

IME 4590
MOLD DESIGN & CONSTRUCTION
COURSE SYLLABUS - Fall Semester 2009

2009-2010 Catalog Description:

Mold and die design, processing and part requirements, molded holes and undercuts, threads, tool-making processes, tooling materials, special fixtures. Mold and die construction using a wide range of cavity production methods. Computer analysis of temperature, pressure, and filling characteristics of a mold. Lecture/Lab: (2 - 3), Credit: 3 hrs, Prerequisites: IME 2500 & IME 2540

Prerequisites by topic:

- An understanding of the product attributes and process design differences among the major plastics processes. (IME 2500 - Plastics Properties and Processes)
- A basic understanding of the different types of tooling used to form plastics. (IME 2500)
- An understanding of the various machining processes. (IME 2540 – Machining Processes)

Texts:

- Kazmer, D. O. (2007). Injection mold design engineering. Hanser. Munich, Germany. (TB)
- Mold Design and Construction (lecture/lab supplement), 2009. (LM)
- Engelmann, P. & Dealey, R. (2000). Injection mold design guidelines: Maximizing performance using copper alloys - Reprint of a nine part series. Modern Mold and Tooling. New York: Copper Development Association. (CDA)
- Dealey, R. (2006). Injection Mold Design Interactive Tutorial (RD)

Reference:

- Shoemaker, J. M. (Ed.). (2006). Moldflow Design Guide. Munich: Hanser.

Course Coordinator & Lecture Instructor:

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Laboratory Instructors:

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Objectives ¹:

At the end of the semester the student should be able to:

1. Correctly apply design parameters to molds, dies, and tooling for plastics processing. (D)
2. Identify and explain the function of component parts of molds, dies, and tooling for plastics. (A)
3. Correctly specify mold and die construction materials based on the demands of the given application. (F)
4. Understand the strengths and weaknesses of different methods of cavity generation. (A)
5. Predict, simulate, and understand a plastics' flow characteristics within a mold. (B & C)
6. Calculate basic requirements of mold and die components. (F)

¹ Upper case letters in the parentheses at the end of each objective refer to the TAC of ABET (ET2K).

Week of	Lecture topics	Assignments	Lab activity
Sept 7	Course Introduction Processing Overview	TB <i>Ch 1, Ch 6.1-6.5</i> LM <i>Ch 2 "Design Principles"</i> LM <i>Ch 3 "Introduction to Synergy"</i> LM <i>Ch 4 "Gate Placement"</i> CDA <i>Article #1</i>	Moldflow Design Principles Moldflow Demo Gate Location Assignment
Sept. 14	Flow characteristics Types of injection molds Mold components	TB <i>Ch 7, Ch 8</i> LM <i>Ch 5 "Molding Window Analysis"</i> CDA <i>Article #3</i> RD <i>Nomenclature - General Mold Terms, Mold Terms; Section 4</i> Gate Location Assignment (3%) Due at End	Molding Window Assignment Mold Doctor Assignment Open Lab
Sept. 21	Gating/Runners/Sprue Hot runner systems Valve gating systems	TB <i>Ch 12.2 Appendix B</i> CDA <i>Article #5</i> LM <i>Chapter 8 "Results Interpretation"</i> Mold Doctor: <i>Nomenclature - Runners and gates;</i> <i>Sections 40, 41, 42 & 43</i> Mold Doctor Gate Assignment (4%) Due	Mold Tear Down #1 (E-101) Open Lab
Sept. 28	Surface treatments, platings & coatings	TB <i>Ch 2, Ch4 all but 4.4, Ch 5</i> CDA <i>Article #8</i> LM <i>Ch 6 "Gate and Runner Design"</i> LM <i>"How to Select the Proper Mold Steel"</i> RD <i>Sections 6-9, 16-28, 33, 34 & 45</i> Molding Window Assignment (3%) Due	Mold Tear Down #2 (E-101) Support Pillar Assign Runner Sizing Assignment
Oct 5	Tool materials & Cavity generation Venting & Texture	TB <i>Ch 9</i> CDA <i>Articles # 2 & 6</i> LM <i>Ch 7 "Basic Packing"</i> RD <i>Section 30-32 & 35</i> Support Pillar Assignment (3%) Due	Packing Assign Open Lab
Oct. 12	Mold cooling	TB <i>Ch 11</i> RD <i>Section 46-48</i> Runner Sizing Assignment (3%) Due	Open Lab
Oct. 19	Ejection systems	RD <i>Sections 13 & 14</i> Packing assignment (4%)Due	Cooling Assign Open Lab
Oct. 26	Midterm Review Midterm Exam (25%)	CDA <i>#4 & 7</i>	Open Lab
Nov. 2	Mold actions Slides, lifters, hydraulic cores, etc	TB <i>Ch 13</i> RD <i>Nomenclature-Mold Actions; Sections 10-12</i> Cooling Assignment (4%)Due	Final Project Assign Open Lab
Nov. 9	Specialty tools Designed caused defects	Analysis of Mold Doctor Tutorial (4%) Due	Open Lab
Nov. 16	Extrusion Dies		Open Lab
Nov. 23	Blow Molds		Open Lab
Nov. 30		<i>"Know The True Cost of Your Molds"</i>	Open Lab
Dec 7	Synthesis Final review	Final Project (20%) Due	Review
Dec 17	Comprehensive Final (25%)	Thursday, December 17, 2009 @ 2:45-4:45 p.m.	

Evaluation:

1. Lab Projects & Drawings	40%
2. Homework & Quizzes	4%
3. Mold Doctor Assignment	4%
4. Mid-Term	25%
5. Final	25%
6. Participation	2%
Total	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

Performance Criteria ²:

The student should be able to:

Objective 1

- a. Correctly apply design parameters to mold and component drawings produced for this course. [2, 5]

Objective 2

- a. Correctly identify and explain the function of various mold components and elements either from a drawing, or when presented with such an item. [5]

Objective 3

- a. Be able to identify the factors most likely to affect material selection, and identify those factors for a given tooling component or element. [4]
- b. Specify several logical tooling materials, given the factors for a specific component or element. [4]

Objective 4

- a. List the strengths and weaknesses of a given method of cavity/core generation. [4]
- b. Use known strengths and weaknesses of cavity/core generation techniques to identify the techniques most appropriate for the production of a given component. [4]

Objective 5

- a. Use flow analysis software to simulate the behavior of molten plastics within a mold. [1, 4]
- b. Correctly interpret the results of a flow analysis. [1, 4]

Objective 6

- a. Calculate the distance between support pillars to achieve acceptable mold deflection. [2, 3]
- b. Calculate profile extrusion die dimensions required to optimize draw down and die swell. [3, 5]

² Numbers in brackets refer to the method of evaluation as listed in the previous section.

Laboratory Projects:

Students in this class are required to do a series of five plastic flow exercises requiring between 10 and 20 analyses to optimize key elements of plastic flow throughout the distribution system and the part cavity. Students will gain familiarity injection mold design practice by doing a comprehensive set of mold designs. These CAD designs will include all of the major tooling systems within an injection mold.

Expectations for Participation:

Usage of Electronic Devices during Class

Cell phones are to be turned off or set to vibrate. PDA's and Blackberries may be accessed for scheduling issues related to class. Laptops may be used for taking notes pertaining to the topic being discussed in the class at the time of use. Surfing the web, sending email, text messaging, talking on a cell phone, listening to an iPod or Mp3 player in class is prohibited.

Professional Meetings

As a part of class participation, each class member is expected to attend at least one Western Michigan Section meeting of the Society of Plastics Engineers (SPE). Transportation to meetings in Grand Rapids will be arranged prior to each meeting. Section meetings are on the second Tuesday of each month.

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 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 attended.

If sickness or other unforeseen circumstances prevent attendance, the student may call his/her instructor to leave a message.

Unexcused Absences

If more than two (2) class periods are missed, for illnesses other than flu, a written doctor's excuse is required or the absence will be considered unexcused. One third of the participation grade will be deducted for each unexcused absence.

Late Assignments

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

Academic Honesty

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://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.