

**EMA 6938: X-ray Methods**  
University of Florida  
Department of Materials Science and Engineering  
3 Credits, Spring 2014  
MWF 7<sup>th</sup> period (1:55pm) CSE E112

**Course Description:** This course will provide an introduction to the principles and methods of materials characterization via x-ray interactions. The course will focus primarily on diffraction and scattering techniques for crystallographic and thin film analysis. The following general topics will be covered in class:

X-ray properties and interactions with matter  
X-ray characterization methods.  
X-ray optics and diffractometer geometry.  
Crystallography, diffraction, and symmetry.  
XRD applications and data analysis.  
High resolution x-ray scattering techniques.

**Instructor:** Dr. Paul Carpinone  
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Phone: 392-2437  
Office Hours: MW 8<sup>th</sup> Period

**Class Meeting Times:** MWF 7<sup>th</sup> Period (1:55p – 2:45p)

**Recommended Textbooks:** *General text on x-ray diffraction:*  
Elements of X-Ray Diffraction (3rd Edition)  
Cullity and Stock. (2001) ISBN: 0201610914

*Useful as a general review of crystallography:*  
Materials Science and Engineering: An Introduction  
Callister and Rethwisch (2009) ISBN: 0470419970

*Text on thin film analysis:*  
Thin Film Analysis by X-Ray Scattering  
Birkholz. (2005) ISBN: 3527310525

**Grading:**

Exams (2)	60%
Quizzes (4)	30%
Homework	10%

Exams and quizzes may be curved at the discretion of the instructor. The final exam is cumulative.

Grades will be made available on the UF e-learning site (lss.at.ufl.edu).

Students requiring a makeup exam or other special accommodations must arrange these in advance with the instructor.

<b>Grading Scale:</b>	≥90%	A
	<90% and ≥85	B+
	<85% and ≥80	B
	<80% and ≥75	C+
	<75% and ≥70	C
	<70% and ≥60	D
	<60%	F

**Academic Honesty:** UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.”

**Course Outline:**

<b>Week of:</b>	<b>Topics</b>
6-Jan	Course introduction. Generation, properties, and interactions of x-rays. X-ray analytical methods.
13-Jan	Crystal lattices, nomenclature. Geometry, symmetry.
20-Jan	<b>Quiz 1 (20-Jan)</b> Diffraction from crystals
27-Jan	Diffraction intensities
3-Feb	Powder XRD
10-Feb	<b>Quiz 2 (10-Feb)</b> Structure determination and refinement
17-Feb	Stress, crystallite size, phase identification, lattice parameter measurements, phase quantification <b>EXAM 1 (28-Feb)</b>
24-Feb	
3-Mar	SPRING BREAK (No Class)
10-Mar	Thin films, multipurpose diffractometer geometry, XRR

17-Mar	XRR, GIXD
24-Mar	<b>Quiz 3 (24-Mar)</b> Texture, phi scans, pole figures
31-Mar	Crystal quality
7-Apr	<b>Quiz 4 (7-Apr)</b> High resolution XRD, reciprocal space mapping
14-Apr	High temperature XRD Special topics
21-Apr	Review <b>EXAM 2 (23-Apr)</b>

**Exam Schedule:**

Exam 1	28 February 2014
Exam 2	23 April 2014 (Last day of class)

**Quiz Schedule:**

Quiz 1	20 January 2014
Quiz 2	10 February 2014
Quiz 3	24 March 2014
Quiz 4	7 April 2014

Quiz dates may be adjusted depending on course progress. Any changes to the quiz schedule or quiz content will be announced in advance during class.

**Homework:** Homework will be assigned periodically throughout the course and will be announced in class. Homework will generally be due one week after being assigned.

**Attendance Policy:** Course attendance is recommended. There will be no penalties for absence. Extended absences or absences on an exam or quiz date should be arranged in advance with the instructor. University policies on course attendance can be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

**Students with disabilities:** Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.