



Youngstown State University Upgrades EE Teaching and Research Labs

To produce next generation Digital Microelectronics Education

Organization

- Youngstown State University

Challenges

- Lack of curriculum to produce next-generation workforce in microelectronics
- Balancing lab equipment needs with budget constraints

Solutions

- Ten new lab stations equipped with Keysight oscilloscopes, digital multimeters (DMMs), power supplies, and network analyzers

Results

- University provides students with industry-relevant hands-on experience
- Lab equipment is scalable for in-person or remote learning

Modern Test Equipment Elevates Microelectronics Education and Training

Youngstown State University (YSU) is the first and only college in Ohio dedicated to science, technology, engineering, and mathematics (STEM). The university's STEM Professional Services programs have successfully placed students in internships to give them hands-on experience with the possibility of multiple job opportunities before graduation.

YSU's Electrical Engineering Technology program is instrumental in providing an industry-ready workforce to various industries in the United States. The faculty is actively involved in research related to very-large-scale integration (VLSI) applications to create integrated circuits, microelectronics, computer hardware, additive manufacturing, flexible electronics, microelectronic chip design, and hardware security. Microelectronics is a subdivision of the field of electronics that covers very small and microscopic elements to manufacture electronic components. The technology is rapidly evolving the ever-increasing demand for inexpensive and lightweight products.

This case study discusses how YSU invested in new lab technology to elevate their students' learning experience.

Challenges

To stay competitive, universities must develop industry collaborations while balancing capital expense investments in their labs to meet student and research needs.

As competition for technology jobs increases, students need to consider how employable they will be with a degree from the universities they are considering for their education.

When YSU faculty made the decision to upgrade their EE labs, they evaluated three potential solutions and compared the benefits and costs of each. Equipping a new lab can be costly, and the YSU team wanted to be sure their investment would provide:

- Accurate and reliable test results for existing and emerging technologies — students are industry-ready when entering the workforce.
- Remote functionality to expand the lab's reach so more students would have lab access.
- Convenient access to technology and measurement experts for students and professors for equipment setup and application assistance.
- Seamless design, build and troubleshoot experience in microelectronics, which would encourage students towards a thriving career path as digital design engineers.

Professor and Director Frank X. Li, Ph.D., and Assistant Professor Vamsi Borra, Ph.D., evaluated proposals from Keysight and two other leading test equipment manufacturers. They selected a Keysight solution, citing Keysight as a market-leading test and measurement manufacturer with the ability to meet all their outlined criteria. Dr. Borra stated, "We couldn't just buy the least expensive equipment; we didn't want to compromise on the student's learning experience."

Solutions

Working with their local Keysight representative's recommendations, Drs. Li and Borra determined to outfit ten new lab demonstration stations to augment their RF and digital design capabilities. Although the lab space can accommodate more stations in the future, current Covid restrictions limit the number of students in the lab at any given time. Each lab station has the following instruments:

- Keysight InfiniiVision MSOX4000A oscilloscope
- Keysight 34465A digital multimeter
- Keysight 33622A waveform generator
- Keysight E36312A triple output power supply

YSU also added RF capability with Keysight's E4980B vector network analyzer and the Keysight N9000B CXA signal analyzer. To help with microelectronics design, the lab installed the Keysight EXR208A Infiniium EXR-Series oscilloscope with eight channels. The EXR-Series oscilloscope has power supply testing and power integrity analysis capabilities to decode all common protocols.

In addition, YSU purchased Keysight PathWave Lab Operations for Remote Learning (PW9112EDU), which enables remote equipment management. Now professors can set up labs virtually, schedule student lab time and instrument access, and monitor student progress remotely. Students can collaborate in teams, complete labs remotely, and get the same hands-on experience they would when on campus, even if they cannot attend classes in person.



Image courtesy of Youngstown State University

Results

YSU installed its new Keysight solutions in time for the fall 2021 semester. The students are currently 100% on campus, and the university is confident they can quickly switch over to a remote or hybrid model if needed. This lab setup also allows YSU's Electrical and Computer Engineering (ECE) program to expand accessibility to potential students outside of the local geographic area. Students gain industry-level skills, more specifically in digital electronics design and development, in the labs upon graduating from the ECE program. YSU's ECE program is working towards developing the curriculum and conducting research into assured and trustworthy microelectronics solutions.

Assistant Professor Borra stated, "The confidence in the recorded data and the easy troubleshooting of complex circuits using Keysight equipment is exceptional." YSU looks forward to augmenting the curriculum to include advanced labs they could not perform with the previous lab equipment.



Image courtesy of Youngstown State University

Learn More

- [Keysight Academic Teaching Lab Solutions](#)
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