Course profile

Summer 2023

Course Code: VE320

Course Name: Introduction to Semiconductor Devices

Course Credits: 4.0

Course Category: Required

Degree Program: General Courses for ECE Degree Programs

Classroom: online

Prerequisites: Ve215, Vp240 (or Vp260)

Lecture time: Tuesday 16:00-17:40; Thursday 16:00-17:40; Friday 16:00-17:40 (odd weeks)

Instructor:

Yaping Dan (但亚平)

[Yaping.dan@sjtu.edu.cn](mailto:Yaping.dan@sjtu.edu.cn)

Office Hours: Tuesday and Thursday 10am – 12pm

Teaching Assistants:

* Zhou, Zhiyu: 020507zzy@sjtu.edu.cn
* Chen, Zhuojia: chenzhuojia@sjtu.edu.cn
* Zhou, Yuhao: zhouyuhao@sjtu.edu.cn

Textbook:

1: “Semiconductor Physics and Devices: Basic Principles”, 4th ed., Donald A.

Neamen, Publishing house of electronic industry

Course Description:

In the first part of this course, the semiconductor physics will be covered including energy band theory, equilibrium concentration of electrons and holes, continuity equation, drift and diffusion currents, generation and recombination processes. In the second part of this course, the principle of the following devices will be covered: PN junctions, metal-semiconductor junctions, MOS capacitors and MOSFETs.

Course outline: (Tentative and subject to change)

|  |  |  |  |
| --- | --- | --- | --- |
| Week | Date | Lecture Topics | Assignments |
| 1 | May 14 | Ch 0 and Ch 1 Introduction to solids, crystal structures |  |
| May 16 | Cha1 and Ch2 Introduction to quantum mechanics (2.1, 2.2) |  |
| May 17 | Ch2 Introduction to quantum mechanics (2.3 – 2.6) |  |
| 2 | May 21 | Ch3 Introduction to the Quantum Theory of Solids  (3.1, 3.2, 3.3) |  |
| May 23 | Ch3 Introduction to the Quantum Theory of Solids(3.4, 3.5) | HW#1 |
| 3 | May 28 | Ch3 (3.6) + Ch4 Semiconductor in equilibrium (4.1) |  |
| May 30 | Ch4 Semiconductor in equilibrium(4.2,4.3,4.4) | HW#2 |
| May 31 | Ch4 Semiconductor in equilibrium (4.5, 4.6) |  |
| 4 | June 4 | Ch4 Semiconductor in equilibrium (4.6), Ch5 Carrier transport（5.1) |  |
| June 6 | No lecture, holiday | HW#3 |
| 5 | June 11 | Ch5 Carrier transport (5.2, 5.3) Ch6 (6.1) |  |
| June 13 | Ch6 Non-Equilibrium Excess Carriers (6.2) |  |
| June 14 | No lecture | Midterm#1 |
| 6 | June 18 | Ch6 Non-Equilibrium Excess Carriers in Semiconductors (6.2,6.3) |  |
| June 20 | Ch6 Non-Equilibrium Excess Carriers in Semiconductors (6.4,6.5) | HW#4 |
| 7 | June 25 | PN junction electrostatics Chp7.0,7.1 |  |
| June 27 | PN junction electrostatics Chap7.2,7.3 | HW#5 |
| June 28 | Chapter 7.4 Chapter 8.1 |  |
| 8 | July 2 | PN junction IV Chap8.1, 8.2 |  |
| July 4 | PN junction IV Chap8.3 8.4 | HW#6 |
| 9 | July 9 | Schottky Junction Chap9.1 |  |
| July 11 | Schottky Junction Chap9.2 | HW#7 |
| July 12 | No lecture | Midterm#2 |
| 10 | July 16 | MOS Capacitor Chap10.1 |  |
| July 18 | MOS Capacitor Chap10.2, 10.3 |  |
| 11 | July 23 | MOS Capacitor Chap10.3, 10.4 |  |
| July 25 | MOSFET Chap10.4 | HW#8 |
| July 26 | MOSFET Non-ideal effect Chap11.1,11.2, 11.3 |  |
| 12 | July 30 | MOSFET Non-ideal effect Chap11.4,11.5 |  |
| Aug 1 | BJT Chap12.1, 12.2 | HW#9 |
| 13 | Aug. 6 | BJT Chap12.3, 12.4 |  |
| Aug. 8 | No lecture | final |