

TECHNOLOGY 344: Material and Processes in the Plastics Industry

2007-08 Catalog Data: TECH 344 Material and Processes in the Plastics Industry (3 Credits)

Catalog Description: Laboratory demonstrations and experimentation supplemented by reading, reports, and field trips to gain a general appreciation of the materials and processes used to manufacture plastic products. Laboratory experimentation includes a wide variety of small, experimental equipment including injection molding, vacuum forming, heat laminating, thermoforming, casting, and welding.

Prerequisites: General Chemistry knowledge.

Co-requisites: None

Textbooks:

- B. Strong, Plastics, Materials and Processing, 2nd Edition, Prentice Hall, Upper Saddle River, New Jersey, 2000.

Instructor: Robert A. Tatara, PhD

ABET/TAC/NAIT Engineering & Technology Outcomes	Student Learning Objectives	Assessments
<p>A. Mastery of knowledge, techniques, skills, modern tools of disciplines.</p>	<p>A. Students will Describe the Fundamental Structure of Plastics:</p> <ol style="list-style-type: none"> Students will draw & explain basic organic molecules. <ol style="list-style-type: none"> Students will label the atoms and bonding types. Students will differentiate & give examples of alkanes, alkenes, alkynes, and aromatics. Students will interpret & draw polymer chains. <ol style="list-style-type: none"> Students will compare polymerization reactions. Students will compare & contrast functional groups & tacticity. Students will describe chain topology. Students will compare & contrast structure & applications of thermoplastics & thermosets. <ol style="list-style-type: none"> Students will select commodity and engineered plastics. Students will differentiate crystalline & amorphous plastics. Students will name, draw, and label elastomers. <ol style="list-style-type: none"> Students will explain elastomers. Students will summarize polyisoprene. Students will select & qualify other elastomers. <p>B. Students will Predict Plastics Properties:</p> <ol style="list-style-type: none"> Students will describe effects of structural features on plastics properties. <ol style="list-style-type: none"> Students will quantify & solve molecular weight distribution. Students will qualitatively evaluate crystallinity effects. Students will state force and stress vs. strain relationship. <ol style="list-style-type: none"> Students will name & illustrate forces. Students will subdivide stress-strain curves. Students will compare stress-strain curves for different plastics. 	<p>Midterm Examination Final Examination Homework Assignments Classroom Assignments Performance Task 1 Performance Task 2 Performance Task 3</p>

ABET/TAC/NAIT Engineering & Technology Outcomes	Student Learning Objectives	Assessments
	<p>3. Students will distinguish & explain mechanical, physical, thermal, environmental, electrical, and optical properties.</p> <p>a. Students will select ASTM techniques.</p> <p>4. Students will explain interactions of modifiers.</p> <p>a. Students will classify additives, fillers, & reinforcements.</p> <p>C. Students will Describe Plastics Design and Finishing Processing:</p> <p>1. Students will differentiate design methods.</p> <p>2. Students will classify ways of assembling plastics.</p> <p>a. Students will select machining methods.</p> <p>3. Students will explain methods of finishing plastics.</p> <p>a. Students will give examples of joining & decorating.</p> <p>4. Students will compare & contrast rapid prototyping procedures.</p> <p>D. Students will Observe Plastics Processing Techniques:</p> <p>1. Students will recite observed processing methods.</p> <p>E. Students will Recognize the Environmental Aspects of Plastics:</p> <p>1. Students will recite recycling codes.</p> <p>2. Students will explain waste reduction techniques.</p> <p>a. Students will evaluate source control, recycling, regeneration, degradation, landfills, & incineration.</p> <p>F. Students will Analyze, in Depth, Specific Plastics Topic:</p> <p>1. Students will construct the history of a plastics topic, or</p> <p>2. Students will differentiate a plastic, or</p> <p>3. Students will detail a plastics processing method, or</p> <p>4. Students will describe, in detail, a plastic product.</p>	
<p>B. Apply current knowledge and adapt to emerging applications of math, science, engineering, and technology.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NIU Gen Ed Goals - Students: <i>a.iii. perform basic computations, display facility with use of formal and quantitative reasoning analysis and problem solving, and interpret mathematical models and statistical information.</i></p> </div>	<p>A. Students will Describe the Fundamental Structure of Plastics:</p> <p>2. Students will interpret & draw polymer chains.</p> <p>a. Students will compare polymerization reactions.</p> <p>b. Students will compare & contrast functional groups & tacticity.</p> <p>c. Students will describe chain topology.</p> <p>3. Students will compare & contrast thermoplastics & thermosets.</p> <p>a. Students will select commodity and engineered plastics.</p> <p>b. Students will differentiate crystalline & amorphous plastics.</p> <p>4. Students will name, draw, and label elastomers.</p> <p>a. Students will explain elastomers.</p> <p>b. Students will summarize polyisoprene.</p> <p>c. Students will select & qualify other elastomers.</p> <p>B. Students will Predict Plastics</p>	<p>Midterm Examination Final Examination Homework Assignments Classroom Assignments Performance Task 1 Performance Task 2</p>

ABET/TAC/NAIT Engineering & Technology Outcomes	Student Learning Objectives	Assessments
	<p style="text-align: center;">Properties:</p> <p>1. Students will describe effects of structural features on plastics properties.</p> <p>a. Students will quantify & solve molecular weight distribution.</p> <p>b. Students will qualitatively evaluate crystallinity effects.</p> <p>3. Students will distinguish and explain mechanical, physical, thermal, environmental, electrical, and optical properties.</p> <p>a. Students will select ASTM techniques.</p> <p>4. Students will explain interactions of modifiers.</p> <p>a. Students will classify additives, fillers, & reinforcements.</p> <p style="text-align: center;">C. Students will Describe Plastics Design and Finishing Processing:</p> <p>1. Students will differentiate design methods.</p> <p>2. Students will classify ways of assembling plastics.</p> <p>a. Students will select machining methods.</p> <p>3. Students will explain methods of finishing plastics.</p> <p>a. Students will give examples of joining & decorating.</p> <p>4. Students will compare & contrast rapid prototyping procedures.</p> <p style="text-align: center;">E. Students will Recognize the Environmental Aspects of Plastics:</p> <p>2. Students will explain waste reduction techniques.</p> <p>a. Students will evaluate source control, recycling, regeneration, degradation, landfills, & incineration.</p> <p style="text-align: center;">F. Students will Analyze, in Depth, Specific Plastics Topic:</p> <p>1. Students will construct the history of a plastics topic, or</p> <p>2. Students will differentiate a plastic, or</p> <p>3. Students will detail a plastics processing method, or</p> <p>4. Students will describe, in detail, a plastic product.</p>	

ABET/TAC/NAIT Engineering & Technology Outcomes	Student Learning Objectives	Assessments
<p>C. Conduct, analyzes, and interprets experiments; apply experimental results to improve processes.</p> <div data-bbox="82 348 440 758" style="border: 1px solid black; padding: 5px;"> <p>Gen Ed Goals - Students: <i>b. develop an ability to use modes of inquiry across a variety of disciplines in the humanities and the arts, the physical sciences and mathematics, and social sciences.</i> <i>b.iv. demonstrate an ability to use scientific methods and theories to understand the phenomena studied in the natural and social sciences.</i></p> </div>	<p>D. Students will Observe Plastics Processing Techniques:</p> <ol style="list-style-type: none"> 1. Students will recite observed processing methods. 	<p>Final Examination Performance Task 3</p>
<p>D. Ability to apply creativity in the design of systems, components, or processes appropriate to program objectives.</p> <div data-bbox="58 932 415 1266" style="border: 1px solid black; padding: 5px;"> <p>NIU Gen Ed Goals - Students: <i>c. develop an understanding of the relatedness of various disciplines by integrating knowledge from several disciplines and applying that knowledge to an understanding of important problems and issues.</i></p> </div>	<p>C. Students will Describe Plastics Design and Finishing Processing:</p> <ol style="list-style-type: none"> 1. Students will differentiate design methods. 2. Students will classify ways of assembling plastics. <ol style="list-style-type: none"> a. Students will select machining methods. 3. Students will explain methods of finishing plastics. <ol style="list-style-type: none"> a. Students will give examples of joining & decorating. 4. Students will compare & contrast rapid prototyping procedures. 	<p>Final Examination Homework Assignments Classroom Assignments Performance Task 2 Performance Task 3</p>
<p>E. Function effectively on teams.</p> <div data-bbox="82 1440 440 1917" style="border: 1px solid black; padding: 5px;"> <p>NIU Gen Ed Goals- Students: <i>b.iii. demonstrate a knowledge of cultural traditions and philosophical ideas that have shaped societies, civilizations, and human self-conceptions.</i> <i>d. develop social responsibility and preparation for citizenship through global awareness, environmental sensitivity, and an appreciation of cultural diversity.</i></p> </div>		<p>Classroom Assignments Performance Task 3</p>

ABET/TAC/NAIT Engineering & Technology Outcomes	Student Learning Objectives	Assessments
<p>F. Identify, analyze, and solve technical problems.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Gen Ed Goals - Students: <i>b. develop an ability to use modes of inquiry across a variety of disciplines in the humanities and the arts, the physical sciences and mathematics, and social sciences.</i> <i>b.iv. demonstrate an ability to use scientific methods and theories to understand the phenomena studied in the natural and social sciences.</i></p> </div>	<p>A. Students will Describe the Fundamental Structure of Plastics:</p> <p>3. Students will compare & contrast thermoplastics & thermosets. a. Students will select commodity and engineered plastics. b. Students will differentiate crystalline & amorphous plastics.</p> <p>4. Students will name, draw, and label elastomers. a. Students will explain elastomers. b. Students will summarize polyisoprene. c. Students will select & qualify other elastomers.</p> <p>B. Students will Predict Plastics Properties:</p> <p>1. Students will describe effects of structural features on plastics properties. a. Students will quantify & solve molecular weight distribution. b. Students will qualitatively evaluate crystallinity effects.</p> <p>2. Students will state force and stress vs. strain relationship. a. Students will name & illustrate forces. b. Students will subdivide stress-strain curves. c. Students will compare stress-strain curves for different plastics.</p> <p>3. Students will distinguish & explain mechanical, physical, thermal, environmental, electrical, and optical properties. a. Students will select ASTM techniques.</p> <p>4. Students will explain interactions of modifiers. a. Students will classify additives, fillers, & reinforcements.</p> <p>C. Students will Describe Plastics Design and Finishing Processing:</p> <p>1. Students will differentiate design methods.</p> <p>2. Students will classify ways of assembling plastics. a. Students will select machining methods.</p> <p>3. Students will explain methods of finishing plastics. a. Students will give examples of joining & decorating.</p> <p>4. Students will compare & contrast rapid prototyping procedures.</p> <p>E. Students will Recognize the Environmental Aspects of Plastics:</p> <p>2. Students will explain waste reduction techniques. a. Students will evaluate source control, recycling, regeneration, degradation, landfills, & incineration.</p>	<p>Midterm Examination Final Examination Homework Assignments Classroom Assignments Performance Task 1 Performance Task 2</p>
<p>G1. Communicate effectively in writing.</p>	<p>A. Students will Describe the Fundamental Structure of Plastics:</p> <p>1. Students will draw & explain basic organic molecules. a. Students will label the atoms and bonding types. b. Students will differentiate & give examples of</p>	<p>Midterm Examination Final Examination Homework Assignments Classroom Assignments Performance Task 1 Performance Task 2 Performance Task 3</p>

ABET/TAC/NAIT Engineering & Technology Outcomes	Student Learning Objectives	Assessments
<p>NIU Gen Ed Goals- Students: <i>a. develop habits of writing, speaking, and reasoning necessary for continued learning.</i> <i>a.i. communicate clearly in written English, demonstrating ability to comprehend, analyze, and interrogate critically.</i></p>	<p>alkanes, alkenes, alkynes, and aromatics.</p> <p>2. Students will interpret & draw polymer chains. a. Students will compare polymerization reactions. b. Students will compare & contrast functional groups & tacticity. c. Students will describe chain topology.</p> <p>3. Students will compare & contrast thermoplastics & thermosets. a. Students will select commodity and engineered plastics. b. Students will differentiate crystalline & amorphous plastics.</p> <p>4. Students will name, draw, and label elastomers. a. Students will explain elastomers. b. Students will summarize polyisoprene. c. Students will select & qualify other elastomers.</p> <p>B. Students will Predict Plastics Properties:</p> <p>1. Students will describe effects of structural features on plastics properties. a. Students will quantify & solve molecular weight distribution. b. Students will qualitatively evaluate crystallinity effects.</p> <p>2. Students will state force and stress vs. strain relationship. a. Students will name & illustrate forces. b. Students will subdivide stress-strain curves. c. Students will compare stress-strain curves for different plastics.</p> <p>3. Students will distinguish & explain mechanical, physical, thermal, environmental, electrical, and optical properties. a. Students will select ASTM techniques.</p> <p>4. Students will explain interactions of modifiers. a. Students will classify additives, fillers, & reinforcements.</p> <p>C. Students will Describe Plastics Design and Finishing Processing:</p> <p>1. Students will differentiate design methods.</p> <p>2. Students will classify ways of assembling plastics. a. Students will select machining methods.</p> <p>3. Students will explain methods of finishing plastics. a. Students will give examples of joining & decorating.</p> <p>4. Students will compare & contrast rapid prototyping procedures.</p> <p>E. Students will Recognize the Environmental Aspects of Plastics:</p> <p>1. Students will recite recycling codes.</p> <p>2. Students will explain waste reduction techniques. a. Students will evaluate source control, recycling, regeneration, degradation, landfills, & incineration.</p>	

ABET/TAC/NAIT Engineering & Technology Outcomes	Student Learning Objectives	Assessments
	<p>F. Students will Analyze, in Depth, Specific Plastics Topic:</p> <ol style="list-style-type: none"> 1. Students will construct the history of a plastics topic, or 2. Students will differentiate a plastic, or 3. Students will detail a plastics processing method, or 4. Students will describe, in detail, a plastic product. 	
<p>G2. Communicate effectively orally.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NIU Gen Ed Goals - Students: <i>a. develop habits of writing, speaking, and reasoning necessary for continued learning.</i> <i>a.i. communicate clearly in written English, demonstrating ability to comprehend, analyze, and interrogate critically.</i> <i>aii. communicate in a manner that unites theory, criticism, and practice in speaking & writing.</i></p> </div>	<p>D. Students will Observe Plastics Processing Techniques:</p> <ol style="list-style-type: none"> 1. Students will recite observed processing methods. 	<p>Classroom Assignments Performance Task 3</p>
<p>I. Understand professional, ethical, and social responsibilities.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NIU Gen Ed Goals - Students: <i>d. develop social responsibility and preparation for citizenship through global awareness, environmental sensitivity, and an appreciation of cultural diversity.</i></p> </div>	<p>B. Students will Predict Plastics Properties:</p> <ol style="list-style-type: none"> 1. Students will describe effects of structural features on plastics properties. <ol style="list-style-type: none"> a. Students will quantify & solve molecular weight distribution. b. Students will qualitatively evaluate crystallinity effects. 3. Students will distinguish & explain mechanical, physical, thermal, environmental, electrical, and optical properties. <ol style="list-style-type: none"> a. Students will select ASTM techniques. 4. Students will explain interactions of modifiers. <ol style="list-style-type: none"> a. Students will classify additives, fillers, & reinforcements. <p>D. Students will Observe Plastics Processing Techniques:</p> <ol style="list-style-type: none"> 1. Students will recite observed processing methods. <p>E. Students will Recognize the Environmental Aspects of Plastics:</p> <ol style="list-style-type: none"> 1. Students will recite recycling codes. 2. Students will explain waste reduction techniques. <ol style="list-style-type: none"> a. Students will evaluate source control, recycling, regeneration, degradation, landfills, & incineration. 	<p>Classroom Assignments Performance Task 1 Performance Task 2 Performance Task 3</p>

ABET/TAC/NAIT Engineering & Technology Outcomes	Student Learning Objectives	Assessments
	<p>F. Students will Analyze, in Depth, Specific Plastics Topic:</p> <ol style="list-style-type: none"> 1. Students will construct the history of a plastics topic, or 4. Students will describe, in detail, a plastic product. 	
<p>J. Respect for diversity and a knowledge of contemporary professional, societal, and global issues.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NIU Gen Ed Goals - Students: <i>d. develop social responsibility and preparation for citizenship through global awareness, environmental sensitivity, and an appreciation of cultural diversity.</i></p> </div>	<p>F. Students will Analyze, in Depth, Specific Plastics Topic:</p> <ol style="list-style-type: none"> 1. Students will construct the history of a plastics topic, or 2. Students will differentiate a plastic, or 3. Students will detail a plastics processing method, or 4. Students will describe, in detail, a plastic product. 	<p>Performance Task 1 Performance Task 2</p>
<p>K. Commitment to quality, timeliness, and continuous improvement.</p>	<p>E. Students will Recognize the Environmental Aspects of Plastics:</p> <ol style="list-style-type: none"> 1. Students will recite recycling codes. 2. Students will explain waste reduction techniques. <ol style="list-style-type: none"> a. Students will evaluate source control, recycling, regeneration, degradation, landfills, & incineration. 	<p>Final Examination Homework Assignments Classroom Assignments</p>
<p>M. Ability to use modern laboratory techniques, skills, and/or equipment effectively.</p>	<p>D. Students will Observe Plastics Processing Techniques:</p> <ol style="list-style-type: none"> 1. Students will recite observed processing methods. 	<p>Final Examination Performance Task 3</p>
<p>N. Ability to manage projects effectively.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>NIU Gen Ed Goals - Students: <i>c. develop an understanding of the interrelatedness of various disciplines by integrating knowledge from several disciplines and applying that knowledge to an understanding of important problems and issues.</i></p> </div>	<p>F. Students will Analyze, in Depth, Specific Plastics Topic:</p> <ol style="list-style-type: none"> 1. Students will construct the history of a plastics topic, or 2. Students will differentiate a plastic, or 3. Students will detail a plastics processing method, or 4. Students will describe, in detail, a plastic product. 	<p>Performance Task 1 Performance Task 2</p>

Computer Usage: MS Office.