# EE 533 ANTENNA ENGINEERING- Fall 2014

**Instructor:** Andy Olson
632 Cobleigh Hall
994-5967
andyo@ece.montana.edu
Office hours: See class web site

**Prerequisite:** EE 334 or equivalent and senior or graduate standing

**Course Website:** http://www.coe.montana.edu/ee/andyo/EE533/EE533hpg.htm

**Course Description** (from the MSU Catalog):
-- *Introduction to the electromagnetic theory and practice of antenna design and analysis. Common antenna structures are studied, including dipoles, arrays, horns, and reflectors. Applications will be explored in wireless communication, remote sensing, and related fields. Numerical electromagnetic simulation techniques are used for antenna modeling..*

This is a first course on antennas, providing an introduction to antenna fundamentals and characteristic properties, classes of antennas and their uses, and antenna measurements. Several fundamental antenna types will be analyzed in detail to explore their properties and to illustrate basic analytical techniques that may be generally applied to antenna problems. To reinforce the analytical approach the course will introduce elementary numerical techniques using Matlab and NEC, and students will construct and experimentally characterize their own antennas.

**Text:** *Antenna Theory: Analysis and Design*, 3rd Edition, Constantine A. Balanis (Wiley, 2005)
ISBN: 0-471-66782-X

**Software and Other Tools:**
To reinforce the analytical approach the course will introduce antenna modeling using elementary numerical techniques in Matlab, MathCad and NEC (Numerical Electromagnetic Code) software. ADS (Advanced Design System) from Agilent Technologies may be used when we get to patch antenna design to plot far field patterns.

**Supplemental References (not required):**
*Antenna Theory and Design,* by Warren L. Stutzman and Gary A. Thiele,m (Wiley; 2 edition 1997)
ISBN: 978-0471025900

Radiowave Propagation and Antennas for Personal Communications, by Kazimierz Siwiak and Yasaman Bahreini, ISBN: 978-1596930735

Other reference texts and materials will be listed in class as appropriate.

**Class Meetings:**

Lecture: M, W, F 9:00-9:50 am Room: 632 Cobleigh
Final: 8-9:50 December 12th

Field tests of antennas will be scheduled as required

**Grading:**

- Homework: 25%

  Homework will be used to help students gain insight into antenna theory as well as design and analysis skills. Students are encouraged to develop team skills by discussing homework with their colleagues. To draw the most from this course it is important however, that each individual spend significant time working on homework privately, *before* engaging in collaborative efforts. Neatness and clarity are important and will form a portion of the homework grade. Some of the homework may require physical characterization of an antenna or device, or numerical simulations. There will be 7 or 8 assignments over the course of the semester.

- Lecture/Presentation: 25%, Report: 25%
  It is important at the graduate level that you be able to communicate technical information to others. Student teams will be responsible for preparing a report and a presentation to the class on an antenna they have designed and built. Aspects of the report will include design and simulation of the antenna, and field measurement test results.

- Exam I: 25% (in class)

- Class participation:
  *Class attendance and participation is required, and will constitute portion of your grade.*

**Additional comments for your Lecture/Presentation and Report:**

The student is encouraged to look at chapters 11,12,12,12,15 for ideas on an antenna to build. Be creative! I once built a 2.5 GHz medium gain antenna with a 1 lb coffee can for an aperture coupled with a large salad bowl lined with aluminum foil for a reflector dish!

**Topical List for EE 533:**
After completing this course, each student should be familiar with the following, and be able to apply/design them as appropriate:

- Review of fundamental concepts
- Fundamental Antenna Parameters (1,2)
- Vector Potentials, current sources, fields, Far-Field Radition (3)
- Aperture, Loop, and Wire Antenna fundamentals (4,5)
- Measurement methods (17)
- Antenna arrays (6)
- Broadband Antennas and matching (9,10,11)
- Microstrip and patch antennas (14)