

SYLLABUS: POLYMER PHYSICS (MSE: 20-261-753)

Quarter: Winter, 1999: 5:00 - 6:55 TR 413 Rhodes Hall

Instructor: Prof. Greg Beaucage
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540 ERC/410B Rhodes

Textbook:

- 1) **"Introduction to Polymer Physics" M. Doi, Clarendon Press 1996.**
- 2) **Class Notes Posted on the Web at:**
<http://www.eng.uc.edu/~gbeucag/BeaucageResearchGroup.html>
- 3) "Scaling concepts in polymer physics" P. G. de Gennes 1979.
- 4) "The theory of polymer dynamics" Oxford University Press, 1986.
- 5) "Principles of polymer chemistry." P. J. Flory, 1953.

Level: Graduate (Undergraduate by petition)

Synopsis of Course: This course is aimed at equipping students with a basic level of knowledge of the terminology and mathematics involved in the physical understanding of polymers. Most of the topics deal with post 1970 concepts involving the statics and dynamics of polymeric materials. The course is intended for graduate students who would like to gain an understanding of modern approaches to polymer physics. The course will closely follow the recent book of Doi. Doi's intent is similar to that of this course, "...to present a framework to graduate students in a concise and self-contained manner..." Prerequisite is "...a knowledge of undergraduate-level statistical mechanics..." Introductory courses in polymers and thermodynamics would be a sufficient minimum preparation for the course. The syllabus follows Doi's 5 chapters.

1.) Properties of an isolated polymer molecule.

Ideal chain
Segmental distribution
Non-ideal chains
Scaling laws

2.) Concentrated solutions and melts

Thermodynamics of polymer solutions
Concentration fluctuations in polymer solutions
Blends
Block copolymers

3.) Polymer gels.

Elasticity
The stress optical law
Interactions between partial chains
Swelling of gels

4.) Molecular motion of polymers in dilute solution.

Brownian motion
Bead-spring model
Dynamic light scattering

5.) Molecular motion in entangled polymer systems.

Dynamics of concentration fluctuations
Reptation
Viscoelasticity of polymers

Course requirements:

Quizzes (Equal Weight)

8 to 10 Weekly Quizzes

End of each Thursday Class, 1 problem (usually with 5 parts)
20 minutes

Final Exam

During Finals Week. (**3 Quizzes**)