

Analysis of the Structure of Materials  
EMA3513C  
Class Periods: MWF Period 3 9:35-10:25  
Location: Little Hall 109

Prof. Kevin S. Jones  
160 Rhines Hall  
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352 846-3301  
352 219-6641 cell  
Office Hours: MWF 4<sup>th</sup> period

1. Catalog Description:

Fundamentals of crystallography, x-ray and electron diffraction, scanning and transmission electron microscopy, surface analysis and microprobe techniques. Laboratory. (Credits: 4)

2. Prerequisites:

EMA3010

3. Course Objectives:

EMA 3513 is the Materials Science and Engineering department's introduction to the characterization of materials. As such, the objectives of this course are:

- a. to familiarize the student with the basic understanding of photon/matter interactions, specifically x-ray generation and interaction with solids
- b. to introduce the students to methods of analytical analysis of materials
- c. to introduce the student to basic crystallography including stereographic projections and to then introduce various methods of characterizing the structure of solids
- d. to allow the students the opportunity to design and perform the open ended analysis of the composition and structure of the components in a complex engineering system (e.g. a computer) and subsequently present their findings orally in class

The goal of this class is to provide the students with the basic understanding and practical knowledge necessary to characterize an unknown material both chemically and microstructurally.

This 4 credit course will address the professional component of ABET by providing 1 credit of basic science in understanding atomic and molecular physics, 2 credits in Engineering science of materials characterization and 1 credit of engineering design in the development of an approach to the characterization of an unknown engineered object

This year in the lab we will be characterizing the composition and structure of the components of a variety of devices.

This course addresses the following MSE Program outcomes:

- a) Ability to apply knowledge of mathematics, science and engineering to materials systems (medium coverage) This will be assessed through questions on quizzes and tests
- b) Ability to conduct experiments analyze and interpret data (medium coverage). This will be assessed through the oral presentations of lab results.
- c) Ability to function on multi-disciplinary teams (low coverage). This will be peer assessed by your teammates.
- d) Ability to communicate effectively in both oral and written form (medium coverage). This will be assessed through the oral presentations of lab results and the written lab report.
- e) Ability to use techniques skills and tools needed for practice as a materials engineer (medium coverage) This will be assessed through evaluation lab quizzes.
- f) Ability to engage in lifelong learning. This will be assessed by grading the ability of students to do the on-line research needed for the characterization reports and presentations.

4. Instructor: Dr. Kevin Jones

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<http://jones.mse.ufl.edu>

Period 4, MW or by appointment

5. Laboratory Teaching Assistant:

tbd

6. Laboratory Schedule:

Lab starts the Week of January 14th

7. Material and Supply Fees:

\$35/student

8. Textbooks and Software Recommended:

Materials Characterization

Yang Leng

Any edition

ISBN: 9780470822982

Recommended Reading:

Elements of X-Ray Diffraction

B.D. Cullity

Any edition

ISBN: 0-201-61091-4

## 9. Course Outline:

- Week 1 – Chapter 1 section 1.1/handout on x-rays
- Week 2 – X-Ray Formation and absorption
- Week 3 – Chapter 5 SEM and FIB
- Week 4 – Chapter 6 EDS/EELS
- Week 5 – Chapter 8 XPS/AES
- Week 6 – Chapter 8 AES/SIMS
- Week 7 – Handout FTIR
- Exam 1 February 26
- Symposium – Reverse Engineering Symposium Feb 28 evening 6-9PM
- Week 9 – Spring Break
- Week 10 – Chapter 1 section 1.2 Crystallography
- Week 11- Stereographic Projections
- Week 12 – Chapter 2 X-Ray Diffraction
- Week 13 – Structure Factor
- Week 14 – Diffraction Methods
- Week 15 – Transmission Electron Microscopy
- Exam 2 April 20
- Symposium- Reverse Engineering Symposium April 21 evening 6-9PM

## 10. Attendance and Expectations:

There are no penalties for class absences, however I do ask you show up punctually and class participation is considered subjectively as part of your final grade. Lab attendance is part of your grade.

## 11. Grading:

Quizzes 30%, Exam 1 20%, Exam 2 20%, Lab attendance 5%, Presentations 20%, Class Participation 5% (based on peer assessment)

## 12. Grading Scale:

92-100= A; 91.9-89 = A-; 88.9-86 = B+; 85.9-82 = B; 81.9-79= B-; 78.9-76 = C+; 75.9-72 = C; 71.9-69 = C-; 68.9-66 = D+; 65.9-62 = D; 61.9-59 = D-; Less than 59 = E.

Grades may be curved up at the end of the course at the discretion of the instructor.

## 13. Make-up Exam Policy

All missed exams and quizzes must be scheduled ahead of the absence with either the instructor or TA. Emergency and Medical absences will require verification.

## ***Students Requiring Accommodations***

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://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.

### ***Course Evaluation***

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### ***University Honesty Policy***

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.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

#### *Health and Wellness*

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

#### *Academic Resources*

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu). <https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall, 846-1138.** Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus:**

[https://www.dso.ufl.edu/documents/UF Complaints policy.pdf](https://www.dso.ufl.edu/documents/UF%20Complaints%20policy.pdf).

**On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.