Analysis of the Structure of Materials

EMA 3513C All Sections
Class Periods: MWF, period 3, 9:35-10:25am
Location: LIT 0121
Academic Term: Spring 2022

Instructor:
Kristy Schepker
kschepker@ufl.edu
352-273-2252
Office Hours: Tue 9-11am, or by appointment at NRF (Research Service Center)

Teaching/Lab Assistants:
Please contact through the Canvas website

- Danielle Alverson, dalverson@ufl.edu, office hours TBD and posted to canvas
- Nathan Arndt, narndt@ufl.edu, office hours TBD and posted to canvas

Course Description
Laboratory fundamentals of crystallography, x-ray and electron diffraction, scanning and transmission electron microscopy, surface analysis and microprobe techniques.

Course Pre-Requisites / Co-Requisites
Prerequisite EMA3010

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:

- to familiarize the student with the basic understanding of photon/matter interactions, specifically x-ray generation and interaction with solids
- to introduce the students to methods of analytical analysis of materials
- to introduce the student to basic crystallography and to then introduce various methods of characterizing the structure of solids
- to allow the students the opportunity to design and perform the open ended analysis of the composition and structure of an engineered component and subsequently present their findings orally in class

Materials and Supply Fees
$50 equipment fee, $35 M&S fees

Relation to Program Outcomes (ABET):
The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	**Coverage***
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to recognize ethical and professional responsibilities in engineering situations and make	Medium

informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
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	High
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

Both books are available vie the UF digital collection, and hard copies can be found if desired.

- Title: Fundamentals of Powder Diffraction and Structural Characterization of Materials, Second Edition
- Author: Pecharsky, Vitalij. author.; Zavalij, Peter.
- Publication date and edition: 2nd edition, 2009
- ISBN number: ISBN : 0-387-09579-9

- Title: Scanning Electron Microscopy and X-Ray Microanalysis : A Text for Biologists, Materials Scientists, and Geologists
- Author: Joseph Goldstein, Dale E. Newbury, Patrick Echlin, David C. Joy, Alton D. Romig Jr., Charles E. Lyman, Charles Fiori, and Eric Lifshin
- Publication date and edition: 2nd edition, 1992
- ISBN number: ebook ISBN 9781461304913

- Software: GSAS-II
- Toby, B. H., & Von Dreele, R. B.
- Open Source, 2013: https://subversion.xray.aps.anl.gov/trac/pyGSAS

Recommended Materials

- Title: Elements of x-ray diffraction
- Author: Cullity, B.D.
- Publication date and edition: 2nd edition, 1978
- ISBN number: 0201011743

Course Schedule:

Schedule is subject to change; announcement of any significant changes will be posted to Canvas. Reading suggestions for each lecture will be kept updated in Canvas. Open discussions and question threads are also available on Canvas. Homework will not be assigned; example questions will be made available collaboration and discussion of these is strongly encouraged.

Week of:	Monday	Wednesday	Labs (W/F)	Friday
(1) 1/3-7	Holiday No Class	Crystallography	**No Labs this week**	Crystallography
(2) 1/10-14	Miller indices/spacing	Xray interactions	Crystallography worksheet	Xray generation
(3) 1/17-21	Holiday No Class	Powder diffraction	Xray worksheet	Powder diffraction
(4) 1/24-28	**QUIZ**	Reciprocal space/lattice	XRD sample prep	Indexing patterns
(5) 1/31-2/4	Databases	Intensities and shape in pattern	Index scans/phase ID	Quantitative XRD
(6) 2/7-11	Synchrotron/Neutron	GIXRD	Quantitative/GSAS	XRR
(7) 2/14-18	**QUIZ**	HRXRD	Quantitative/GSAS + Pick project material	Pole Figures
(8) 2/21-25	SEM basics	SEM/BSD imaging	Characterize Unknown	EDS
(9) 2/28-3/4	WDS	**MIDTERM**	Project tool time/ proposals	XRF
3/7-11	SPRING BREAK			
(10) 3/14-18	FTIR	Raman	Project Data	AFM
(11) 3/21-25	UV/Vis	CT	Project Data	CT
(12) 3/28-4/1	**QUIZ**	XPS	Project Data	Auger
(13) 4/11-15	TEM	TEM	Project Data	TEM
(14) 4/18-22	Presentations	Presentations	**No Labs this week Possible presentation spillover on Wed.**	Reading Day
(15) 3/25-29	**Final Exam Group C Tue 4/26 12:30-2:30**			

Attendance Policy, Class Expectations, and Make-Up Policy

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 as work will be submitted each week. Late assignments, quizzes or exams will not be accepted without preapproval.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:
https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Lab Assignments (5)	100 each	15%
Quizzes (3)	100 each	20%
Midterm Exam	100	20%
Final Exam	100	20%
Project Paper and Presentation	100	15%
Group Evaluation	10	10%
		100%

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

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 Conduct 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. 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/.

COVID-19
- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

Academic Resources

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

Career Resource 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*:* http://www.distance.ufl.edu/student-complaint-process.