

Analysis of the Structure of Materials
EMA3513C
Class Periods: MWF Period 3 9:35-10:25
Location: LEI 142

Prof. Kevin S. Jones
160 Rhines Hall
kjones@eng.ufl.edu
352 846-3301
352 219-6641 cell
Office Hours: MWF 4th 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 4 credits on Engineering Topics

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:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (M)
3. an ability to communicate effectively with a range of audiences (M)
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (M)
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives (L)
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions (M)
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (L)

4. Instructor: Dr. Kevin Jones
160 Rhines Hall
(352) 846-3301
kjones@eng.ufl.edu
<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 16th

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 March 6
 Symposium – Reverse Engineering Symposium March 8 evening 6-9PM
 Week 9– Chapter 1 section 1.2 Crystallography
 Week 10– Stereographic Projections
 Week 11 – Chapter 2 X-Ray Diffraction
 Week 12 – Structure Factor
 Week 13 – Diffraction Methods
 Week 14 – Transmission Electron Microscopy
 Exam 2 April 24
 Symposium- Reverse Engineering Symposium April 26 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 who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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://sccr.dso.ufl.edu/process/student-conduct-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
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, 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 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: <https://counseling.ufl.edu>, 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

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. <https://lss.at.ufl.edu/help.shtml>.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/state-authorization-status/#student-complaint>.