

# ORGANIZATIONAL LECTURE

**ECE753**

## **Modern Antennas in Wireless Telecommunications**

**Objective:** To provide fundamental knowledge in the theory and practice of antenna design and deployment in modern wireless telecommunication systems

**Contact:**

Prof. Natalia K. Nikolova

ITB-A 220, ext. 27141

e-mail: [nikolova@ieee.org](mailto:nikolova@ieee.org)

# OUTLINE

theory of electromagnetic radiation

fundamental antenna parameters

basic antenna measurement techniques (8-hour lab)

classical radiating elements

matching techniques

antenna arrays

fundamental limitations of electrically small antennas

smart antennas

# LECTURE PLAN

Course homepage:

<http://www.ece.mcmaster.ca/faculty/nikolova/antennas.htm>

## **Lecture Plan: (updated lectures available for download)**

Introduction into antenna theory and practice

Radiation integrals and auxiliary potential functions; basic theorems

Fundamental antenna parameters

Antenna measurements

Infinitesimal dipole; wire and loop radiating elements

Wire antennas – dipoles, monopoles, Yagi-Uda array

Arrays – analysis and design

Printed antennas

Reflector antennas

Horn antennas

## **Seminars:**

Smart antennas and signal processing antennas

Fundamental limitations of electrically small antennas

# PREREQUISITES, EVALUATION

## Prerequisites:

4FJ4 Microwave Engineering

2FH3 Electromagnetics I and 3FK4 Electromagnetics II

## Evaluation:

Weekly Assignments	40 %
--------------------	------

Project	40 %
---------	------

Laboratory (8 hours)	20 %
----------------------	------

# COURSE SCHEDULE

**Lectures:** 3 hours/week (for 12 weeks), holidays worked out

**Estimated End of lectures: Fri, April 20, 2012**

**Assignments:** weekly (announced in class and posted)

**Seminars (6 h) and Labs (8 h): Apr. 20 to May 4, 2012**

**Lab reports due: May 4, 2012, 5 pm (hardcopies)**

**Projects:**

- (a) Design of antennas
- (b) Presentation at seminar series and written technical report

# LITERATURE SOURCES

## Recommended texts:

**L. V. Blake and M. W. Long, *Antennas*, 3<sup>rd</sup> ed., Scitech 2009.**

**C. A. Balanis, *Antenna Theory, Analysis and Design*, 3<sup>rd</sup> ed. Hoboken, NJ: Wiley, 2005.**

Lecture notes (distributed in class and available for download).

# LITERATURE SOURCES

## **Alternative sources:**

1. Elsherbeni and Inman, *Antenna Design & Visualization Using MATLAB*, 2006.
2. J. D. Kraus and R. J. Marhefka, *Antennas (for all Applications)*, 3rd ed. McGraw-Hill, 2002. (the previous editions authored by Kraus only are fine, too).
3. W. L. Stutzman and G. A. Thiele, *Antenna Theory and Design*, 2nd ed., 1998.
4. R. S. Elliot, *Antenna Theory and Design, A Classical Reissue*, 2003.
5. V. Fusco, *Foundations of Antenna Theory and Techniques*, Pearson, 2008.

## **On antennas and propagation:**

1. R. E. Collin, *Antennas and Radiowave Propagation*. McGraw-Hill, 1985.
2. K. Siwiak, *Radiowave Propagation and Antennas for Personal Communications*, 2nd ed. Artech House, 1998.
3. J. Doble, *Introduction to Radio Propagation for Fixed and Mobile Communications*. Artech House, 1996.

## **On smart antennas:**

1. T. K. Sarkar, M. C. Wicks, M. Salazar-Palma, R. J. Bonneau, *Smart Antennas*. Wiley, 2003.
2. G. T. Okamoto, *Smart Antenna Systems and Wireless LANs*, Kluwer, 1999.

# SOFTWARE ASSIGNMENT AND DESIGN PROJECT

assignments and projects require access to EM simulators:  
FEKO, HFSS

access provided by the ECE Department

(contact Chris Fulton [fulton@mail.ece.mcmaster.ca](mailto:fulton@mail.ece.mcmaster.ca))