MSE 441: METALS PROCESSING

Spring 2012

Instructor: Mohamed Aboukhatwa, 201C MSEB, 333-7946, mkhatwa@illinois.edu

Lecture: MWF 11-11:50 am, Room 4101 MSEB

Office Hours: R 3:00 - 5:00 pm
F 3:00 - 5:00 pm
Or by appointment

Website: http://compass.illinois.edu/

Required textbook: Principles of Metal Manufacturing processes, Beddoes and Bibby

Recommended books: (available at Grainger Library)

ASM Handbook, Desk Edition and vols. 1-20, Q.669.1Am35mabr (reference);
Manufacturing with Materials, L. Edwards, M. Endean, 670.42M4181995 (reserve);
Mechanical Metallurgy, Dieter, G. E., 3rd ed., 669.94D56m1986 (reserve)

Course Outline

1. Metal processing and manufacturing
   1.1 Materials used in manufacturing
   1.2 Primary manufacturing processes- steelmaking
   1.3 Primary manufacturing processes- aluminum production
   1.4 Secondary manufacturing
2. Solidification and casting processes
   2.1 Major casting techniques
   2.2 Solidification mechanism
   2.3 Solidification volume shrinkage
   2.4 Heat Transfer during solidification
   2.5 Casting defects
   2.6 Shape casting materials

3. Stress and strain during deformation (a limited review)

4. Bulk deformation processes
   4.1 Friction during bulk deformation
   4.2 Forging
   4.3 Extrusion and drawing
   4.4 Rolling

5. Sheet forming processes
   5.1 Formability
   5.2 Shearing
   5.3 Bending
   5.4 Stretch forming
   5.5 Deep drawing
   5.6 Effect of anisotropic sheet properties on formability

6. Powder metallurgy
   6.1 Powder production
   6.2 Powder characteristics
   6.3 Powder compaction
   6.4 Metal injection moulding

7. Machining
   7.1 Mechanical machining methods
   7.2 Nontraditional machining processes
8. Joining processes

  8.1 Welding
  8.2 Brazing
  8.3 Soldering

9. Heat treating and surface modification

  9.1 Phase equilibrium in Fe-C alloys
  9.2 Transformation of austenite
  9.3 Diffusional processes
  9.4 Flame and induction hardening
  9.5 Plating and thin film coating

# Topics not discussed in the required textbook

Grading: 20% Assignments*
  5% Quizzes‡
  35% Midterm exam** – Wednesday, March 14th (Tentative - topics 1 to 4)
  40% Final exam** – during Finals week (topics 5 to 9)

* Assignments should be handed in at the beginning of the lecture on the day indicated on the assignment sheet. Late assignments should be stamped by the department’s office and will be penalized 25% per day. Each student is allowed to submit only one assignment up to 2 days late without a penalty. For each assignment, only 1 or 2 problems may be graded but all are scored.

‡ Quizzes will be scheduled during regular lecture hours. Students will be informed of the quiz date one week in advance.

** Exams are closed book.