

Introduction to Materials Science and Engineering

EMA 3010 (22480)

Class Periods: M, W, F, Period 5, 11:45 am-12:35 pm.

Location: CSE E221

Academic Term: Fall 2021

Instructor:

Name Wolfgang Sigmund

Email Address: sigmund@ufl.edu

Office Location: Rhines Hall 225A

Office Phone Number: 352-846-3343

Office Hours: Mondays from 2:00 pm to 3:00 pm and anytime on request via zoom. F2F meetings available on email requests.

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Ramon Monroig: Please contact through the CANVAS website

Course Description

Conceptual perspective for origin of materials behavior and the interrelationships of structure, property, and performance. Materials selection and use of familiar material - metals, ceramics, polymers, electronic materials and composites in electronic, structural and other engineering applications.

Course Pre-Requisites / Co-Requisites

CHM 2045 (or equivalent)

Course Objectives

This is an introductory course, designed to provide the fundamental concepts of Materials Science and Engineering. Students will be able to describe structure, properties, and applications of metallic, ceramic, polymeric and composite materials.

Materials and Supply Fees

N/A

UF All-Access for e-book

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
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	
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	
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	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

*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

- Title: Fundamentals of Materials Science and Engineering: An Integrated Approach
Author: William D. Callister and David G. Rethwisch
Publication date and edition: 2019, Wiley 5th Edition
ISBN number: 9781119035640
- This course participates in the UF All Access program. You need to acquire the e-book version with access to both Wiley Plus and Perusall as these online tools will be used for assessment as indicated in the evaluation of grades and will provide you with additional learning tools. The simplest and affordable way to acquire the e-book is via UF ALL ACCESS. This includes a UF Negotiated rate for both products of \$87.50. Login at <https://www.bsd.ufl.edu/G1CO/IPay1f/start.aspx?TASK=INCLUDED> and Opt-In to gain access to your required course materials. UF All Access will provide you with your required materials digitally at a reduced price and the charges will post directly to your student account, allowing any available Financial Aid funds to cover the cost of your materials. This option will be available starting 1 week prior to the first day of classes and ending 3 weeks after the first day of class.

Recommended Materials

- Title: Understanding Materials Science, Author: Rolf Hummel; 1998, Springer, 1st Edition, ISBN number : 0387983031
- Title: Essentials of Modern Materials Science and Engineering Author: James Newell; 2009, Wiley, 1st Edition

Course Schedule

This course is face to face, i.e. synchronous.

Below is the intended/tentative schedule of classes and exams.

W	Class dates	Topic	Chapter
1	August 23	Course Objectives, Syllabus, Wiley Introduction	0
	August 25	Introduction	1
	August 27	Atomic Structure and Interatomic Bonding	2
2	August 30	Atomic Structure and Interatomic Bonding	2
	September 1	Structure of metals, ceramics	3
	September 3	Structure of metals, ceramics	3
3	September 8	Structure of metals, ceramics	3
	September 10	Structure of Polymers	4
4	September 13	Structure of Polymers	4
	September 15	Review Lecture	1-4
	September 17	EXAM 1	1-4
5	September 20	Defects in Solids	5
	September 22	Defects in Solids	5
	September 24	Defects in Solids	5
6	September 27	Diffusion	6
	September 29	Diffusion	6
	October 1	Diffusion	6
7	October 4	Review Lecture	5-6
	October 6	EXAM 2	5-6
8	October 11	Mechanical Properties	7
	October 13	Mechanical Properties	7
	October 15	Mechanical Properties	7
9	October 18	Deformation and strengthening mechanisms	8
	October 20	Deformation and strengthening mechanisms	8
	October 22	Failure	9
10	October 25	Failure	9
	October 27	Review Lecture	7-9
	October 29	EXAM 3	7-9
11	Nov 1	Phase Diagrams	10
	Nov 3	Phase Diagrams	10
	Nov 5	Phase Diagrams	10
12	Nov 8	Phase Transformations	11
	Nov 10	Phase Transformations	11
	Nov 12	Phase Transformations	11
13	Nov 15	Review Lecture	10-11
	Nov 17	EXAM 4	10-11
	Nov 19	Types and Applications of Materials	13
14	Nov 22	Composites	15
15	Nov 29	Composites	15
	Dec 1	Economic, Environmental and Societal Issues in MSE	20
	Dec 3	Economic, Environmental and Societal Issues in MSE	20
16	Dec 6	Review Lecture	13, 15, 20
	Dec 8	EXAM 5	13, 15, 20

Course Format

This course uses a team-based learning approach that uses pre-class preparation materials (including watching pre-recorded lectures and reading assignments) and live lectures. The class time will be dedicated to lectures and/or In-Class Exercises and Discussions. Your completion and involvement in all these aspects of the course is critical to success.

Pre-Class Preparation Materials

Pre-Recorded Lectures will help you prepare for the active learning activities and are a critical aspect of learning the content of this course. You are required to watch them using Perusall. Whether you watch and interact with the lectures will be evaluated and will be worth 10% of the grade.

Reading assignments will also help you prepare for the active learning activities and are another critical aspect of learning the course content. Your completion of the reading will be worth 20% of your grade and will be assessed using Perusall.

Active Learning Activities

Attendance to Live Classes is not required but highly encouraged. Students are encouraged to ask questions and participate. The fundamental concepts will be repeated as required.

Homework Problems

Homework is given 15 times online in Wiley Plus and is worth 30% of your grade.

Exams

There will be 5 exams throughout the semester. Your lowest exam grade will be dropped. The exam content may change, and the dates are tentative and will be finalized after the add/drop period.

Each exam is weighted equally, and each exam will be worth **10%** of your final grade.

You have one week after the test results are posted to resolve any questions about scores and grades. No changes to your exam grade will be made after that time.

Exam Conflicts with other course exams

The official UF policy on exam conflict resolution states that when two exams conflict, the course with the higher number will take priority. There will be no exceptions to this rule.

Make-up exams

Students who do not take an exam will receive a grade of 0. Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Syllabus Changes

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

Evaluation of Grades

Assignment	Number of Assignments	Percentage of Final Grade
Reading (Perusall)	About 15	20%
Prerecorded lectures (Perusall)	About 10	10%
Homework	About 15	30%
Exams	5 (10% each, drop the lowest)	40%
Total		100%

Grading Policy

Percent	Grade	Grade Points
92.0 - 100	A	4.00
88.0 - 91.9	A-	3.67
84.0 - 87.9	B+	3.33
80.0 - 83.9	B	3.00
76.0 - 79.9	B-	2.67
72.0 - 75.9	C+	2.33
68.0 - 71.9	C	2.00
65.0 - 67.9	C-	1.67
62.0 - 64.9	D+	1.33
59.0 - 61.9	D	1.00
56.0 - 58.9	D-	0.67
0.00 - 55.9	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.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.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.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. The student who records must be present in the classroom.

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/>.

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://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>.

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.