EDMM 2500
PLASTICS PROPERTIES AND PROCESSING

COURSE SYLLABUS

2018-2019 Catalog Data:
Effects of polymer chemistry, additives, plasticizers, fillers, and reinforcements on the properties of plastics. Molding, forming, extrusion, casting, lamination, coating, welding, and decorating of thermoplastic and thermoset materials. Lecture/Lab: (2/3 hours per week), Credits: 3 hrs. Recommended prerequisite: CHEM 1100.

Prerequisites by topic:
Working knowledge of the periodic table, chemical reactions, compound formation, valence and bonding. (CHEM 1100 - General Chemistry I)


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Lab Instructor: Michael Schmidt, michael.l.schmidt@wmich.edu

<table>
<thead>
<tr>
<th>Course Objectives</th>
<th>Course Performance Criteria (department)(^1)</th>
<th>ABET/ETAC Outcomes(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify a logical potential polymer for a given plastic product.</td>
<td>(D3) List of series of appropriate polymers for a given well-defined application.</td>
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<td>2. Perform experiments with major forming, casting and molding processes found in the plastics industry</td>
<td>(C2) Determine the most appropriate process settings for a combination of process variables in a compression molding experiment.</td>
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<td>3. Define the dependent and independent processing variables found within plastics processes.</td>
<td>(C1) Correctly differentiate between dependent and independent variables in write-ups of the laboratory experiments.</td>
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<td>4. Identify the relationship between the chemical make-up of selected plastics and certain of their resulting physical and mechanical properties.</td>
<td>(B3) Determine the molecular weight of a mer given a chemical diagram of a polymer.</td>
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<td>5. Evaluate polymer materials and product disposal at the end of use.</td>
<td>(J1) Determine appropriate methods disposal processing of waste plastics based upon the makeup of the polymer(s) involved.</td>
<td>j*</td>
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<td>6. Correctly identify the plastics process used to manufacture a product from the attributes of the part.</td>
<td>(B4) Determine the process used to produce a plastic part, through deductive reasoning based strictly on product design attributes.</td>
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Performance Criteria\(^1\): EDMMS performance criteria may be found at http://www.wmich.edu/edmms
ABET/ETAC Outcomes\(^2\): Outcomes may be found at http://www.abet.org/
* Results tracked in ABET course notebook
<table>
<thead>
<tr>
<th>WEEK OF</th>
<th>LECTURE TOPICS</th>
<th>ASSIGNMENTS</th>
<th>LAB ACTIVITY</th>
</tr>
</thead>
</table>
| Week 1  | Course introduction  
Molecular weights & weight distributions | Chapter 4  
Modules 0 & 1  
Safety Guidelines | No lab meeting  
View E-learning demonstrations of Compression and Injection molding, Rotational, Slush & Dip Casting, Thermoforming, and Fluidized bed coating |
| Week 2  | Polymerization reactions | Chapter 3  
Module 2 | Discussion of lab write-ups, E-learning resources, plant tour setup & display guidelines, Synopsis guidelines, process variables and Lab Safety |
| Week 3  | Structure & compounds  
Additives | Chapter 7  
Module 3  
Industrial tour – prep (1%) due | Open lab  
IM – Group 1 & 2, PP |
| Week 4  | Colorants & Fillers | Synopsis (2%) due | Open lab  
IM – Group 3 & 4, PP |
| Week 5  | Reinforcements  
Test methods | Chapter 6 & 8 | Open Lab  
IM – Group 5 & 6, PP |
| Week 6  | Olefins  
Test 1 | Appendix E  
Module 4 (*Bring Activity to lecture)  
Display 1 follow-up letter (1%) due | First Displays (3%)  
Open Lab  
IM – Group 1 & 2, ABS |
| Week 7  | Commodity &  
*Specialty polymers  
**Engineering thermoplastics | Module 5 (Bring Activities 1* & 2** to lecture)  
Display 2 follow-up letter due  
Slush/dip lab (2%) due | Second Displays  
Open Lab  
IM – Group 3 & 4, ABS |
| Week 8  | *Thermoset resins  
Plastification | Appendix F  
Module 6 (*Bring Activity to lecture)  
Display 3 follow-up letter due  
Fluidized Bed lab (2%) due | Third Displays  
Open Lab  
IM – Group 5 & 6, ABS |
| Week 9  | *Extrusion systems  
Injection molding | Module 7 (*Bring Activity to lecture)  
Module 8 (videos 1 & 2)  
Chapter 13  
Display 4 follow-up letter due  
Thermoforming Memo (3%) due | Fourth Displays  
Open Lab  
IIM – Group 1 & 2, PC |
| Week 10 | Test 2  
*Blow molding | Module 9 (*Bring Activity to lecture)  
Display 5 follow-up letter due  
Frisbee lab (2%) due | Fifth Displays  
Open Lab  
IM – Group 3 & 4, PC |
| Week 11 | Compression molding  
Other thermoset processes | Module 8 (video 3)  
Display 6 follow-up letter due | Sixth Displays  
Open Lab  
IM – Group 5 & 6, PC |
| Week 12 | *Thermoforming  
Castings & coating processes | Chapter 15  
Module 13 (*Bring Activity to lecture)  
Compression lab (4%) due | Open Lab |
| Week 13 | Decorating processes | Chapter 19  
Begin Module 16  
Rotational presentations (2%) due | Rotational Casting presentations |
| Week 14 | Environmental issues  
Final review & synthesis | Chapter 2  
Injection Comparison lab (4%) due | Comprehensive Lab Clean-up |
| Week 15 | Comprehensive Final Exam | |

*Indicates the module example parts are due at the class meeting after the lecture is actually presented.
Evaluation:
1. Lab experiments 22%
2. Industrial tour and display 5%
3. Reports and papers 3%
4. Modules & quizzes 12%
5. Attendance 4%
6. Test 1 14%
7. Test 2 14%
8. Final exam 16%
9. Identification exam 10%
100%

The grading scale for this course is as follows:
93-100 = A
89-92 = BA
83-88 = B
79-82 = CB
73-78 = C
69-72 = DC
63-68 = D<62 = E

Usage of Electronic Devices during Class
Cell phones are to be turned off or set to vibrate. They are to be placed either at the front of your desk or in a backpack or purse. Surfing the web, sending email, text messaging, talking on a cell phone, listening to an iPod or Mp3 player in class is prohibited.

Laboratory Projects:
Students in this class are required to do experiments in the following areas: compression molding, injection molding, rotational casting, dip or slush casting, fluidized bed coating, and thermoforming. Students will gain familiarity with the molding, casting and forming equipment used for these experiments. The primary purpose of this work is to gain an understanding of the relationship between process, product, and material variables.

Oral and Written Communications:
Each student will function as a member of a lab team for the duration of the semester. All lab experiments will be conducted and discussed as a group; however the write-up for each experiment must be done individually. Group communication and coordination will be evaluated during the presentation each group delivers to explain the inter-relationship of process and product that they observed during their plant tour. Precise, succinct, and thorough writing is required for each of the laboratory experiments, as well as the reports.

Academic Honesty
Experiments are best done as a group. Write-ups will be done as an individual. Failure to observe this directive will result in the penalties outlined in the University Policy on Academic Honesty. You are responsible for making yourself aware of and understand the University policies and procedures that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. The academic policies addressing Student Rights and Responsibilities can be found in the Undergraduate Catalog at http://catalog.wmich.edu/content.php?catoid=24&navoid=974.

If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s) and if you believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

You must make yourself aware of and abide by the “Western Michigan University Sexual and Gender-Based Harassment and Violence, Intimate Partner Violence, and Stalking Policy and Procedures” related to prohibited sexual misconduct under Title IX, the Clery Act and the Violence Against Women Act (VAWA) and Campus Safe. Under this policy, responsible employees (including instructors) are required to report claims of sexual misconduct to the Title IX Coordinator or designee
(located in the Office of Institutional Equity). Responsible employees are not confidential resources. For a complete list of resources and more information about the policy see [www.wmich.edu/sexualmisconduct](http://www.wmich.edu/sexualmisconduct). In addition, students are encouraged to access the Code of Conduct:
- Office of Student Conduct [www.wmich.edu/conduct](http://www.wmich.edu/conduct)
- Division of Student Affairs [www.wmich.edu/students/diversity](http://www.wmich.edu/students/diversity)
- University Relations Office [http://www.wmich.edu/registrar/calendars/interfaith](http://www.wmich.edu/registrar/calendars/interfaith)

**Academic Accommodation:**
Any student registered with Disability Services for Students (DSS) who would like to discuss accommodations for this class should contact the instructor of record in a timely manner. Students with documented disabilities who are not registered with DSS should call the office at (269) 387-2116 or visit [www.wmich.edu/disabilityservices](http://www.wmich.edu/disabilityservices). Students cannot request academic accommodations without scheduling an appointment and meeting with a DSS staff member. If a student does not register with DSS, their academic accommodations/modifications cannot be executed.

**Expectations for Attendance:**

**Excused Absences**
Each student is allowed to miss two (2) class periods without being penalized. These two (2) excused absences are provided as a buffer against family problems, weather, job and class conflicts. In the case of illness, WMU does not wish to have any student attend class if they suspect that they have the flu. Please email your instructor immediately to determine how assignments and tests will be handled.

The two (2) excused absences in no way relieve the student of any class responsibilities. The student is responsible for all missed materials and should review other class members' notes for lectures and demonstrations missed. Any assignment due on the day of an excused absence is considered due at the beginning of the next class period attended.

If sickness or other unforeseen circumstances prevent attendance, the student should email his/her instructor at the time of the absence.

**Unexcused Absences**
If more than two (2) classes are missed, a doctor's note or other documentation is required or the absence will be considered unexcused. The attendance grade will be reduced for each unexcused absence.

**Late Assignments**
Late assignments will be docked a substantial amount of if they are accepted at all. An assignment over 1 week late will require either Dr. Engelmann or Mr. Schmidt to determine if the assignment will be accepted and what additional penalty will be applied.

**Safety**
All students are expected to:
- conduct themselves in accordance with both departmental and college safety
- wear ANSI Z87.1 approved safety glasses at all times in the lab
- safely dispose of chemicals that can’t be recycled
- ONLY put WATER (and soap) in the sink!!
**Failure to follow safe procedures will result in a lower grade.**
Clean-up Responsibilities

Between five and ten minutes before the end of each class period, it is the responsibility of each class member to:
1. Place molded items in your locker or book bag
2. Return tools to tool cabinet or to designated location.
3. Return materials being worked on to locker or designated areas.
4. Brush machine or bench top clean of any waste materials.
5. Sweep the floor of the work area.

If each class member will do his/her part, then the laboratory will remain orderly, clean, safe, and a good environment in which to work.

Comprehensive laboratory clean-up is the last lab period. The laboratory will be returned to the same (or better) condition that existed on the first day of class. Failure to participate will result in loss of one full letter grade. If you are unable to participate at the scheduled time, you must arrange a mutually acceptable make-up time.

Materials to Be Provided by Students:
1. A shop coat or other protective clothing
2. ANSI Z87.1 approved pair of safety glasses
3. Padlock
4. Materials for group display & presentation

Prepared by: Paul Engelmann Date: March 2018