SYLLABUS
MSE 453 Plastics Engineering

Catalog Description and Prerequisites
An introductory course to plastics engineering. Examines components of plastics and data banks; viscoelasticity, yield, and fracture; reinforced polymers; and forming, design (project), and current advances. Prerequisite: MATSE 450. 3 hours. 3 lecture-discussion hours/week

Class meeting time: Friday 2:00 to 4:50 PM Room 305 MSEB; two class meetings will be off-campus.

Instructor: Dr. Louis Reifschneider
Contact: phone: (309) 438-2621; lgreifs@illinois.edu; COMPASS email for MSE 453.
Office hour: Friday 12:30 to 1:30 PM in adjunct office 205A MSBE.

Textbook: Class notes (handouts and Compass postings) and Student developed "journal"

References (note: not certain which could be on reserve, * available in office)

7. Introductory notes, design notes, processing notes, and cost analysis notes: L. Reifschneider*

Course Topics:
1. Review of Polymer Science and Engineering fundamentals
   a. modulus, creep, Tg, crystallinity
2. Process selection (alternatives) (class discussion and activities, laboratory demonstrations)
   a. Extrusion
   b. Injection Molding (and variations)
   c. Thermoforming
   d. Blow Molding
   e. Rotational Molding
   f. Compression Molding (reinforced thermosets)
   g. Tooling requirements for each process
3. Cost modeling
   a. Injection molding
   b. Thermoforming
4. The Plastic Product Design Process
   a. From customer needs to commercial product
   b. Product specification
   c. Material selection
   d. Process selection
   e. Design for Manufacturability
   f. Cost analysis
   g. Prototyping
   h. Design examples: design for stiffness and creep
5. Material selection
   a. Data sheets, Corporate Design References, and Environmental resistance of resins
   b. Polymer families and Additives (class presentations)
   c. Life Cycle Analysis and Recycling
6. Discussions of trade journal articles as appropriate
   a. Trends in materials, processing, and applications
Course Objectives:
1. To review engineering aspects of polymer processing-structure-property relationships.
2. To evaluate different methods of processing plastics in terms of method, advantages and disadvantages.
3. To teach students various methods of cost analysis.
4. To describe and demonstrate methods of plastics product design.
5. To evaluate usefulness and drawbacks of plastics data sheets.
6. To evaluate plastics company’s web sites for design data and information.
7. To evaluate properties, processing methods, cost, etc. of commercial plastics and plastics systems. (student presentations)
8. To provide students with an appreciation of problems and perspectives in environmental, life cycle and recycling aspects of plastics use.
9. To develop an appreciation of current trends in plastics engineering.
10. To design a product based on plastics taking into consideration (but not limited to) mechanical, thermal, environmental, cost, manufacturability, and life cycle factors.

Course Outcomes:
1. Knowledge of uses and techniques of plastics processing, including limitations.
2. Ability to "cost" plastics products, including life cycle analysis.
3. Ability to evaluate company supplied information for design purposes.
4. The appropriate design of a product made with commercial plastic resins.
5. Recognition of means to develop life-long learning habits in the area of plastics engineering.

Course Assessment

<table>
<thead>
<tr>
<th>Tentative weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
</tr>
</tbody>
</table>

1. Process selection and product design review questions and participation of in-class discussion.
2. Laboratory demonstration review questions.
3. Oral (Power Point) presentations on
   a. a family of polymers and a plastics company web site
   b. team presentation of 3rd design problem (see below)
4. Written reports for three design problems
   a. 1st: Cost Analysis of thermoforming vs. injection molding for a specific product
   b. 2nd: Metal to Plastic replacement (modulus, geometric rigidity, creep)
   c. 3rd: Bio-preferred Material Design for product & packaging (team project)
5. Midterm exam: materials overview, process selection, cost analysis, the design process
6. Final exam: design problems, material & additive alternatives, life cycle analysis including questions submitted by the students on their oral presentations and drawn from assigned articles in trade magazines
7. Student evaluations of the oral presentations before and during presentations.

Total 100