

**CHEN 4836/5836 – Nanomaterials**  
Syllabus – Fall 2020

**INSTRUCTOR:** Prof. C. Wyatt Shields IV  
Email: Charles.Shields@colorado.edu

**CLASS HOURS:** Th/Th 11:40am–12:55pm MT  
In Person Location: JSCBB A115  
Zoom Location: <https://cuboulder.zoom.us/j/93276201060> (Passcode: 197939)

**COURSE TAs:** Evan Mueller, Advanced TA  
Email: Evan.Mueller@colorado.edu  
Suxuen Yew, TA  
Email: Suxuen.Yew@colorado.edu

**OFFICE HOURS:** M 12:30–2:00pm MT Suxuen Yew  
Zoom: <https://cuboulder.zoom.us/j/96803167590> (Passcode: 289277)  
W 4:30–5:30pm MT Prof. Shields  
Zoom: <https://cuboulder.zoom.us/j/95593250782> (Passcode: 688469)  
Th 5:00–6:30pm MT Evan Mueller  
Zoom: <https://cuboulder.zoom.us/j/93903811074> (Passcode: 550840)  
*Office hours will not be recorded*

**TEXT:** Introduction to Nanoscience (1<sup>st</sup> Edition) – CRC Press (Optional)  
Required reading will be uploaded prior to class

**COURSE MATERIALS:** Canvas will contain announcements, lecture material, supplementary material, homework assignments, grades, solutions, corrections, etc.

**COURSE REQUIREMENTS:** No mandatory prerequisites; however, the class is geared toward first-year graduate students and senior/junior-level chemical and biological engineering undergraduate students. Basic knowledge of chemistry, biochemistry, physics, math and thermodynamics is helpful. See me in advance if you have questions regarding these prerequisites.

<b><u>COURSE GRADES:</u></b>	<b>CHEN 4836 (Undergrad)</b>	<b>CHEN 5836 (Grad)</b>
• Homework	25%	20%
• Midterm I	20%	15%
• Midterm II	20%	15%
• Journal Club	10%	15%
• Research Proposal	20%	30%
• Course Participation	5%	5%

**ASSIGNMENTS & DEADLINES:**

- Unless otherwise noted, all homework assignments are due on Friday at 5pm MT by Gradescope.
- Assignments turned in after 5pm will be counted for 50% of possible points for 24 hours after the due date/time.
- *No credit* will be given for assignments turned in more than 24 hours after the due date/time.
- All grade contesting must occur via email to Suxuen within one week of their return date/time to the class; any contesting after this window will not be considered.

**IMPORTANCE OF THE COURSE:** Nanomaterials are poised to revolutionize many aspects of our daily life. Examples include nanoscale electronics, surface probes and injectable “robots” that can detect disease. As engineers, it is essential to gain an understanding of the laws that drive interactions at the nanoscale to develop useful, next-generation nanomaterials. In this course, we will survey topics at the heart of nanomaterials, including scaling laws, intermolecular forces, fabrication methods and characterization techniques. As we develop fundamental understandings, we will turn our attention to applied themes in nanomaterials such as colloidal assembly, drug delivery and nanodevices that are at the cutting-edge of ongoing research. These topics will illustrate the importance and impact of nanomaterials in society.

**LEARNING OBJECTIVES:** By engaging in class, this course will help you:

- develop an understanding of the laws governing nanoscale systems;
- apply principles of nanoscience to design and engineer useful materials;
- identify contemporary problems and apply nanoscale principles to address those problems;
- learn skills in persuasive scientific writing;
- sharpen your problem-solving abilities; and
- improve your ability to work in teams.

**ABET STUDENT OUTCOMES:** This course will provide students with:

- 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 specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental and economic factors;
- an ability to communicate effectively with a range of audiences;
- 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;
- an ability to acquire and apply new knowledge, using appropriate learning strategies; and
- a working knowledge of advanced biological sciences.

**MIDTERM EXAMS:** Two 90-minute exams will be held remotely outside of scheduled class time. Exams will not be cumulative. Students requiring special accommodations should contact me directly at least one week prior to the exam to coordinate arrangements.

**JOURNAL CLUBS:** Graduate students, paired based on research interests, will take turns to lead the class in a 40-minute journal club every Thursday, tentatively starting October 8. Each pair will be required to select, present and lead the discussion of one research article that relates to nanomaterials. Topics can include themes not yet discussed in class. Presentations should last approximately 20 minutes to give ample time for class discussion. Undergraduate students, grouped in trios based on research interest, will prepare a written assignment along the same lines. All journal club assignments must consider diverse perspectives (e.g., racial, gender, political and ethnic). Students will be evaluated on their ability to identify the central hypothesis, summarize research methods and assess the findings and interpretations of the authors. Students will be evaluated on their evaluation of the strengths and weaknesses of the article. Graduate students will also be graded on their ability to guide class discussions.

**RESEARCH PROPOSAL:** In lieu of a final exam, this course will culminate in a proposal to provide an opportunity to apply principles from the course to address real-world problems. The proposal must broadly relate to nanomaterials and nanoscale systems, but students have autonomy in deciding the problem as well as the technology proposed to address that problem. At the end of the semester, proposals will be reviewed by your peers and scored in a manner representative of real scientific review panels. Students will have the opportunity to address the criticisms raised during peer review by the end of the semester. Grades will be determined by the quality of the: (i) initial proposal, (ii) criticisms raised and (iii) responses to criticisms. Criticisms received by peers (good or bad) will *not* be a part of the final

grade. Undergraduate students will work in groups 3 or 4; graduate students will work independently. Length requirements for undergraduate students will be shorter than those for graduate students.

**CLASSROOM BEHAVIOR:** Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the policies on [classroom behavior](#) and the [Student Code of Conduct](#).

**REQUIREMENTS FOR COVID-19:** As a matter of public health and safety due to the pandemic, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements, and public health orders in place to reduce the risk of spreading infectious disease. Required safety measures at CU Boulder relevant to the classroom setting include:

- maintain 6-foot distancing when possible,
- wear a face covering in public indoor spaces and outdoors while on campus consistent with state and county health orders,
- clean local work area,
- practice hand hygiene,
- follow public health orders, and
- if sick and you live off campus, do not come onto campus (unless instructed by a CU Healthcare professional), or if you live on-campus, please alert [CU Boulder Medical Services](#).

Students who fail to adhere to these requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to [Student Conduct and Conflict Resolution](#). For more information, see the policies on [COVID-19 Health and Safety](#) and [classroom behavior](#) and the [Student Code of Conduct](#). If you require accommodation because a disability prevents you from fulfilling these safety measures, please see the “Accommodation for Disabilities” statement on this syllabus.

Before returning to campus, all students must complete the [COVID-19 Student Health and Expectations Course](#). Before coming on to campus each day, all students are required to complete a [Daily Health Form](#).

Students who have tested positive for COVID-19, have symptoms of COVID-19, or have had close contact with someone who has tested positive for or had symptoms of COVID-19 must stay home and complete the [Health Questionnaire and Illness Reporting Form](#) remotely. In this class, if you are sick or quarantined, please notify me as soon as possible (within 24 hours). Due to FERPA student privacy laws, students are not required to state the nature of their illness during this notification.

**ACCOMMODATION FOR DISABILITIES:** If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or [dsinfo@colorado.edu](mailto:dsinfo@colorado.edu) for further assistance. If you have a temporary medical condition or injury, see [Temporary Medical Conditions](#) under the Students tab on the Disability Services website.

**HONOR CODE:** All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code ([honor@colorado.edu](mailto:honor@colorado.edu)); 303-492-5550). Students found responsible for violating the academic

integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the [Honor Code Office website](#).

**PREFERRED NAMES & PRONOUNS:** CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

**SEXUAL MISCONDUCT, DISCRIMINATION, HARASSMENT & RELATED RETALIATION:** The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, intimate partner abuse (including dating or domestic violence), stalking, or protected-class discrimination or harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or [cureport@colorado.edu](mailto:cureport@colorado.edu). Information about the OIEC, university policies, [anonymous reporting](#), and the campus resources can be found on the [OIEC website](#).

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

**RELIGIOUS HOLIDAYS:** Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please contact me if you have a conflict with one of the exams so we can make appropriate arrangements. See the [campus policy regarding religious observances](#) for full details.