

ME259 – Rheology

FACULTY INFORMATION:

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Office Hours: M/W 3:00 – 4:15 pm through zoom link or by appointment
Zoom link: <https://ucmerced.zoom.us/my/achuang5> (Backup for online learning)

COURSE INFORMATION:

Term: Fall 2021
Designation : ME 259
Course Title: Rheology
Credits: 3 Credit Hours
Prerequisite(s): Fluid Mechanics and Solid Mechanics
References: Kontopoulou, Marianna, ed. *Applied polymer rheology: polymeric fluids with industrial applications*. John Wiley & Sons, 2011.
Macosko, Christopher W. *Rheology: Principles, Measurements and Applications*. Wiley and Sons, 1994.
Bird, Robert Byron, Robert Calvin Armstrong, and Ole Hassager. *Dynamics of polymeric liquids*. Vol. 1: Fluid mechanics, 1987.
Morrison, Faith A. *Understanding rheology*. Vol. 1. No. 3.1. New York: Oxford university press, 2001.
Class Date/Time: MW 1:30 – 2:45 pm
Location: GRAN 155 (Zoom backup: <https://ucmerced.zoom.us/my/achuang5>)

COURSE LEARNING OUTCOMES:

This course will focus on the introduction of fundamental knowledge of rheology. Upon completion, students should be able to:

1. Apply fundamentals of rheology to examine complex fluid flow problems. [ME PLO 1,2]
2. Articulate the basic fundamentals of rheological flow properties related to shear processing problems. [ME PLO 3]
3. Understand the nature of solid-liquid flow behavior. [ME PLO 3]
4. Work more effectively in groups to work through open-ended problems. [ME PLO 4]
5. Demonstrate professionalism, and respectful interaction with faculty and colleagues. [ME PLO 5, 6]

PROGRAM LEARNING OUTCOMES:

The course relates to these following program learning outcomes:

1. Are able to identify significant research questions in mechanical engineering, and contextualize their research in the current literature of the field
2. Are able to apply their knowledge of mathematics, science, and engineering to solve a problem, and to design and implement a suitable solution
3. Are able to design and conduct experiments and/or simulations of mechanical systems, and to analyze and evaluate
4. Have lifelong learning skills; are able to acquire and use new engineering techniques, skills, and tools for research and development in mechanical engineering, and to develop new methods and discover new knowledge
5. Exhibit high professional standards in research, demonstrating objectivity, ethical conduct, and integrity

6. Are able to communicate effectively through oral, visual, and written means, with a broad range of technical audiences

COURSE CONTENTS:

This introductory course is designed to offer a broad overview of rheological principles. There are three components of this course: general rheological principles, experimental methods, and applications. The applications of rheology will focus on systems such as suspensions, foams, gels, coatings, etc. Major experimental techniques will be discussed, and, participants having taken this course will be familiar with the peculiar flow characteristics of complex systems, be able to quantify Non-Newtonian fluids and be able to interpret /design rheological experiments.

1. General Overview: flow phenomena in polymeric fluids, mathematical preliminaries
2. Material functions for Polymer Liquids
3. Generalized Newtonian Fluids
4. Linear Viscoelasticity
5. Rheometry
6. Gels and Chemorheology of Reacting Systems
7. Suspensions and Multiphase Systems
8. Polymer Melts and Solutions
9. If time permitted: Special Topics: Associative Polymers, Coatings Rheology, Tribology

GRADING POLICY & DISTRIBUTION:

90.0 – 100	A	HW Assignments	30%
80.0 – 89.9	B	Midterm exams	30%
70.0 – 79.9	C	Final exams or project	30%
< 69.9	F	In-class Quizzes	10%
		Bonus points	TBD
TOTAL			100%

Homework Assignments:

Homework will be assigned and will be posted on Canvas. The assignment will be due online. Late submission will not be accepted.

In-class Quizzes:

There will be quizzes at the end of the classes to test your basic understanding of the learning content. Please make sure not to miss the classes and to focus on the lecture content throughout the class.

Midterm Exam:

There will be one midterm exam. Some parts will be closed book and some parts are open book. You are allowed to use the textbook and course notes and/or written notes. There will not be any make-up exam available.

Final Exam: There will be either a final exam or a final project. Current final exam date is set by the university to be on 12/11 (Saturday) between 11:30 am and 2:30 pm. Details of the final exam or final project will be announced later in the class.

Grade Disputes:

If a student feels that an exam or homework set was graded unfairly, or if there is an error in the grading, it should be brought to instructor's attention within one week after the graded material is handed back. Scores will not be reconsidered beyond one week after they are handed back.

COURSE EVALUATION NOTICE:

During the last two weeks of the semester, you will be provided an opportunity to evaluate this course and your instructor. On Monday of the 15th week of classes, you will receive an official email from evaluation administrators with a link to the online evaluation site. You will have two weeks to complete this evaluation. Your participation in this evaluation is an integral part of this course. Your feedback is vital to improving education at UC Merced.

CLASSROOM/ZOOM RULES:

Courtesy in the classroom is a necessary for enhancement of learning. The following administrative guidelines and rules shall apply:

- Please turn off all cell-phones, pagers, beepers, etc. before entering the classroom.
- Do not read newspapers or use your smart phone once the lecture has started.
- Refrain from socializing with fellow students during the lecture.

Your cooperation in complying with these rules is appreciated by the instructor and your classmates.

Courtesy in online zoom is a necessary for enhancement of learning. The following administrative guidelines and rules shall apply:

- Please turn off all cell-phones, pagers, beepers, etc. before entering zoom.
- Focus on the instructional content and turn on video to show your face at all time.
- Mute yourself besides asking or answering questions.

Your cooperation in complying with these rules is appreciated by the instructor and your classmates.

CAMPUS RESOURCES, POLICY AND STUDENT EXPECTATIONS:

Please refer to the "Resources and Policy" Tab in CatCourses.

DISCLAIMER:

In the event of a major campus emergency, the above requirements, deadlines and grading policies are subject to changes that may be required by a revised semester calendar. Any such changes in this course will be posted once the course resumes on CANVAS or can be obtained by contacting the professor via email or phone.