TOPIC: IC DESIGN OVERVIEW

Description

IC design overview is to introduce fundamentals of IC design to those interested in this field. It starts from basic binary logic blocks followed by arithmetic modules. Modules are organized in a logical way to perform computation. Then how to transform and realize a design into an integrated circuit by hardware description language and state-of-the-art design tools. In the end, how one can validate and confirm the success of the design. A concise yet insightful view can help learners quickly grasp the essences of IC design. It would be highly useful to people want to have a jump start and know how we train students in Taiwan.

Length: 6 hours (of four 1-hr lectures and one 2-hr TSRI lab tour)

Lecture 1: Binary logic & Arithmetic Modules

Lecturer: Prof. Chih-Hung Kuo, NCKU

PhD, Electrical Engineering, University of Southern California

Area: IC Design/ Electrical Engineering

TOPIC: IC DESIGN OVERVIEW

Lecture 2: Essences of Computer Organization

Lecturer: Prof. Ing-Chao Lin, NCKU

PhD, Computer Science and Engineering, Pennsylvania State University

Area: IC Design/ Computer Science & Information Engineering

Lecture 3: Transform Design using HDL & EDA Tools

Lecturer: Prof. Lih-Yih Chiou, NCKU

PhD, VLSI and Circuit Design, Purdue University

Area: IC Design/ Electrical Engineering

Lecture 4: IC Design Flow (followed by a lab tour at TSRI)

Lecturer: Dr. Hann-Huei Tsai

Vice Director, National Applied Research Laboratories (NARLabs)

Area: IC Design

TOPIC: FUNDAMENTALS OF DEVICE PHYSICS AND FABRICATION

Description

The Essentials of Semiconductor Engineering – Fundamentals of Device Physics and Fabrication" is concerned with semiconductor properties, materials, devices, and manufacturing technology. It considers the fundamental fields of semiconductor technology and identifies synergistic interactions within various areas in one concise course. Topics may include Basics of Semiconductor Materials and Integrated Circuits, Silicon Wafer Fabrication Processes, Semiconductor Physics, Semiconductor Devices and How They Are Used.

Length: 3 hours

Lecturer: Prof. Jen-Sue Chen, NCKU

PhD, Materials Science, California Institute of Technology

Area: Semiconductor Process Technology/Materials Science

TOPIC: INTRODUCTION OF ADVANCED PACKAGING TECHNOLOGY: THE AI, IOT AND THE APPLICATION OF 5G

Description

This course will introduce advanced packaging technology. AI, IoT and the application of 5G with high computing performance, high speed transmission and low power consumption are becoming more important. Using the advanced package technology, the Moore's low can be prolonged, which is also a big challenge in semiconductor industry. This course will introduce the evolution of package from 2D to 3D, including wafer handling, wafer thinning, bonding, 2.5D/3D packing, and fan-out technology, etc.

This course will arrange the visit of Taiwan semiconductor Research Institute. TSRI under the National Applied Research Laboratories is a consolidation of the National Chip Implementation Center (CIC) and National Nano Device Laboratories (NDL). TSRI provides the integrates research environment for related fields of study in Taiwan to enhance the overall cultivation of quality talents.

Length: 3 hours (of one1-hr lecture and one 2-hr lab tour at TSRI)

Lecturer: Dr. Handing Hsueh

National Advanced Research Lab TSRI, Tainan

Area: Semiconductor Process Technology

TOPIC: DIGITAL TWIN AND IC PACKAGING

Description

With traditional transistor pitch scaling facing fundamental challenges, advanced package has been widely used as one of the effective enablers for "More-than-Moore" technology. Adopting advanced package enables technologies adopting is poised to help enabling the future 5G, HPC, AIOT device applications to integrate a variety of functional dies with different wafer nodes, wafer sizes, and so on – into one packaged unit. In order to help the audience realize the advantages of advanced package, the speakers will provide a range of differentiated packaging enabling technologies, including key technology trends, process challenges, corresponding Methodology, Material, Simulation tool enabling solutions, and so on.

Length: 6 hours (of one 3-hr lecture and one 3-hr talk by entrepreneurs from CORETECH SYSTEM CO., LTD.)

Lecturer: Assistant Prof. Chi-Hua Yu, NCKU

PhD, Civil Engineering, National Taiwan University

Area: Smart & Sustainable Manufacturing/Engineering Science

TOPIC: VLSI PROCESS INTEGRATION AND DEVICE MEASUREMENT

Description

Two topics will be included. First, the knowledge requirement and working content of VLSI integration engineering will be introduced. Content will include VLSI process concept, MOSFET device fabrication and I-V curves; FinFET and GAA structures. Second, for the packaging technology, flip-chip, WLCSP, FO-WLP and their technology problems will be introduced as well. Hope to introduce the concept of VLSI integration into students at short period. This course contains basic knowledge of physical characteristics for VLSI application. Carriers behavior, PN junction, MOS capacitor and MOSFET will be introduced. Besides, the I-V measurement of MOSFET will be described as well.

Length: 6 hours

Lecturer: Associate Prof. Ching-Yuan Ho, NCKU

PhD, Mechanical Engineering, National Tsing Hua University

Area: Semiconductor Packaging and Testing/Mechanical Engineering

TOPIC: TECHNIQUES OF NANOMATERIALS AND NANOCOMPOSITES

Description

This course will introduce the basic principle of fabrication of nanomaterials and nanocomposites. The unique properties of nanomaterials strongly depend on their morphology and composition, leading to specialized applications, such as sensing, optical and electronic devices. Therefore, the fabrication process of nanomaterials plays an important role in manipulating the material properties. The properties of nanocomposites can be influenced by the intrinsic properties of individual materials and extrinsic properties of syngenetic effects between materials, which make it possible to engineer the desired properties of nanocomposites. This course also focuses on designing the special functions of nanomaterials and nanocomposites for desirable applications.

Length: 6 hours

Lecturer: Assistant Prof. Su-Wen Hsu, NCKU

PhD, Materials Science and Engineering, University of California, San Diego

Area: Key Materials/Chemical Engineering