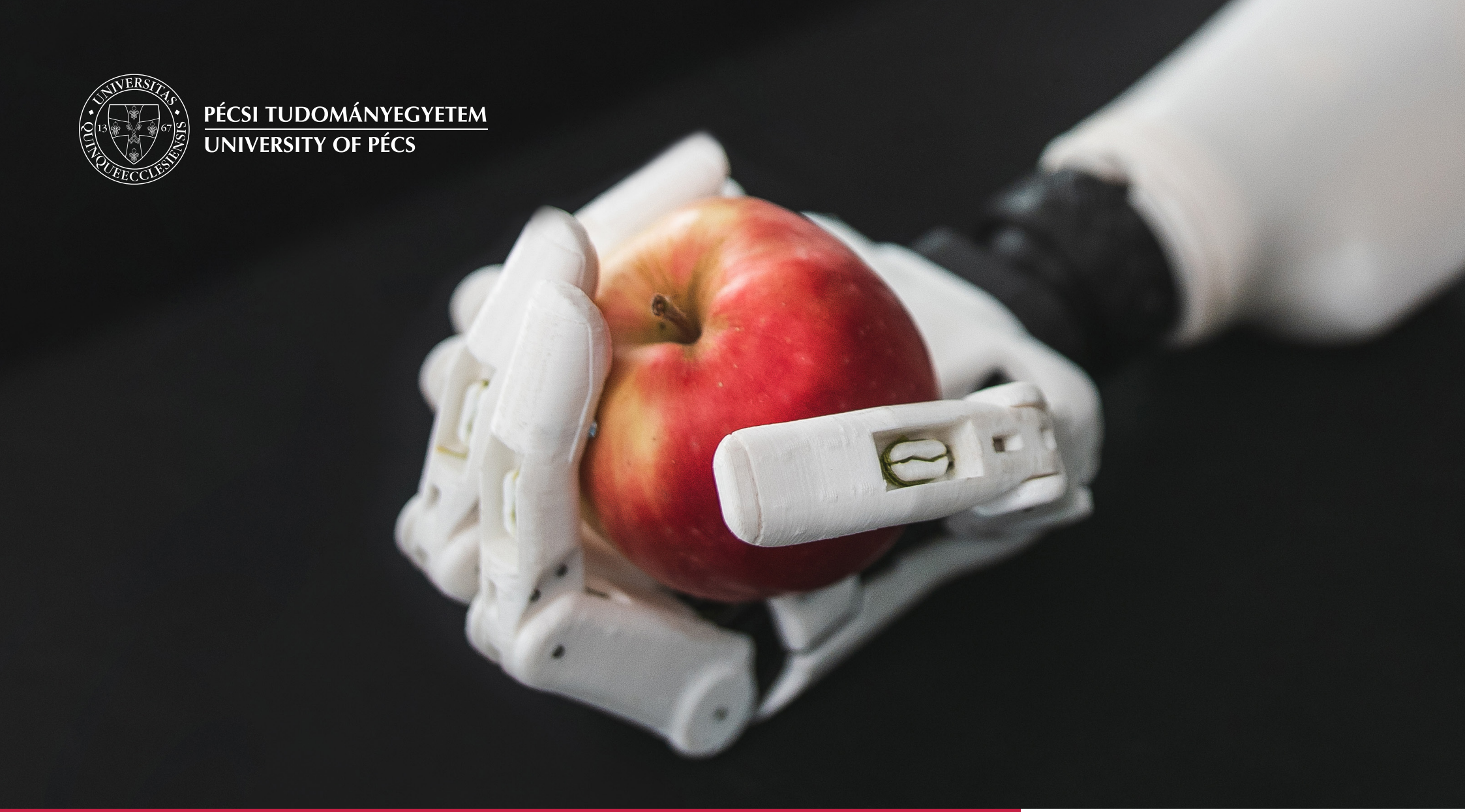
PÉCSI TUDOMÁNYEGYETEM
UNIVERSITY OF PÉCS



THE PROFESSION OF THE FUTURE!

AT THE FRONTIER OF SCIENCE — THE NEW MASTER'S DEGREE PROGRAM IN BIOMEDICAL ENGINEERING AT THE UNIVERSITY OF PÉCS

BIOMEDICAL
ENGINEERING
PROGRAM

AT THE FRONTIER OF SCIENCE

THE NEW MASTER'S DEGREE PROGRAM IN BIOMEDICAL ENGINEERING AT THE UNIVERSITY OF PÉCS

4 semesters, 120 credits, 4-week internship

- Level of education: Master's of Science degree (MSc)
- Qualification: Certified Medical Engineer

In 2019, the Faculty of Engineering and Information Technology at the University of Pécs worked in close cooperation with the Medical School to launch a special type of training specifically targeting the frontier of engineering and medical sciences. The concept was based on several years of successful brainstorming and collaboration, which led to the creation of two exciting ventures in Pécs, Hungary: a 3D Printing and Visualisation Centre offering unique technological capabilities across Hungary and the Centre for Biomedical Engineering and Innovation Program, featuring a network of engineering and medical research teams working together to develop new processes and achieve scientific results.

The development of technical sciences and medicine is both an engine for developed societies and a response to their need for sustainability. Thought it is common knowledge, close cooperation between different academic disciplines is essential in order to make strides and realize significant advancements in 21st century science. Our collective knowledge is so expansive that change and growth can no longer originate from one single discipline. This realization led the University of Pécs to combine new knowledge in engineering and medicine in order to discover novel opportunities for medical and technical innovation. The aim of the new MSc program is to train professionals with interdisciplinary theoretical and practical knowledge related to engineering, informatics, medicine, medical science, health sciences and natural sciences. Medical engineering can be applied to an extremely wide range of practical and theoretical fields including independent research, development and project works by groups of health and technical professionals (clinical, diagnostic and curative) and engineers. After practice, these groups will in turn be capable of leading other groups independently.

Graduates of the new four-semester MSc training program that includes a four-week internship will obtain an accredited degree in Biomedical Engineering. Students in this program will learn about mechanical hands that operate with artificial intelligence and living tissues that are generated with 3D printers. These technological marvels are just two examples that exemplify how wide the spectrum of engineering and medical knowledge can be for scientific research, innovation and collaboration. Students can choose from several specific fields of study depending on which area they would like to concentrate on:

- Neuro-rehabilitation and Human-Machine Interface (HMI);
- Imaging;
- 3D Bio and Tissue Printing.

Our goal is to create an environment for acquiring theoretical and practical knowledge for students to be confident when utilizing the best practices and latest knowledge from both disciplines in order to understand and solve specific problems. This program features hands-on practice within the framework of the evolving educational and research infrastructure of the Faculty of Engineering and Information Technology, the Medical School, and external corporate partnerships. The end result is to develop professionals who can confidently apply technical and IT solutions to solve medical problems and create technologies that improve people's quality of life, combining the best of both disciplines. We have taken the latest international trends into account in developing our training program, with the help of partner institutions such as ETH in Zurich, Nanyang University of Technology in Singapore, or the Department of Biomedical Engineering at the University of Houston in Texas, USA.

As our training is strongly based on candidates' former scientific knowledge, we welcome applications from undergraduates in engineering, IT, medical science, health science, natural science, general medicine, dentistry, and pharmacology. The program is designed for students who are inspired by the application of cutting-edge technologies and the challenge of new discoveries at the frontiers of science.

During MSc program, students will learn about the following disciplines and specializations:

— Natural sciences (mathematics, physics, functional anatomy, physiology, biophysics, molecular biology): 20-30 credits;

— Economic and human sciences (quality management, ethical issues of medical research, health care): 10-20 credits;

— Medical engineering (instruments and techniques for measuring signals of biological origin, theory of technical and biological systems, process control, biomechanics, biomedical computer practice, bioinformatics, biocompatible materials, biotechnology, biomedical sensors, medical image processing, medical optics, speech and hearing diagnostics, pharmaceutical biotechnology, intelligent medical devices): 15-35 credits.

Undoubtedly, biotechnology is the profession of the future, an important field that will provide professionals with many lucrative and transformative career opportunities. Relationships that the University of Pécs has fostered with market partners also contribute to the overall appeal of this MSc program of study. For students committed to research, the opportunity to pursue careers as university researchers and lecturers is also available.

AT THE FRONTIER OF SCIENCE

STUDENTS IN THE PROGRAM WHO BECOME MEDICAL ENGINEERS WILL DEVELOP THE FOLLOWING PROFESSIONAL COMPETENCIES:

THE MEDICAL ENGINEER HAS KNOWLEDGE OF:

— The scientific and technical theory and practice related to the medical engineering profession (mainly functional anatomy, physiology, mathematics, physics, biophysics, biomechanics, biochemistry, molecular biology).

— Instruments required for biomedical measurements and therapeutic treatments and an understanding of their diagnostic and therapeutic applications.

— The tools and methods of computer modelling and simulation related to the field of health engineering.

— The tools and methods of mathematical modelling and computer simulation of technical and biological systems.

— Basic communication, management, organizational and engineering ethics skills.

— The basics of quality assurance.

— The basics of electrical safety related to electronic devices used in healthcare.

— The organizational tools and methods related to management, and the legislation necessary to work in this profession.

— Measurement technology and measurement theory related to the field of health engineering.

— Information and communication technologies related to the field of health engineering.

— How to use relevant international Internet literature sources and other up-to-date databases.

AT THE FRONTIER OF SCIENCE

STUDENTS IN THE PROGRAM WHO BECOME MEDICAL ENGINEERS WILL DEVELOP THE FOLLOWING PROFESSIONAL COMPETENCIES:

THE MEDICAL ENGINEER HAS THE ABILITY TO:

— Apply scientific and technical knowledge to process, systematize, analyse and make conclusions on the information collected during the operation of the systems and processes used in health care.

— Model and characterize the functional structure of the human body and physiological processes and regulations.

— Enrich the knowledge base of the field of health engineering with original ideas.

— Apply integrated knowledge of the equipment and processes used in healthcare, electronics and informatics.

— Plan and manage the complex use of technical, economic, environmental, and human resources.

— Apply and further develop procedures, models and information technologies used in the design, organization and operation of healthcare systems and processes.

— Ensure the quality assurance of systems, technologies and processes used in healthcare to make measurements and process control tasks.

AT THE FRONTIER OF SCIENCE

OUR EDUCATIONAL INFRASTRUCTURE

Within the University of Pécs, both the Faculty of Engineering and Information Technology and the Medical School have made great efforts in recent decades to ensure that both the infrastructure and equipment supporting education meet modern standards and expectations for educational and research purposes. The buildings of the Faculty of Engineering went through several reconstructions and the Medical School's campus has been re-designed within the framework of the Modern Cities program.

The constantly expanding services available on the University of Pécs campus increase the possibilities and opportunities for students to have quality experiences. Indoor and outdoor sports facilities are available to our students (gym, swimming pool, outdoor pool, and sports fields), providing the essential conditions for a healthy lifestyle. Additionally, there are also countless restaurants, buffets, and entertainment venues in the city.

The conditions for fulfilling the foreign language requirements required for the completion of the Biomedical Engineering program are provided in our institution. In order to pass the language exam, English and German language instruction takes place four hours a week over the period of four semesters, and two professional language courses serve our foreign language training at the faculty with multimedia language laboratories.

LIBRARIES:

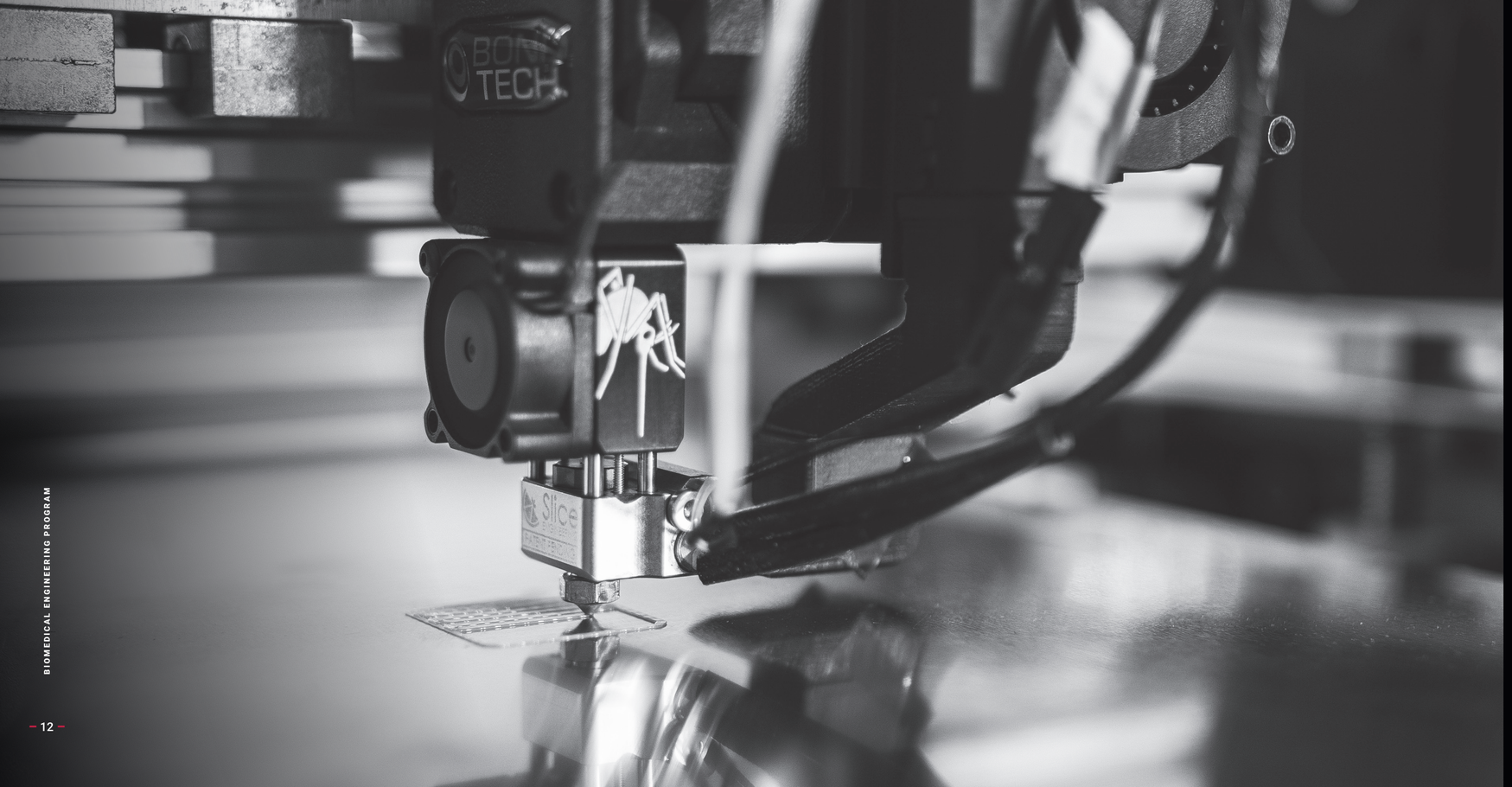
The Library Network connects all of the libraries at the University of Pécs. There are approximately 900,000 books, audio-visual documents and other documents, and 90,000 volumes of journals available for students and professors. This includes major journals, textbooks, CD-ROM databases and literature. Inter-library loans are also provided from domestic and international libraries, so it is possible to quickly and efficiently find any necessary literature for a wide range of student research interests, both in traditional paper-based forms and digital mediums. In addition, the South Transdanubian Regional Library and Knowledge Centre operates in the city of Pécs, which is available to students in a modern building that is more than 13,000 m^2.

https://lib.pte.hu/
https://www.tudaskozpont-pecs.hu/

LABORATORIES AND RESEARCH CENTRES:

University of Pécs Medical School Medical Simulation Education Centre (MediSkillsLab):

The facility is responsible for the acquisition of technical and non-technical skills and abilities during undergraduate and post-graduate medical and health professional training. The MediSkillsLap has several simulators to demonstrate and practice a wide range of skills, from the simplest interventions (e.g. venipuncture or catheter insertion) to complex simulations (e.g. surgical procedures or emergency patient care). The lab includes so-called "basic task trainers", virtual visualization tools, and high-fidelity patient simulators. The MediSkillsLab is currently located on 350 square meters, and its expansion is scheduled to begin in 2021 with a total area of over 1,600 square meters. During renovations a complete cadaver operating room, a virtual reality laboratory and several other educational units (e.g. a dental simulation unit) will be



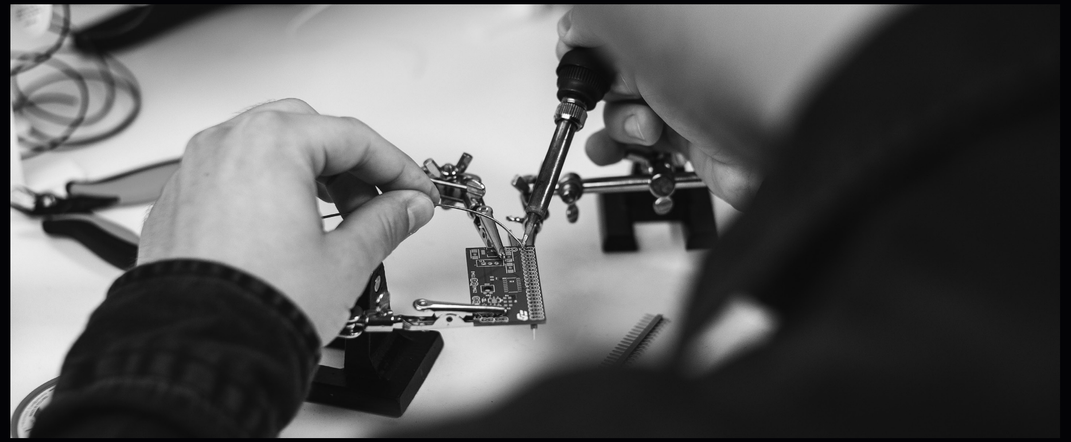
created for training purposes. The MediSkillsLab in an important practical training location for Biomedical Engineering students at the university.

http://aok.pte.hu/hu/egyseg/index/3014
https://www.youtube.com/watch?v=_PRCAwPHids

3D PRINTING AND VISUALIZATION CENTRE

The interdisciplinary research centre is primarily engaged in medical technology developments. A wide variety of 3D printing and visualization technologies are available at the facility. In addition to traditional fused filament fabrication (FFF) desktop apparatus, industrial 3D printers (selective laser sintering - SLS or PolyJet technologies) and dual-extruder machines are also available. Scanning and some other designing stages are also taking place in the 3D Printing and Visualisation Centre. Multidisciplinary teams working at the university participate in research and teaching activities. The institution's research is mainly related to materials technology, but it also supports other areas like biotechnology and bioprinting. The device and software development portfolio was designed in close collaboration with the Medical School. The 3D Centre is also involved in the development and production of medical devices (e.g. prostheses, exoskeletons) and laboratory devices (e.g. microfluidic systems). Its software development activities primarily cover systems supporting medical and health sciences in higher education. The 3D Centre has been accepting trainees since it opened.

http://pte3d.hu/



BIO-MECHATRONICS LABORATORY

The Laboratory was primarily designed to support education. The workstations allow students to understand a wide range of electronic design and control processes and to acquire related skills. The primary purpose of this lab is for modelling physiological and biological processes and connecting them to the human-machine interface field. The implementation of small group projects is an important feature of this lab, and therefore workstations can hold a maximum of two students at a time. The laboratory's equipment can also support relevant research activities related to the field of medical engineering, which is closely related to the field of Biomedical Engineering.

MATERIALS TECHNOLOGY LABORATORY

This lab is for acquiring a wide range of materials technology knowledge, which is also closely related to the field of Biomedical Engineering. Dynamic and static material studies can be complete here, and the lab facilitates hands-on practice and training. Both plastics and metals can be tested with the measuring equipment. The Department of Biophysics and the Central Electron Microscope Laboratory are also important partners in the teaching of structural studies.

BIO-MECHANICAL LABORATORY

This laboratory was established in a clinical environment (Department of Neurosurgery and the Clinical Centre), and the work done here is closely related to the field of human-machine science. The laboratory actively supports both teaching and research activities. The lab equipment can analyse healthy and pathological forms

of movement, and students can also learn about modern robot-assisted rehabilitation techniques.

The Faculty of Engineering and Information Technology has eight centrally managed computer laboratories with 26 computers per laboratory. Each laboratory is renovated every two years on average in order to ensure that the computers in the laboratories are always up-to-date and meet stringent software requirements required for the research. Computers can run basic word processing, spreadsheet programs, state-of-the-art design software, development environments, and software packages that support engineering and scientific data processing, modelling, simulation, and visualization. We have licenses for the following state-of-the-art software: AutoCAD 2000 (60 licenses), Autodesk Education Master Suite 2011 (50 licenses), Solidedge ST2 Education, Solidworks, ANSIS, VBExpress, CADKEY, CosmosM 2.8, Vis-Sim, MicroCAP, Revit, LabView 2018, Catia P2 Solution, Maple10 and 11, SPSS, SWI Prolog, NetBeans, Java, Oracle 9i DeveloperSuite, MagicDeveloper, iBolt, UniPaas, Navision, Adobe Web Premium CS4 4.0 (26 licenses), COREL DRAW GRAPHICS SUITE X5 EDU, MS Office, and MS VisualStudio 2010. Computers in the computer labs also run Python (Anaconda Navigator) and Matlab 2019.

In addition to the central computer labs, other labs listed below are available to students with special equipment:

CISCO REGIONAL NETWORK ACADEMY

The faculty operates the CISCO Regional Network Academy to acquire network knowledge. Students are taught in a laboratory equipped by CISCO.

NATIONAL INSTRUMENTS MEASUREMENT LABORATORY

In cooperation with the company National Instrument Hungary, a new measurement laboratory was established in 2010. There are four NI-ELVIS II in the laboratory (Educational Laboratory Virtual Instrumentation Suite), a complex tool suitable for measurement, data collection, signal generation, and signal analysis. The lab also includes high-speed A/D cards as well as a video digitizer card with NI VISION software to support machine vision and image processing.

NETWORK LABORATORY

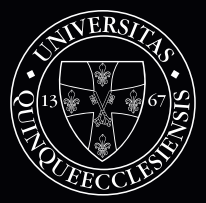
The special feature of this lab, which was set up with 23 computers in 2010, is that network configurations, topologies and other related settings can be selected optionally, making it excellent for teaching and researching these kind of topics. The laboratory is also an Industrial Ethernet Competence Centre. This was established with the generous support from the Phoenix Contact company, which donated expensive equipment for students to use to learn about industrial Ethernet technology.

PROGRAMMABLE LOGIC CONTROLLERS (PLC) LABORATORY

In this laboratory, devices and controlled technologies were installed from Klöckner-Moeller, Siemens, Omron, Mitshubishi, Schneider, and Allen Breadly. Siemens Karlsruhe development centre has installed a PCS 7 process control system in the laboratory. There are 12 computers available for the development of the user program. The design of the laboratory allows room for one or two people but can accommodate maximum of 16 students in total. The process control system communicates with technology via Profibus. The Master devices are also connected to each other via industrial Ethernet and the development system is connected by a wireless system.

UP FEIT HPC LABORATORY

UP FEIT is a laboratory with high-performance computers, the purpose of which is primarily to support high-performance, parallel calculations. The lab machines are suitable for parallel computing, thus supporting computational tasks in solving engineering and scientific problems (e.g. multiparameter optimization, finite element modelling and simulation, artificial neural networks, etc.). Parallel processing can dramatically reduce the amount of time required for running calculations.



www.cbei.pte.hu/biomedical-engineering-msc
biomedicalengineering@mik.pte.hu