EEC 660 Nanoscale Solid State Electronics

Catalog Data: EEC 660 Nanoscale Solid State Electronics(4-0-4)

Prerequisite: EEC 514, undergraduate course(s) in solid state electronics or permission of instructor.

The objective of this course is to provide the students with an in-depth understanding of the principles of modern solid state electronic devices. Emphasis is on nanoscale devices and devices made of nanoscale materials. The course begins with a brief review of quantum theory of solids, properties of solid nanostructures, and fundamental principles of conventional electronic devices. In-depth discussion on specific nanoscale devices allows the students to gain the knowledge in the operational principles of state-of-the-art technology in electronic devices, including hot electron transistor, HEMT, RTD, single electron transistor, and molecular devices.

Textbooks:
3. Class notes

References:
1. “Fundamentals of Nanoelectronics” G. W. Hanson, Pearson (2008)

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Description: This course provides the students with an in-depth understanding of the principles of modern solid state electronic devices. Emphasis is on nanoscale devices and devices made of nanoscale materials.

Course Outline:

1. Quantum theory of solids: effective mass, energy bands, density of states, potential well, etc. 2 weeks
2. Electronic structures and properties of solid state nanostructures: quantum-size effect, transport of charge, tunneling 2 weeks
3. Review of fundamental principles of conventional electronic devices (diodes, BJT, FET, MOSFET) 2 weeks
4. High electron mobility transistor 1 week
5. Hot electron transistors 1 week
6. Resonant tunneling diodes 1 week
7. Single electron transistors 1 week
8. Molecular electronics  1 week
9. Solar cell  1 week
10. Bioelectronic devices  1 week
11. Additional topics

**Grading:**

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