

# CHEG 4103 P05 INTRODUCTION TO POLYMER SCIENCE AND TECHNOLOGY

**Department of Chemical Engineering**  
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**Office Hours** T 9:30 – 12:30 PM

**Time / Place** Lecture: MW 2:00 - 3:20 pm,

(Section P01) Location: S. R. Collins, 209

## RECOMMENDED TEXTBOOK:

J. R. Fried, *Polymer Science and Technology*, **Prentice Hall**, 2nd Edition, (2003), Upper Saddle River, NJ. ISBN: 978-0130181688

## REFERENCES, SOURCES AND FURTHER READING

P. J. Flory, *Principles of Polymer Chemistry*, **Cornell University Press**, (1953), Ithaca, NY.

D. R. Paul, J. W. Barlow and H. Keskkula, Polymer Blends in **Encyclopedia of Polymer Science & Technology**, 2<sup>nd</sup> Edition, **3**, (1988), 758.

## **COURSE DESCRIPTION:**

Homopolymers. Copolymers. Microstructure. Commodity and Specialty Polymers. Polymer Nanocomposites. Polymer Blends. Miscible and Compatible Blends. PVT Behavior of Polymers. Binary Interaction Model. Solubility Parameter Approach. Entropic Difference Model. Phase Diagrams. Molecular Weight. Glass Transition Temperature. Copolymer Composition. Natural Polymers. Protein. DNA. Sequence Distribution. Sequence Alignment. Polymer Solution. Reversible Copolymerization. Oligomers. Viscoelasticity. Rubber Elasticity. Polymer Processing. Extrusion. Molding. Thermoforming. Callendering. Coating. Twin Scree Extruder. Polymer Diffusion. Polymer Characterization Methods. Mechanical Testing.

**Prerequisite:** CHEM 2033 – Organic Chemistry

## **COURSE OBJECTIVES:**

- i) To learn how to synthesize variety of polymers ranging from LDPE to PEEK, PPS.
- ii) Familiarization with structure-property relations.
- iii) Distinguish between compatible and miscible blends
- iv) Understand the EOS, equations of state for polymers
- v) Use Binary Interaction Model, Solubility Parameter Approach and Entropic Difference models to predict compositional windows of Miscibility
- vi) Construct Temperature – Composition Phase Diagrams. Derive Conditions when they become circular, hyperbolic, LCST, UCST Boundaries, when they become hourglass etc
- vii) Learn principles of polymer diffusion
- viii) Learn Polymer Characterization Techniques

## **COURSE EVALUATION METHODS**

### **Preparation for Class**

The students are expected to spend approximately two hours in preparation for each hour of lecture.

### **Homework**

There will be six homework assignments during the semester. These assignments will be given regularly and adequate time for their completion is provided. Due dates are given when the homework assignment is handed out. Assignments should be submitted (neatly) hand-written.

Each student is required to submit all homework assignments on time. **Failure to submit one assignment will result in a 25 point penalty given to the student's over-all grade.** Each additional failure to submit will cost an additional 50 points. Self-organized group study sessions on homework assignments are encouraged, but individual homework submissions are required.

## Exams

There are three in-term and one comprehensive final exam for the course. The exams are closed book and closed notes. Students will be able to use hand held calculators in exams. The final exam will not be returned.

Examinations will consist of multiple choice and worked-out solution to problems (the remainder). Credit for problem solving will be divided between analysis and solution. Worked-out problems must be of the proper form: (Given, Required, Schematic, Analysis, Solution). Approximately 2/3 of the credit of worked-out problems will come from the analysis of the problem, i.e. discarding extraneous information, determining the correct analysis tools (i.e. the right equations or principles) stating the correct assumptions, making the proper simplifications, and justifying those simplifications. Approximately 1/3 of the credit will come proper application of the analysis to obtain the correct numerical answer including units. 2. Exams missed without an official or instructor's prior excuse will not be made up, and the student will receive a score of zero. 3. Exam answers will not be posted but will be discussed in class or available for inspection at the professor's office. Students may look at their exam papers but they must be returned at the end of class. 4. Tests and quizzes will usually be closed book. 5. Guessing is not allowed on any problem, including multiple-choice problems. Evidence of the reasoning or computation that lead to the chosen answer must be clearly shown. All unsupported answers will be marked as incorrect. 6. Any evidence of cheating on exams no matter how minor will result in an F for the course and charges filed with Student Judicial Services. 7. Possession of any electronic device other than an NCEES approved calculator, scrap paper, books, or notes during an exam will be considered evidence of cheating and result in an F for the course. NCEES approved calculators are listed on <http://ncees.org/exams/calculator-policy/> 8. You may not stand or leave your seat during an exam for any reason. If medical conditions prevent you from taking an exam without leaving your seat, please make arrangements for testing with Academic Testing Services prior to the scheduled exam.

## Grading System

ITEM	CONTRIBUTION	Percentage
Homework Assignments	6 home works at 100 points each	5%
Quizzes	5 to 6 (pop up quizzes)	15%

3-term Exams	3 at 100 points each	50% (16.67% each)
Final (Comprehensive) Exam	100 points	30%
<b>TOTAL</b>		<b>100</b>

Above 90	A
Between 80 and 89	B
Between 70 and 79	C
Between 60 and 69	D
Below 60	F

In addition, any student not attending the final examination will fail the course.

### **Ethical Conduct**

Students will be expected to adhere to the ethical standards of the engineering profession. Cheating is prohibited and the representation of the work of another as your own will be grounds for dismissal from the class with a failing grade.

I will not tolerate cheating. "It is the aim of the faculty of the University to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to serious consequences, possibly suspension." 2. Please see the descriptions of Cheating and Plagiarism found in the University Catalog: For homework or projects plagiarism means using any work other than your own (including other texts) without clear, unambiguous acknowledgment. For quizzes and exams it means copying or trying to copy any other students work, any use of cellphones or electronic media during exams, any notes or open texts other than explicitly allowed by the instructor.

### **Class Attendance**

- Attendance is mandatory for all lectures. Roll will be taken at the beginning of each class.
- Absence and tardy policy - **excessive (3 or more) or unexcused absences or tardiness** will potentially lower the grade in the class by penalty of up to **50 points**.
- Absence due to religious observance - The Prairie View University Catalog states that a student who is absent from classes for the observance of a religious holy day will be allowed to take an examination or complete an

assignment scheduled for that day within a reasonable time after the absence. The instructor must be informed of the observance at least two weeks before the exam.

- Absence due to officially approved trips – The Prairie View University Catalog states that the person responsible for a student missing class due to a trip should notify the instructors of the departure and return schedule in advance of the trip. The student may not be penalized and is responsible for the material missed.
- Whether an absence is excused or unexcused is determined solely by the instructor with the exception of absences due to religious observance and officially approved trips described above or illness or family death, as discussed below. Absence because of, interviews, or personal reasons **MUST** be discussed (by email, phone, or in person) with the instructor before the class is missed.
- Illness and Death Notification The Center for Campus Life is responsible for notifying the campus community of student illnesses, immediate family deaths and/or student death. Generally, in cases of student illness or immediate family deaths, the notification to the appropriate campus community members occur when a student is absent from class for four (4) consecutive days with appropriate verification. It is always the student's responsibility for missed class assignments and/or course work during their absence. The student is encouraged to contact the instructor immediately regarding the absences and to provide verification afterwards. The notification from the Center for Campus Life does not excuse a student from class, assignments, and/or any other course requirements. The request for notification must be made within two weeks of the absence. The notification is provided as a courtesy.

### **Classroom Policy on Student Disability**

It is the University's standing policy to accommodate all expressed disabilities of individual students. Students having documentation of special needs are requested to discuss these needs with the instructor so that the proper accommodations can be made.

### **Classroom Policy**

All students are expected to come to class alert and ready to participate. Get a drink and visit the restroom before class. If you must leave the class before the end of the session, do not return. Sleeping, reading newspapers, and doing homework for other classes are not allowed during class. Students are expected to assist in maintaining a classroom environment that is conducive to learning. Inappropriate behavior in the classroom shall result, minimally, in a request to leave the class.

Disruptive or unprofessional behavior will not be tolerated.

**Cellular phones must remain turned off at all times during the class. Laptop use is prohibited in class. No exceptions, zero tolerance.**

No Tobacco Products: No exceptions, zero tolerance

## **Instructor's Absence due to Conference Commitments**

Schedule changes due to instructor's absence will be announced at least one class day in advance in the class.