

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

Course level : Graduate students

Course goals : Understanding knowledge of nanoelectronics, and the technology applied to nanodevices.

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. Solid-state-electronic properties (2/21) Book A, B
2. Carrier concentration and density of states (3/6) Book A, B
3. Carrier transport (3/13) Book B
4. PN junction (3/20) Book B
- Exam 1 (3/27)
5. Field effect transistors (3/31) Book B
6. Schottky barrier, Ohmic contacts, and MESFET (4/10) Book B
7. Bipolar transistors (4/17) Book B
8. Light-emitting-diodes, Laser diodes, Photodetectors (4/24) Book B
9. Solar cells (5/1) Book B
10. Tunneling devices (5/8) Book B
- Exam 2 (5/15)
11. Single-electron device (5/22) Book C
12. Carbon nano tube (5/29) Book C
13. Molecular devices (6/5) Book C
14. In class Presentation & Reports (6/12)

Grading : Exam 1- 30%, Exam 2- 30%, In class presentation20%, report 20%.

For the report :

Submit the title of the topic and the abstract describing what you want to study to the instructor via e-mail by the 2<sup>nd</sup> midterm exam for approval. After approved, you can start your work. The title has to be relevant to the course. Early submission is highly recommended. The maximum page number is 15, not including references. The title of the topic cannot be exactly the same with any other paper. The topic is assumed to be generated from studying several papers or books. It is suggested that students start from review papers. Turn in the paper at the date that your group gives presentation in class. Sentences or paragraphs are exactly same with any other person's work no matter with or without citations, including public or non-public papers, will be regarded as plagiarism. Once a term paper is regarded as plagiarism, the student will fail to get any score with that paper. English is required for this term paper.

For the presentation :

Each group is allowed to give a talk in 25 mins and the Q & A in 5 mins. The topic is exactly the same with that of the term paper. The grade for the presentation (20%) will be assessed by the whole class. English is required for the presentation. Language fluency will not be considered in grading. Instead, whether the speech is well organized, the topic is significant, the review is in depth, the coverage of the content is adequate, and the answers for questions are satisfied, will be the factors for evaluation. However, clear expression by the speaker will help the audience to learn easily which may lead to a positive evaluation.