

# Electromagnetism 1

Syllabus Number

4D101

Special Subjects

Elective 2 credit

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## 1. Course Description

Students will learn the followings in this course,

- (1) The idea and mathematical expression of the sources and fields
- (2) How to calculate electromagnetic quantities in fields and circuits.

## 2. Course Objectives

The goal of this course is to acquire knowledge and skills so as to be able to correctly calculate electromagnetic quantities in electromagnetic fields and circuits.

## 3. Grading Policy

You will be graded by your quiz results and submitted reports (total 50%) and final examination marks (50%). Quiz results and reports are returned within 2 weeks after submission.

## 4. Textbook and Reference

Textbook

Textbook is "Basics of Electromagnetism" by WADA Sumio (Japanese).

Supplementary English materials will be provided if necessary.

## 5. Requirements(Assignments)

Read the corresponding part of the text carefully and solve the example problems (~3 hours).

## 6. Note

None.

## 7. Schedule

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|------|---|
| [1]  | Electricity basics 1 (Current and battery, power consumption)   |
| [2]  | Electricity basics 2 (Ohm's law, Joule heat, units for electromagnetism)  |
| [3]  | Electric field and potential 1 (Coulomb's law, electric field and field lines, field examples)                            |
| [4]  | Electric field and potential 2 (Gauss' laws and their applications)   |
| [5]  | Electric field and potential 3 (Electric energy and potential, electric field and potential of parallel plate electrodes) |
| [6]  | Electric field and potential 4 (Force and stored energy in capacitors, conductors and electrostatic induction)            |
| [7]  | Direct current circuit 1 (Electric field in conductor and ohm's law, circuit basics)                                      |
| [8]  | Direct current circuit 2 (Direct/parallel connection, connection of sources)  |
| [9]  | Direct current circuit 3 (Kirchhoff's law and its applications)   |
| [10] | Direct current circuit 4 (Capacitors)   |
| [11] | Basics of magnetic phenomena 1 (Magnetic force and field, laws of magnetic phenomena)                                     |
| [12] | Basics of magnetic phenomena 2 (Current model of magnets, strengths of magnetic field and force)                          |
| [13] | Basics of magnetic phenomena 3 (Ampere's law and its applications)  |
| [14] | Basics of magnetic phenomena 4 (Lorentz force, electricity generation by magnetic force)                                  |
| [15] | Basics of magnetic phenomena 5 (Power generators and motors)  |