



# ENEE 789G: Advanced Topics in Electrophysics: Magnetism and Magnetic Technology

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## Course Goals:

To develop an in depth understanding of the physics, materials issues and technology of magnetism, spintronics and related applications. The course will cover fundamental concepts from classical and quantum theories of magnetism, to modern micromagnetics and spin-dependent transport. This will also discuss advanced magnetic storage, random access memory and various applications of magnetic sensors for field sensing.

## Course Prerequisite(s):

The course will be self-contained, but prior exposure to the some or all of the following will be helpful. ENEE 380 or equivalent upper undergraduate electro-magnetostatics, ENEE690 or equivalent graduate level course in quantum mechanics is beneficial but not necessary.

## Topics Prerequisite(s):

Undergraduate electrostatics, magnetostatics, elementary quantum theory of atoms.

## Textbook(s)

*Introduction to Magnetic Materials*, Cullity and Graham, Wiley 2009; *Modern Magnetic Materials*, O'Hanley, 2000; *Physics of Magnetism*, Chikazumi and Charap, Krieger Pub. Co., 1978

## Reference(s):

*Introduction to Solid State Physics*, 9ed, Kittel

## Core Topics:

Introductory magnetostatics, experiments, classical and quantum theory of magnetism, energetics and domain structures, domains and magnetization reversal processes; magnetization dynamics; magnetotransport, spin transport, spin-based magnetoresistance, spin-torque interactions; magnetic devices, spin valves, tunnel junctions, MRAM, nano-oscillators

## **Course Structure:**

3 hours lecture per week, homework, midterm and final exams, optional group term paper

## **Grading Method:**

Regular

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**Last Updated: July 12, 2011, Prof. R.D. Gomez**