

「電磁學」課程大綱

(11310 EE 214000, Electromagnetism)

一、課程說明

本課程為電機系核心課程之一。以積分方程、微分方程的數學語言建構馬克士威方程組(Maxwell's equations)，據以解釋實驗觀察到之靜電、穩態電流、靜磁、電磁感應及與材料之交互作用等物理現象。課程也將透過平面波、傳輸線、天線等工程實例示範反射、穿透、色散等波動通性。本課程所需要的先備知識為：微積分(一二)、向量分析、普通物理(一二)、電路學、傅立葉轉換。對選修電磁波、光電工程、光電子學、微波工程、高頻電路設計、固態電子元件等進階課程至關重要。

Course descriptions

In this core subject of EE program, Maxwell's equations under the framework of integral equations and differential equations will be employed to justify the phenomena of electrostatics, steady-state currents, magnetostatics, electromagnetic induction and field-matter interaction. Engineering examples, like plane waves, transmission lines and antennas, will also be addressed to illustrate the general wave properties, such as reflection, transmission and dispersion. The prerequisites of this subject include Calculus I & II, Vector Analysis, General Physics I & II, Electric Circuit Theory, Fourier Transform. The knowledge of this subject matters for advanced ones such as Electromagnetic Waves, Optoelectronic Engineering, Photonics, Radio-frequency Engineering, RF Circuit Design and Solid-state Electronic Devices.

二、教材(Teaching materials)

N. N. Rao, *Elements of Engineering Electromagnetics*, 6th edition, Pearson, 2004.

David K. Cheng, *Field and Wave Electromagnetics*, 2nd edition, Addison Wesley, 1989.

Supplementary slides in pdf files

三、教學方式

課堂講授、影片觀摩、隨堂問答、現場演示實驗、團隊專題

Teaching methods

Lectures, video watching, in-class Q&A, demo experiments, group project

四、教學進度(Syllabus)

1. Vectors and fields (Ch 1 of Rao's textbook, Weeks 1-2)
2. Maxwell's equations in integral form (Ch 2, Weeks 3-4)
3. Maxwell's equations in differential form (Sec. 3.1-3.3, Weeks 5-6)
4. Midterm exam
5. Uniform plane waves in free space (Sec. 3.4-3.7, Weeks 6-9)
6. Group project
7. Fields and waves in electric materials (Ch 4, Weeks 9-11)

8. Transmission lines (Selected topics in Ch 6-7, Weeks 11-12)
9. Electromagnetic potentials (Sec. 5.1-5.4, Weeks 13-14)
10. Antenna (Sec. 10.1-4, Week 15)
11. Final exam (Week 16)

五、成績考核

期中考(30%)，期末考(35%)，團隊專題及演示實驗報告(20%)，小考(15%)

Evaluation policy

Midterm exam (30%), Final exam (25%), Group project and demo experiment reports (20%), Quizzes (15%)

六、可連結之網頁位址

數位學習平台：<https://eeclass.nthu.edu.tw/>

Hyperlinks

EEclass: <https://eeclass.nthu.edu.tw/>

七、生成式人工智慧使用規則(Generative Artificial Intelligence access rules)

本課程同意學生利用人工智慧(AI)進行協作或互學。根據本校公布之「大學教育場域 AI 協作、共學與素養培養指引」，本課程採取有條件開放，以下說明如何使用生成式 AI 於課程產出。

學生須於課堂作業或報告中的「標題頁註腳」或「引用文獻後」簡要說明如何使用生成式 AI 進行議題發想、文句潤飾或結構參考等使用方式。若經查核使用 卻無在作業或報告中標明，教師、學校或相關單位有權重新針對作業或報告重新評分或不予計分。本門課授課教材或學習資料若有引用自生成式 AI，教師也將在投影片或口頭標注。修讀本課程之學生 於選課時視為同意以上倫理聲明。