

UNIVERSITY OF CALIFORNIA, DAVIS  
Department of Chemical Engineering and Materials Science

**EMS 289C: More Advanced Functional Properties of Materials (CRN: 32209)**  
**3 units, TR 1:40-3:00pm, 1130 Bainer Hall**

**COURSE OUTLINE – Spring 2015**

Instructor: Professor Yayoi Takamura  
2009 Kemper Hall  
email: ytakamura @ ucdavis.edu  
Office hours: W: 2:00-3:00 pm or by appointment  
Course webpage: SmartSite

Textbook: No specific textbook will be required for the class. Readings will be posted on the course SmartSite and will consist of sections from various textbooks (examples are listed below) and journal articles.

1. R.E. Newnham, *Properties of Materials*, Oxford University Press, 2005, ISBN: 978-0198520764
2. T. Tsurumi, H. Hirayama, M. Vacha, and T. Taniyama, *Nanoscale Physics for Materials Science*, CRC Press, 2010, ISBN: 978-1-4398-0059-1
3. N.A. Spaldin, *Magnetic Materials: Fundamentals and Device Applications*, Cambridge University Press, 2003, ISBN: 978-0521016582
4. B.D. Cullity and C.D. Graham, *Introduction to Magnetic Materials, 2<sup>nd</sup> Edition*, Wiley, 2008, ISBN-978-0471477419
5. C. Kittel, *Introduction to Solid State Physics*, Eighth Edition, Wiley, 2004, ISBN: 978-0471415268

Prerequisites: Graduate standing in Engineering, Physics, or Chemistry. Completion of EMS 272 is recommended.

<u>Grading:</u>	Homework	60%
	Final Oral presentation	40%

Course Policies:

1. Homework is due in class on the specified due date. No late homework will be accepted.
2. Unless you are instructed otherwise, you may discuss homework problems with other students in the class, but submitted work must be your own. The UC Davis Code of Academic Conduct will be strictly enforced. (see <http://sja.ucdavis.edu/cac.html>)
3. It is expected that students will abide by the UC Davis Principles of Community (see <http://principles.ucdavis.edu/>).

Note: EMS 289C is a temporary course number for courses before they get approved for a permanent course number. Therefore, it shows up as Physics and Chemistry of Materials and it is a variable unit class. Please make sure to enroll for 3 units for this version of the class.

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**Tentative List of Topics - Spring 2015**

- Electronic properties in nanostructures
- Scanning tunneling microscopy/spectroscopy
- Metal oxide semiconductor (MOS) transistors
- Ferroelectrics/Piezoelectrics
- Magnetic properties of materials
  - Atomic origins of magnetism
  - Diamagnetic materials
  - Paramagnetic materials
  - Ferromagnetic materials
    - Ferromagnetic metals
    - Dilute magnetic semiconductors
    - Magnetic oxides
  - Antiferromagnetic materials
  - Ferrimagnetic materials
  - Ferromagnetic domains
  - Anisotropy
  - Magnetic devices/spintronics
- Magnetic characterization techniques