

ECE 484 – Antennas & Propagation

Catalog Description: Introduction to antennas and radiowave propagation.

Credits: 4 **Terms Offered:** Spring, in alternate years

Prerequisites: ECE 390, ECE 391X

Courses that require this as a prerequisite: None

Structure: Two 100-minute lectures per week

Instructors: A. Weisshaar

Course Content:

- Introduction: design issues, examples of typical antennas
- Fundamentals of electromagnetic radiation: Maxwell's equations, potential functions, wave equation, retarded potential, short current element, near and far fields, Poynting's theorem
- Basic antenna parameters: radiated power, radiation resistance, radiation efficiency, input impedance, radiation pattern, directivity and gain
- Design of simple wire antennas: linear dipole, $\lambda/2$ -dipole, folded dipole, monopoles, loaded dipoles
- Design of matching and feeding networks: quarter-wave transformer, series section transformer, stub matching, lumped element networks, feed point location, delta- and T-match, baluns
- Design of antenna arrays: principle of pattern multiplication, broadside and endfire arrays, array synthesis, coupling effects and mutual impedance, parasitic elements, Yagi-Uda antenna
- Design of aperture-type antennas: rectangular aperture, circular aperture, horn antenna, reflector antennas, microstrip patch antennas
- Properties of receiving antennas: reciprocity, effective antenna area, radar cross section
- Transmit-receive system: Friis transmission formula, radar
- Radio-wave propagation: ground effects, reflections, diffraction, scattering, multipath propagation, fading

Measurable Student Learning Outcomes:

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

1. **Identify** basic antenna parameters (ABET outcomes: A, e)
2. **Design and analyze** wire and aperture antennas (ABET outcomes: A, C, E, K, M, n, o)
3. **Design and analyze** matching and feeding networks for antennas (ABET outcomes: A, C, E, K, M, n, o)
4. **Design and analyze** antenna arrays (ABET outcomes: A, C, E, K, M, n, o)
5. **Analyze** wireless transmit-receive systems (ABET outcomes: A, E, m, n)
6. **Identify** the characteristics of radio-wave propagation (ABET outcomes: A, e, m)

Graduate students must solve more difficult problems that require a higher-level understanding of antenna and wave propagation concepts

Learning Resources:

- Cheng, David. K., *Field and Wave Electromagnetics*, 2nd Ed., Addison-Wesley, Reading MA, 1989
- Class notes

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: 5/7/07