

ChE 444 – POLYMERIC MATERIALS

Type (check one): Required: X Elective: _____

2005-2006 Catalog Data: ChE 444. Polymeric Materials. Introduction to chemistry, physics, technology and uses of common high polymers currently being produced. Prerequisite: ChE 443. Offered in the Spring semester. *One semester; three credits.*

Prerequisites: ChE 443

Co-Requisites: None

Textbook: F. Rodriguez, et al., *Principles of Polymer Systems*, 5th Edition, Taylor & Francis, 2003.

Other Required Materials: None

Other References: J. R. Fried, *Polymer Science & Technology*, 2nd Edition, Prentice Hall, 2003.
G. Odian, *Principles of Polymerization*, Wiley-Inter-Science, 2004.
Anil Kumar & R. K. Gupta, *Fundamentals of Polymers*, McGraw-Hill, 1998.

Instructor: Dr. Asit K. Ray, Professor of Chemical Engineering

Course Objectives:

1. Students will learn the chemistry, physics, technology, engineering of man-made polymers. (ABET: a,e,k)
2. They will learn to apply this knowledge to analyze various processes for making different polymers. (ABET: a,e,k)
3. They will learn to apply this knowledge to solve industrial type design projects which includes selecting a polymer based on required end use polymer properties and then selecting the process for making the specified polymeric product, based on processing properties available, ease of process control, cost, and safety. (ABET: a,e,k)
4. Students will work in teams of 2 or 3 on these design projects and write informal reports. (ABET: g,k)

Prerequisites by Topics:

1. Basic principles of chemistry with emphasis on bonding, intermolecular forces, liquids, solutions, properties of elements, properties of atoms and molecules in the bulk, chemical thermodynamics, study of organic compounds.
2. Principles of fluid mechanics and applications to chemical processing.
3. Chemical kinetics of isothermal and non-isothermal systems.

Topics:

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|------------------------------------|---|
| 1. a. Introduction | 4. a. Mechanical properties of small deformations |
| b. Basic structures of polymers | b. Ultimate properties |
| c. Physical states and transitions | c. Structure and property relationship |
| 2. a. Polymer formation | 5. a. Carbon chain polymers |
| b. Polymerization processes | b. Heterochain polymers |
| 3. a. Molecular weight of polymer | 6. Fabrication processes |
| b. Viscous flow | 7. Polymer reaction engineering |
| | 8. Examinations |

Class Schedule: Three 50-minute sessions per week

Prepared by: _____ **Asit K. Ray, Ph.D.** _____ **Date:** _____ **January 2006** _____

**Professional Component:
ChE 444 – POLYMERIC MATERIALS**

Category (check one)	<input type="checkbox"/> Math/Basic Science <input checked="" type="checkbox"/> Engineering <input type="checkbox"/> General Education <input type="checkbox"/> Other
Design (check one)	<input type="checkbox"/> Significant <input checked="" type="checkbox"/> Some <input type="checkbox"/> None
Realistic Constraints (check all that apply)	<input checked="" type="checkbox"/> Economic <input checked="" type="checkbox"/> Environmental <input type="checkbox"/> Sustainability <input checked="" type="checkbox"/> Manufacturability <input type="checkbox"/> Ethical <input type="checkbox"/> Health & Safety <input type="checkbox"/> Social <input type="checkbox"/> Political

Relationship to Program Outcomes:

Check all that apply:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) a recognition of the need for and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice