UNIVERSITY OF CALIFORNIA, DAVIS
Department of Materials Science and Engineering

EMS 172: Smart Materials

CRN: 41639; **Class times**: TR: 1:40-3:10pm in Chem 166 and F: 2:10-3:00pm in Wellman 212

COURSE OUTLINE - Fall 2019

Instructors: Professor Yayoi Takamura
2009 Kemper Hall
email: ytakamura @ ucdavis.edu
Office hours: M4:00pm and W 11:00am or by appointment in 2009 Kemper
Course webpage: Canvas

Teaching Assistant: Mingzhen Feng
Email: mzfeng @ ucdavis.edu
Office hour: T 9am in 1033 Academic Surge

Textbook:

1. R.E. Hummel, *Electronic Properties of Materials*, 3rd/4th Edition, Springer, 2001/2011, ISBN: 0-3876-95144/1-4419-8163-9 (4th edition available free electronically, or in soft cover form for $24.99, from Springer when using a UC Davis IP address.)
2. A course reader is available for purchase from the campus bookstore from Repographics.
3. Supplemental readings may be required.

Other Recommended Textbooks: A copy of these textbooks will be on reserve at the library and form the basis of the course reader.

1. L. Solymar and D. Walsh, *Electrical Properties of Materials*, 7th/8th Edition, Oxford Press, 2004/2014, ISBN: 0-19-926793-6
2. S.O. Kasap, *Principles of Electronic Materials and Devices*, 3rd Edition, McGraw-Hill, 2006, ISBN: 0-07-295791-3
3. N.A. Spaldin, *Magnetic Materials: Fundamentals and Device Applications*, 1st/2nd editions, Cambridge University Press, 2003/2010, ISBN: 978-0521016582/978-0521886697

Prerequisites: CHE 110A or PHY 9D; ENG 6 or ECH 60 or equivalent (recommended)

Grading:		
	Homework (~ 7 assignments)	40%
	Exam 1 (Thurs. Nov. 7th, in-class)	25%
	Final (Wed., Dec. 11th, 6 pm)	35%

Course Policies:

1. Homework is due promptly at the start of class on the due date via Canvas (preferred for color plots) or in paper. Late homework will be penalized 10% of the total point value per day up to 48 hrs past the deadline.
2. Exams will be closed book, closed notes, but you will be allowed one 8 ½ " x 11" cheat sheet (double sided) for the midterm exam and two 8 ½ " x 11" cheat sheets (double sided) for the final exam.
3. 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/files/cac.pdf)
4. It is expected that students will abide by the UC Davis Principles of Community (see http://occr.ucdavis.edu/poc/).

Upon successful completion of this course, students will understand the basic electronic, optical, and magnetic properties of materials in the solid state and their structure-property relationships. ABET student outcome (1) states that students will gain *an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.*

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TENTATIVE CLASS SCHEDULE + READINGS

Fall 2019

Date	Topic	Readings
Sept. 26	Intro, Crystal Structures, Bonding	
Sept. 27	*Schrödinger's Equation*	*Hummel Ch.4*
Oct. 1	Energy Bands in a Crystal	Hummel Ch. 5.1, 5.2, 5.7
Oct. 3	Electrons in a Crystal	Hummel Ch. 6
Oct. 4	*Electrons in a Crystal/Problem Solving*	*Hummel Ch. 6*
Oct. 8	Conductors	Hummel Ch. 7.1-7.4
Oct. 10	Conductors/Superconductors	Hummel Ch. 7.5, 7.6
Oct. 11	*Problem Solving*	
Oct. 15	Intrinsic Semiconductors	Solymar & Walsh Ch. 8 (Course reader)
Oct. 17	Intrinsic Semiconductors	Solymar & Walsh Ch. 8 (Course reader)
Oct. 18	*Problem Solving*	
Oct. 22	Extrinsic Semiconductors	Solymar & Walsh Ch. 8 (Course reader)
Oct. 24	Extrinsic Semiconductors/Devices	
Oct. 25	*Problem Solving*	
Oct. 29	Devices/Dielectrics	Kasap Ch. 7 (Course Reader)
Oct. 31	Dielectrics	Kasap Ch. 7 (Course reader)
Nov. 1	*Review for Midterm Exam*	
Nov. 5	Ferroelectric Properties	Kasap Ch. 7 (Course reader)
Nov. 7	MIDTERM EXAM – in class	Through Dielectrics
Nov. 8	*Internship and Career Center Presentation (tentative)*	
Nov. 12	Ferroelectric Properties	
Nov. 14	Optical Properties	Hummel Ch. 10
Nov. 15	*Problem Solving*	
Nov. 19	Optical Properties	Hummel Ch. 11/12
Nov. 21	Magnetic Properties	Hummel Ch. 14-16
Nov. 22	*Problem Solving*	
Nov. 26	Magnetic Properties	Hummel Ch. 14-16/Supplemental
Nov. 28/29	THANKSGIVING HOLIDAY	NO CLASS
Dec. 3	Magnetic Properties	Hummel Ch. 14-16
Dec. 5	Magnetic Properties	Hummel Ch. 14-16
Dec. 6	*Final Exam Review*	
Dec. 11	FINAL EXAM– 6 pm	Everything in the course with emphasis on material after the midterm exam