Schedule: MWF 11:00am–11:50pm in 4101 MSEB.

Course websites:

- Schedule, lecture slides, and gradebook: MSE441 website (Compass2g)
- Homework: Assignments will be provided via Compass2g
- Announcements and online discussion forums: MSE441 Spring 2020 on Piazza

Scope: Extraction, primary and secondary metallurgy, steel and aluminium making, casting techniques, solidification and heat transfer during casting, bulk metals shaping (forging, extrusion, drawing, rolling, sheet forming), powder metallurgy, additive manufacturing and metallic glass processing. Relationships between the processing of metals, the microstructures that are produced, and the behavior of metal components.

Objectives: Students will be able to explain how different processing routes yield different microstructures. Students will learn how to control processing parameters, how to avoid processing defects, and how fundamentals of physical metallurgy relate to processed bulk material. Students will calculate process parameters. Moreover, students will be able to apply empirical and theoretical models to metals processing.

Prerequisites: MSE406 as well as its prerequisites. *If you have not passed MSE406, please see the instructor before continuing.*

Instructor: Robert Maass (rmaass; 408B MSEB near the west stairwell)

Teaching Assistants: Quentin Rizzardi (qpr2)

Text: *Principles of metal manufacturing processes*, Beddoes and Bibby, Butterworth-Heinemann 1999.

Additional/Alternative Reading: *Manufacturing Processes and Systems*, Ostwald and Muoz, Wiley & Sons 1997. *Mechanical Metallurgy*, Dieter, McGraw-Hill 1986. *Steel Manual*, Verlag Stahleisen 2008. *ASM Handbook*, Desk Edition vols. 1-20. *Steels*, Honeycombe and Bhadeshia, Butterworth-Heinemann 2006. *An Introduction to Metallurgy*, Cottrell, Universities Press 1990.

Special accommodations: To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact their lecturer and the Disability Resources and Educational Services (DRES, disability.illinois.edu) as soon as possible, and no later than Jan. 31.

i>clickers: Quizzes will be administered in lectures using the i>clickers. The i>clicker remote may be purchased at any of the bookstores and must be registered on the MSE441 website on Compass2g, under the tab on the left menu "Register your i>clicker" **You need to register your i>clicker by Jan. 27, when the i>clicker roster will be synced for the last time**.

Course evaluation:

20%×(Homework) + 5%×(In-lecture i>clicker) +
30%×(Midterm) + 45%×(Final) = Total

Numerical total score corresponds to the following final grades:

A+ (98–100)	B+ (88–90)	C+ (78–80)	D+ (68–70)	
A (94–97)	B (84–87)	C (74–77)	D (64–67)	F (0–60)
A– (91–93)	B– (81–83)	C– (71–73)	D– (61–63)	

Homework (20%): Assignments will be available on Compass2g.

- Homework assignments are due **11:59 pm on their due date** See end of this document for detailed class schedule. Late submissions will not be accepted. Only PDF files will be considered for grading.

- You will receive a grade for ALL assigned homework problems. Your HW score will also appear in the grade book.

Lectures (5%): Prompt and regular attendance at lectures is required to obtain credit for i>clicker quizzes: 75% participation, 25% correctness.

Midterm and Final Exam (30% + 45%): Exam locations will be announced soon. The midterm is tentatively scheduled to take place on Mar. 13. If you are unable to attend an exam then you must inform your professor by email at the earliest possible opportunity. For non-emergency absences this notification must be at least *one week in advance*. **Bring your student ID to the exam, and arrive with sufficient time to sign in.**

The midterm is expected to cover lectures 1-21 (Metal processing and manufacturing; Solidification and casting processes; Review of Mechanical Behavior.); see also below.

Grade Reporting: All assessment scores are stored on the MSE441 website. Any errors in grade reporting appearing in the gradebook must be reported within 2 weeks of the due date of the assessment item or by the last day of class, whichever is earlier. If you have a missing grade for a homework, contact the *TA*. If you have a missing grade from an exam, or i>clicker, contact the instructor.

Obtaining help: The main two ways to obtain help are online at Piazza or in person at office hours. You can also speak with your professor briefly after lecture. Please do not send email directly to TAs or professors for routine help or absences. In cases of emergencies related to exams (e.g., illness) you should email your professor at the earliest possible opportunity.

Online Forum (Piazza): This class uses Piazza for all communication between the instructor, TAs, and students. Please visit MSE441 Spring 2020 on Piazza to register. The class link will take you to the current class page at any time. Official class announcements will be sent via Piazza, so you must register with an email address that you regularly check. If you desire, you can post anonymously on Piazza or make a private post just to the instructors (this should be done rather than emailing the professor directly). *Note that Piazza should be used to communicate with your instructors, rather than email.*

Office Hours: TA office hours will be held in MSEB 408F on Wednesdays between 3–5 pm. Please collect the key in the business office. The first hour (3–4pm) will be a time to meet up with fellow MSE441 students to work on homework problems or lecture material, and the second hour (4–5pm) will be staffed by a TA. Office hours will start Jan. 29. Do not ask TAs to work the homework problems before they are due; it is fine to ask specific questions on the details of your attempted solutions, or to work out problems that are similar to homework problems.

Absences: Excused Absence Request Form: illinois.edu/sec/7157716

1. Excuses from assessments will only be given in the following circumstances:
   (a) Illness.
   (b) Personal crisis (e.g., car accident, required court appearance, death of a close relative).
   (c) Required attendance at an official UIUC activity (e.g., varsity athletics, band concert).
   (d) Job interview, etc.
2. In all cases you must complete the online Excused Absence Request Form and upload a scan of the official written documentation explaining your absence.
3. In cases (a) or (b) an official excuse letter from the Dean on Duty must be submitted via the online form within 2 weeks of the due date of the missed assessment, but no later than reading day (May 7). In cases of extended or unusual illness, late submission of excuse documentation will be considered. See Student Assistance Center.

4. In case (c) an official letter from the designated university official must be submitted via the online form at least one week prior to the due date of the missed assessment.
5. In case (d) an copy of the invitation must be submitted via the online form.
6. If you will not be able to take an exam due to illness or any other reason, you must send an email to your professor at the earliest possible opportunity. Excused exams will be replaced by a weighted average of the other exam scores at the end of semester.
7. Notwithstanding the above, at the professor's discretion you may be required to make up any excused work or attend substitute instruction or assessment.

Academic Integrity, Harassment, and Discrimination: You are bound by the University Honor Code in this course. Any violation of the Honor Code will result in disciplinary action. In addition, harassment or discrimination of any kind will not be tolerated. Please report any concerns immediately to your professor.

Planned Course Topics:

1. Introduction.
2. Primary metals processing and manufacturing.
3. Secondary metals processing and manufacturing.
4. Solidification and casting processes.
5. Bulk deformation processes.
6. Sheet forming processes.
7. Powder metallurgy.
8. Additive manufacturing
9. Metallic glass processing

Calendar and Topics: The planned lecture schedule is displayed on the last page of this document. Chapter numbers on the lecture schedule are referring to the main lecture book by Beddoes and Bibby. Assignment due dates are also listed on the lecture schedule. Changes to schedule will be announced.

Planned Field Trip: In order to link the lecture material with real world processing, a field trip to a metals producer is planned. Details will follow. Note that guiding a full class through a manufacturing site requires significant logistical planning and company resources. The visit is planned on the basis of the roster count. **Participation is mandatory, and an unexcused absence will lead to a penalty of 0.5 percent points of your total final score.**

Changes to syllabus: May occur as deemed necessary by the professor; they will be announced.

	Assignments available	due	Chapter	Description
01 W Jan 22				No Class
02 F Jan 24			1.1-1.4	Logistics and Introduction
03 M Jan 27			1.1-1.4	Extractive Metallurgy
04 W Jan 29			1.1-1.4	Extractive Metallurgy
05 F Jan 31	HW1		1.5	Primary Iron and Steelmaking
06 M Feb 03			1.5	Primary Iron and Steelmaking
07 W Feb 05			1.5	Steelmaking
08 F Feb 07	HW2	HW1	1.5	Secondary Metallurgy - Refinement
09 M Feb 10			1.5	Secondary Metallurgy - Refinement
10 W Feb 12			1.6	Primary Aluminium Production
11 F Feb 14	HW3	HW2	1.7-2.2	Major Casting Techniques
12 M Feb 17			2.2	Major Casting Techniques
13 W Feb 19			2.3-2.4	Solidification Mechanisms
14 F Feb 21	HW4	HW3	2.3-2.4	Solidification Mechanisms
15 M Feb 24			2	Excercise Solidification
16 W Feb 26			2	Excercise Solidification
17 F Feb 28	HW5	HW4	2.3-2.4	Solidification Mechanisms
18 M Mar 02			2.5	Solidification and Heat Transfer
19 W Mar 04			2.5	Solidification and Heat Transfer
20 F Mar 06		HW5	2.6-2.7	Casting Materials and Bulk Deformation
21 M Mar 09	HW6		3	Review of Mechanical Behavior
22 W Mar 11			4.1-4.2	Bulk Deformation - Friction and Forging
23 F Mar 13		HW6	2	**Written Midterm, Lectures 1-21**
			— Spring break —	
24 M Mar 23	HW7		4.3	Forging
25 W Mar 25			4.4	Extrusion
26 F Mar 27		HW7	4.4	Extrusion
27 M Mar 30	HW8		4.5	Drawing
28 W Apr 01			4.5	Drawing
29 F Apr 03		HW8	4.6	Rolling
30 M Apr 06	HW9		4.6	Rolling
31 W Apr 08			4.6	Rolling
32 F Apr 10		HW9		**Field Trip Haynes**
33 M Apr 13			5.1-5.5.4	Sheet Forming
34 W Apr 15			4	Excercise Extrusion
35 F Apr 17	HW10		4	Excercise Rolling
36 M Apr 20				**Guest Lecture AFRL**
37 W Apr 22			5.4-5.6	Sheet Forming
38 F Apr 24		HW10	5.6-5.7	Sheet Forming
39 M Apr 27	HW11		6.1-6.4	Powder Metallurgy
40 W Apr 29				Additive Manufacturing
41 F May 01				**Guest Lecture Steel Dynamics**
42 M May 04				Metallic Glass Intro
43 W May 06		HW11		Metallic Glass Casting
T May 07				*Reading day*
May 08-15	**FINAL**		1–10, 12	Comprehensive Final Exam