

Electronics I

Department of Electrical Engineering
Amirkabir University of Technology (Tehran Polytechnic)
Instructor: Dr. Mohammad Yavari
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Topics:

1. Introduction to Electronics

- 1.1. Electronics versus Microelectronics
- 1.2. Examples of Electronic Systems
- 1.3. Basic Concepts
- 1.4. Amplifiers

2. Basic Physics of Semiconductors and PN Junction

- 2.1. Intrinsic Semiconductors
- 2.2. Doped Semiconductors
- 2.3. Current Flows in Semiconductors
- 2.4. The *pn* Junction
- 2.5. The *pn* Junction with an Applied Voltage
- 2.6. Capacitive Effects in the *pn* Junction

3. Diode Models and Circuits

- 3.1. The Ideal Diode
- 3.2. Terminal Characteristics of Junction Diodes
- 3.3. Modeling the Diode Forward Characteristic
- 3.4. Operation in the Reverse Breakdown Region—Zener Diodes
- 3.5. Rectifier Circuits
- 3.6. Limiting and Clamping Circuits
- 3.7. Special Diode Types

4. Physics of Bipolar Junction Transistors

- 4.1. Device Structure and Physical Operation
- 4.2. Current–Voltage Characteristics
- 4.3. BJT Circuits at DC
- 4.4. Transistor Breakdown and Temperature Effects

5. Physics of MOS Field-Effect Transistors

- 5.1. Device Structure and Physical Operation
- 5.2. Current–Voltage Characteristics
- 5.3. MOSFET Circuits at DC
- 5.4. The Body Effect and Other Topics

6. Transistor Amplifiers

- 6.1. Basic Principles
- 6.2. Small-Signal Operation and Models
- 6.3. Basic Configurations
- 6.4. Biasing
- 6.5. Discrete-Circuit Amplifiers

References:

- 1. A. Sedra and K. Smith, *Microelectronic Circuits*, 8th Edition, Oxford University Press, 2020.
- 2. B. Razavi, *Fundamentals of Microelectronics*, Third Edition, John Wiley & Sons, 2021.
- 3. Class Notes.

Prerequisites

Electrical Circuits I, Electrical Circuits II (prerequisite)

Grading:

Homeworks: 10% Spice Projects: 10% First Midterm: 25% Second Midterm: 25%
Final: 30%