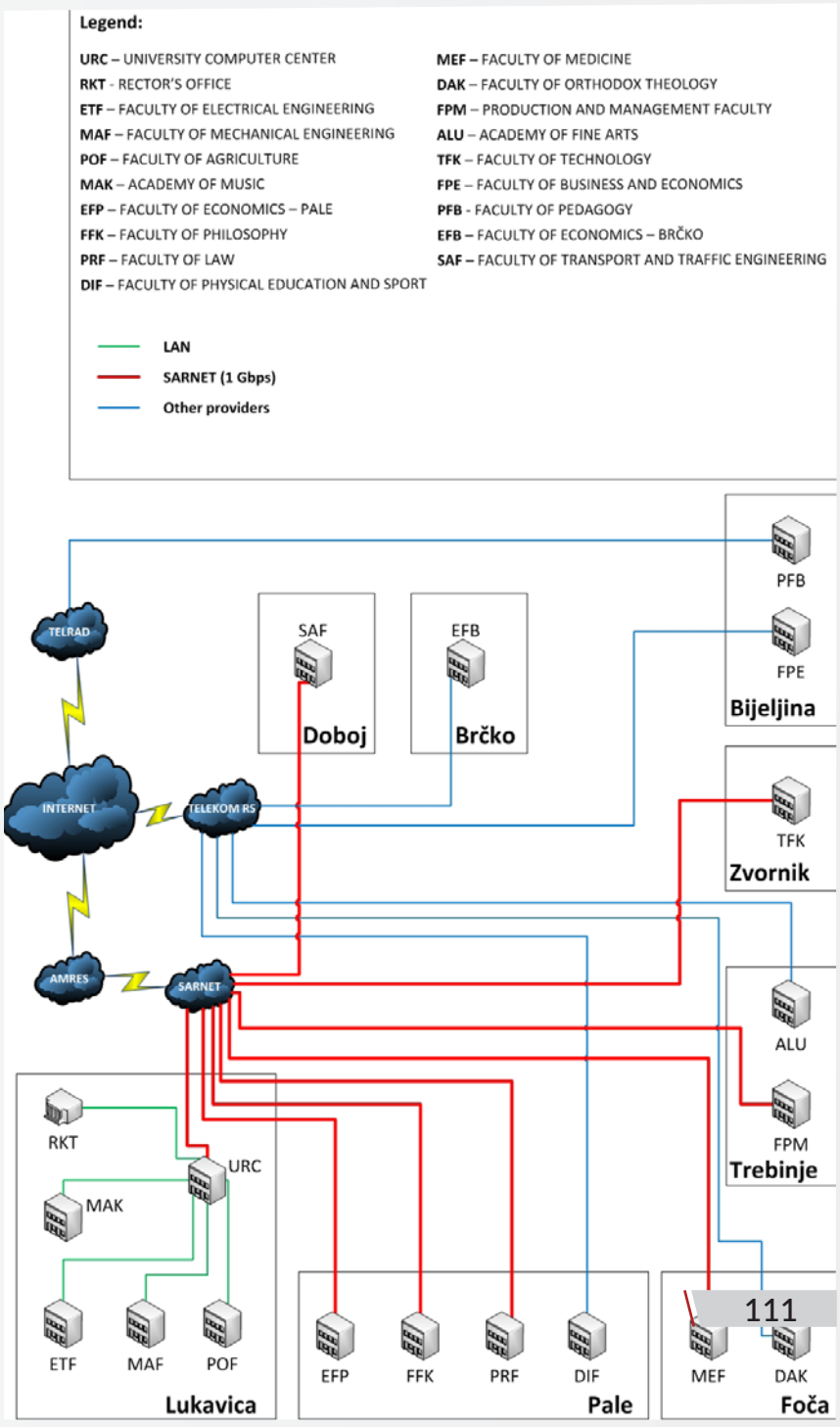
URCIS provides free registration of the new subdomain .UES.RS.BA and maintenance of the old subdomain .UNSSA.RS.BA for all organizational units of the University and for various university associations that need to set up an internet presentation. Hosted presentations are visible under the institution's own domain (eg www.institution.ues.rs.ba). Registration of domains and 'web hosting' also applies to all students of the University of East Sarajevo.

Software platform (services, application)



It provides space on the server, access to the system applications required for the implementation of the website (Joomla, WordPress, MySQL, etc.), as well as remote access to the system.

Software platform

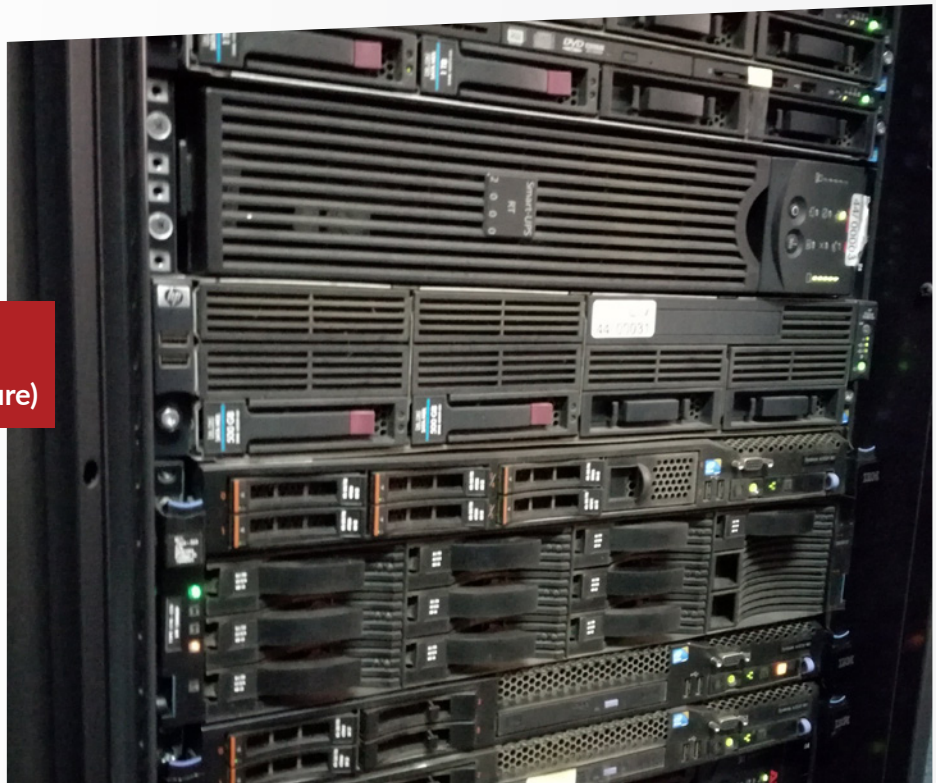


Some of the activities included are the maintenance of full online functionality of the web servers and the visibility of presentations, server monitoring and web services, server protection against potential attacks by hackers, the ability to remote access the server for stand-alone presentations as well as regular data backup.

Communication technologies - set up computer networks, infrastructure development and user-based services based on Internet technologies. URCIS provides communication services and represents the central hub of the VPN network that connects all organizational units of the University. This system meets high standards of security that enable secure and uncompromised data transmission electronically.

Hardware platform (Infrastructure)

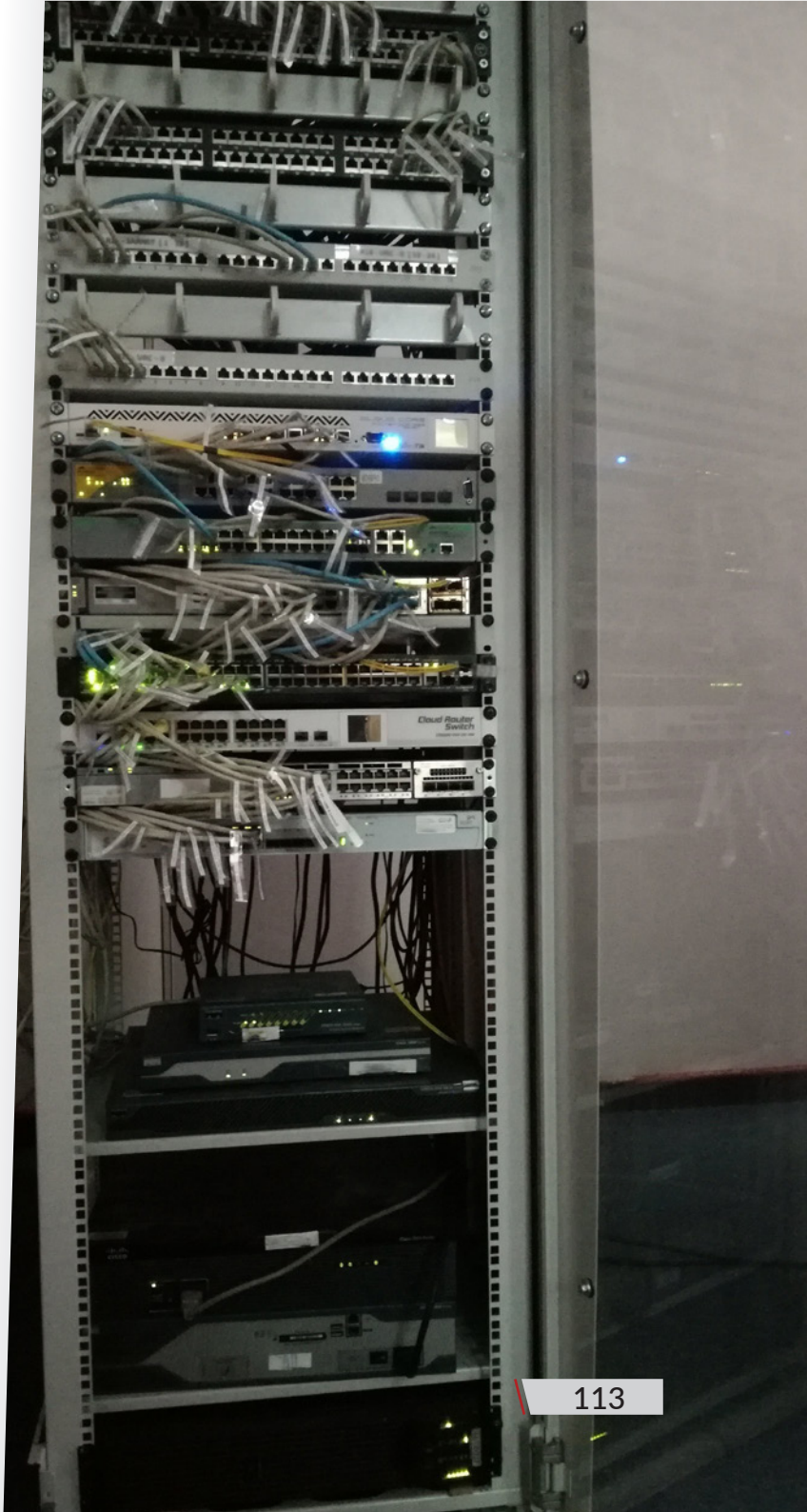
The server infrastructure is based on IBM and HP hardware. Currently, 12 IBM servers and 4 HP servers are in use. IBM storage system - SAN is used to store and backup data.



Hardware platform (Infrastructure)

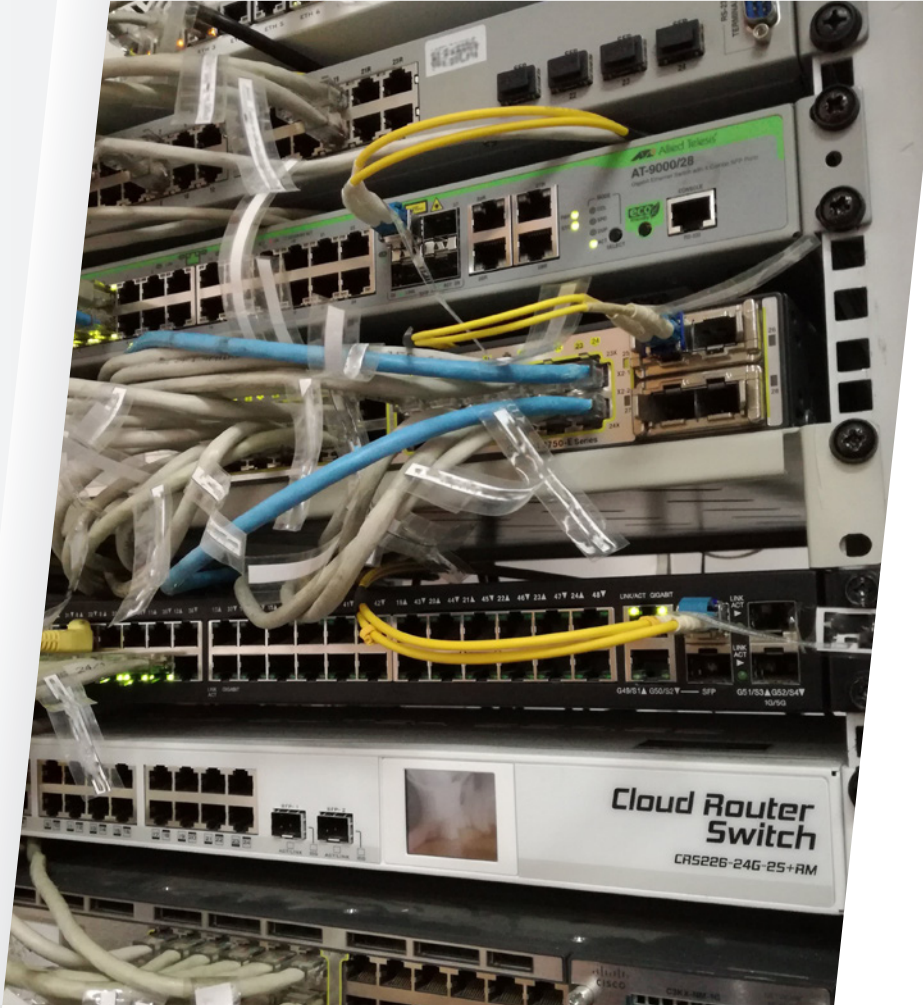
The basis of the hardware equipment is the ESXI solution, which enables the use of a large number of virtual servers. The two branches of Linux distribution RedHat and Debian represent the basis of virtual servers. The network infrastructure of the University Computer Center makes 1Gbps a symmetrical optical link through the academic network of the Republic of Srpska (Sarnet), which brings together almost all organizational units of the University.

Active communication equipment is based on Cisco products. L3 controllable switches with SFP optical modules are used to achieve high speed data transfer. To achieve VPN secure network, Cisco ASA 55xx series firewalls are used, both at the central location of the University Computer Center as well as at the organizational units of the University.



University Computer Center East Sarajevo provides a wide range of non-commercial services to students as well as all employees at the University of East Sarajevo.

URCIS provides support to users in order to maintain the continuity and functionality of the University's information system, as well as the operation and availability of services to which the University faces the Internet.



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