

**MSE 562 Soft Materials**  
**Spring 2022**  
**Tu/Thu 9:00 am to 10:15 am WALC B091**

**Instructor:** Prof. Carlos Martinez

Email: ([cjmartinez@purdue.edu](mailto:cjmartinez@purdue.edu))

Phone: 4-3271

Office: ARMS 2327

Office Hours: Contact Prof. Martinez via email with questions.

**Prerequisite:** Junior standing in MSE or at least 2<sup>nd</sup> year chemistry and physics

**Course Modality:** Face-to-Face

**Course Description:**

Soft materials are an important and diverse class of materials that share the common trait of being easily deformable by external stresses, electric or magnetic fields or even thermal fluctuations. These materials are the foundation of important technologies that are used in everyday life including ceramic and pharmaceutical processing (tablet formation), cosmetics (hand creams), cleaning products, foods (milk, mayonnaise) and bio-technologies (drug delivery). The aim of this class is to gain a fundamental understanding of the physical and chemical underpinnings of common soft materials systems and how they are used to engineer technologically relevant materials and structures.

**Goals:**

1. Gain a fundamental understanding of the physical and chemical underpinnings of common soft material systems.
2. Learn how soft materials are used to engineer and fabricate common and advanced technologies.
3. Learn techniques used to characterize soft materials.

**Textbook:**

**NOTE: All the necessary reading material for the course will be provided on BrightSpace in PDF format. There is no need to buy a book for the class.**

J. N. Israelachvili, *Intermolecular and Surface Forces, Second Edition: With Applications to Colloidal and Biological Systems*, Academic Press; 2 edition, 1992 or 3rd edition 2011 (either edition is fine).

**Supplementary Textbooks:**

1. R. J. Hunter, *Introduction to Modern Colloid Science*, Oxford Science Publication, 1993.
2. P-G. de Gennes, F. Brochard-Wyart and David Quere, *Capillarity and Wetting Phenomena, Drops, Bubbles, Pearls, Waves*, Springer, 2002.
3. I. D. Morrison and S. Ross, *Colloidal Dispersions, Suspensions, Emulsions and Foams*, Wiley-Interscience, 2002.

4. J. Goodwin, *Colloids and Interfaces with Surfactants and Polymers: An Introduction*, Wiley-Interscience, 2004.

**Course Content:**

All course content will be available through the BrightSpace course website. Lectures will be composed of a mixture of oral and written content, small group activities and large group discussions.

**Homework:**

Homework will be assigned every couple of week except for weeks when there is an exam. The homework is due on Friday at 5:00 pm. The homework and exam schedule is included in a calendar below. We will use GradeScope to submit and grade homework and exams. Homework questions will be answered via email. Consultation with other students and the instructor are encourage, but the homework must reflect your own work

Late homework are only accepted if submitted by Sunday at 5:00 pm following the Friday deadline and will suffer a **50% reduction** of the initial homework points. **Assignments submitted after that point will not be graded.**

**Grading:**

Grading Scale				60% 3 exams	40% Homework, in-class activities, etc
A	95%	C+	70%	<p><b>Note:</b> I reserve the right to make alterations in the scale downward based on class performance. Students are responsible for checking the accuracy of the grade book (which will be maintained on BrightSpace) – notify me if you believe there are discrepancies or missing grades.</p>	
A-	90%	C	65%		
B+	85%	C-	60%		
B	80%	D+	55%		
B-	75%	D	50%		
		F	< 49%		

**Class Attendance:**

Students are expected to attend all classes in-person unless they are ill or otherwise unable to attend class. If they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus, students should stay home and contact the Protect Purdue Health Center (496-INFO).

If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too

sick to progress in the course, notify your academic case manager and notify me via email or BrightSpace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.

**Communication:**

All class content resides on BrightSpace, and students are encouraged to check the class website daily for announcements. My preferred way of communicating individually with students is via **email** and recommend students to check their email at least daily and more often on exam day. Feel free to contact me with any questions, and I'll do my best to get back to you ASAP. However, Monday to Friday, I will reply to emails received after 7 pm the next morning, and during the weekend will be answered on Monday.

**Exam Absences:**

Missing an exams is only "excused" for the following verifiable reasons: serious illness (including COVID-19 related), family or personal emergencies, religious observations, or official University or MSE-departmental business. ***If you need to miss an exam for one of these reasons, you should make arrangements with Prof. Martinez prior to your absence.*** In case of emergency, e-mail Prof. Martinez or call the School of Materials Engineering as soon as possible at (765) 494-4100. If you have questions about absences, contact the Dean of Students Office at odos@purdue.edu or (765) 494-1747. The University expects that students will attend classes for which they are registered.

*Students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus.* Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact Prof. Martinez as soon as possible by email, through Brightspace, or by phone. If you cannot to make direct contact with Prof. Martinez and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.

## 2022 Tentative Lecture, Homework and Exam Schedule.

Subject to change during the semester.

Week	Tuesday	Thursday	Topics	Deadlines and Notes
1	January 10, 2022	January 12, 2022	Intro and Sedimentation	
2	January 17, 2022	January 19, 2022	van Der Waals Forces	
3	January 24, 2022	January 26, 2022	Electrostatic Forces and DLVO	<b>Homework #1 Due January 27 at 5pm</b>
4	January 31, 2022	February 2, 2022	Aggregation and Depletion Flocculation	
5	February 7, 2022	February 9, 2022	<b>Exam Review and Exam #1</b>	<b>Exam # 1 on Thursday February 9</b>
6	February 14, 2022	February 16, 2022	Rheology and other characterization techniques	
7	February 21, 2022	February 23, 2022	Surfactants	
8	February 28, 2022	March 2, 2022	Emulsions	<b>Homework #2 Due March 3 at 5pm</b>
9	March 7, 2022	March 9, 2022	Microfluidics and Bubbles	
10	March 14, 2022	March 16, 2022	<b>Spring Vacation</b>	<b>No classes</b>
11	March 21, 2022	March 23, 2022	<b>Exam Review and Exam 2</b>	<b>Exam # 2 on Thursday March 23</b>
12	March 28, 2022	March 30, 2022	Foams, LBL, and Hydrogels Part 1	
13	April 4, 2022	April 6, 2022	Hydrogels Part 2 and Liquid Crystals	
14	April 11, 2022	April 13, 2022	Liquid Crystals Part 2 and Cellulose Nanocrystals	<b>Homework #3 Due April 14 at 5pm</b>
15	April 18, 2022	April 20, 2022	Soft Electronics and Kindle Example	
16	April 25, 2022	April 27, 2022	<b>Exam Review and Exam 3</b>	<b>Exam #3 on Thursday April 27</b>
17	May 2, 2022	May 4, 2022	Finals Week	<b>No Final Exam</b>

### Protect Purdue Plan

The Protect Purdue Plan, which includes the Protect Purdue Pledge, is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, wearing a mask in classrooms and campus building, at all times (e.g., no eating/drinking in the classroom),

disinfecting desk/workspace prior to and after use, maintaining proper social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights.

### **Feedback to Prof. Martinez**

Students are encouraged to provide written or oral feedback to Prof. Martinez about this course and its contents at any point during the semester. Students are also encouraged to complete the end-of-semester course evaluations with honest and constructive feedback about the strengths and weaknesses of both the course and the instructor. All feedback is read and considered by Prof. Martinez and will be useful in the continual assessment and redesign of this course in the future. Thank you in advance for your feedback.

### **Academic Integrity**

Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." See <https://www.purdue.edu/odos/academic-integrity/index.html>. Academic integrity is one of the highest values that Purdue University holds, as evidenced by the student-initiated Purdue Honors Pledge: "*As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.*" <https://www.purdue.edu/provost/teachinglearning/honor-pledge.html> Individuals are encouraged to alert university officials to potential breeches of academic integrity by either emailing [integrity@purdue.edu](mailto:integrity@purdue.edu) or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern. Forms of cheating in MSE 420 that will not be tolerated include copying during examinations, illegal crib sheets, willingly sharing answers or facilitating cheating, copying/sharing homework solutions, copying text from websites/books/other resources, etc. It is okay to work together on homework assignments or class projects; however, all students should complete their own homework assignments with unique answers/figures/cartoons, etc.

## **Use of Copyrighted Materials**

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally. Notes taken in class are, however, generally considered to be “derivative works” of the instructor’s presentations and materials, and they are thus subject to the instructor’s copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructors.

## **Emergencies**

In the event of a major campus emergency, course requirements, deadlines, and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Information about changes in this course will be posted on Blackboard and/or distributed via email to your @purdue.edu email address. Emergency preparedness is your personal responsibility. Purdue University is actively preparing for natural disasters or human-caused incidents with the ultimate goal of maintaining a safe and secure campus. For full details, visit: [http://www.purdue.edu/ehps/emergency\\_preparedness/](http://www.purdue.edu/ehps/emergency_preparedness/)

- For any emergency call 911.
- There are nearly 300 Emergency Telephone Systems throughout campus that connect directly to the Purdue Police Department (PUPD). If you feel threatened or need help, push the button and you will be connected to the PUPD.
- If we hear a fire alarm we will immediately evacuate the building and proceed outside. Do not use the elevator. If we are notified of a Shelter in Place requirement for a tornado warning, we will shelter in the lowest level of this building away from windows and doors. If we are notified of a Shelter in Place requirement for a hazardous materials release or civil disturbance, we will shelter in our classroom shutting any open doors and windows.
- HAMP Building Emergency Plan [https://www.purdue.edu/ehps/emergency\\_preparedness/bep/HAMP-bep.html](https://www.purdue.edu/ehps/emergency_preparedness/bep/HAMP-bep.html)

## **Grief Absence Policy for Students**

Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for missed assignments or assessments in the event of the

death of a member of the student's family. For more information, contact the Dean of Students directly: <https://www.purdue.edu/odos/>

### **Mental Health Information**

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and <http://www.purdue.edu/caps/> during and after hours, on weekends and holidays, or through its counselors physically located in the Purdue University Student Health Center (PUSH) during business hours.

### **Violent Behavior Policy**

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity. To report any incidents (or students) of concern, click on the "Report Concerns" menu at <https://www.purdue.edu/odos/> and complete a general (or specific) incident report.

### **Students with Disabilities**

Purdue University is required to respond to the needs of the students with disabilities as outlined in both the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 through the provision of auxiliary aids and services that allow a student with a disability to fully access and participate in the programs, services, and activities at Purdue University. If you have a disability that requires special academic accommodation, please make an appointment to speak with Prof. Martinez within the first three (3) weeks of the semester in order to discuss any adjustments. It is the student's responsibility to notify the contact the Disability Resource Center at: [drc@purdue.edu](mailto:drc@purdue.edu) or by phone: 765-494-1247 of an impairment/condition that may require accommodations and/or classroom modifications. More details are available on our course BrightSpace under Accessibility Information.

### **Nondiscrimination**

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures

and limitations as set forth in [Executive Memorandum No. D-1](#), which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit [www.purdue.edu/report-hate](http://www.purdue.edu/report-hate) to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.

***This syllabus is subject to change. Any and all changes during the semester will be documented on BrightSpace as “announcements”. CJM 12-22-22***