

**Introduction to Materials Science and Engineering**  
EMA3010 Sections 8E43(11118), 3010(16189), 5896(17271)

**Class Periods:**

8E43(11118) MWF (3) 11:00 -12:15 PM  
3010(16189) MWF (2) 9:30 – 10:45 AM  
5896(17271) Thursday (6-7) 3:30 -6:15 PM  
Tuesday (6) 3:30 – 4:45 PM

**Location:** Online

**Academic Term:** Summer C 2021

**Instructor:**

Nancy Ruzycki

[nruzycki@mse.ufl.edu](mailto:nruzycki@mse.ufl.edu)

352.846.2991 (office)

Office Hours: Tuesday 1 PM, Wednesday 1 PM via ZOOM link posted to Canvas or by appointment.

**Teaching Assistant/Peer Mentor/Supervised Teaching Student:**

Please contact through the Canvas website

TBD

**Course Description**

Conceptual perspective for origin of materials behavior, including structure, property, performance interrelationships. Materials selection and use of familiar materials, including metals, ceramics, polymers, electronic materials, and composites in electronics, structural and other engineering applications. (3 Credit Hours)

**Course Pre-Requisites / Co-Requisites**

CHM 2045 General Chemistry (or equivalent).

**Course Objectives**

Clearly state the learning objectives of the course, and how those objectives will be accomplished (give a list of specific actions or course elements).

**Materials and Supply Fees**

Students will be using Granta CES Edupack and Thermocalc which will be made available to you through UF Apps. Students will also be using Python Jupyter Notebooks/labs for some data analysis related to mechanical properties. This is available at UF apps. If you are good with python you can run in whatever shell window you want. Students will be using Materials Project for structure and properties of materials <https://materialsproject.org/> Students will be using the crystalviewer available at nanoHub for lattice visualization.

<https://nanohub.org/tools/crystalviewer>

We will also be using ChemTube 3D <https://www.chemtube3d.com/>

**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
- Author
- Publication date and edition
- ISBN number

(if course notes derived from various published sources are used, provide information above for each source)

(if course notes are developed by the instructor, so state)

### **Recommended Materials**

- Title: **Fundamentals of Materials Science and Engineering: An Integrated Approach**
- Author: **William D. Callister, Jr. and David G. Rethwisch**
- Publication date and edition: **2019 5<sup>th</sup> Edition (Wiley), e-book with Wiley Plus**
- ISBN number: **ISBN-13: 978-1119175483**

PLEASE NOTE: You need to acquire the e-book version with access to Wiley Plus 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 cheapest way to acquire the e-book is via UF ALL ACCESS. .Login at the following website and Opt-In to gain access to your UF All Access course materials -<https://www.bsd.ufl.edu/AllAccess>

UF All Access will provide you with your required materials digitally at a reduced price, and the charge will be posted to your student account. This option will be available starting one week prior to the start of the semester and ends three weeks after the first day of class.

### **Course Schedule**

Below is the intended/tentative schedule for activities and exams. These are subject to change if needed.

| Week | Class Dates                                  | Topics  | Book Chapter | Pre-class | In -Class  | Homework                            |
|------|--|---|--------------|-----------|--|-------------------------------------|
| 1    | 5/10,12,14<br>(MWF)<br><br>5/11, 13<br>(T/R) | Getting started<br>Intro to unit on<br>Structure and<br>Properties, Introduction<br>to the Materials<br>Tetrahedron<br>Getting started with<br>Granta | 1            | None      | Granta Activity<br><br>Mentimeter<br><br>Google Jamboard | Granta<br>Activity<br><br>Materials |

|   |   |   |                             |   |  |  |
|---|---|---|-----------------------------|---|--|--|
|   |   | Principles of structure –<br>role of electrons  |                             |   |  |  |
| 2 | 5/17, 19, 21<br>(MWF)<br><br>5/18, 20<br>(T/R)  | Atomic Structure and<br>Interatomic Bonding   | 2                           | Pretest on<br>Bonding<br>(Canvas)   | Materials Project<br><br>Granta Activity   | Wiley<br>homework<br>Chapters 1-2  |
| 3 | 5/24, 26, 28<br>(MWF)<br><br>5/25, 27<br>(T/R)  | Structures of metals and<br>ceramics  | 3                           | Pretest on<br>Structures  | Apps for<br>visualizing<br>atomic orbital<br><br>In class activity<br>on bond s and<br>structure   | Wiley<br>homework 3<br><br>nanoHub<br>homework<br><br>ChemTube<br>Homework   |
| 4 | 5/31<br>6/2-4<br>(MWF)<br><br>6/1, 3  | 5/31 – Monday is a<br>holiday<br><br>Polymer Structure  | 4                           | Pretest on<br>Polymers  |  | Wiley<br>homework 3<br><br>Granta<br>exercise  |
| 5 | 6/7 (M) 6/8<br>(T)<br><br><b>Wednesday<br/>6/9</b><br><b>Thursday<br/>6/10</b><br><br>6/11 Friday | Review for Exam 1<br><br><b><u>Exam 1 75 minutes</u></b><br><b><u>Chapters 1-4</u></b><br><br>Imperfections in Solids | 1-4<br><br><br><br>5        | Make sure all<br>homework is<br>completed<br><br><br>Pretest on<br>Defects in<br>Solids | In class problem<br>solving  | Homework<br>Chapter 5<br><br><br>Granta<br>Exercise  |
| 6 | 6/14 (M),<br>6/15 (T)<br><br><br>6/17 (W)<br>6/18 (R)<br><br><br>6/19 (F)                         | Imperfections in Solids<br><br><br>Diffusion<br><br><br>Diffusion   | 5<br><br><br>6<br><br><br>6 | Case Studies<br>on<br>Imperfection<br>in solids<br>application                          | <br><br><br>Presentation of<br>student selected<br>case studies in<br>class (breakout<br>rooms)<br><br>Problem solving<br>breakout rooms | Student<br>selected case<br>study<br><br><br>Homework<br>Chapter 6<br><br>Materials<br>project bonus<br>work<br><br>Diffusion<br>programming<br>bonus work |
| 7 | 6/21  | Break Week  |                             |   |  |  |
| 8 | 6/28 (M)<br>6/29 (T)  | Review for Exam 2   | 5-6                         |   | In class problem<br>solving  |  |

|    |   |  |                           |   |  |   |
|----|---|--|---------------------------|---|--|---|
|    | 6/30 (W)<br>6/31(R)<br><br>7/1 (F)                      | <b><u>Exam 2 75 minutes</u></b><br><b><u>Chapters 5.6</u></b><br><br>Mechanical Properties             | 7                         | Pretest<br>mechanical<br>properties               | In class Jupyter<br>notebook for<br>mechanical<br>properties | Granta<br>Exercise<br>material<br>screening and<br>selection for<br>mechanical<br>properties        |
| 9  | 7/5 (M)<br><br>7/6, 9 (T)<br>7/7,10 (WF)                | 7/5 Monday is a holiday<br><br>Mechanical Properties<br>Deformation and<br>Strengthening<br>mechanisms | 8                         | Pretest on<br>Deformation<br>and<br>strengthening | In class problem<br>solving                                  | Homework<br>chapters 7-9<br><br>Granta<br>exercise<br>Mechanical<br>properties and<br>strengthening |
| 10 | 7/12,<br>13(MT)<br><br>7/14,15<br>(W,R)<br><br>7/16 (F) | Failure<br><br>Review for Exam 3 (7-9)<br><b>Exam 3 (two day take<br/>home)</b><br><br>Phase diagram   | 9<br><br><br><br>10       |   | In class case<br>study on failure                            | <b>Take home<br/>EXAM 3</b><br><br>Thermocalc<br>Exercise<br>Homework<br>Chapter 10                 |
| 11 | 7/19, 20<br>(MT)<br><br>7/21-22<br>(WR)<br><br>7/23 (F) | Phase diagrams<br><br>Phase diagrams/Phase<br>transformations<br><br>Phase transformations             | 10<br><br>10/11<br><br>11 |   | In class activity<br>phase diagrams                          | Jupyter<br>notebook on<br>Phase<br>Diagrams<br>Homework<br>Chapter 11                               |
| 12 | 7/26-27<br>(MT)<br><br>7/28, 29 (W,<br>R)<br>7/30 F     | Exam 4 Review ( 10-11)<br><br><b>Exam 4 (75 minutes in<br/>class)</b><br>Composites (R)                | 10-11<br><br><br>15       | Pretest<br>composites                             | In class problem<br>solving                                  | Homework<br>Chapt 15. Do-<br>It Poms<br>Exercise<br><br>Design a<br>composite                       |
| 13 | 8/2, 3(MT)<br><br>8/3, 4(WR)                            | Types and applications<br>of materials<br>Economic,<br>Environmental and<br>Social issues in MSE       | 13                        |   | In class material<br>screening<br>exercise                   | Granta<br>Exercise on<br>Applications   |

|  |              |                                    |  |  |  |   |
|--|--------------|------------------------------------|--|--|--|---|
|  | 8/4,5 (R, F) | <b>EXAM 5 culminating Activity</b> |  |  |  | Exam Activity<br>(75 minutes)<br>Granta |
|--|--------------|------------------------------------|--|--|--|---|

Course Website: 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/> or <https://ufl.instructure.com>. Within CANVAS the students can purchase and access the book and links to programs for use in class.

### ***Online Course Recording***

Our class sessions may 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.

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

#### **Course Format**

This course uses a team-based learning approach that uses pre-class preparation materials and active learning activities during class time. Your completion and involvement in all these aspects of the course is critical to success. You will be required to participate in at least 50% of all class activities at minimum including lectures this includes engagement in polls, chat questions for exit tickets and formative assessments.

#### **Pre-Class Preparation Materials**

- Reading assignments will be your first exposure to the course topics, will engage you in social learning, and will be a key pre-class activity helping you prepare for both the pre-recorded lectures and the in-class active learning activities.
- There will be pre-recorded lectures to watch and to post questions on prior to class. There will be lectures in class to go over these "Sticky points" and to apply the knowledge from the chapter to real world situations and applications. These pre-videos are worth points towards your class engagement. Beyond their grade value, your completion and involvement in this component is critical to success.

#### **Active Learning Activities**

- Social Learning in class through problem solving in break out rooms will allow you to engage with your peers and work as part of a team to solve a real world related problem.
- Attendance to Live Classes is highly encouraged since there will be discussion as well as individual and group work on exercises. Students are encouraged to ask questions and participate. The fundamental concepts will be repeated as required. You are required to participate in at least 50% of class activities and class time, these small activities along with the pre-tests and pre-reading questions are worth 15% of your grade.
- Group Exercises (GE) will be given during the live classes. These exercises will be performed in groups during class time and counted for credit. In total, GEs will be worth 40% of the grade. As such, attendance is essential to receive credit for this component.

#### **Homework Problems**

Homework is worth 20% of your grade and includes Wiley homework and other exercises. Homework problems will be provided via Wiley Plus to help students prepare for the exams.

### **Attendance**

#### **In-Class Expectations and General Make-Up Policy**

- Online Teaching. Although rarely, our class sessions may be audio visually recorded. 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 be recorded for exit and in class question credit, but not shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited. The university syllabi policy, including the information regarding COVID impacts can be found on the following website:<http://www.syllabus.ufl.edu/syllabus-policy/>

b) Proper behavior in class is always important and leads to a relaxed and productive educational environment. Students are expected to login into zoom 5 minutes before class time and be respectful to the instructor and to fellow students. Students who do not comply with these requirements, or who behave disorderly or disrespectfully, will be kicked out of the zoom session.

c) Students not presenting an exam, or participating in pre-class and in-class activities will receive a grade of zero (0) and there will be no make-up. Similar to the case for exams described in 15.e, exceptions will only be entertained in cases of excused absences, which must comply with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation. In general, acceptable reasons for excused absence include illness, serious family emergencies, special curricular requirements, military obligation, court-imposed legal obligations, religious holidays and participation in official university activities such as music performances, athletic competition or debate.

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.

### **Exams**

a) There will be 5 exams presented in class throughout the semester.. Each exam is weighted equally, and exams will be worth 25% of your final grade. You will have 75 minutes to complete each exam. Exams will be presented on CANVAS using Respondus LockDown Browser and Zoom. One Exam will be take home with a two day return for the work. All students will receive a formula sheet for exams.

b) There will be an optional EIT comprehensive final exam during the last week you can take to replace your lowest test score if you want.

c) 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.

d) 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.

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

### **Syllabus Changes**

The instructor reserves the right to make changes to the syllabus as needed. Any changes will be clearly announced on CANVAS and in class Course Communication E-Learning will be the primary avenue for communication and course management. All announcements for the course will be made using the announcement system on the E-Learning site. Make sure and change your E-Learning settings so that you get notifications about announcements, assignments, exams, changes, etc. in a timely manner. If you are sending e-mails to the instructor, please use CANVAS mail and be sure to include a meaningful subject phrase, and 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

### **Evaluation of Grades**

| Assignment | Total Points | Percentage of Final Grade |
|------------|--------------|---------------------------|
|------------|--------------|---------------------------|

|  |        |      |
|--|--------|------|
| Formative Assessments (Pre-readings, Pre-tests, in class formative chat, poll questions) | varies | 15%  |
| Exams (5)  | varies | 25%  |
| Group Exercises  | varies | 40%  |
| Homework   | Varies | 20%  |
|  |        | 100% |

### ***Grading Policy***

| <b>Percent</b> | <b>Grade</b> | <b>Grade Points</b> |
|----------------|--------------|---------------------|
| 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.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

### ***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/policies/student-honor-code-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
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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](mailto: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](mailto:title-ix@ufl.edu), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto: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://care.dso.ufl.edu>.

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