Special Topics: Physical Metallurgy

EMA 6938 Section PMET
Class Periods: MWF, Period 5, and 11:45a – 12:35p
Location: WEIL 0279 and online
Academic Term: Fall 2025

Instructor:
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352-846-3373
MAE 221
Office Hours: TBD

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- TBD

Course Description
In-depth discussion of fundamentals of physical metallurgy and principles of microstructure evolution. 3 credit hours.

Course Pre-Requisites / Co-Requisites
EMA 3050 or instructor permission.

Course Objectives

a) to familiarize the student with those terms, concepts, and definitions (i.e. jargon) used to describe the properties and processes of common engineering metals.
b) to reacquaint the student with those fundamental principles of chemistry and physics which predetermine and control behavior of metals in response to external forces, whether mechanical, physical (electrical, magnetic, optical, thermal) or chemical in nature.
c) to develop a fundamental understanding of the relationships between material composition, structure, and properties resulting from synthesis, processing or service.
d) to develop an understanding of the testing procedures used to characterize some of the more common physical properties for engineering metals, and how these properties should be used when specifying conditions where optimum performance without failure can be expected.
e) to develop an understanding of the atomistic and defect structures, and how they result in the microstructure and influence the properties of metals.
f) to develop an understanding of the processes occurring in metals during heating that influence the microstructure and properties.
g) to develop an understanding of the effects of alloying of metals upon the microstructure and properties.

Required Textbooks and Software
No textbooks are required for this course. Course content will be captured in posted notes and videos. The following books may be helpful references.

- Physical Metallurgy Principles
  - Abbaschian, Abbaschian, and Reed-Hill
  - Any edition
  - 978-8131520697

- Phase Transformations in Metals and Alloys (This is my favorite metallurgy textbook.)
  - Porter and Easterling
  - Any edition

- 978-1420062106

Course Schedule
Course schedule is subject to change but will be kept up to date on Canvas.

Week 1-2: Remedial metallurgy (review of material from previous classes)
Week 3: Structure and bonding, intro to matlab
Week 4: Crystal defects, intro to mtex
Week 5: Characterization techniques
Week 6: Characterization techniques
Week 7: Anisotropy and orientation
Week 8: Dislocations and plasticity
Week 9: Midterm exam
Week 10: Grain boundaries
Week 11: Annealing
Week 12: Complex phase diagrams
Week 13: Phase diagrams and microstructure
Week 14: Diffusion
Week 15: Prepare for final exam

Attendance Policy, Class Expectations, and Make-Up Policy

- Group chat/discussions
  - This term we will be using a group chat for class discussion, with the platform decided during a poll on the first day of class. Rather than emailing questions to me or the TA, please post your questions in the discussion platform.
  - Once finalized, the discussion group and instructions to join will be posted to Canvas. All questions about course content/logistics and other non-private information should be in the discussion group.
- Homework
  - Homework will be assigned approximately weekly.
  - Homework will not be graded, but solutions will be posted
- Attendance and Absences
  - Attendance is not mandatory, but attending lectures or watching their recordings is the best way to get course content. A small portion grades are based on participation, which includes live participation in class and participation in the online discussion board.
  - If you are sick (with covid or mental health stuff or anything else) please let me know! I can work with you if I know, but I'm not psychic.
  - Verification of an absence may be required in extreme circumstances, e.g. missing a midterm exam with no notice. Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.
- "Quizzes"
  - Unannounced quizzes (approx. 10 minutes duration) will be given periodically via Canvas. They will be primarily graded for completion, and I will go over the answers in class.
  - The lowest quiz grade will be dropped.
  - The quizzes are meant to show me what concepts the class is struggling with.
- Extra Credit
  - Students that make a useful demo that I can use in class will receive up to five extra credit points (based on demo quality) to be assigned to the lowest homework grade. "Standard" projects will receive 3 points, with additional points awarded for exceptional work and points detracted for sub-par work. In order to receive credit, student must provide a typed description of the class concept being demonstrated (minimum of a half page single spaced). Within reason, there is no maximum

number of demos a student can submit. Extra credit will be accepted until the last day of classes. A maximum of one demo per week per student will be accepted.
    - Students giving helpful advice in the group chat (not just giving the answers, but actually helping) will also be awarded bonus points.
    - Additional opportunities for extra credit may be announced during lecture.
- Be Nice!
    - Incivility toward students, staff, or faculty will not be tolerated.
    - If you'd like me to call you by a different name, different pronouns, etc. just let me know!

Evaluation of Grades

Assignment	Percentage of Final Grade
Quizzes + participation	25%
Midterm Exam 1	10%
Midterm Exam 2	15%
Final Exam	20%
Project	30%
	100%

Grading Policy

Percent	Grade	Grade Points
93.0 - 100.0	A	4.00
90.0 - 92.9	A-	3.67
87.0 - 89.9	B+	3.33
83.0 – 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 – 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

UF General Academic Policies & Resources (Honor Policy, DRC, Academic and Health Resources): https://go.ufl.edu/syllabuspolicies
Graduate Level Academic Policies and Regulations (Attendance and Grading policy): https://gradcatalog.ufl.edu/graduate/regulations/

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: https://go.ufl.edu/syllabuspolicies. Instructor-specific guidelines for courses must accommodate these policies.

Commitment to a Positive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

• Your academic advisor or Graduate Coordinator
• HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
• Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu