

Introduction to Polymer Science and Engineering

ECH4905/ECH6937

Class Periods: M,W,F | Period 8 (3:00 pm – 3: 50 pm)

Location: **FAC 0127**

Academic Term: Fall 2021

Instructor:

Prof. Yeongseon Jang

y.jang@ufl.edu

(352) 294-1289

Office Hours: Fridays 11-12 pm in ChE 210 or anytime by appointment (Zoom)

– Please contact Prof. Jang via email at least 24 hours prior to visit Office Hours.

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

No ST/TA assigned to this course. Please contact Prof. Jang directly through the Canvas website or email

Course Description

This course offers an overview of polymer science and engineering. Polymer structure-property relationships at microscopic and macroscopic levels, polymer synthesis and kinetics, thermodynamics of polymers in solution and bulk, state-of-the-art characterization/fabrication techniques, and recent applications of functional polymers will be covered. 3 credits.

Course Pre-Requisites / Co-Requisites

Course Objectives

1. Learn chemical structure and formulas of common polymeric materials
2. Characterize molecular weight (MW) and MW distribution in terms of common parameters
3. Distinguish different polymerization reactions and mechanisms
4. Predict conversion kinetics and MW resulting from polymerization reactions
5. Estimate the thermodynamic interaction and miscibility of polymer solutions and blends
6. Identify the physical states and transition temperatures of polymers
7. Describe the methods to characterize properties of polymers
8. Apply the knowledge to critically analyze polymer engineering results in the current literature

Materials and Supply Fees

Synchronous lecture videos, homework assignments, guidelines for term paper, any other announcements, and grades will be posted on Canvas. It is the students' responsibility to check it regularly.

Required Textbooks and Software

Course notes are developed and provided by the instructor, based on the recommended textbooks below.

Recommended Materials

- **Introduction to Polymers**, 3rd Edition, Robert J. Young and Peter A. Lovell, ISBN: 978-14-398-9195-7
- **Contemporary Polymer Chemistry**, Harry Allcock, Fred Lampe Deceased, James Mark, Prentice Hall, 2003 (3rd edition), ISBN-13: 978-0130650566
- **Polymer Physics**, Michael Rubinstein, Ralph H. Colby, Oxford University Press, 2003, ISBN: 978-0-19-852059-7
- Other recommended reading materials and articles will be suggested during classes.

Course Schedule

Week 1: Chapter 1. A brief Introduction to Polymer Science, HW

Week 2-3: Chapter 2. Characteristics of Polymers: Configuration, Molecular Weight, Conformation, HW

Week 4-7: Chapter 3. Synthesis and Reactions of Polymers: Polymerization, HW, **Midterm**

- Week 8-10: Chapter 4. Polymer Solution and Blends: Phase Diagram, Flory-Huggins Theory, HW
 Week 11-12: Chapter 5. Transitions in Polymers: Thermal, Mechanical, Viscoelastic Properties, HW
 Week 13-14: Chapter 6. Fabrication & Processing of Polymers, HW
 Week 15-16: Chapter 7. Recent Development of Functional Polymers & Biodegradable Polymers – **Term Papers**

Final: 12/15/2020 (Tuesday), 12:30 – 2:30 pm

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance of all synchronous lectures is highly recommended.

- You are expected to **wear approved face coverings at all times during class** and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

Dates and format for Midterm will be announced at least 2 weeks in advance. Students who do not attend an exam at the scheduled time will receive a score of zero for that exam.

Requests for make-up exams will be considered only for those students who missed due to an acceptable reason. 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. It is required that, **whenever possible, the student notifies the instructor about the situation prior to the exam, preferably at least two weeks in advance.**

Evaluation of Grades

| Assignment | Total Points | Percentage of Final Grade |
|--------------------|---------------------|----------------------------------|
| Homework Sets (10) | 100 (10 each) | 20 % |
| Midterm Exam | 150 | 30% |
| Final Exam | 150 | 30% |
| Term Paper | 100 | 20% |
| Total | 500 | 100% |

- **Homework assignments** will be given no more than once per week, generally due the following week. Students should be turned in scanned copies of homework to Canvas by the due dates. Late homework will not be accepted.
- **Midterm & Final: Time-limited online Midterm** will be announced at least 2 weeks in advance. **Final will be for 2 hours on 12/14/2021, 12:30 – 2:30 pm.** Students will be allowed to have their notes for formulas during exams. Calculator is required. Partial credit will be assigned to the right solving process, but no credit will be given for problems that have a solution only with no work leading to this solution.
- **Term Paper:** The term project aims to assist students in gaining better insights into state-of-the-art polymer science and engineering. The peer-reviewed research articles that introduce recent developments on biodegradable polymers and recycling will be provided during the class. Students must submit the term paper that summarizes the background and fundamental applied for the topic and provides a summary including perspectives in the fields. **The report will be limited to 3,000 words, due by December 10 (Friday), 2021.** Detailed writing guidelines will be posted to Canvas. The report grading rubric includes both technical and writing merits.

Grading Policy

| <i>Percent</i> | <i>Grade</i> | <i>Grade Points</i> |
|----------------|--------------|---------------------|
| 94.0 - 100.0 | A | 4.00 |
| 88.0 - 93.99 | A- | 3.67 |
| 80.0 - 87.99 | B+ | 3.33 |
| 75.0 - 79.99 | B | 3.00 |
| 70.0 - 74.99 | B- | 2.67 |
| 65.0 - 69.99 | C+ | 2.33 |
| 60.0 - 64.99 | C | 2.00 |
| 55.0 - 59.99 | C- | 1.67 |
| 50.0 - 54.99 | D+ | 1.33 |
| 45 - 49.99 | D | 1.00 |
| 40 - 44.99 | D- | 0.67 |
| 0 - 39.9 | 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/>.

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 Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. 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
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.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: <http://www.counseling.ufl.edu/cwc>, 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/>.

COVID-19

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

Academic Resources

E-learning technical support, 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://www.crc.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://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.