

Physical Metallurgy I
EMA 4120
Class Periods: MWF Period 5, 11:45a -12:35p
Location: WEIL0279
Academic Term: Fall 2025

Instructor:

Victoria Miller (she/her/hers)

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(352) 846-3373

221 MAE

Office Hours: TBD by poll of class

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.

Materials and Supply Fees

N/A

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Low
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare,	High

as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	Medium
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Low
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

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

Required Computer

Recommended Computer Specifications: <https://it.ufl.edu/get-help/student-computer-recommendations/>
 HWCOE Computer Requirements: <https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/>

Course Schedule

Week 1-2: Remedial metallurgy (review of material from previous classes)
 Week 3: Structure and bonding
 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: Solidification (pure metals and alloys)
 Week 12: Diffusional solid-state transformations
 Week 13: Diffusionless transformations
 Week 14: Engineering performance of metals
 Week 15: Prepare for final exam

Important Dates

Sep 10	Midterm 1 (in class)
Week 9	Take-home Midterm 2
Finals Week	Take-home Final Exam

Attendance Policy, Class Expectations, and Make-Up Policy

- Group chat/discussions
 - This term we will be using a Canvas discussions. Rather than emailing questions about the course content to me or the TA, please post your questions in the discussion platform.
 - All questions about course content/logistics and other non-private information should be in the Canvas Discussions.
 - Extra credit may be given to students who are helpful to others in the Canvas Discussion platform.
- Homework
 - Homework will be assigned approximately every 2 weeks.
 - Late homework (and other assignments) will be accepted until the solutions are posted with 10% of the total points deducted for each day (or part thereof) late. Exceptions to this late policy (e.g., exams) will be announced in class and recorded in OneNote.
- 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 physical 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 in class or via Canvas. They will be primarily graded for completion, and I will go over the answers in class.
 - 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, the 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 Canvas Discussions (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
Homework	20%
Quizzes + participation	15%
Midterm Exam 1	10%
Midterm Exam 2	15%
Final Exam	20%
Project	20%
	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

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/syllabuspolices>. 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, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate 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