

# EDMM 3500

## PRODUCTION THERMOPLASTICS PROCESSING

### COURSE SYLLABUS

#### 2018-2019 Catalog Data:

Injection molding, blow molding, and extrusion. Effects of thermoplastic melt characteristics on product design and part quality. Effects of machine design, set-up, and operation on part cost and profitability. Overview of processing machinery including take-off and sizing equipment. Lecture/Lab: (2-3), Credits: 3 hrs. Prerequisites: EDMM 2500

#### Prerequisites by topic:

1. Knowledge of the elements of plastication. (EDMM 2500 - Plastics Properties and Processing)
2. Basic understanding of extrusion, injection molding, and blow molding. (EDMM 2500)
3. Working knowledge of the parts of the injection molding cycle. (EDMM 2500)
4. Ability to correctly differentiate independent and dependent process and product variables. (EDMM 2500)

#### Textbooks:

- Engelmann, P. V. & Shoemaker, J. M. (2018). Production thermoplastics processing. (Lecture/lab manual).
- Regloplas (Ed). (2007). Temperature Control by means of fluid media 5<sup>th</sup> Ed.
- Reiloy Westland Corporation. (2012). Cylinder & screw handbook.  
[https://www.plastixs.com/system/documents/docs/000/000/635/original/9th\\_Edition\\_Handbook\\_Reiloy\\_Westland\\_N.pdf?1428510267](https://www.plastixs.com/system/documents/docs/000/000/635/original/9th_Edition_Handbook_Reiloy_Westland_N.pdf?1428510267)

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**Laboratory Instructor:** Jay Shoemaker (269) 276-3347, [Jay.Shoemaker@autodesk.com](mailto:Jay.Shoemaker@autodesk.com)

Course Objectives	Performance Criteria (department) <sup>1</sup> Course	ABET/ETAC Outcomes <sup>2</sup>
1. Understanding how to improve process stability application of plastication principles.	(B3) Correctly identify stable plastication from a normal shear rate curve.	b
2. Understand the integrated systems within injection, extrusion, and blow molding.	(A1) Set up and operate injection molding and extrusion production equipment.	a
3. Understand the role of different types of auxiliary equipment as related to plastics processing.	(A1) Set up and operate auxiliary equipment as an integral part of the primary processing system	a
4. Identify the root causes of molding defects (faults) and how they can be corrected.	(F1) Correctly identify the root cause of a given molding fault, and at least one probable corrective action solely from the observation of a molded product.	f
5. Know the importance of molding safety as it relates to mechanical and electrical safeguarding of manufacturing personnel.	(I1) Safely operate industrial plastics processing equipment without causing injury or putting anyone at risk	i
6. Function as a member of a team to set up production equipment and collect process data.	(E3) Participate as an equal team member in the process of setting up equipment, gathering data and shutting down production.	e

**Performance Criteria<sup>1</sup>:** EDMMS performance criteria may be found at <http://www.wmich.edu/edmmms>

**ABET/ETAC Outcomes<sup>2</sup>:** Outcomes may be found at <http://www.abet.org/>

<i>WEEK OF</i>	<i>LECTURE TOPICS</i>	<i>ASSIGNMENTS</i>	<i>LAB ACTIVITY</i>
<b>Week 1</b>	Course Intro Synopsis guidelines Plastication		No lab
<b>Week 2</b>	Screws & Barrels	“Cylinder & Screw Handbook”	Toshiba Demo Motan Demo
<b>Week 3</b>	Extrusion	<b>Synopsis (3%) Due</b>	Extrusion Pelletizing Demo
<b>Week 4</b>	Down-Stream Equipment		Cincinnati & Mold Change Demo
<b>Week 5</b>	Injection Molding Overview Non-Return Valves & Nozzles	"How to Track a Perfect Part" <b>Exam Questions Due</b>	Blown Film Demo
<b>Week 6</b>	<b>Test 1</b> Clamping Mechanisms	TBD	Open Lab
<b>Week 7</b>	Machine Sizing Scientific Molding	TBD	Open Lab
<b>Week 8</b>	Molding Faults	“Moisture Splay” <b>Exam Questions Due</b>	Open Lab
<b>Week 9</b>	Specialty Injection Processes <b>Test 2</b>		Open Lab
<b>Week 10</b>	Auxiliary Equipment	<b>Lab Report (6%) Due</b> “Temperature Control . . .”	Sheet Demo
<b>Week 11</b>	Extrusion Blow Molding	<b>Lab Report (6%) Due</b>	Sheet Lab group 1
<b>Week 12</b>	Injection Blow Molding Stretch Blow Molding	<b>Lab Report (6%) Due</b> “Blow Molding Comparison”	Sheet Lab group 2
<b>Week 13</b>	Design & Process Integration	<b>Lab Report (6%) Due</b> <b>Exam Questions Due</b>	Sheet Lab group 3
<b>Week 14</b>	Final Exam Review	<b>Sheet Lab Report (6%) Due</b>	Lab Clean-up
<b>Week 15</b>	<b>Comprehensive Final Week 1</b>		

**Evaluation:**

1. Laboratory Experiments	
Five Lab Reports	30%
2. Synopsis	3%
3. Homework & Quizzes	6%
4. Test 1	16%
5. Test 2	16%
6. Final Exam	19%
7. Molding Defect Analysis Exam	6%
8. Attendance	4%
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	100%

The grading scale for this course is as follows:

93-100 = A    83-88 = B    73-78 = C    63-68 = D  
 89- 92 = BA    79-82 = CB    69-72 = DC    <62 = E

**Laboratory Projects:**

Students in this class are required to do a series of pilot-scale experiments in injection molding and extrusion. Students will gain familiarity with injection molding presses, extruders, down-line extrusion equipment and peripheral equipment used for these experiments as the primary purpose of this work is to gain an understanding of the relationship between independent variables, dependent variables and sources of experimental error.

**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 back pack 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.

**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 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>

### **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. Shoemaker to determine if the assignment will be accepted and what additional penalty will be applied.

### **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 are unable to participate at the scheduled time, you must arrange a mutually acceptable make-up time.

### **Safety**

All students are expected to:

- conduct themselves in accordance with both departmental and college safety
- wear ANSI 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.**

### **Materials to Be Provided by Students:**

1. A shop coat or other protective clothing
2. ANSI approved pair of safety glasses
3. Padlock

Prepared by: Paul Engelmann

Date: March 2018