

TKU212242

Fundamentals of Electronics

Elektronika Dasar

BASIC INFORMATION

Course Credit	3 / 150 minutes per Week
Course Type	Required
Course Classification	Engineering Topics
Prerequisites	Electricity & Magnetism; DC Circuits; Differential Equations

STUDENT AND LEARNING OUTCOMES

Covered Student Outcomes

Fundamental and Engineering Knowledge (KP.1) Development of Engineering Solution (KP.2)

Learning Outcomes

- LO1** Students are able to understand the characteristics of various non-linear components (diode, transistor and operational amplifier), and their implementation.
- LO2** Students are able to apply the basic information about characteristics of linear and non-linear components for analyzing the behaviour of electronic circuits.
- LO3** Students are able to design electronic circuits for certain purposes.

COURSE DESCRIPTION

Fundamentals of Electronics course introduces the students to the world of electronics. Using the knowledge and understanding from Electricity & Magnetism, and DC Circuits courses as the foundations, this courses discusses the characteristics of various non-linear electronic components, which can be used to implement various electronic circuits such as rectifiers, amplifiers, logic gates and filters. Students is required to take both Electricity & Magnetism, DC Circuits and Differential Equations courses before taking this course.

TOPICS

1. Analysis of Linear Circuits (Review)

1.1 Kirchhoff's Laws

1.2 Thevenin's and Norton's Theorem

2. Analysis of Nonlinear Circuits

2.1 Introduction to Nonlinear Components

2.2 Analytical Solution

2.3 Graphical Analysis

2.4 Piecewise Linear Analysis

2.5 Incremental Analysis (Linearization)

3. Semiconductor Diodes

3.1 PN Junction

3.2 Covalent Bonding

3.3 Diode Characteristic

3.4 Diode Approximation

3.5 Half-Wave and Full-Wave Rectifier Circuits

3.6 Rectifier Circuits with RC Filter

4. Dependent Sources and Amplifiers

4.1 Circuit with Dependent Sources

4.2 Large-Signal Analysis

4.3 Small-Signal Analysis

4.4 Signal Amplification

4.5 Input and Output Impedance

4.6 Characteristic of Ideal Amplifier

5. Bipolar Junction Transistor (BJT)

5.1 Transistor Construction

5.2 Operation Principle

5.3 Basic Configuration

5.4 Biasing (Large-Signal Analysis)

5.5 Small-Signal Model of BJT

5.6 BJT Amplifier

6. Metal Oxide Semiconductor Field Effect Transistor (MOSFET)

6.1 MOSFET Construction

6.2 Operation Principle and Characteristic

6.3 Basic Configuration *)

6.4 Biasing (Large-Signal Analysis) *)

6.5 Small-Signal Model of MOSFET *)

6.6 MOSFET Amplifier *)

7. Introduction to Digital Circuits

7.1 Logic Gates

7.2 Power Dissipation in Logic Gates *)

7.3 CMOS Logic *)

8. Operational Amplifier Basic and Analysis

8.1 Basic Characteristics

8.2 Ideal Operational Amplifier

8.3 Open-Loop and Closed-Loop Response

8.4 Analysis of Operational Amplifier Circuit

9. Operational Amplifier Circuits

9.1 Basic Operational Amplifier Circuits

9.2 Instrumentation Amplifier

10. Non-ideal Characteristics of Operational Amplifier

10.1 Non-ideal Characteristics

10.2 Negative Feedback vs Positive Feedback Operational Amplifier Circuit

10.3 Application of Positive Feedback Operational Amplifier Circuit

11. Filters

11.1 Filtering Concept

11.2 Transfer Function and Types of Filter

11.3 Passive and Active Filters

11.4 First-Order Filter and its Design Technique

11.5 Second-Order Filter and its Design Technique

11.6 Cascaded-Filters

12. Oscillator (Operational Amplifier Based) *)

12.1 Square Wave Generator (Relaxation Oscillator)

12.2 Triangular Wave Generator

12.3 Positive Feedback and Oscillation (Barkhausen Criterion)

12.4 Sine Wave Generator

13. Power Supply and Regulator *)

13.1 Series

13.2 Shunt

13.3 Switching

REFERENCES

- [1] Boylestad, R.L., Electronic Devices and Circuit Theory, 1999, Prentice Hall Int'l Inc, New Jersey.
- [2] Sedra, A. S. & Smith, K. C., Microelectronics Circuits, 2011, 6th edition, Oxford Series in Electrical and Computer Engineering.
- [3] Behzad Razavi, B., Fundamentals of Microelectronics, 2014, John Wiley & Sons, Inc., New York.
- [4] Agarwal, A. & Lang, J.H., Foundations of Analog and Digital Electronic Circuits, 2005, Elsevier Inc., San Francisco