Semiconductor Certification Program

Introduction

The semiconductor industry, at the forefront of innovation, is experiencing explosive growth driven by emerging technologies ranging from communication and healthcare to automotive and renewable energy like AI, IoT, and 5G/6G. As the demand for faster, more efficient, and smaller electronic devices continues to soar, the need for skilled professionals in this field has never been greater. Developed as a result of a collaboration between the Industry and universities, the Semiconductor Certification Program is designed to equip students with the essential in-depth knowledge and practical skills required to succeed in the dynamic semiconductor industry.

Students will gain proficiency in characterizing key semiconductor devices (LEDs, BJTs, MOSFETs) through hands-on experimentation and data analysis. Furthermore, they will develop expertise in designing and simulating critical RF circuits, including active mixers and FET amplifiers, utilizing industry-standard software like Keysight ADS. The program emphasizes practical application through the design, simulation, and optimization of these circuits, incorporating advanced simulation techniques and robust design methodologies.

Learning Outcomes

By the end of the program, students will be able to:

- Characterize basic semiconductor devices.
    - Measure and analyze the IV characteristics of devices such as LEDs, BJTs, and MOSFETs.
    - Learn to effectively characterized device parameters from measured data for device characterization.
- Understand the key differentiating features between different semiconductor device types.
    - Compare and evaluate the operating principles, characteristics and applications of devices like LEDs, BJTs, and MOSFETs.
- Gain practical experience in designing key RF system components.
    - Design low-power single-transistor active mixers using the Advanced Design System (ADS) software.
- Develop skills in simulating and optimizing circuits.
    - Simulate circuit performance, verify device models, design bias networks, and optimize circuit parameters for desired performance metrics.
- Master circuit stability analysis and matching network design for RF amplifiers.
    - Perform stability analysis, design input and output matching networks, and optimize amplifier performance.

Keysight Requirements for Universities

The university must adopt Keysight Semiconductor Teaching Solution's **Modeling, Design, and Measurement Module** to be eligible to participate in the Semiconductor Measurement Certification Program.

- **Keysight Pathwave Advanced Design System**: The Keysight Advanced Design System (ADS) is the premier Electronic Design Automation (EDA) platform for designing high-frequency and high-speed digital physical layer components, from single-purpose amplifiers to complex RF modules and high-speed digital boards.
- **Keysight B2902B**: Compact benchtop Source Measure Units (SMUs) for various I-V (current versus voltage) measurements, performed quickly and with high resolution and accuracy.
- **SR101EDUA Digital Learning Suite**: Keysight's Digital Learning Suite (DLS) platform controls engineering lab resources, provides tools to visualize, compare and analyze measurement data, and enables industry-standard test and measurement instrument control using the Test Automation test sequencer.
- **Semiconductor Modeling, Design, and Measurement Module lab sheets**: A step-by-step guide in understanding semiconductor fundamentals.

The **university** must also ensure students complete all **Modeling, Design, and Measurement Module lab sheets** where certification is being pursued.

Module lab sheets topics

Basic semiconductor devices and measurements

- IV curve measurement of LED
- Gummel characteristics of BJT
- Output characteristic measurement of MOSFET

Low-power single-transistor active mixer design

- Device model DC verification
- Bias network design
- Device model RF verification
- Device model large-signal verification
- Mixer matching circuit design
- Mixer conversion gain versus LO drive level
- Mixer conversion gain versus RF signal level

Amplifier design based on FET
• Amplifier DC and AC simulation • Creating a matching network • Amplifier stability analysis • Running optimizations

Certification Process for Universities and Students

- University completes and submits Keysight Semiconductor Certification Program application form.
- Keysight certifies that the university course and lab topics meet the program requirements.
- Keysight notifies the university of acceptance.
- Students are notified of the certification program by the course professor.
- At the end of the course/labs, the top students (15% – 20%) are eligible for certification.
- Class professor provides Keysight with names of students qualifying for certification based on class grade and quality of lab work.

Student Recognition

- Keysight provides verification of certification with certificate.
- Keysight inserts student name into list on Keysight's website: University Student Certification Program | Keysight
- Certified students receive a digital badge that can be used to showcase their competencies.

Types of certifications

Certification	Description
Modeling, design, and measurement	Characterize key semiconductor devices, design, and simulate low-power mixers and FET amplifiers using Keysight ADS, and optimize circuit performance through advanced simulation techniques.

Certification acknowledgement

- Identification as being among the best.
- Confirmation of technical expertise.
- Credentials verified through Keysight webpage and LinkedIn.

Certification value

- Equipped with industry-ready skills and knowledge.
- Create outstanding resumes.
- Increase in employment opportunities.

Industry access

- Demonstrated value for Industry.