ECE 390 – Electric & Magnetic Fields

Catalog Description: Static and quasi-static electric and magnetic fields.

Credits: 4 **Terms Offered:** Fall

Prerequisites: MTH 255, ENGR 203 (concurrent enrollment in ENGR 203 allowed)

Courses that require this as a prerequisite: ECE 331, ECE 484, ECE 485, ECE 499 Engineering Magnetics, ECE 593

Structure: Three 80-minute lectures per week

Instructors: A. Weisshaar (primary), A. Jander (secondary)

Course Content:

- Introduction, review of vector analysis
- Static electric fields in free space: Coulomb's law, Gauss's law, and electric potential, electric dipole
- Static electric fields in presence of material medium: conductors, dielectrics, polarization, electric flux density, and dielectric constant
- Boundary conditions, capacitance, electrostatic energy, Poisson's and Laplace's equations. Boundary value problems, method of images
- Steady electric currents, static magnetic fields in free space, Ampere's circuital law, vector magnetic potential
- Biot-Savart law, magnetic dipole, magnetization, and magnetic materials
- Permeability, boundary conditions magnetic circuits. Inductance, magnetic energy and forces

Measurable Student Learning Outcomes:

At the completion of the course, students will be able to…

1. **Identify** the characteristics of static electric and magnetic fields in free space and material media (ABET Outcomes: A, E, m)
2. **Identify** the characteristics of static magnetic fields in free space and material media (ABET Outcomes: A, E, m)
3. **State** Maxwell's equations, and **apply** to solve a variety of boundary value problems including method of images (ABET Outcomes: A, E, M, N)
4. **Calculate** the capacitance, inductance and the resistance of several configurations using electromagnetic concepts (ABET Outcomes: A, c, E, M)

Learning Resources:

- David K. Cheng, *Field and Wave Electromagnetics,* Addison-Wesley Publishing Company, 2nd edition, 1992 (required)

Students with Disabilities:

Accommodations are collaborative efforts between students, faculty and Services for Students with Disabilities (SSD). Students with accommodations approved through SSD are responsible

for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through SSD should contact SSD immediately at 737-4098.

Link to Statement of Expectations for Student Conduct:
http://oregonstate.edu/admin/stucon/achon.htm

Revised: 5/24/07