University of Wisconsin - Madison
College of Engineering [EGR]
Last Offered: 2011-2012 Spring [1124]
Direct Link to this Syllabus :

1. E C E 440, Electromagnetic Fields and Waves
2. Credits : 3   Contact Hours : 3.0

a. Other Supplemental Materials : None

• Specific Course Information :

a. Brief description of the content of the course (Course Catalog Description) : Laplace's and Poisson's equations; conformal mapping and boundary value problems; Maxwell's equations; boundary conditions, plane wave propagation, reflection and refraction at oblique incidence, surface impedance concept; ionized media; anisotropic materials; radiation from antennas.
b. Pre-requisites or Co-requisites : ECE 265 or Cons Inst
c. This is a Selected Elective course.

• Specific Goals for the Course :

a. Course Outcomes :

1. This is a second advanced course for undergraduates specializing in electromagnetics.
2. The purpose of the course is to provide senior-level students with methods to analyze and understand advanced electromagnetic field problems that arise in various branches of engineering.

• ABET Student Learning Outcomes :
(a) Ability to apply mathematics, science and engineering principles.
(c) Ability to design a system, component, or process to meet desired needs.
(e) Ability to identify, formulate and solve engineering problems.
(g) Ability to communicate effectively.
(k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

- **Brief List of Topics to be Covered**:
  1. Maxwell's equations (review).
  2. Poynting theorem for complex $e$ and $m$.
  3. Fields in anisotropic materials.
  4. Plane waves; polarization; plane waves in a plasma, space charge waves; reflection at normal incidence; multiple dielectrics; reflection and refraction at oblique incidence; surface waves; linear isotropic materials--dielectrics, semiconductors and superconductors; plane waves in anisotropic materials-crystals, ferrites and plasmas.
  5. Lorentz reciprocity theorem.
  6. Antennas and radiation; linear antennas; aperture radiation; receiving antennas; induced emf method; transmitting-receiving system.
  7. Optics; ray and geometrical optics; dielectric optical waveguides.
  8. Sources of coherent radiation.