

APPL260
Materials Science and Engineering:
Living in a Material World
Spring, 2024

Introduction	This course will be an introduction to a broad range of topics in materials science and with a strong focus on how materials, processing and engineering come together in design and <i>vice versa</i> . Why are some materials hard and others soft? Why can certain plastics be lighter than steel and at the same time be stronger? How do I select materials for my design? In short, we'll be exploring the natural and made-made materials that shape our marvelous world.
Methods	This class will be a combination of in-class lectures, in-class demonstrations and hands-on experiments so you will experience first-hand why materials do what they do and how to select the appropriate material for the right application or a design.
Results	By the end of this course, students should be able to do the following: <ul style="list-style-type: none"> • Recognize and name material classes, list their generic properties and explain their behavior • Explain the mechanical behavior of different structural materials and apply this to a design • Discuss material selection and how this will impact fatigue and failure. Nothing lives forever! • Select functional materials (electrical, magnetic, optical...) and apply this to a design • Explain the role of processing on final material properties and design performance • Justify material selection for a design from an environment and sustainability point of view
Discussion	(Describe how this course will impact your students.) This class will provide a basic understanding of materials science that will be valuable in understanding the world around you. Another goal of this class is to help you develop an entrepreneurial mindset so that you will understand the bigger picture; draw connections between what you learn in this class and what you have learned in other classes; recognize opportunities; and learn from mistakes to create value for yourself and others.
Engineering Student Outcomes	(Choose relevant ABET and KEEN outcomes from this list .) <ul style="list-style-type: none"> • An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics • An ability to apply engineering design to produce solutions that meet specific needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

- An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.

Class Essentials

➤ CONTACT INFORMATION

Dr. Theo Dingemans

Teaching assistants

 Office Location

1111 Murray Hall

 Email

tjd@unc.edu

 Phone

+1(919) 843-4048

Not applicable

➤ LOGISTICS

 Class meeting times

Tuesday/Thursday 2:00-3:15 PM?

 Class meeting location

Morehead 213

 Office Hours

By appointment

 Required Texts & Software

- *Materials Science and Engineering 10th Edn.* By William D. Callister and David G. Retwisch (Wiley)

 Pre-requisites

- CHEM 102 and PHYS 116/118. Or permission from instructor

Resources

 Lecture slides

I will post lecture slides to Canvas immediately before or after class.

Course content

➤ COURSE TOPICS

- Week 1 Introduction to materials, their history and their impact in everyday life
- Week 2 Matching material to design or does the design dictate the material?

- Week 3-4 Metals, ceramics and molecules: what holds them together?
- Week 5-6 Strength, stiffness, yielding and ductility
- Week 7-8 If you can make it, someone can break it: fracture, fatigue, creep, wear and tear
- Week 9 Durability, oxidation, corrosion and degradation
- Week 10 Spring break! No classes
- Week 11-12 Functional materials and their role in applications
- Week 13-14 Design, materials and the role of processing
- Week 15-16 Materials and sustainability: how to choose your materials wisely
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➤ COURSE SCHEDULE

(Insert week-by-week schedule, or provide link if this is online in a separate document.)

To help you succeed

Health

Your mental and physical health is very important to me! Let me know how I can support you and your health this semester. If you need accommodations from ARS, please let me know ASAP.

Course Expectations and policies

Attendance:

- Class attendance is required, and I will record attendance. Let me know ahead of time if you are missing class for any reason and it will be an excused absence. Please do not come to class if you are not feeling well or under quarantine for COVID exposure.
- While in person attendance is expected, you can attend via Zoom, if necessary, especially due to illness or COVID exposure. Let me know ahead of time if you need to attend via Zoom.

➤ COURSE EXPECTATIONS AND POLICIES

- (Insert course expectations and policies)

Example expectations and policies:

- Watch all online lectures and do all reading assignments before coming to class (in-class quizzes will help to encourage you to do this).
- Participate in class discussions and problem-solving activities.
- During class time, do not use your phone or computer for something unrelated to class; research shows that this is distracting to other students in the class. If there is an urgent situation, then you can leave the classroom to use your phone or computer.
- Come to every scheduled class and lab session and let me know ahead of time if you cannot attend.

- Turn in assignments on time; if an assignment is up to 24 hours late, there is a 25% deduction, and if an assignment is beyond 24 hours late, you will get a zero. If you need an extension, you must ask at least 24 hours before the time that the assignment is due (you can avoid a grade deduction this way).

Assignments & Evaluation

➤ YOUR COURSE GRADE

30%: Homework and quizzes	Two in-class written quizzes, 20 min for each quiz
20%: One midterm exam	In-class written exam (40 min)
20%: Final exam	1h15 min, covers all material discussed in class
20%: Labs and lab reports	Lab attendance and graded lab reports
10%: In class presentation	In-class team presentation. 15 min ppt presentation + 5 min for questions
100%: total	

➤ GRADE INTERPRETATION & HONOR CODE

Your final course grade will be determined from a standard scale:

A	93+
A-	90.0 - 92.9
B+	87.0 - 89.9
B	83.0 - 86.9
B-	80.0 - 82.9
C+	77 - 79.9
C	73 - 76.9
C-	70 - 72.9
D+	67 - 69.9
D	60 - 66.9
F	<60

ACADEMIC HONESTY

There will be clear communication if assignments are individual or group. For individual assignments, while I encourage collaboration, it is a violation of the honor code if a student duplicates work or obtains solutions from another student and submits it on their own. Please reference the honor code: <http://honor.unc.edu>.

➤ MAJOR COURSE DUE DATES

Midterm exam	TBD
In class presentation	TBD
Final exam	TBD

Student Resources

SEE, SAY, DO SOMETHING

We're happy you are here and eager to learn. Despite our best intentions to follow a plan, life may throw us a curve ball.

CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their

ACCESSIBILITY RESOURCES

The University of North Carolina at Chapel Hill facilitates the implementation of reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability or pregnancy complications resulting in barriers to fully accessing University courses, programs and activities.

<p>website: https://caps.unc.edu/ or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more. (source: <i>Student Safety and Wellness Proposal for EPC, Sep 2018</i>)</p> <p>If you or someone you know is experiencing some distress or you are concerned about the well-being of a student, please report it here: https://deanofstudents.unc.edu/carereport. It is important to support one another. If you see something, say, and do something.</p>	<p>Accommodations are determined through the Office of Accessibility Resources and Service (ARS) for individuals with documented qualifying disabilities in accordance with applicable state and federal laws. See the ARS Website for contact information: https://ars.unc.edu or email ars@unc.edu.</p>
<p>Title IX Resources</p> <p>Any student who is impacted by discrimination, harassment, interpersonal (relationship) violence, sexual violence, sexual exploitation, or stalking is encouraged to seek resources on campus or in the community. Please contact the Director of Title IX Compliance (Adrienne Allison – Adrienne.allison@unc.edu), Report and Response Coordinators in the Equal Opportunity and Compliance Office (reportandresponse@unc.edu), Counseling and Psychological Services (confidential), or the Gender Violence Services Coordinators (gvscc@unc.edu; confidential) to discuss your specific needs. Additional resources are available at safe.unc.edu.</p>	<p>Community Standards in Our Course</p> <p><i>As long as it is possible to do so safely, we will be meeting in person this semester. I understand the ongoing COVID-19 pandemic may require changes to this plan and will be monitoring the situation closely. If I need to change the format of the course temporarily due to outbreaks of illness, I will announce this via email and the course Canvas site.</i></p>
<p><u>Attendance Policy</u></p> <p>University Policy: As stated in the University’s Class Attendance Policy, no right or privilege exists that permits a student to be absent from any class meetings, except for these University Approved Absences:</p> <ol style="list-style-type: none"> 1. Authorized University activities: University Approved Absence Office (UAAO) website provides information and FAQs for students and FAQs for faculty related to University Approved Absences 2. Disability/religious observance/pregnancy, as required by law and approved by Accessibility Resources and Service and/or the Equal Opportunity and Compliance Office (EOC) 3. Significant health condition and/or personal/family emergency as approved by the Office of the Dean of Students, Gender Violence Service Coordinators, and/or the Equal Opportunity and Compliance Office (EOC). 	

I will work with students to meet attendance needs that do not fall within University approved absences, such as a job interview, illness/ flu or club activity.	
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I reserve to right to make changes to the syllabus, including project due dates and test dates (excluding the officially scheduled final examination), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.