# TKU211221

Electricity & Magnetism

Fisika Listrik & Magnet

## BASIC INFORMATION

| | |
|---|---|
| **Course Credit** | 3 / 150 minutes per Week |
| **Course Type** | Required |
| **Course Classification** | Basic Science |
| **Prerequisites** | Classical Mechanics; Fluid, Heat & Waves |

## STUDENT AND LEARNING OUTCOMES

### Covered Student Outcomes

Fundamental and Engineering Knowledge (KP.1)

### Learning Outcomes

**LO1** Students are able to understand the concepts related to electricity, such as electric charge, electric force, electric field and electric potential.

**LO2** Students are able to understand the concepts related to magnetism, such as magnetic field, magnetic force and electromagnetic induction.

**LO3** Students are able to understand the concepts related to electronic components (resistor, capacitor and inductor) as well as electronic circuits (DC and AC circuits).

## COURSE DESCRIPTION

Electricity and Magnetism course is the continuation of Classical Mechanics, and Fluid, Heat & Waves courses. It discusses the concepts and theories related to Electromagnetism. Students is required to take both Classical Mechanics, and Fluid, Heat & Waves courses before taking this course.

## TOPICS

**1. Electric Charge and Force**

1.1 Electric Charge

1.2 Coulomb's Law

1.3 Superposition Principle

**2. Electric Field and Gauss's Law**

2.1 Electric Field and Force

2.2 Electric Dipole

2.3 Continuous Charge Distribution and its Electric Field

2.4 Electric Flux

2.5 Gauss's Law

**3. Electric Potential**
3.1 Electric Potential Energy and Electric Potential
3.2 Equipotential
3.3 Conductors - Electrostatic Shielding

**4. Capacitance and Dielectric**
4.1 Capacitance - Basic Concept
4.2 Energy Storage in Capacitor
4.3 Dielectric - Electric Field and Capacitance
4.4 Capacitors in Series and Parallel

**5. Current and Resistance**
5.1 Electric Current and Current Density
5.2 Ohm's Law
5.3 Resistivity, Conductivity and Resistance
5.4 Resistor in Series and Parallel
5.5 Energy and Power in Electric Circuit

**6. DC Circuit**
6.1 Electromotive Force
6.2 Kirchhoff's Laws
6.3 Application of Kirchhoff's Laws
6.4 Electrical Measuring Instrument
6.5 RC Circuits - Charging and Discharging

**7. Magnetic Field and Force**
7.1 Magnetic Field
7.2 Magnetic Force
7.3 Motion of Charged Particles in Magnetic Field
7.4 Mass Spectrometer
7.5 Magnetic Force on Current-Carrying Conductor
7.6 Magnetic Dipole and Torque on Current Loop
7.7 DC Motor and Hall Effect

**8. Source of Magnetic Field**
8.1 Biot-Savart's Law
8.2 Magnetic Field of Straight Current-Carrying Conductor
8.3 Force between Parallel Conductors
8.4 Magnetic Field of a Circular-Current Loop
8.5 Ampere's Law
8.6 Magnetic Field of a Solenoid

**9. Electromagnetic Induction**
9.1 Induction Experiment

9.2 Faraday's Law
9.3 Lenz's Law
9.4 Motional Electromotive Force
9.5 Eddy Current
9.6 Maxwell's Equations

**10. Inductance**

10.1 Mutual Inductance and Self Inductance
10.2 Magnetic Field energy and Energy Stored in Inductor
10.3 RL, LC and RLC Circuits

**11. Alternating Current**

11.1 Phasors
11.2 Resistance and Reactance
11.3 RLC Series Circuits
11.4 Power in AC Circuits
11.5 Resonance in AC Circuits

## REFERENCES


[1] Young & Freedman, 2008, University Physics with Modern Physics, Addison-Wesley Publishing Co., Boston
[2] Halliday-Resnick-Walker, 2004, Fundamentals of Physics, John Wiley & Sons, Inc., New York
[3] Randall D. Knight, 2008, Physics for Scientists and Engineers, Addison-Wesley Publishing Co., Boston