ELEC 318 Electromagnetic Fields
Course Syllabus, Spring 2015

Prerequisites: ELEC 202, ELEC 204, ELEC 206, PHYS 222/272, MATH 234, MATH 335

Course description: Static and magnetic fields; experimental laws and their relation to Maxwell's equations; Laplace and Poisson's equations; boundary value problems; time-varying fields and plane waves.

Instructor: Dr. Gregory J. Mazzaro, Grimsley Hall Room 312
phone: 843-953-0429, e-mail: gmazzaro@citadel.edu
office hours: MW 13:30–14:30, TR 13:30–16:30 (open-door otherwise)

Class Schedule: Sec 01, TR 08:00–09:15 // GRIMS 328
Sec 81, TR 17:15–18:30 // GRIMS 322

Textbook: Fawwaz Ulaby, Eric Michielssen, and Umberto Ravaioli, *Fundamentals of Applied Electromagnetics*, 7th Edition, Prentice Hall, 2014.

References: Matthew Sadiku, *Elements of Electromagnetics*, 6th Edition, Oxford University Press, 2014.

Stuart Wentworth, *Fundamentals of Electromagnetics with Engineering Applications*, 1st Edition, John Wiley & Sons, 2005.

Course webpage: http://ece.citadel.edu/mazzaro ("ELEC 318")

Course objectives:

(1) to use vector calculus and Maxwell's Equations to solve for electric & magnetic fields
(2) to convert vectors, length/surface/volume, derivatives/integrals between coordinate systems
(3) to classify electric and magnetic materials from constitutive parameters
(4) to apply boundary conditions to determine static fields on either side of a material mismatch
(5) to calculate flux, energy density, and total energy in electric and magnetic fields
(6) to determine the resistance, capacitance, and inductance of electromagnetic geometries
(7) to calculate forces generated/experienced by magnetism
(8) to determine the direction, speed, and power of waves propagating in material media

Grading:

written homeworks	15%	$90\% \le A < 100\%$
3 in-class exams	15%, 15%, 20%	$80\% \le B < 90\%$
quiz (1, announced)	5%	$70\% \le C < 80\%$
take-home exam	5%	$60\% \le D < 70\%$
final exam (comprehensive)	25%	$F < 60\%$

Lecture notes. Partial lecture notes will be available on the course website before each class. It is recommended that students print these notes out ahead-of-time and bring them to each class.

Special accommodations. Upon receipt of a bona fide letter from the Office of Access Services, Instruction, and Support (OASIS), appropriate accommodations will be made for students with learning disabilities.

Attendance policy. Class attendance is mandatory. Absences in excess of 20% of the class meetings will result in a failing grade for the course. Unexcused absence from a test, quiz, or a final exam will result in a zero score for that test, quiz, or exam.

Homework. Completed assignments must be turned in at the *start* of class on the due date. Only neat and legible work is acceptable. Late homework will not be accepted. Due dates and solutions for assignments will be posted on the course webpage. Collaboration on homework is permitted and encouraged, but plagiarism is not. Collaboration on a take-home exam is *not* allowed.

Classroom rules:

(1) Students must arrive for class on time. Attendance will be taken at the *start* of class.
(2) Food and drinks (other than water) are prohibited in the classroom.
(3) All personal electronic devices (e.g. cell phones) must be silenced or turned off. Use of personal electronic devices (e.g. for sending text messages) during class is prohibited.

Calculators for exams. Calculators approved for use on the Fundamentals of Engineering licensing exam are permitted for use on ELEC 318 exams: http://ncees.org/exams/calculator-policy

Academic integrity. Group studying is encouraged. While it is permissible to ask other students for assistance outside of classroom, it is *not* permissible to copy any portion of another student's work. Cheating in any form (e.g. plagiarism) will be fully prosecuted under the Citadel honor code.

Lec	Topic	Book	
3	**Vector algebra:** scalars & vectors, unit vector, vector addition & subtraction, position & distance vectors, vector multiplication, components	3.1	
	Coordinate systems & transformations: Cartesian, cylindrical, spherical	3.2-3.3	
	Vector calculus: differential length/area/volume, line/surface/volume integrals, del, gradient, divergence, curl, Laplacian, field classification	3.4-3.7	
4	**Electrostatic fields:** Coulomb's Law, continuous charge distributions, Gauss' Law & applications, electric potential, E/V relationship, Poisson's equation	4.1-4.5	**Exam 1**
	Electric fields in material space: field intensity, flux density, dipole, material properties, convection & conduction current, conductors & dielectrics, polarization & dielectric constant, linear/isotropic/homogenous, boundary conditions, resistance	4.6-4.8	
	Electrostatic boundary-value problems: Laplace's equation, uniqueness, capacitance, energy density, method of images	4.9-4.11	**Exam 2**
5	**Magnetostatic fields:** Biot-Savart Law, Ampere's Law & applications, flux density, magnetic scalar & vector potentials	5.1-5.4	
	Magnetic forces, materials, & devices: torque & moment, magnetization, material classification, boundary conditions, inductance, magnetic energy, forces on & due to magnetism	5.5-5.8	
6	**Maxwell's equations:** Faraday's Law, transformers and EMF, displacement current, continuity equation, relaxation time, time-varying potentials, time-harmonic fields	6.1-6.11	**Exam 3**
7	**Electromagnetic wave propagation:** in free space, in lossy/lossless dielectrics, in conductors	7.1-7.2, 7.4	**Final Exam**

Final exam: Section 01, TR 08:00-09:15 – TBD
Section 81, TR 17:15-18:30 – TBD