TKU211221

Electricity & Magnetism

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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