ENGINEERING ELECTROMAGNETICS
EP440, FALL 2014

ERAU Daytona Beach Campus
M W F, 2:15-3:15
Room: CoAS 501

Instructor: Jonathan B. Snively
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Office: 319.05 **(**CoAS Building)
Office Hours: MWF 3:30-5:00 (or by Appt.)

Textbook: D. K. Cheng, Field and Wave Electromagnetics, 2nd Edition, Chapters 1-8, 9?, 10?
Prerequisites: CS223, MA442 (Co-Req.), PS250, PS303, and PS320.
Blackboard will only be used for mass emails and the posting of textbook solutions –
The most important course materials will instead be posted on the course website!

Homework assignments will be posted on the website and announced in class. Feel free to work on homework problems in groups or individually. Show all details of solutions (in legible form), and please cite all sources used and list any collaborators. Assignments should be submitted to the grader's mailbox by 5:00PM on the days they are due. *Late assignments will be graded at 70% credit if submitted before the next exam.*

All **Exams** are closed book and closed notes. Calculators are neither required nor allowed. The **Final Exam** will be comprehensive, and is tentatively scheduled for 12:30-2:30 PM on Saturday, December 6th.

Weighting:

Homework	15%
Exam #1 (9/17)	20%
Exam #2 (10/15)	20%
Exam #3 (11/14)	20%
Final Exam (12/6)	25%
Total =	100%

Probable Grading Scale:

A	90 ≤ your grade
B	75 ≤ your grade < 90%
C	60 ≤ your grade < 75%
D	50 ≤ your grade < 60%
F	your grade < 50%

Grading: I reserve the right to apply *favorable* curves, to adjust grade scales, or to adjust the weightings of graded materials to maintain an appropriate and fair distribution of grades.

Academic Integrity: *Cheating, plagiarism, and fraud are unacceptable in all forms, constituting serious academic integrity violations.* In accordance with Departmental and University policies, they can result in a failing grade or dismissal from the University.

Attendance will not be taken, but you are fully responsible for *all* materials presented in class, including *any* assignments collected or important announcements made. **Office hours** are as-posted – For other times, individual appointments are encouraged to confirm my availability.

> **A Message from DSS:** *ERAU is committed to the success of all students. It is University policy to provide reasonable accommodations to students with disabilities who qualify for services. If you would like to request accommodations due to a physical, mental, or learning disability, please contact the Disability Support Services Office at 226-7916 located on the West side of the Wellness center – Building #20. All discussions are confidential.*

Main Course Topics and Learning Outcomes:

1. Integral and Differential Forms of Maxwell's Equations (Review and Introductions)
   - **a.** Understand relationship between, and derivations of, integral and differential forms.
   - **b.** Define and understand the displacement current and its physical importance.
   - **c.** Appreciate Maxwell's Equations and the Lorentz force as the summary equations of classical electrodynamics.
2. Electrostatics (Chapter 3-4) / Magnetostatics (Chapter 6)
   - **a.** Reduce Maxwell's Equations to describe electrostatic and magnetostatic fields.
   - **b.** Calculate electric fields by integration and by symmetry arguments using Gauss's law, and magnetic fields by Ampere's Law and the Biot-Savart Law.
   - **c.** Derive and solve Poisson's and Laplace's equations for useful geometries.
   - **d.** Understand and apply the Method of Images to determine electric fields.
   - **e.** Understand polarization, permittivity, and the relationship between **D** and **E** fields, and magnetization, permeability, and the relationship between **B** and **H** fields.
   - **f.** Define and understand the electric potential *V* and magnetic vector potential **A**.
   - **g.** Calculate capacitance for simple configurations of electrodes, and self-inductance for simple coil geometries.
   - **h.** Understand and calculate energy stored in electric and magnetic fields.
   - **i.** Understand and calculate electric and magnetic forces.
   - **j.** Understand and apply boundary conditions for electric and magnetic fields.
3. Electrodynamics (Chapter 7)
   - **a.** Understand and apply Faraday's Law for Induction, and motional emf.
   - **b.** Understand the application of the Maxwell-Ampere law (i.e., with polarization current).
   - **c.** Understand the combined boundary conditions for **E**, **D**, **B**, and **H** fields in media.
   - **d.** Derive the electromagnetic wave equation from Maxwell's Equations.
   - **e.** Understand the basis for complex phasor time-harmonic solutions.
4. Electromagnetic Waves (Chapter 8)
   - **a.** Use complex time-harmonic wave representations to describe EM waves.
   - **b.** Understand mathematically EM wave parameters (wavenumber, frequency), wave energy (Poynting flux), wave impedance, and polarization.
   - **c.** Understand and mathematically describe the propagation of plane waves in unbounded linear media, including wave attenuation in conducting media.
   - **d.** Understand propagation in plasmas, group and phase velocity.
   - **e.** Understand and mathematically describe reflection and refraction at boundaries.
5. Transmission Lines, Waveguides and Cavities (Chapter 9.2 / Chapter 10, *as time permits*)
   - **a.** Understand the fundamentals of TEM propagation on parallel-plate transmission lines.
   - **b.** Understand and mathematically describe the TE and TM mode propagation between parallel-plates and rectangular waveguides.
   - **c.** Understand and mathematically describe the TE and TM modes of rectangular cavities.
   - **d.** Qualitatively appreciate and understand the special function solutions for cylindrical waveguides and cavities, and for dielectric waveguides.
6. Antennas and Radiation (Chapter 11, *as time permits*)
   - **a.** Understand the application of phasor retarded potentials in radiation problems for electric and magnetic dipoles.
   - **b.** Calculate basic antenna parameters such as directivity and radiation resistance.