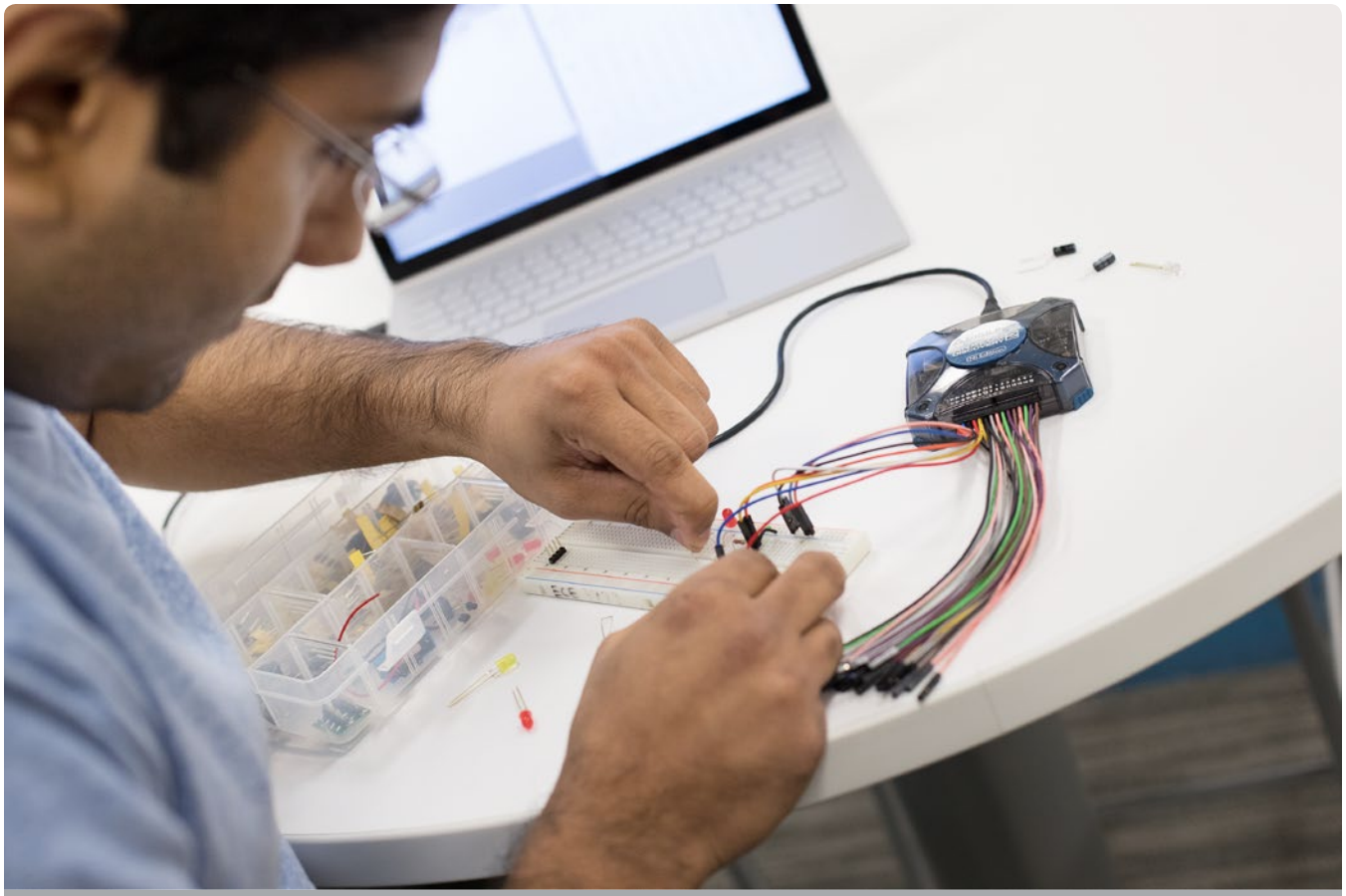
Analog Discovery 2

Going Beyond the Curriculum: Siddaganga Students Learn Anywhere, Anytime

There's no substitute for the experience of learning in labs. They provide students with vital knowledge that can't be gained with just lectures and textbooks. But many students are limited by lab time constraints that don't always allow them to finish their experiments. To alleviate this issue, the Siddaganga Institute of Technology provided students with the portable Analog Discovery 2–NI Edition to help them fully absorb content outside the confines of a traditional lab environment.

NATIONAL INSTRUMENTS™



NI Product Used:

- Analog Discovery 2–NI Edition

Industry:

- Academic

Application Area:

- Electrical Engineering Teaching

The Challenge

Conventional labs are failing students by denying them the time and laboratory resources they need to fully understand theoretical content and benefit from critical comprehension.

The Solution

With portable devices such as the Analog Discovery 2–NI Edition, students can complete labs outside the confines of traditional laboratory time and professors can offer more opportunities to experiment with concepts that traditionally have involved only theoretical discussion.

At Siddaganga Institute of Technology, students must typically spend two to three hours in a lab each week to complete their assigned lab work. This work reinforces the lessons taught throughout the week and provides a real, hands-on experience to supplement the theory students learn just before the lab. But students must often choose between finishing the lab or taking the time to fully understand the content. They find it cumbersome to build the circuits, connect and measure the outputs, and draw conclusions within the stipulated time. Many students turn in half-completed lab assignments after getting confused during the lab and running out of time. The worst-case scenario is students resorting to copying a peer's lab work when they run out of time, which results in no knowledge gained, a wasted lesson, and no opportunity to truly retain the translation of the theory.

Students at Siddaganga Institute of Technology use Analog Discovery 2 to test basic concepts in electrical engineering.

Siddaganga faculty members knew they needed to develop a new approach with labs that focused on content, lessons learned, and the engineering intuition built during the experiment instead of forcing students to race against the clock just to complete an experiment.

Introducing Portable Labs

Students can benefit from laboratories featuring portable devices because they offer unlimited time to complete a lab. In addition, the instructors can create more labs that are smaller in scope and supplement theory but historically have not fit into the curriculum. The idea is to take all of the components and hardware used in the lab and loan them to a student for the semester. Students can fit their entire lab setups in their backpacks, take them anywhere they want, and complete work at any time. Siddaganga achieved this using Analog Discovery 2–NI Edition, a portable, low-cost, all-in-one instrument for the school's Analog Circuits lab, Digital Circuits lab, and Linear ICs and Communications lab.

Initially, Siddaganga faculty members tried a partial solution: they asked students to simulate and build their circuits before coming into the lab and then use traditional benchtop equipment to conduct the actual experiment. This saved some time and reduced some student complaints; however, it did not fully eliminate the challenges the students faced. The most common challenge was manually building

"There is now unlimited time to complete labs because all students can have the Analog Discovery 2–NI Edition with them all the time. We are used to conventional labs; it is now time for us to change to portable labs."

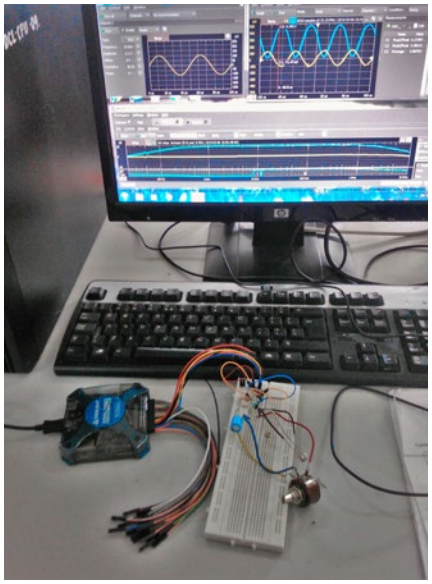
Dr. K.C. Narasimhamurthy

a bode plot by slowly increasing frequency, measuring a point, and repeating. Analog Discovery 2 solved this and other problems by fully integrating easy-to-configure software and hardware.

Analog Discovery 2 offers the following portable devices, among others, that proved versatile enough for use in three different labs: a fast enough oscilloscope for analog modulation schemes, variable power supplies and function generators for use in analog courses, and a logic analyzer that has eradicated problems in the digital lab.

Going Beyond the Curriculum

Implementing a portable lab has greatly improved student sentiment toward the labs and increased the students' understanding of theory. They have found the compact device easy to use, and the time constraints that added pressure to complete the labs are no longer an issue. After Siddaganga implemented portable labs, the number of students who failed practical examinations decreased significantly. Students have more confidence in the outcomes of the laboratory, which they gained only when they fully understood the content.



Students use several Analog Discovery 2 instruments to better understand the system they have built.

Beyond the benefits of making the labs portable, Analog Discovery 2 reduced the need for manually adjusting and plotting parameters in the labs, which further decreased the time constraints on the students. For example, when teaching operational amplifier theory, instructors needed to teach and demonstrate the frequency response of the operational amplifier. But getting an accurate representation of the frequency response by sweeping the input frequency by hand was almost impossible with traditional lab equipment. Students quickly lost interest because they had to repeat frequencies or redo the entire lab. Though students could simulate this, they were not convinced with simulated results. Only with a hardware component were the students satisfied with their understanding. They used Analog Discovery 2 software to set up frequency sweeps and bode plots with a single click, which eliminated the challenge of taking measurements by hand. The software automation and hardware specifications inspired educators to look back at the lab assignments and redesign them to further solidify theoretical concepts that could not be taught in conventional labs. For example, educators added a gain bandwidth verification step to a common-emitter amplifier lab, which was impossible in the previous lab setup.

LabVIEW software integration was key in Siddaganga's decision to use Analog Discovery 2. This integration expanded the device so students could further explore signal processing. In the near future,

Siddaganga students should be able to demodulate their analog and digitally modulated RF signals using LabVIEW. To further demonstrate theoretical concepts, the faculty has added second-year labs for sensor/actuator-based experiments (for example, interfacing with IR sensors, light-dependent resistors, and temperature sensors to control fans, lights, and other actuators).

Future Implementation

The next step is implementing portable labs in more courses so all students can standardize on the same hardware and every course can benefit from the same time-saving measures. As portable labs expand, all professors need to consider redesigning syllabi to take advantage of the extra time and functionality to teach information that was previously only theoretical.

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