

From the original N.S.F. Application:

Community College component:

Goals

The objective of the PCB module is for engineering students to complete a team-based design experience in an introductory circuits laboratory course. Unlike at most universities, engineering students at a community college take the same introductory circuits course, regardless of major. This provides a unique opportunity to build engineering teams of students with various interests – from computer engineers to civil engineers.

The module will introduce engineering students to computer-aided design and manufacturing, practical hands-on assembly of PCBs, and testing of manufactured components. The PCB module would be implemented in the laboratory portion of an introduction to engineering course. While community colleges are not subjected to ABET Accreditation criteria, the PCB module is a first step in addressing two criteria: “Engineering programs must demonstrate that their graduates have... (c) an ability to design a system, component, or process to meet desired needs; (d) an ability to function in multi-disciplinary teams.”

Project Plans

Perhaps the most complex laboratory experiment in an introductory circuits course deals with op-amps. This is due to the many connections required for just a single op-amp. Op-amp experiments thus tend to be very simple. The PCB module would allow students to design, build and test a simple system-level op-amp design. The design could consist of a buffer, summer and amplifier interfaced to a sensor for input and a digital-to-analog chip. Op-amps could be placed in cascade, and by incorporating capacitors (the topic generally following op-amps), the student teams could design a system to solve first and second order differential equations.

A second phase of the PCB project would be to develop a module for a second semester circuits class, which is generally taken only by computer engineers and electrical engineers, or in a digital design course. The modules would also be made available to the Electronics Program.

The project would be a three-week design/analyze/build/test experience, with a one- or two-week intercession for fabrication.

Week 1: Teams are formed, design specifications distributed. PCB design software introduced (PCB design software is available free online, such as PCB123, or PCB express)

Week 2: Teams bring in analysis of design, and create PCB schematic for submittal to vendor.

Intersession: Designs submitted to off-campus vendor. PCBs returned.

Week 3: Components soldered to fabricated circuit boards. PCB tested.