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EE 315000 Electromagnetic Waves

國立清華大學電機工程科學系

Spring, 2023

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Class location: Delta 202
Class schedule: M3M4W2

Teaching Assistants (TAs): 孫紹偉 willysun6482@gmail.com tel: 03-5162333

General Information

This course is to study electromagnetic waves. We will first understand the basic concepts of a wave. An electromagnetic wave contains vector components of electric and magnetic fields. It is better to learn the subject from the viewpoint of a scalar wave. Following the conceptive understanding of a wave, we will start to study the voltage and current waves on a transmission line. We then study the vector fields in a plane wave. Once we learn about the reflection and transmission of an electromagnetic wave at boundaries, we will try to understand waveguide and cavity as elements for propagating and storing electromagnetic waves, respectively. To send and receive an electromagnetic wave, it needs an antenna. The last part of the course is about transmission and receiving antennas.

The textbook chosen for this course is Field and Wave Electromagnetics by D. K. Cheng. As electromagnetics is a well-established knowledge, most other textbooks also serve well for the purpose of this course.

This course will be lectured mostly in English and slightly in Chinese for clarity. This course is synchronized with the pre-recorded DELTAMOOCx at https://univ.deltamoocx.net/courses/course-v1:AT+AT_032_1112+2023_02_01/about

You are encouraged to view the MOOCx course recordings by yourselves before or after the class.

Usually, I will give a 2-hour lecture in the Monday class. Before each lecture (likely to be on each Friday), you will receive a review sheet for you to prepare and review the content to be lectured on Monday. In every Wednesday class, we will partition the class into a few groups to discuss the review sheet. Each student will receive a notification on which group to join prior to the Wednesday class. Our teaching assistants will lead discussions on review questions. I will move myself into different groups to answer questions. You have to turn in the review sheet electronically through the EECLASS by 10 pm on every Wednesday. If you manage to turn in the review sheet by 10 am Wednesday , you get 10% extra credit. Homework assignments will be given every 2-3 weeks.

Textbook

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

Reference book

Fawwaz T. Ulaby, Fundamentals of Applied Electromagnetics 6th Ed., PEARSON Prentice Hall, 2007. (新月圖書，東華書局代理)

Ramo, Whinnery, and van Duzer, Fields and Waves in Communication Electronics, 2nd Ed., John Wiley & Sons, 1984.

Grading Policy:

Homework	10% (late homework not accepted)
Weekly review/quiz (open books/notes)*	30%
One midterm exam	30%
One final exam	30%

* weekly review/quiz includes those lectured, to be lectured, or assigned in homework.

* Review/Quiz (1) Review sheets will be distributed before Monday class and have to be turned in electronically by 10 pm on every Wednesday through the EECLASS. If you turn in the review sheet before the end of the Wednesday class, you get 10% extra for the earned score of the review sheet. (2) Quiz will be distributed from time to time in a class in a paper form.

* In case we need to adjust scores in the end of the semester, your performance in quiz, question asking/answering, discussion, attendance in the class will become the weighting factor for the adjustment.

* Homework will be assigned every few weeks via posting on the EECLASS

Course Handouts: Updates on slides can be found on the course website.

Course Contents

Week 1 (Feb. 13): time-varying field & wave
Week 2 (Feb. 20) : introduction to transmission line
Week 3 (Feb. 27): key features of transmission line (no class on Monday, Feb. 27)
Week 4 (March 6): Smith Chart
Week 5 (March 13): Plane wave
Week 6 (March 20): polarization of EM wave
Week 7 (March 27): EM wave in material
Week 8 (April 3): no class (Midterm Exam #1)
Week 9 (April 10): power and energy of an EM wave
Week 10 (April 17): EM wave incident on conducting boundaries

Week 11 (April 24): EM wave incident on dielectric boundaries
Week 12 (May 1): Introduction to waveguide
Week 13 (May 8): rectangular waveguide
Week 14 (May 15): cylindrical waveguide
Week 15 (May 22): dielectric waveguide
Week 16 (May 29): resonator of EM wave
Week 17 (June 5): dipole antenna
Week 18 (June 12) – Final Exam