# Electronics I

Department of Electrical Engineering
Amirkabir University of Technology (Tehran Polytechnic)
Instructor: Dr. Mohammad Yavari
Fall 2020

## 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
   - 2.1 Doped Semiconductors
   - 2.1 Current Flows in Semiconductors
   - 2.1 The *pn* Junction
   - 2.1 The *pn* Junction with an Applied Voltage
   - 2.1 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*, 7th Edition, Oxford University Press, 2015.
2. B. Razavi, *Fundamentals of Microelectronics*, John Wiley & Sons, Second Edition, 2014.
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%