# Electromagnetism 2

Syllabus Number

4D102

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.
- (3) Basics of electromagnetic wave engineering.

# 2. Course Objectives

The goal of this course is to acquire knowledge and skills 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

The textbook is "Basics of Electromaginetism" 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

[1]	Electromagnetic induction and AC circuits 1 (Electromagnetic induction, difference from the electromotive force)
[2]	Electromagnetic induction and AC circuits 2 (Self induction, circuit of an inductor and DC source)
[3]	Electromagnetic induction and AC circuits 3 (Alternating current, circuit of an inductor and a capacitor)
[4]	Electromagnetic induction and AC circuits 4 (AC source and resistors, inductors, capacitors)
[5]	Electromagnetic induction and AC circuits 5 (Complex voltage and current, impedance, AC circuits)
[6]	Maxwell equations and electromagnetic waves 1 (4 laws of electric/magnetic fields)
[7]	Maxwell equations and electromagnetic waves 2 (Differential laws with sources and vortices)
[8]	Maxwell equations and electromagnetic waves $3$ (Existence of electromagnetic waves)
[9]	Antenna systems 1 (Potential equations, electromagnetic radiation via antennas)
[10]	Antenna systems 2 (Antenna length and EM wavelength, antenna's impedance, directivity and gain)
[11]	Antenna systems 3 (Basic antennas, antenna variations, feeder lines and impedance matching)
[12]	Propagation of electromagnetic waves 1 (Speed and propagation of EM waves, cases of VHF/UHF/SHF waves)
[13]	Propagation of electromagnetic waves 2 (Electric field strength in free space, fundamental propagation loss, EM wave propagation over earth plane)
[14]	Propagation of electromagnetic waves 3 (Refraction, visible distance of EM waves, wave propagation in non-uniform air)
[15]	Propagation of electromagnetic waves 4 (Diffraction, fading, Mitigation of fading)