Taiwan-Europe Semiconductor Short-term Training Program 2024

July to August 2024

JUL / Lecture and Project Options:

-Analog Design Essentials & Power Management IC Design in CMOS BCD Technologies

-Full-Custom IC Design & Silicon Photonics Design and Analysis

-Full-Custom IC Design & CMOS MEMS IC Design

-Cell-based IC Design

AUG / Internship

SYNOPSYS / Chroma ATE / TSRI

中華民國外交部
MINISTRY OF FOREIGN AFFAIRS
REPUBLIC OF CHINA (TAIWAN)

TSRI

Integrated Circuit Design and Implementation Courses

All courses are located in Taiwan.

July 2024

Course Options (choose one)

1 Analog Design Essentials & Power Management IC Design in CMOS BCD Technologies	**1 July-19 July** Lecture	**22 July-26 July** Project
2 Full-Custom IC Design & Silicon Photonics Design and Analysis		
3 Full-Custom IC Design & CMOS MEMS IC Design		
4 Cell-based IC Design	**1 July-12 July** Lecture	**15 July-26 July** Project

August 2024

SYNOPSYS / Chroma ATE / TSRI	**29 July-23 August** Internship

The official website of the internship company is as follows: scan the QR code below.

SYNOPSYS   Chroma ATE   TSRI

Note 1: In conjunction with the course, we offer internship opportunities in the Taiwanese industry, subject to industry qualification review. Providing your course completion certificate will assist in obtaining internship opportunities.

Note 2: Internship opportunities at Chroma ATE and Synopsys are limited [to those?] who have taken the Silicon Photonics course and project.

1 Analog Design Essentials & Power Management IC Design in CMOS BCD Technologies

1 July-19 July

Weekday / 09:00-11:45, 13:15-17:00

Analog Design Essentials (2-week)

D1

Introduction
IC Design Flow

D2

Fundamental Of Circuit Design:
1) MOSFET
2) Analog/Digital Signal

D3

Fundamental Of Circuit Design:
3) Logic Gate;
4) Analog Circuit Basics

D4

Operational Amplifier:
1) Concept
2) Stability

D5

Operational Amplifier:
3) Architecture
4) Gm/ID

D6

EDA Tools For Circuit Design:
1) PDK
2) Virtuoso

D7

EDA Tools For Circuit Design:
3) Hspice
4) Simulation

D8

Non-Ideal Effect
1) Process Variation
2) PVT

D9

Layout
1) Concept
2) Layout Dependent Effect

D10

Layout
3) Design Rules
4) DRC/ LVS/PEX Verification

Power Management IC Design in CMOS BCD Technologies(1-week)

D11

- Introduction
- High Voltage Circuit Design and simulation

D12

Chip Implementation:
Schematic and Circuit Simulation

D13

Protection Mechanism I:
Internal LV Device

D14

Protection Mechanisms II:
1) HV Device
2) HV I/O Device & ESD Rules

D15

Chip Implementation:
Full Chip Layout and simulation

Project / 22 July-26 July

Project 1 : Operational Amplifier Design Essentials - Hybrid-Compensated Two-Stage OTA Design (1-week)
Project 2 : Power Management IC Implementation in BCD Technologies - High-voltage linear regulator (1-week)

2 Full-Custom IC Design & Silicon Photonics Design and Analysis

1 July-19 July
Weekday / 09:00-11:45   13:15-17:00

Full-Custom IC Design and Simulation (1-week)

D1
- Full-Custom IC Design Overview
- Circuit Simulation with ADE and Spectre

D2
Fundamentals of Full-Custom Cell Design and Simulation

D3
Layout Skill and Implementation

D4
Layout Verification (DRC/LVS/LPE) and Debugging

D5
Hands on Labs for Layout and Post-Sim.

Silicon Photonics Design and Analysis (2-week)

D6
- Introduction
- Si waveguides
- Si Bending
- Y-junction and MMI

D7
- Grating coupler and edge coupler
- Coupler testing

D8
- Si ring resonator
- Modulator frequency response

D9
Modulator testing: spectrum

D10
Modulator testing: S-parameter and eye diagram

D11
- Foundry process
- Mach-zehnder interferometer
- Depletion/thermal phase shifter

D12
- PAM4 circuit design and pre-simulation
- Circuit layout

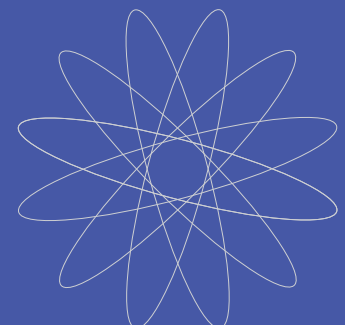**D13**
Silicon photonics related company visiting

D14
Photodetector theory and testing

D15
- Post simulation
- Design rule checking

Project : Silicon Photonics / 22 July-26 July

Design project: DP-QPSK coherent detection using 2D grating coupled silicon based receiver
Testing project: 1 to 8 channel grating and edge coupler and fiber optical alignment methods

3 Full-Custom IC Design & CMOS MEMS IC Design

1 July-19 July
Weekday / 09:00-11:45   13:15-17:00

Full-Custom IC Design and Simulation (1-week)

D1
- Full-Custom IC Design Overview
- Circuit Simulation with ADE and Spectre

D2
Fundamentals of Full-Custom Cell Design and Simulation

D3
Layout Skill and Implementation

D4
Layout Verification (DRC/LVS/LPE) and Debugging

D5
Hands on Labs for Layout and Post-Sim.

CMOS MEMS IC Design, Simulation and Testing(2-week)

D6
- Preview of MEMS technology
- TSRI CMOS MEMS Process
- Lab.(design accelerometer in simulation version)

D7
- Applications of CMOS MEMS technology
- Characterizing the MEMS devices
- Lab. (design accelerometer in tape-out version)

D8
- Applications of accelerometer
- Design and architecture of accelerometer
- Simulation by CoventorWare

D9
- TSRI CMOS MEMS process flow and design rules
- TSRI CMOS MEMS MPW
- The MEMS measuring instruments in TSRI

D10
- Introduction of capacitive sensing readout circuit
- IP user guide
- Lab.(g sensor readout circuit simulation and integrate MEMS with readout circuit)

D11
- Application and working principle of resonator Design and architecture of resonator Lab.(design resonator in simulation version)

D 12
- Lab.(design resonator in simulation and tape-out version)
- Introduction and design of TIA readout circuit
- Lab.(simulation of TIA circuit)

D13
MEMS related company visiting

D14
- TIA layout guideline
- Layout verification
- Combine MEMS and readout circuit
- Lab.(design TIA for simulation and layout)

D15
Introduction and practical operation of MEMS laboratory

Project：Design of sub-MHz resonator/oscillator (MEMS Resonator + TIA read circuit) /22 July-26 July

Design a CMOS MEMS Resonator
Design of a transimpedance amplifier
Integration of CMOS MEMS oscillator

4   Cell-based IC Design

1 July-12 July
Weekday / 09:00-11:45   13:15-17:00

Cell-based IC Design, Implementation and Verification (2-week)

D1 **D2** **D3**	**D4** **D5**	
Verilog Coding, Simulation and Debug (1)	Logic Implementation (2)**	

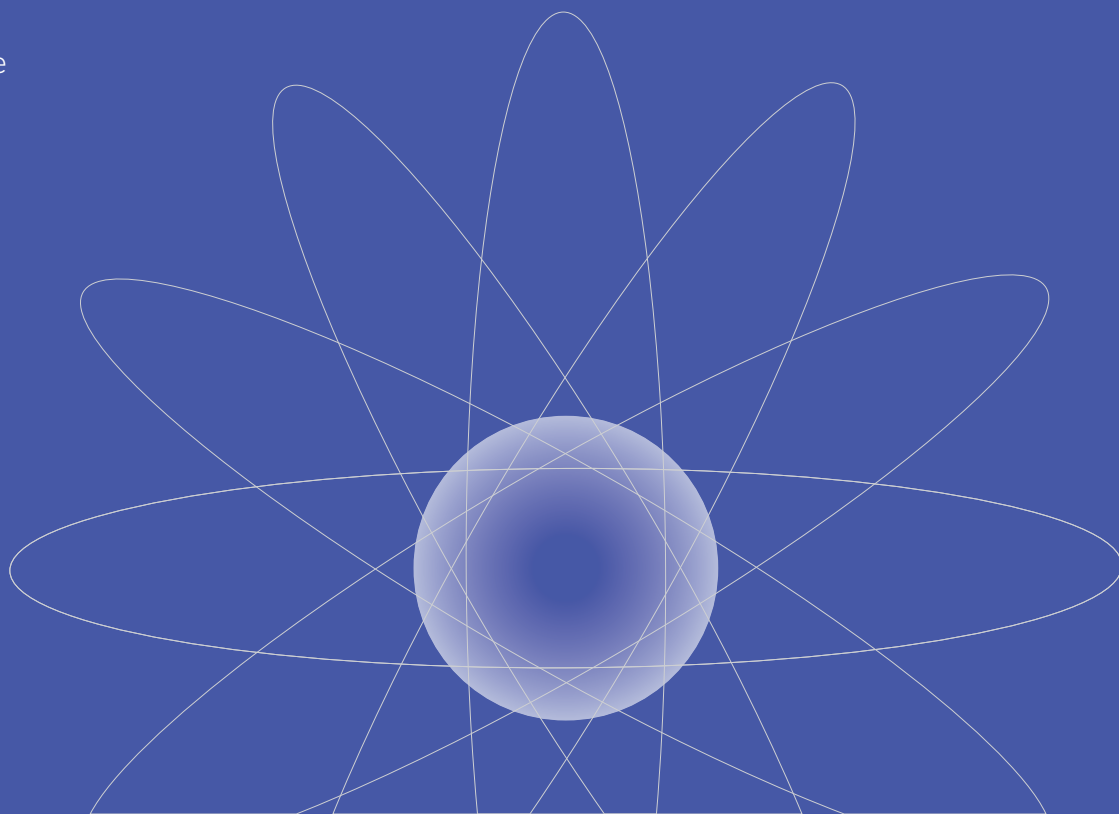|		
D6	**D7** **D8** **D9**	**D10**
Logic Implementation (2)	Physical Implementation (3)**	Project

** Logic Implementation = Logic Synthesis, Pre-layout Verification,
    Physical Implementation = P&R, DRC/LVS, Post-layout Verification

Project : / 15 July-26 July

Job Assignment Machine
Seam Carving Engine

Target Audience

We look forward to your joining.

We recommend students majoring in electronics and electrical engineering or those interested in semiconductor, electronics, microelectromechanical systems, and optoelectronic sciences and applications to participate in this program. This includes college students, master's, and PhD students.

Welcome to Taiwan.

Taiwan is an island nation located in East Asia. It has a vibrant economy, a renowned semiconductor industry, and friendly people. Taiwan is a captivating destination known for its thriving semiconductor sector, dynamic democracy, and remarkable economic achievements. Taiwan's semiconductor industry has garnered worldwide recognition, earning it the title of the "Silicon Valley of Asia." The island is home to leading semi-conductor companies and has become an indispensable player in shaping the digital era. Taiwan is most famous not only for its technological achievements but also for its robust democracy. Taiwan upholds the values of freedom, human rights, and civic engage-ment.