

**ECE 520.219-220, Fields, Matter, and Waves,
Fall 2009 -- Spring 2010**

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Catalog Data:

Basic principles of electromagnetics for engineers. Topics include: Vector analysis, electrostatic fields in vacuum and material media, stationary currents in conducting media, magnetostatic fields in vacuum and material media. Maxwell's equations and time-dependent EM-fields, EM-waves and radiation, waveguides, applications.

Prerequisite: 110.108-109, 171.101-102. **Co-requisite:** 110.202

Text: W. H. Hayt, Jr. and J. A. Buck, "*Engineering Electromagnetics*", 7-th edition, McGraw-Hill, 2006

Supplemental recommended texts: W. F. Hughes and E. W. Gaylord, "*Basic Equations of Engineering Science*", Schaum's outline series; McGraw-Hill. Greatly useful book.
W. B. Smythe, "*Static and Dynamic Electricity*", Hemisphere Publ., 1988. Unique, unsurpassed, huge collection of problems in the field and their analytical solutions.

Goals: The course is intended to introduce students to basic notions and principles of electrostatics and electrodynamics, including also basic mathematical tools, like vectorial analyses, partial differential equations, etc. It is one of the core courses in ECE department, and a pre-requisite course for many other courses.

Topics for the first semester (520.219):

1. Intro: electromagnetics in nature and in technologies
2. review of vectorial analyses
3. Coulomb law and electric field
4. electric flux density and Gaussian law
5. energy and potential
6. electrical currents and conductors
7. dielectrics and capacitors
8. Poisson's and Laplace's equation
9. magnetic field
10. review and final exam

Grading: home work about 60%; midterm exam, 20%, final exam, 20%.

Engineering Science: 3 credits (100%)

Topics for the second semester (520.220):

11. time-dependent fields and Maxwell equations
12. uniform plane waves
13. matter, constitutive equations; dispersion, phase and group velocities
14. boundaries, reflection and transmission
15. diffraction and Gaussian beams
16. waveguides and resonators
17. course project: literature search and presentation on recent EM applications
18. review and final exam

Grading: home work about 60%; project, 20%, final exam, 20%.

Engineering Science: 3 credits (100%)