

Structure and Mechanical Properties of Materials

EMA 6313 Sections: 14246-14249

Class Periods: T 2-3 (8:30 am - 10:25 am) and R 3 (9:35 am -10:25 pm)

Location: Synchronous Zoom Meetings within CANVAS

Academic Term: Fall 2020

This course is one of the four key technical courses foundational to the MSE graduate program: Materials Thermodynamics (EMA 6316), Diffusion, Kinetics and Transport in Materials (EMA 6136), Structure and Mechanical Properties of Materials (EMA 6313), and Properties of Functional Materials (EMA 6114). As a core course, this class covers a significant amount of graduate-level material and it is designed to challenge you to advance your knowledge and skills. Success will require a considerable investment in preparing for lectures by using textbooks and other sources that you seek out, solving problems, and studying for exams. It is expected that you will have to exhibit significantly more independence, initiative, and ownership of the learning process than was required for success at the undergraduate level.

1. Instructor:

Dr. Juan Claudio Nino

jnino@mse.ufl.edu

(352) 846 3787

Office Hours: M, W 10:00-11:00 am Zoom Meeting; via e-mail or by appointment

2. Teaching Assistant:

Please contact through the Canvas website

- Elizabeth Gager, Zoom Meeting, M, W 11:00 am -12:00 pm

3. Course Description

The course will cover fundamental principles governing the structure of materials and its implications on properties. Structure-property relations will be showcased by covering the mechanical properties of materials. (3 Credit Hours)

4. Course Pre-Requisites / Co-Requisites

EMA 6001 or successful placement exam is a pre-requisite for this course.

5. Course Objectives

At the end of this course, students will be able to apply and utilize crystallography and related materials structure concepts to describe the atomic and molecular arrangement of materials and to establish structure-property relations with particular emphasis on mechanical properties of materials.

6. Required Textbooks and Software

- Crystals and Crystal Structures
Richard J. D. Tilley
2020, 2nd Edition - Wiley
ISBN 978-1-119-54838-6
- Mechanical Behavior of Materials
Marc Meyers and Krishan Chawla
2013, 2nd Edition - Cambridge
ISBN 978-0-521-86675-0
- Crystal Maker and Crystal Diffract
Download most recent installers from <http://www.crystallmaker.com/>
- Students should identify on an individual basis any additional resources required to ensure they have the necessary background in IUPAC nomenclature of organic chemistry, linear algebra, and introduction to materials science. See for example:
 - https://en.wikipedia.org/wiki/IUPAC_nomenclature_of_organic_chemistry;
 - https://cnx.org/contents/mwjClAV_@10.3:UlpNTgE2@10/7-5-Matrices-and-Matrix-Operations
 - <https://www.symbolab.com/solver/matrix-calculator>;
 - Fundamentals of Materials Science and Engineering: An Integrated Approach
William D. Callister, Jr. and D.G. Rethwisch
2012 Fourth Edition (John Wiley & Sons, Inc.); ISBN: 978-1-118-06160-2

This course will use CANVAS and Zoom extensively as a communication and archival tool. The students can access all relevant course information (course notes, homework, problem sets, discussions, announcements, grades, etc.) via the CANVAS entry link: <https://elearning.ufl.edu/>

Our class sessions will be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

7. Course Schedule

Below is the intended/tentative schedule of classes and exams. Please note that **EDGE students are expected to present the quizzes and the second chance exam within 36 h of the time the regular sections presents them.** If this represents a major conflict with their employer or similar, you should contact the instructor the first day of classes to resolve the situation.

Date	Activity - (Z) = Zoom Pre-recorded Sessions	Reading Assignments		Background Reading
	Introduction	Canvas	Tilley = T; Meyers = M	Callister
1-Sep	Introduction, MSE Background Review, Linear Algebra Review	S1		Ch 1-22
3-Sep	Bonding Theories	S2	OpenStax Ch 4-5	Ch 2
8-Sep	Principles of Stereochemistry	S3	Loudon Ch 6	Ch 4
8-Sep	Q&A + In-class exercises	QA		
10-Sep	Quiz 1	Q1		
Z	Elements of Symmetry and Noncrystalline State Descriptors (Z)	S4	T: Ch 3	Ch 3
15-Sep	Fractals	S5	Wahl Ch 4	
15-Sep	Q&A + In-class exercises	QA		
17-Sep	Quiz 2	Q2		
Z	Crystalline State: 2D Symmetry, 2D Point Groups (Z)	S6	T: Ch 1-2	
22-Sep	Crystalline State: Plane Groups, Patterns	S7	T: Ch 3	
22-Sep	Q&A + In-class exercises	QA		
24-Sep	Quiz 3	Q3		
Z	Crystalline State: 3D Symmetry, 3D Point Groups (Z)	S8	T: Ch 4	
29-Sep	Crystal Structures, Structure of Metals, Structure of Ceramics	S9	T: Ch 6	Ch 3
29-Sep	Q&A + In-class exercises	QA		
1-Oct	Quiz 4	Q4		Ch 14
Z	Diffraction and Crystallographic Software (Z)	S10	T: Ch 7	Ch 3
6-Oct	Colloids and Liquid Crystals	S11	Allen: Ch 4	
6-Oct	Q&A + In-class exercises	QA		
8-Oct	Quiz 5	Q5		
Z	Structure of Polymers, Classification, Crystallinity (Z)	S12	Supplemental Notes	Ch 4
13-Oct	Structure of Composites, Structure of Biologics	S13	M: Ch 1.3.7-1.3.9 + SN	Ch 15
13-Oct	Q&A + In-class exercises	QA		
15-Oct	Quiz 6	Q6		
Z	Elasticity Review (Z)	S14	M: Ch 2-2.5	Ch 7
20-Oct	Symmetry Constraints on Materials Properties - Tensors	S15	Supplemental Notes	
20-Oct	Q&A + In-class exercises	QA		
22-Oct	Quiz 7	Q7		
Z	Elastic Properties (Polycrystals), Polymers, Composites & Biologics (Z)	S16	M: Ch 2.10-2.15	Ch 7
27-Oct	Complex Stress States + Stiffness, Compliance, and Anisotropy (I)	S17	M: Ch 2.6-2.9	
27-Oct	Q&A + In-class exercises	QA		
29-Oct	Quiz 8	Q8		
3-Nov	Complex Stress States + Stiffness, Compliance, and Anisotropy (II)	S18	M: Ch 2.6-2.9	
3-Nov	Q&A + In-class exercises	QA		
5-Nov	Quiz 9	Q9		
Z	Viscoelasticity (Z)	S19	M: Ch 2-2.5	Ch 7
10-Nov	Plastic Deformation, Strain Rate Effects, Tension vs. Compression	S20	M: Ch 3-3.4	
10-Nov	Q&A + In-class exercises	QA		
12-Nov	Quiz 10	Q10		
Z	Strengthening Mechanisms (Z)	S21		Ch 8
17-Nov	Fracture in Materials	S22	M: Ch 7-8	Ch 9
17-Nov	Q&A + In-class exercises	QA		
19-Nov	Quiz 11	Q11		
Z	Griffith Crack Theory I (Z)	S23	M: Ch 7-8	Ch 9
24-Nov	Griffith Crack Theory II	S24	M: Ch 7-8	Ch 9
24-Nov	Q&A + In-class exercises	QA		
1-Dec	Creep and Superplasticity	S25	M: Ch 13	Ch 9
1-Dec	Q&A + In-class exercises	QA		
3-Dec	Quiz 12	Q12		
8-Dec	Course Review	S26		
8-Dec	SECOND CHANCE EXAM	E		

The instructor reserves the right to make changes to the syllabus as needed. Any changes will be clearly announced on Canvas and in class.

8. Synchronous Attendance Policy, Class Expectations, and Make-Up Policy

Synchronous Attendance via Zoom is strongly suggested since it is the best way to engage actively with the instructor and fellow students while the topics are being covered and get any clarifying questions answered right when they arise. In addition, a number of exercises will be worked out in class before the quizzes presented on CANVAS.

Proper behavior during class (via zoom) is always important and leads to a relaxed and productive educational environment. Students who behave disorderly or disrespectfully WILL be asked to leave the zoom meeting.

The Zoom meeting portal will open 10 minutes before the actual class starts to allow all students in the waiting room. All students in the waiting room will be allowed in 2 minutes before class starts. Class will start on time. Entering the meeting late can be VERY distracting, you should avoid it.

As shown on the Course Schedule in the previous page, in order to maximize active interaction and involvement of students during the synchronous sessions, there will be a number of prerecorded sessions. The prerecorded sessions will be posted at least two days before the in-class and quiz sessions. These recorded sessions are essential for the exercises in class and quizzes. Students should therefore schedule time to view these sessions outside of class in order to be ready for the exercises and quizzes. After watching the videos, students should post questions on the Discussion board on CANVAS. Students are encouraged to answer the questions in the Discussion. The TA and/or Instructor will moderate the discussion and ensure that questions posted are correct and provide final clarification either in the board or during the following session.

Students not presenting an exam or quiz in time will receive a grade of zero (0) and there will be no make-up for a missed exam or quiz. Exceptions will only be entertained in cases of excused absences, which must comply with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.

9. E-mail Communication

I prefer to be emailed directly at jnino@mse.ufl.edu instead of CANVAS mail; however, you can choose which system to use. Furthermore, because of the volume of e-mails I receive please include in the subject line the course number (EMA6313) followed by the subject of your message. Please begin your e-mail with a salutation. [I know that personal e-mails and texts are often sent without even a name to address the recipient at the opening of the communication, but professionally that is unacceptable]. Close your e-mails by typing your name. Check your e-mail for grammar and spelling. Be concise. All of these guidelines are to promote professionalism.

10. Evaluation of Grades

Assignment	Adding Points	Percentage of Final Grade
Quizzes (12) (10 points each)	Top 10 Count	Up to 100% Maximum of 100 points
Second Chance Exam (20 points)	Up to 20 points*	20% Maximum of 20 points
120 possible total points, yet grade based on a total 100-points basis		

Quizzes (Q) and the Second Chance Exam (SCE) will be presented using Honorlock. Specific guidelines for the Qs and SCE will be posted on CANVAS well in advance. Qs are scheduled on Thursdays as indicated on the schedule. The top 10 Qs scores count towards the grade. The SCE is scheduled on Tuesday December 8th and allows students to add up to 20 points to their scores by answering questions on the topics of the two lowest dropped Qs. This represents a second chance to demonstrate proficiency in these topics and improve the overall score. In theory, a student can score up to 120 points in the course. Presenting the SCE is in this sense optional. Regardless, the grade will be calculated on a 100-points basis (see next section).

11. Grading Policy

The final grade of the course will be calculated based on the total points scored as follows:

Points	≥92	≥88	≥84	≥80	≥76	≥72	≥68	≥65	≥62	≥59	≥56	<56
Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0

In the event that the class average is below 72%, the distribution will be shifted so that the average equals 72%. In order to graduate, graduate students must have an overall GPA and an upper-division GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, and therefore, it does not satisfy this graduation requirement.

More information on UF grading policy found at: <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

12. 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.

13. 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

Structure and Mechanical Properties of Materials (EMA 6313)

Dr. Juan Claudio Nino – Fall 2019

Page 3

<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/>.

14. 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 in this class. (See page 5 of this syllabus).

15. Commitment to a Safe and Inclusive Learning Environment

The 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
- 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

16. 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.

17. Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

18. 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: <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

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 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.

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

UNIVERSITY OF FLORIDA

Student Honor Code (Abridged)

Preamble: In adopting this Honor Code, the students of the University of Florida recognize that academic honesty and integrity are fundamental values of the University community. Students who enroll at the University commit to holding themselves and their peers to the high standard of honor required by the Honor Code. Any individual who becomes aware of a violation of the Honor Code is bound by honor to take corrective action. Student and faculty support are crucial to the success of the Honor Code. The quality of a University of Florida education is dependent upon the community acceptance and enforcement of the Honor Code.

The Honor Pledge: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty 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."***

Violations of the Student Honor Code include (in part):

(a) **Plagiarism**, in the form of quoting oral or written materials including but not limited to those found on the internet, whether published or unpublished, without proper attribution; or submitting a document or assignment which in whole or in part is identical or substantially identical to a document or assignment not authored by the student.

(b) **Unauthorized use of Materials or Resources ("Cheating")**. A student shall not use unauthorized materials or resources in an academic activity. Unauthorized materials or resources shall include:

1. Any paper or project authored by the student and presented by the student for the satisfaction of any academic requirement if the student previously submitted substantially the same paper or project to satisfy an academic requirement.
2. Any materials or resources prepared by another student and used without the other student's express consent or without proper attribution to the other student.
3. Any materials or resources that the faculty member has prohibited.
4. Use of a cheat sheet when not authorized to do so or use of any other resources or materials during an examination, quiz, or other academic activity without the express permission.

(c) **Prohibited Collaboration or Consultation**. A student shall not collaborate or consult with another person on any academic activity unless the student has the express authorization.

1. Prohibited collaboration or consultation shall include but is not limited to:
 - Collaborating when not authorized to do so on an examination, take-home test, writing project, assignment, or course work.
 - Collaborating or consulting in any other academic or co-curricular activity after receiving notice that such conduct is prohibited.
 - Looking at another student's examination or quiz during the time an examination or quiz is given. Communication by any means during that time, including but not limited to communication through text messaging, telephone, e-mail, other writing or verbally, is prohibited unless expressly authorized.
2. It is the responsibility of the student to seek clarification on whether or not use of materials or collaboration or consultation with another person is authorized prior to engaging in any act of such use, collaboration or consultation.