

### Course Description

This is an introductory course for semiconductor device operation principles and technology in common electronic products such as integrated circuit (IC), camcorder, solar cell, memory elements, smartcard, etc. Topics covered include Semiconductor properties, IC fabrication technology, PN junctions, Bipolar Junction Transistors (BJT), MOSFETs, CCD and the future technology trend in the electronic industry. *Prerequisite(s)*: (Level 3 or above in HKDSE 1/2x or 1x Chemistry OR a passing grade in HKCEE Chemistry OR CHEM 1001 OR CHEM 1004) AND (ELEC 2400 OR ELEC 2410 (prior to 2016-17))

### List of Topics

1. Properties of semiconductor
2. Device fabrication techniques
3. PN Junction physics and diode design
4. Optical property of PN Junction: solar cell and LED
5. Metal Semiconductor contact
6. MOS Capacitor
7. CCD camera and CMOS active pixel camera
8. Classical MOSFET characteristics
9. Subthreshold MOSFETs
10. Mobility degradation and velocity saturation
11. Short channel effects
12. Scaling Trends and technology direction

### Statement of Objectives/Outcomes:

On successful completion of this course, students will be able to:

- CO1: communicate with the language of semiconductor (diode, BJT, MOSFET, doping, Fermi-level, drift-diffusion etc.
- CO2: describe the basic principles of some common circuit active elements plus photo active devices (solar cell, LED, CCD)
- CO3: describe the effects of changing the key physical parameters of diode, BJT and MOSFET on the trend (increase or decrease) of the output characteristics
- CO4: remember the operation of a cleanroom
- CO5: operate a probe-station

CO6: match a given model to measurement data by selecting relevant parameters

Textbook(s):

Lecture notes distributed through the course URL

Reference Books/Materials:

Chenming Calvin Hu, *Modern Semiconductor Devices for Integrated Circuits*, Pearson, 2010

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Pre-lecture progress check	10%
In-class discussion exercise	10%
Homework	10%
Bi-Quizzes	18%
Labs	12%
Final Examination	40%