

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: NEB 100

Academic Term: Fall 2019

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 in 166 Rhines Hall; via e-mail or by appointment

2. Teaching Assistant:

Please contact through the Canvas website

- Evan Anguish, MSE Library, M, W 10:30 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
2006, 1st Edition - Wiley
ISBN 978-0-470-01821-7
- 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 extensively as a communication and archival tool. The students can access all relevant course information (course notes, homework, problem sets, solutions, announcements, grades, etc.) via the CANVAS entry link: <https://elearning.ufl.edu/>

7. Course Schedule

Below is the intended/tentative schedule of classes and exams. Please note that **EDGE students are expected to present the exam the same day as the students in class**. 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	Topic	Reading Assignments		Background Reading
		Canvas	Tilley = T; Meyers = M	
20-Aug	Introduction, MSE Background Review, Linear Algebra Review	S1		Ch 1-22
	Structure of Materials			
22-Aug	Bonding Theories	S2	OpenStax Ch 4-5	Ch 2
27-Aug	Principles of Stereochemistry	S3	Loudon Ch 6	Ch 12
29-Aug	Elements of Symmetry and Noncrystalline State Descriptors	S4	Supplemental Notes	
3-Sep	Glasses, Network Models and Fractals	S5	Wahl Ch 4	
5-Sep	Crystalline State: 2D Symmetry, 2D Point Groups	S6	T: Ch 1-2	
10-Sep	Crystalline State: Plane Groups, Patterns	S7	T: Ch 3	
12-Sep	Exercises Session (Set 1)	S8		
17-Sep	FIRST EXAM (25/15)			Ch 3
19-Sep	Crystalline State: 3D Symmetry, 3D Point Groups	S9	T: Ch 4	
24-Sep	Crystalline State: Space Groups, International Tables	S10	T: Ch 5	Ch 12
26-Sep	Crystal Structures, Structure of Metals, Structure of Ceramics	S11	Supplemental Notes	
1-Oct	Diffraction and Crystallographic Software	S12	T: Ch 5	Ch 14
3-Oct	Structure of Polymers, Classification, Crystallinity, Liquid Crystals	S13	Allen: Ch 4	
8-Oct	Structure of Composites, Structure of Biologics	S14	M: Ch 1.3.7-1.3.9 + SN	
10-Oct	Exercises Session (Set 2)	S15		
15-Oct	SECOND EXAM (25/15)			
17-Oct	Symmetry Constraints on Materials Properties - Tensors	S16	Supplemental Notes	Ch 6
22-Oct	Elasticity and Viscoelasticity Review	S17	M: Ch 2-2.5	
24-Oct	Complex Stress States + Stiffness, Compliance, and Anisotropy	S18	M: Ch 2.6-2.9	
29-Oct	Elastic Properties of Polycrystals, Polymers, Composites and Biologics	S19	M: Ch 2.10-2.15	
31-Oct	Exercises Session (Set 3)	S20		
5-Nov	THIRD EXAM (25/15)			
7-Nov	Plastic Deformation, Strain Rate Effects, Tension vs. Compression	S21	M: Ch 3-3.4	
12-Nov	Plastic Deformation of Polymers, Glasses, and Biologics	S22	M: Ch 3.5-3.7	Ch 8
14-Nov	Fracture in Materials	S23	M: Ch 7-8	
19-Nov	Creep and Superplasticity	S24	M: Ch 13	
21-Nov	Fatigue	S25	M: Ch 14	
26-Nov	Exercises Session (Set 4)	S26		
3-Dec	FOURTH EXAM (25/15)			

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

Attendance is strongly suggested since it is the best way to actively engage with the instructor 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 in small groups and this will help as preparation for the exams.

Proper behavior in class is always important and leads to a relaxed and productive educational environment. Thus, eating, drinking, texting, news reading, social media use, working on homework for this or other courses, or other activities that are not part of the class are not allowed. Students who do not comply with these requirements, or who behave disorderly or disrespectfully, WILL be asked to leave the classroom.

Leaving early or arriving late can be VERY distracting, you should avoid it. All electronic devices (laptops, mobile phones, etc.) should be turned off or in silent mode. If your mobile phone rings during class, you will be asked to leave the classroom. The use of smartphones, laptops, tablets or similar personal computers is not allowed unless specific in-class activities requires them, and when explicitly indicated by the instructor. Exceptions may be granted if explicitly requested by the individual student the first day of class and for note taking purposes only. This class is being recorded so no additional audio/video recording is allowed.

Students not presenting an exam will receive a grade of zero (0) and there will be no make-up for a missed exam. 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. Furthermore, because of the volume of e-mails I receive, you always need to identify yourself and the course. In the subject line you should always include the course number (EMA6313) and your first and last name. 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
Four Exams (25 points each)	25 points each of top three scores + up to 15 points from the lowest score	90% Maximum of 90 points
Example 1: (scores in points): E1 = 25, E2 = 22, E3 = 22, E4 = 21; Total points = 84 (25+22+22+15) Example 2: (scores in points): E1 = 13, E2 = 20, E3 = 24, E4 = 21; Total points = 78 (13+20+24+21) Example 3 : (scores in points): E1 = 21, E2 = 21, E3 = 21, E4 = 21; Total points = 78 (21+21+21+15)		
Engagement (see details below)	0, 5, or 10 points depending on online or in class participation level	10% Maximum of 10 points
Grade based on a total points 100 basis		

Exams will be closed book. All relevant backup information considered sufficient and necessary to answer the questions will be included in the exam booklet. Students are allowed to bring one letter-sized paper (8½"x11") with machine printed equations, annotations and any relevant information, all on a single page. **NO PEN or PENCIL ANNOTATIONS, glued pages or similar deviations from a single printed page are allowed.** Printing on both sides (if needed) is allowed.

Engagement points will be given based on the level of course participation and interaction during class and online via CANVAS Discussions. Engagement examples include: posting before class answers to the pre-class questions on the discussion boards; posting correct answers to student-led discussion problems/questions, posting typos and errata found in lecture notes or course textbooks, posting of additional resources that can help students better understand the concepts (students judge the tool effectiveness); effective participation in class during Q&A, group problems, and student-led discussions; active participation in recitation sessions. Based on the total number of participations per student, three levels of Engagement will be determined: Minimal (0 points), Low (5 points), and High (10 points). The instructor will certify every online participation and indicate its validity via comments; a similar tally will be kept for in class participation. This way, students will always know their total number of participations. Students with 10 or more, or above average certified participations will be automatically placed in the High level (and receive 10 points). Students with more than two (2) certified participations and below average certified participations will be placed in the Low level (and receive 5 points). Students with 2 or less certified participations will be placed in the Minimal level (and receive 0 points).

Opting out. Students can opt out of the Engagement category (no points assigned regardless of participation level) and the grade will be calculated solely out of the four exam scores (25 X 4 = 100 points). Students can only opt out during the first week of class by sending an e-mail to the instructor with their request. The opting out decision is irreversible.

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 <https://gatorevals.ua.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.ua.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.