

## SPRING 2019

### EEL 4473/5486

#### ELECTROMAGNETIC FIELDS AND APPLICATIONS II (EEL 4473)

#### ELECTROMAGNETIC FIELD THEORY I (EEL 5486)

1. Text: Sadiku, M.N.O. Elements of Electromagnetics, 7<sup>th</sup> ed., Oxford
2. Instructor: M. A. Uman, Classroom 328 Benton Hall,  
Hours: M-W-F, 4<sup>th</sup> Period, 10:40 am to 11:30 am
3. Instructor Office Hours: M-W-F, 11:40 am – 12:30 pm, or by appointment,  
311 Larsen Hall ([uman@ece.ufl.edu](mailto:uman@ece.ufl.edu))
4. Compact view of the course

Material	Number of Lectures	Chapter(s) in Text
1. Review of Maxwell's equations	4	4.2, 4.5, 4.6, 4.8, 7.2-7.6, 9
2. Electromagnetic wave propagation	5	10
3. Waveguides and Transmission Lines	11	11.1-11.4, 11.7, 12
4. Antennas, Frequency domain	8	13
5. Antennas, Time domain	5	Notes provided
6. Miscellaneous topics in plasma physics	5	13.10, notes provided
Final Exam – Thursday May 2, 2019	Time: 12:00 pm to 2:00 pm	Place: 328 Benton Hall

#### 5. Grading

Hour tests, probably 3 or 4, will be given during lecture periods. The hour tests, in total, will count for 50% of the final grade. The final exam will nominally count for the other 50% (or a greater percentage if the results are significantly better than the hour tests). No credit will be given for homework, but it will be assigned and graded. All tests will be closed book with one personal handwritten sheet of notes allowed and turned in as part of the test.

## COURSE OUTLINE

### 1. Review of Maxwell's equations: Ch. 9, Sections 4.2, 4.5, 4.6, 4.8, 7-2.-7.6

- Electromagnetic (EM) field quantities, units, and constants
- Maxwell's equations for static electric and magnetic fields
- Maxwell's equations for time-varying electric and magnetic fields
- Maxwell's equations in the time and frequency domains

### 2. Electromagnetic wave propagation: Ch. 10

- Waves in general
- Propagation in lossy dielectrics (general case)
- Propagation in lossless dielectrics
- Propagation in good conductors
- Plane wave reflection

### 3. Waveguides: Ch. 12, Sections 11.1-11.4, 11.7

- Transmission lines (TEM waves)
- Transverse magnetic (TM) waves in rectangular waveguides
- Transverse electric (TE) waves in rectangular waveguides
- Wave propagation in the guide
- Cavity resonators
- Transients (time-domain pulses) on transmission lines

4. Antennas, frequency domain: Ch. 13

- Hertzian dipole
- Half-wave dipole and quarter-wave monopole
- Small loop antenna
- Antenna arrays

5. Antennas, time domain: notes provided

- Vector and scalar potentials
- Radiation from a short current pulse on a long antenna

6. Miscellaneous topics in EM interactions with plasma; notes provided

- Introduction to EMC
- Definition of a plasma, Debye length
- Electromagnetic wave propagation in a plasma
- Electrostatic plasma oscillations