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

Quarter: Winter, 1999: 5:00 - 6:55 TR 413 Rhodes Hall
Instructor: Prof. Greg Beaucage
gbeaucag@uceng.uc.edu
556-3063 (Office)/-5152 (Lab)/-9305 (Lab)
540 ERC/410B Rhodes

Textbook:
1) "Introduction to Polymer Physics" M. Doi, Clarendon Press 1996.
3) "Scaling concepts in polymer physics" P. G. de Gennes 1979,

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 Quizes)