

The Essentials of Semiconductor Technology and Supply Chains

Innovative Semiconductor Summer School

Aug. 26th - Sep. 2nd, 2022



June edition, especially for the virtual format recruitment

Date: Aug. 26th – Sep. 2nd, 2022

Application Deadline: June 26th, 2022 (virtual format only)

Language: All courses are offered in English

Number of Participants: Maximum of 40 students (virtual and in-person)

Format: Virtual / On-campus

Completion: NCKU transcript

- **Core Course – 2 credits**

Learn about semiconductor supply chains and the core technologies involved in semiconductor manufacturing.

- **Research Institute/Company Visit**

Provide hands-on activities through onsite visits to research institutes and companies.

2022 INNOVATIVE SEMICONDUCTOR SUMMER SCHOOL



THE ESSENTIALS OF SEMICONDUCTOR TECHNOLOGY AND SUPPLY CHAINS

Core Course - 2 credits

The most comprehensive selection of topics offered by the Academy of Innovative Semiconductor and Sustainable Manufacturing of NCKU. With a theme on the essentials of semiconductor technology and supply chains, a series of lectures will be delivered by both the Academy's faculty and the industry experts from top-notch research centers and businesses in Taiwan for a balanced presentation of this subject. The topics will include IC design, techniques of nanomaterials and nanocomposites, fundamentals of device physics and fabrication, advanced packaging technology with AI, IoT, and 5G application, digital twin and IC packaging, and VLSI process integration and device measurement.

Research Institute / Company Visit (counted toward the contact hours)

The program will arrange field trips to the key industrial hub of high-tech companies in southern Taiwan, Southern Taiwan Science Park (STSP), NCKU Research & Development Center at STSP, and local points of interest nearby. In addition, tours to Taiwan semiconductor Research Institute (TSRI) will be delivered by the invited research experts of the institute. TSRI is part of the National Applied Research Laboratories, is a consolidation of the National Chip Implementation Center (CIC) and National Nano Device Laboratories (NDL) and provides the integrated research environment for related fields of study in Taiwan to enhance the cultivation of quality talents to a large extent. Overall, the onsite visits are to provide hands-on activities for the program students visiting Taiwan from all over the world.

Organizer: Prof. Meng-Hsueh Chiang, NCKU
PhD, Electrical and Computer Engineering,
University of Florida

Area: Semiconductor Process Technology/Electrical Engineering



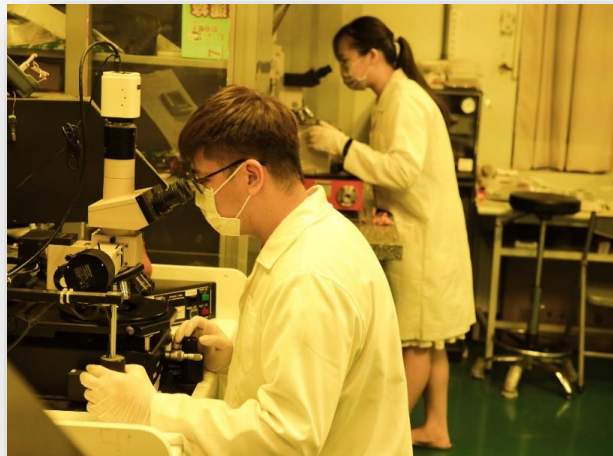


NCKU Academy of Innovative Semiconductor and Sustainable Manufacturing

Leading Next-Generation Technology

The Academy of Innovative Semiconductor and Sustainable Manufacturing was the first to launch at a university in Taiwan to address the nation's high-tech talent constraints and the imperative for advancing semiconductor technology during the AI era. With support from the NCKU's well-established research foundation in science and engineering, the Academy also strives to align the university-based R&D work closer to industry needs by allowing greater flexibility in academic infrastructure in faculty hiring of the industry experts, budgeting, research, and training formats. The five degree programs are on Integrated Circuit Design, Semiconductor Process Technology, Semiconductor Packaging and Testing, Key Materials, and Smart and Sustainable Manufacturing, covering the whole spectrum of the semiconductor industry. The programs aim at educating future talents with a core value on “data-driven & energy-sensitive” competency to help students strive in the highly competitive semiconductor industry.

The Academy is proud and feels responsible to provide an introductory summer program for students who are interested in knowing this fundamentally important semiconductor industry that supports our daily life in an era of chips and automation. The program students will get a big picture of the semiconductor supply chains and the core technologies involved in semiconductor manufacturing with their participation in lectures and the field trips arranged for their first-hand observations in Taiwan.



VIRTUAL TIMETABLE

Time Interval (GMT+8)	Fri. Aug. 26	Sat. Aug. 27	Sun. Aug. 28	Mon. Aug. 29	Tue. Aug. 30	Wed. Aug. 31	Thur. Sep. 1	Fri. Sep. 2
9:10-10:00	Open Ceremony						Field Trip: *Southern Taiwan Science Park (STSP) *NCKU Research & Development Center at STSP *Museum of Archaeology, Tainan Branch of National Museum of Prehistory	Techniques of nanomaterials and nanacomposites (奈米材料與合成科技)
10:10-11:00	Intro of NCKU		IC Design Overview (積體電路設計的綜述)	Digital Twin and IC Packaging (數位學生與IC封裝)	VLSI Process Integration and Device Measurement (積體電路製程整合與元件量測)			
11:10-12:00								
12:10-13:00	Break			Break			Break	Break
13:10-14:00	Fundamentals of Device Physics and Fabrication (元件物理與製程概論)	Free	Free	TSRI tour-IC	TSRI tour- advanced packaging technology	VLSI Process Integration and Device Measurement (積體電路製程整合與元件量測)	Break	Techniques of nanomaterials and nanacomposites (奈米材料與合成科技)
14:10-15:00								
15:10-16:00				enterprise experience sharing- CORETECH SYSTEM CO., LTD. 科盛科技股份有限公司				
16:10-17:00								
17:10-18:00								Presentations & Farewell

Noted:

1. The above courses/schedule are subject to change.
2. The courses start in GMT+8, please notice the corresponding time in your country/ region.
3. Courses before 12 p.m. (GMT+8) will be live-streamed through the online classroom. Virtual participants can join the program with on-campus participants at the same time.
4. Courses after 1 p.m. (GMT+8) will be recorded and provided to virtual participants due to time zone difference.

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 law 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 one 1-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



NCKU

THE TOP UNIVERSITY IN TAIWAN

National Cheng Kung University (NCKU), being established as “Tainan Technical College” in 1931, has transformed into one of the most established, comprehensive universities in Taiwan. With about 21,000 students and 2,000 faculty members in total, NCKU has continued as a leader in the fields of engineering, science, management and medicine. NCKU has always been dedicated to promoting student mobility and welcomes international exchange students from partner universities worldwide every year.



RANKING & PERFORMANCE



2022 QS World Ranking
252



GLOBAL SCORE
48.4



2021 Impact Rankings in Taiwan
Top One



2017 CEO of NCKU
48



台南 Tainan



TAINAN,
THE OLDEST
CAPITAL CITY...

Tainan is the ancient capital of Taiwan. This city continues to host a variety of cultural festivities and religious ceremonies all year round. Traditions have been well sustained in this modernized city. The city's gourmet food culture guarantees one can find delicious food of every kind. Life in Tainan has a charming balance between the new and the old, and the fast and the slow.

FEES

NCKU Innovative Semiconductor Summer School — Virtual

Application Fee	Program fee*
USD 50	USD 200

- ◆ Save on the program fee with a 20% discount by applying for the virtual program before June 15th.
- ◆ ***A full fee waiver is available for students enrolled at a U.S. university and recommended by one professor of his/her home university, as indicated next page.***

YOU ARE CORDIALLY INVITED



2022 Innovative Semiconductor Summer School

The Essentials of Semiconductor Technology and Supply Chains

Date | Aug. 26th - Sep. 2nd, 2022

Application Deadline |

Early Bird for On-Campus: June 15th, 2022

Virtual / On-Campus: June 26th, 2022

**Before
June 26th,
2022**

Taiwan-U.S. student mobility partnership*

- Explore the learning environment of NCKU, a top Taiwanese university with vested connections with the semiconductor manufacturing industry that serves the world.
- Participate in the program online to study with international students from Europe and with local students who take the course in person.
- Ask your professors about this program and seek their advice and support your recommendation form. Five seats of full program fee waiver will be available on a first-come, first-served basis.
- Email one finished recommendation form (scanned copy) to the Academy's Academic and Student Affairs Office at wlteng@mail.ncku.edu.tw to verify if seats with a full fee waiver are still available.

*Applicable to students enrolled with a U.S. university only

RECOMMENDATION FORM



2022 Innovative Semiconductor Summer School

Recommendation Form

Applicant Information

Name: _____
Last First Middle

Department: _____

Program level: bachelor master PhD

Program year: _____

Institution: _____

Email: _____ @ _____

Recommender Information

Name: _____
Last First Middle

Title/Position: _____

Department/Unit: _____

Institution: _____

Email Address _____ @ _____

Signature: _____ Date: _____

Recommendation for enrollment with the program above-titled to be exempt from the program fee.

Please email the scanned copy of this document to Ms. Weili Teng at wlteng@mail.ncku.edu.tw by June 26th, 2022.



Academy of Innovative Semiconductor and Sustainable Manufacturing
National Cheng Kung University
No.1, University Road, Tainan City 70101, Taiwan (R.O.C.)
2022 Summer School
<https://summerschool.web2.ncku.edu.tw/p/412-1108-25404.php?Lang=en>



Double click on the document to get the recommendation form

Academy of Innovative Semiconductor and Sustainable Manufacturing
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