

# Nanoelectronics and Nanotechnology (奈米電子及奈米技術)

Course level: Graduate students

Course goals: This course is intended to introduce fundamental knowledge of solid-state electronic materials properties, the technology for nano fabrication and semiconductor devices as well. Lab practicing is also designed to allow students have hand-on experiences. Finally, nano-scaled one dimensional, two dimensional materials and devices are introduced. Students will also need to present case study or literature study by using the knowledge they have learned in this class.

Pre-requisite: Electron theory in solids (preferred but not mandatory)

Text Book:

A: "Modern Physics for Engineers," Jasprit Singh, John Wiley & Sons, 1999 (ISBN 0-471-33044-2)

B: "Semiconductor Devices: Physics and technology," S. M. Sze, John Wiley & Sons, 2002, 2<sup>nd</sup> edition. (ISBN 0-471-33372-7)

C: "Nanoelectronics and information technology" Rainer Waser, Wiley-VCH, 2005 (ISBN-13:978-3-527-40542-8, ISBN-10: 3-527-40542-9)

Course Outline

1. Introduction (2/23)
2. Solid-state-electronic properties (3/02) Book A, B
3. Carrier concentration and density of states (3/09) Book A, B
4. Carrier transport (3/16) Book B
5. PN junction (3/23) Book B
- Exam 1 (3/30)
6. Field effect transistors (4/6) Book B
7. Lab practicing: FET measurements (4/13)
8. Schottky barrier, Ohmic contacts, and MESFET (4/20) Book B
9. Lab practicing: MESFET, Ohmic and Schottky contact measurements (4/27)
10. Bipolar transistors (5/04) Book B
11. Lab practicing: BJT/HBT measurement (5/11)

12. Light-emitting-diodes, Laser diodes, Photodetectors, Solar cells, Tunneling devices/ Nano materials properties (5/18) Book B/ Book C
13. Lab practicing: LED, photodiode measurements (5/25)
14. Lab practicing: Microfabrication: Layout tool/ device design/ photolithography (6/01)
15. Final exam 2 (6/08)
16. In class Presentation (6/15, 6/22)

Grading: Exam 1- 30%, Exam 2- 30%, In class presentation 20%, Lab practicing, attendance & contribution to the class 20%.

For the presentation:

Each student is allowed to give a talk in 15 mins and the Q & A in 5 mins. The grade for the presentation will be assessed by the whole class. English is required for the presentation. Language fluency may be considered in grading. Students need to present one major paper and include a few references in the presentation. Students are required to present the topic by **utilizing the knowledge they have learned in this class**. The significance, organization, depth/scientific sound, clear presentation, and Q&A will be evaluated for the presentation.