# Introduction to Materials Science and Engineering

EMA 3010 (27334)
***Class Periods:*** M, W, F, Period 4, 10:40 am-11:30 am.
***Location: CSE E222***
**And**
EMA 3010 (24612)
***Class Periods:*** M, W, F, Period 7, 1:55 pm-2:45 pm.
***Location: LIT 0121***
***Academic Term:*** Fall 2022

***Instructor:***
Name: Wolfgang Sigmund, PhD
Email Address: sigmund@ufl.edu
Office Location: Rhines Hall 225A
Office Phone Number: 352-846-3343
Office Hours: Wednesday from 12:45 pm to 1:45 pm via zoom. Additional meeting times available via email request.

***Teaching Assistant/Peer Mentor/Supervised Teaching Student:***
Please contact through the CANVAS website
Yonguk Lee
Email: leey2@ufl.edu
For office hours and location check 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

***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 leaning 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.

| Class dates | Topic | Chapter |
|---|---|---|
| August 24 | Course Objectives, Syllabus, Wiley Introduction | 0 |
| August 26 | Introduction | 1 |
| August 29 | Atomic Structure and Interatomic Bonding | 2 |
| August 31 | Atomic Structure and Interatomic Bonding | 2 |
| September 2 | Structure of Metals, Ceramics | 3 |
| September 7 | Structure of Metals, Ceramics | 3 |
| September 9 | Structure of Metals, Ceramics, Polymers | 3,4 |
| September 12 | Structure of Polymers | 4 |
| September 14 | Review Lecture | 1-4 |
| September 16 | **EXAM 1** | 1-4 |
| September 19 | Defects in Solids | 5 |
| September 21 | Defects in Solids | 5 |
| September 23 | Defects in Solids | 5 |
| September 26 | Diffusion | 6 |
| September 28 | Diffusion | 6 |
| September 30 | Diffusion | 6 |
| October 3 | Review Lecture | 5-6 |
| October 5 | **EXAM 2** | 5-6 |
| October 10 | Mechanical Properties | 7 |
| October 12 | Mechanical Properties | 7 |
| October 14 | Mechanical Properties | 7 |
| October 17 | Deformation and strengthening mechanisms | 8 |
| October 19 | Deformation and strengthening mechanisms | 8 |
| October 21 | Failure | 9 |
| October 24 | Failure | 9 |
| October 26 | Review Lecture | 7-9 |
| October 28 | **EXAM 3** | 7-9 |
| October 31 | Phase Diagrams | 10 |
| November 2 | Phase Diagrams | 10 |
| November 4 | Phase Diagrams | 10 |
| November 7 | Phase Transformations | 11 |
| November 9 | Phase Transformations | 11 |
| November 14 | Review Lecture | 10-11 |
| November 16 | **EXAM 4** | 10-11 |
| November 18 | Types and Applications of Materials | 13 |
| November 21 | Composites | 15 |
| November 28 | Composites | 15 |
| November | Economic, Environmental and Societal Issues in | 20 |
| December 2 | Economic, Environmental and Societal Issues in | 20 |
| Dec 5 | Review Lecture | 13, 15, 20 |
| Dec 7 | **EXAM 5** | 13, 15, 20 |

**Course Format**

This course is a face-to-face class taught in a classroom. In addition to lectures, it applies a *team-based learning approach* via PERUSALL and other group work tools that uses pre- and post-class assignments (including watching pre-recorded lectures or videos, reading assignments, homework). The class time will be dedicated to lectures and/or exercises/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 15% 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 15% of your grade and will be assessed using Perusall.

**Active Learning Activities**

***Attendance to Live Classes*** is not required but highly encouraged since there will be problem solving and group work. Students are encouraged to ask questions and participate. The fundamental concepts will be repeated as required.

**Homework Problems** Homework is required for this course and is provided via CANVAS (WileyPlus) to help students gain deeper understanding. You are allowed to collaborate on homework. However, you need to write your own answers.

**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 **15%** 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 for that exam. 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. Since one exam is dropped, students need to show that excused absences occurred for more than one exam to allow for make-up exams.

**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 and prerecorded lectures (Perusall) | About 25 | 25% |
| Homework problems | About 15 | 15% |
| Exams | 5 (15% each, drop the lowest) | 60% |
| 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.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/.

*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***: https://distance.ufl.edu/state-authorization-status/#student-complaint*.