

IME 3500
PRODUCTION THERMOPLASTICS PROCESSING
COURSE SYLLABUS - Spring 2012

2011-2009 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: IME 2500

Prerequisites by topic:

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

Textbooks:

Engelmann, P. V. (2007). Production thermoplastics processing. (Lecture/lab manual).

Richardson, P. N. (1974). Introduction to extrusion. Brookfield, CT: Society of Plastics Engineers.

References: American Psychological Association. (2009). Publication manual of the American Psychological Association, 6th ed.

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Laboratory Instructors: Dan Switzer, (269) 565-8797 (7:00 AM -4:00 PM), daniel.j.switzer@gmail.com
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Course Objectives	Performance Criteria (department) ¹ Course	ABET/TAC Outcomes ²
1. Understand the physical and chemical bases for plastication.	(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) Demonstrate the safe operation of processing equipment by producing sample parts 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
7. Collect and distill a large amount of technical information into a usable document.	(G1) Collect thorough information using a comprehensive array of references drawn from sources, both inside and outside current university library holdings to improve some element of thermoplastics processing	g

Performance Criteria¹: IME performance criteria may be found at <http://www.wmich.edu/ime>

ABET/TAC Outcomes²: Outcomes may be found at <http://www.abet.org/>

* Results tracked in ABET course notebook

<i>WEEK OF</i>	<i>LECTURE TOPICS</i>	<i>ASSIGNMENTS</i>	<i>LAB ACTIVITY</i>
January 9	Course Intro Synopsis guidelines Plastication Research Paper Planning	"A review of literature..."	Newbury Demo Motan Demo Lab Notebook Discussion
January 16	MLK Observation Screws & Barrels	Synopsis (3%) Due Westland Screw and Barrel Guide http://www.westlandusa.com	Extrusion Pelletizing Demo
January 23	Extrusion	Richardson Ch. 1-6 Research Paper Topic Due	Library Research Tools @ Waldo Library
January 30	Down-Stream Equipment	Richardson Ch. 7-15	Blown Film Demo
February 6	Injection Molding Overview Non-Return Valves & Nozzles	TBD	85 Ton VanDorn Operation Open Lab
February 13	Clamping Mechanisms Machine Sizing	TBD	Sheet Lab group 1 Open Lab
February 20	Scientific Molding	TBD	Sheet Lab group 2
February 27	Mid-term Exam (23%)	Lab Notebook (2%) Due	Cincinnati Operation
March 5	Spring Break		
March 12	Molding Faults	Splay article Research Paper (18%) Due	Mold Change Demo
March 19	Specialty Injection Processes Material Handling Auxiliary Equipment	Lab Report (4%) Due	Open Lab
March 26	Extrusion Blow Molding	"Temperature Controllers" Sheet Lab Report (4%) Due	Open Lab
April 2	Injection Blow Molding Stretch Blow Molding	Lab Report (4%) Due	Open Lab
April 9	Design & Process Integration	Lab Report (4%) Due	Open Lab
April 16	Final Exam Review	Lab Report (4%) Due	Lab Clean-up
April 23	Comprehensive Final (24%) -- Wednesday, April 25 @ 12:30 p.m. – 2:30 p.m.		

Evaluation:

1. Laboratory Experiments	
Five Reports	20%
Lab Notebook	2%
2. Reports and Papers	21%
3. Homework & Quizzes	4%
4. Mid-Term Exam	23%
5. Final Exam	24%
6. Molding Defect Analysis Exam	4%
7. Participation	2%
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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.

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, discussed and written as a group. Group problem solving and interpersonal communication will play a critical role in the depth of understanding each student gains from these experiences. Precise, succinct, and thorough writing is required for all these reports.

Expectations for Participation:Usage of Electronic Devices during Class

Cell phones, PDA's and Blackberries 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. As there is now conclusive data that taking notes on a standard laptop not only lowers the performance of the student using it, but also of those sitting next to and behind the student, laptops may no longer be used during lectures. However, laptops are encouraged for data collection and report activities in the lab. Surfing the web, sending email, text messaging, talking on a cell phone, listening to an iPod or Mp3 player in class is prohibited.

Excused Absences

Each student is allowed to miss **two** class periods without being penalized. These **two** excused absences are provided as a buffer against bad weather, illness, family problems, 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 or other serious contagious illness.

These two (2) excused absences in no way relieve you of any class responsibilities. You are responsible for all missed materials such as handouts 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 you attend.

If sickness or other unforeseen circumstances arise to prevent class attendance, please email your instructor immediately to determine how assignments and tests will be handled.

Unexcused Absences

If more than one (1) class period is missed, a written doctor's excuse is required or the absence is considered unexcused.

Late Assignments

Assignment due dates will be posted and assignments must be handed in on those dates. These dates may be changed for the entire class, but dates will not be changed to meet the needs of an individual student. Late assignments will be docked a substantial amount of points (at least 10%), if they are accepted at all.

Academic Honesty

Experiments are best done with others 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 understanding the policies and procedures in the Undergraduate and Graduate Catalogs that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. [The policies can be found at <http://catalog.wmich.edu> <<http://www.wmich.edu/catalog>> under Academic Policies, Student Rights and Responsibilities.] 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). 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.

Clean-up Responsibilities

At the end of each class period, it is the responsibility of each class member to:

1. Label any products that have been produced and put them in a locker or designated location.
2. Return tools to tool cabinet or to designated location.
3. Return materials to the designated areas.
4. Brush machine(s) clean of any resin pellets and wipe up any hydraulic oil.
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.

NOTE: The last lab period of this class is designated as a comprehensive laboratory clean-up. This time is set aside in each plastics lab class to return the laboratory to the same (or better) condition that existed on the first day of class. Failure to participate in the activity will result in loss of **one full letter grade** in this class. If the student is unable to participate at the scheduled time, special arrangements should be made with the Instructor to establish a mutually acceptable make-up time.

Safety

All students are expected to conduct themselves in accordance with both Departmental and College safety guidelines while in class. Furthermore, students are required to wear their ANSI safety glasses at all times while in the laboratory.

Students **must** comply with safe disposal procedures for all chemicals that cannot be recycled. Procedures are outlined in the departmental Hazardous Materials Policy. Failure to follow safe procedures will result in a lower grade.

Research/Literature Review:

The research is designed to allow the student to explore an area of particular interest. There are,

however, several parameters for acceptability of the project.

1. The area of study must constitute a part of thermoplastics extrusion or molding technology and must be approved by your professor.
2. Literature Reviews are to be a maximum of seven (7) pages double-spaced with 1" margins including figures and illustrations.
3. A minimum of eight (8) references must be **cited** in the paper using APA format.
4. Other specific formatting instructions are found at:
https://www.4spe.org/sites/default/files/write_now09.pdf

Materials to Be Provided by Students:

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

Prepared by: Paul Engelmann

Date: January 2012