CBE C178/CHEM C178 - POLYMER SCIENCE AND TECHNOLOGY (3 UNITS)

COURSE OVERVIEW

SUMMARY

This course serves as an introduction to polymer synthesis, characterization, and the physical properties of polymeric materials. In this course, you will learn different synthetic procedures of polymer synthesis, polymer characterization techniques, polymer physics and statistical mechanics. Emphasis on the molecular origin of properties of polymeric materials and technological applications. Topics include single molecule properties, polymer mixtures and solutions, melts, glasses, elastomers, and crystals. Experiments in polymer synthesis, characterization, and physical properties (only if lab is included).

PREREQUISITES

No official course prerequisites. You only need junior standing. Although based on course content, it recommended the student have a thorough understanding of basic crystallography, statistical mechanics, and organic chemistry.

Spring 2018 did not have the lab component. Lab component is heavily dependent on available space and time. 3 units are still awarded. Professor Nitash Balsara allows use of all HW, textbook (physical copy), and notes, on all of his exams.

TOPICS COVERED

- Introduction, molecular weight, classifications, nomenclature

- Measurement methods, synthetic strategies
- Step-growth polymerization
  Chain-growth polymerization
- Molecular weight distributions and chain transfer
- Anionic, cationic polymerization
- Controlled Radical polymerization
- Ring-opening polymerization
- Copolymerization
- Microstructure and stereoregularity
- Conformations and bonding, chain models
- Radius, end-to-end distance, and polymer structures
- Solution thermodynamics
- Phase behavior and Flory-Huggins
- Light, X-ray, and neutron scattering
- Self-assembly of block copolymers
- Dynamics of dilute solutions
- Solution characterization of polymers
- Polymer Networks
- Linear Viscoelasticity
- Glass transition
- Crystalline polymers
- Emerging applications: polymer solar cells, plastic electronics, plastic lithium batteries

WORKLOAD

COURSEWORK

- 11 Problem Sets
- 2 Midterms
- 1 Final
- 4 short lab reports (if lab component is included).

TIME COMMITMENT

3 hours of class time (MWF), 4-6 hrs HW time per problem set, 10 hrs/wk studying for exams, lab time is unknown due to lack of lab component last time course was offered.

CHOOSING THE COURSE

WHEN TO TAKE

If you have a strong background in statistical mechanics, crystallography, and understand basic organic chemistry and characterization techniques, this is a good class to take to get more exposure to polymers and soft materials.

WHAT NEXT?

- PHYS 141A - Solid State Physics (phys141a.html)
- PHYS 141B - Solid State Physics (phys141b.html)
- CHEM C150/MSE C150 - Materials Chemistry (chemc150.html)

ADDITIONAL COMMENTS AND TIPS

If you have Nitash Balsara as your professor, he will let you use everything on his exams. I recommend his and the GSI's office hours. Professor Balsara made a lot of careless math mistakes on his derivations so make sure to check his math during lecture.

Written by: Matthew Chang

Last edited: Fall 2018

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