

## How adding real time interactive labs to their online faculty development program in Electronics, made IEEE's program more effective and engaging?

The IEEE ([www.ieee.org](http://www.ieee.org)) provides learning opportunities within the engineering sciences, research, and technology. The goal of the IEEE education programs is to ensure the growth of skill and knowledge in the electricity-related technical professions and to foster individual commitment to continuing education among IEEE members, the engineering and scientific communities, and the general public.

IEEE had partnered with IIT Gandhinagar and academics and professionals from around the world to create an innovative new online program to help develop the teaching skills of university faculty.

The program provided faculty with Web-based best-practice courses of study, pedagogical tools, instructor guides, sample problem sets, lab exercises for university courses in electrical, electronic, and computer engineering. The pilot phase of the program, would give more than 500 faculty members in India free online access to course materials on course such as Circuit Analysis, Electronic Devices, Digital Systems and Introduction to Electronics.

The screenshot shows the main webpage for the IEEE Faculty Development program. The header features the text "IEEE Faculty Development" and "IEEE Educational Activities". A navigation menu on the left includes "Main menu", "Navigation", and "Settings". The main content area is titled "IIT Gandhinagar Indian Institute of Technology Gandhinagar" and contains a welcome message from IEEE, a description of the program, and a list of technical courses, real world engineering projects, and becoming a better instructor. A discussion forum and private files section are visible on the right.

IEEE Faculty Development

You are logged in as Sparsha Sparsha (Logout)

IEEE Educational Activities

Home

Main menu

- Empowerment of Teachers, by Prof. Deepak Phatak

Navigation

- Home
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Settings

- Front page settings
  - Turn editing on
  - Edit settings

IIT Gandhinagar Indian Institute of Technology Gandhinagar

IEEE, the world's largest professional association dedicated to advancing technological innovation and excellence for the benefit of humanity, has partnered with IIT Gandhinagar and academics and professionals from around the world to create an innovative new online program to help develop the teaching skills of university faculty.

When complete, the program will provide faculty with Web-based best-practice courses of study, pedagogical tools, instructor guides, sample problem sets, lab exercises, and online simulations for university courses in electrical, electronic, and computer engineering. The pilot phase of the program, to be released soon, will give more than 2,000 faculty members in India free online access to course materials on:

Technical Courses	Real World Engineering Projects	Becoming a Better Instructor
<ul style="list-style-type: none"><li>Circuit Analysis</li><li>Introduction to Electronics</li><li>Digital Systems</li></ul>	<ul style="list-style-type: none"><li>Circuit Analysis</li><li>Introduction to Electronics</li><li>Digital Systems</li></ul>	<ul style="list-style-type: none"><li>Writing Effective Multiple Choice Exams</li><li>Cooperative Learning</li></ul>

IEEE Faculty Discussion Forum

Hello! Welcome to the IEEE Faculty Discussion Forum!

This forum is meant to provide participants of the IEEE Faculty Development Program to share and exchange information and build a community of knowledge experts.

[Click here to enter the forum.](#)

My private files

No files available

[Manage my private files](#)

Fig 1: Main webpage for delivering the online FDP program

All of the online courses were passive in nature and was mostly to be consumed as PDFs of text and pictures. The suggested labs were also passive in nature and lacked any interactivity or ability to engage and motivate learners. The problem for IEEE was to develop and integrate online simulation labs which can help the learners to do the lab experiments, as prescribed in the course, online. There were four courses in which this had to be done - Circuit Analysis, Electronic Devices, Digital Systems and Introduction

to Electronics. Each of these courses had multiple modules in which the experiments needed to be integrated.

DoCircuits worked with IEEE to provide a solution to this problem using their proprietary virtual labs in Electronics. DoCircuits ([www.DoCircuits.com](http://www.DoCircuits.com)) is a premier Cloud Based Virtual Electronics Lab. DoCircuits is changing the way students in Engineering and Technical Colleges learn electronics by empowering them with tools to conduct their Lab experiments online. Students get access to state of the art virtual test and measurement instruments and real life like components on the cloud. DoCircuits is being used by over 400 schools in over 150+ countries

DoCircuits is not only an online tool but also a collaborative tool. It allows creators to easily create custom lab assignments and integrate them with a learning management system. It also allows learners to share their labs and results with other learners and collaborate on a project as well. Since its cloud based, learners can access the simulation anytime and from anywhere. The use of virtual devices like oscilloscope, AFG, multimeters, etc provides a lab like experience and the use of such devices fulfils competency requirement from an industry perspective.

DoCircuits was integrated as lab modules with every theory module in the courses. Features like authentication, security, access to DoCircuits plans were integrated with the LMS using APIs so that the user experience with online labs is seamless.

Lets take an example of a course. For example the “Electronic Devices” course had the following modules.

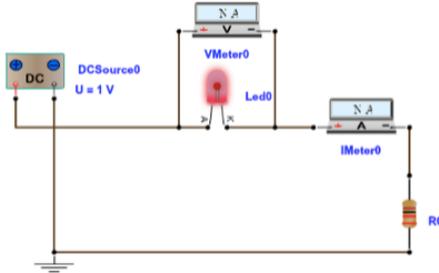
1. Introduction to the Diode
2. Semiconductors: Origin of the Band Gap, and Intrinsic and Extrinsic Semiconductors
3. Carrier statistics and carrier concentration
4. Motion of charge carriers in electric and magnetic fields
5. PN Junctions
6. Brief introduction to optoelectronic devices
7. Bipolar Transistors
8. Field Effect Devices

Each of these modules had virtual lab experiments integrated with them in an open source Learning management system - Moodle. Let's take for example the module “Brief introduction to optoelectronic devices”. This module had the following labs integrated

- Light emitting diode characteristics
- Photo diode characteristics

4 **Lab Exercise**

### Exercise 1: LED Characteristics



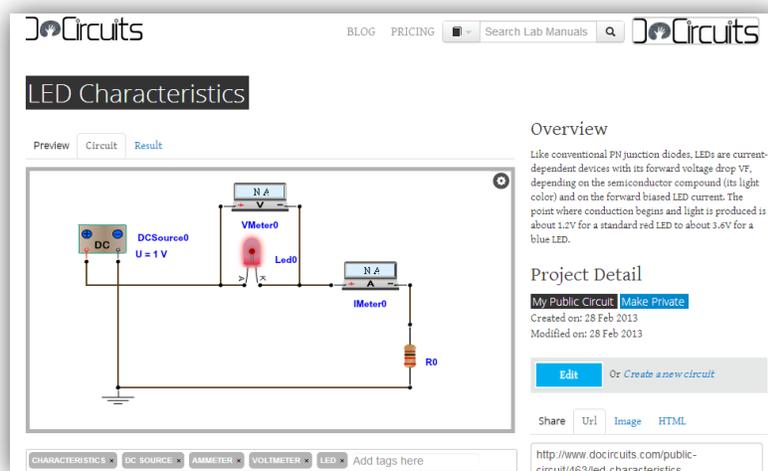
**Aim:** To plot the forward bias characteristics of an LED and determine the cut-off voltage.

**Apparatus:** DC source, voltmeter, ammeter, LED, resistor

**Theory:** Light Emitting Diodes or LED's, are among the most widely used of all the different types of semiconductor diodes available today. They are the most visible type of diode that emit a fairly narrow bandwidth of either visible light at different colored wavelengths, invisible infra-red light for remote controls or laser type light when a forward current is

**Fig 2 : Lab experiment integrated with Moodle LMS**

When a user clicks on the image of the experiment, the user is automatically redirected to the experiment page on docircuits, where she can launch the experiment and run it. The user can then change various parameters of the circuit, add more components or even create a new experiment on the virtual breadboard. This facility allowed the users to not only read the theory for the course, but also try out the various experiments involved – all virtually on their computing device.



**Docircuits** BLOG PRICING Search Lab Manuals Docircuits

## LED Characteristics

Preview Circuit Result

Like conventional PN junction diode, LEDs are current-dependent devices with its forward voltage drop  $V_f$ , depending on the semiconductor compound (its light color) and on the forward biased LED current. The point where conduction begins and light is produced is about 1.2V for a standard red LED to about 3.6V for a blue LED.

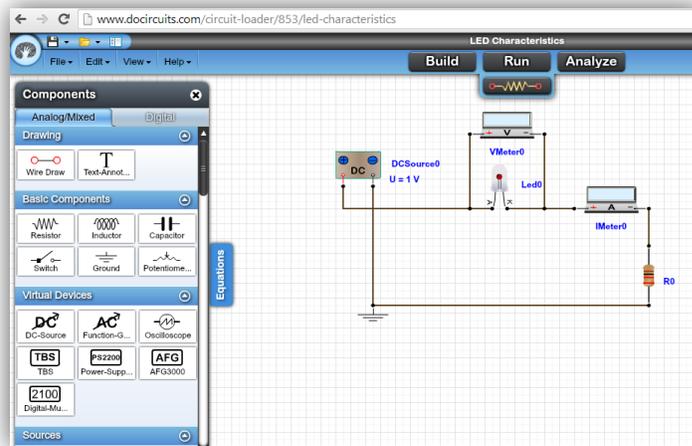
**Project Detail**  
[My Public Circuit](#) [Make Private](#)  
 Created on: 28 Feb 2013  
 Modified on: 28 Feb 2013

[Edit](#) Or [Create a new circuit](#)

Share [Url](#) [Image](#) [HTML](#)

<http://www.docircuits.com/public-circuit/463/led-characteristics>

**Fig 3: Lab Manual for an Experiment**



**Fig 4: Lab experiment loaded in www.docircuits.com**

## Results

Over 500+ teachers used the virtual labs as part of the online courses and the integration of the virtual labs was the highlight of the online FDP program. Each faculty spent dedicated hours as part of the program to try out the experiments and in case of some courses like Digital Systems, perform new lab experiments on the platform. The integration of activity based learning made them appreciate and apply the theoretical concepts presented in the modules.

**“DoCircuits Labs was the most fun part of the FDP Course” Prof Avinash from BVM College, Ahmedabad sums up what the participants felt about working with DoCircuits labs as part of the online course.**