

**EMA 4120 Physical Metallurgy I**  
**Section 3006—Fall Semester 2014**  
**Instructor: Burton Patterson**

1. Catalog Description: An in-depth discussion of fundamentals of physical metallurgy and microstructure evolution. Credits: 3 hours.
2. Pre-requisites: EMA 3050- Introduction to Inorganic Materials
3. 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.
4. Contribution of course to meeting the professional component - This is a 3 credit course. It provides 3 credits towards engineering sciences.
5. Relationship of course to program outcomes - This course addresses the following MSE Program outcomes (note: Numbers refer to the list of MSE Program outcomes found at <http://mse.ufl.edu/students/prospective/undergraduate.html#outcomes>):
  1. Ability to apply knowledge of mathematics, science, and engineering to materials systems. (Low coverage)
  4. Ability to apply and integrate knowledge of structure, properties, processing, and performance to solve materials selection and design problems within realistic constraints. (High coverage)
  6. Ability to identify, formulate, and solve engineering problems. (Medium coverage)
  8. Ability to communicate effectively in both oral and written form. (Medium coverage)
  9. Understanding of the economic impact of engineering solutions. (Low coverage)

10. Understanding of the global, societal, and environmental impact of engineering solutions. (Low coverage)
12. Knowledge of contemporary issues. (Medium coverage)
13. Ability to use the techniques, skills, and tools needed for practice as a materials engineer. (Low coverage)

**6. Instructor: Burton R. Patterson**

- a. **Office: 223 MAE**
- b. **Telephone: 352-846-3781**
- c. **E-mail address: patters@mse.ufl.edu**
- d. **Office hours: Tues & Thurs 11am-noon, or by appointment**

**7. Teaching Assistant - none**

**8. Class Times: MWF Period 5 (11:45am-12:35 pm)**

**9. Laboratory: None**

**10. Class Location: MAEB 234**

**11. Materials and Supplies Fees: None**

**12. Textbooks Required**

- a. **Title: *Physical Metallurgy Principles***
- b. **Author: Reza Abbaschian, Lara Abbaschian, Robert E. Reed-Hill,**
- c. **Publisher: Cengage Learning**
- d. **Publication date and edition: 2010/1994, Fourth Edition**
- e. **ISBN number: 13: 978-0-495-43851-9; 10:0-495-43851-0**

**13. Recommended Reading: Per instruction during course.**

**14. Course Outline (flexible as needed)**

- a. August 25: Introduction to course and metals
- b. Aug 27-29: Review of Metal Properties
- c. Sept 1: Labor Day (No class)
- d. Sept 3-5: Chapter 1-Structure of Metals
- e. Sept 8-12: Chapter 2-Analytical Methods
- f. Sept 15-17: Chapter 3-Crystal Binding
- g. Sept 19-24: Chapter 4-Dislocations
- h. Sept 26-29: Chapter 5- Plastic Deformation
- i. Oct 1,3: Chapter 6- Grain Boundaries, Test 1 review
- j. Oct 6: Test #1
- k. Oct 8-10: Chapter 7-Vacancies
- l. Oct 13-15: No class (tentative!)
- m. Oct 17: Homecoming (No class)
- n. Oct 20 Chapter 7-Vacancies
- o. Oct 22-29: Chapter 8-Annealing

- p. Oct 31-Nov 5: Chapter 9-Solid Solutions, Test 2 review
  - q. Nov 7- Test #2
  - r. Nov 10-12: Chapter 10-Phases
  - s. Nov 14-21: Chapter 11-Binary Phase Diagrams
  - t. Nov 24: Chapter 12 -Substitutional Diffusion
  - u. Nov 26-28: Thanksgiving (No class)
  - v. Dec 1-3 Substitutional Diffusion (cont.)
  - w. Dec 5-8: Chapter 13-Interstitial Diffusion
  - x. Dec 10: Review for final exam (Test #3)
  - y. Dec 17, 3:00 pm-5:00 pm: Final Exam (on topics since Test #2)
15. Attendance and Expectations: Attendance is strongly encouraged, but will not be recorded. While attendance is not mandatory, experience has shown that those who attend lectures learn more and earn higher grades in the course. Arrival on time is expected. Turn off all telephones before entering classroom.
16. Grading –
- i. Test #1- 28%
  - ii. Test #2- 28%
  - iii. Test #3- 28%
  - iv. Homework and Pop Quizzes- 16%
- Homework is due at the end of class, but will be accepted at my office until 5pm of the date due. Homework will be graded and returned. Late homework will be accepted with a penalty. If lack of attention and preparation by the class is perceived by the instructor, pop quizzes will be used to force attention. A pop quiz will be handed out at the beginning of class and collected after the appropriate time for an answer, typically 10 minutes.
17. Grading Scale: 90-100 A, 88-89 A<sup>-</sup>, 85-87 B<sup>+</sup>, 81-84 B, 78-80 B<sup>-</sup>, 75-77 C<sup>+</sup>, 71-74 C, 68-70 C<sup>-</sup>, 65-67 D<sup>+</sup>, 61-64 D, 58-60 D<sup>-</sup>, <57 E). Top person in class adjusted to 96% and same shift applied to all student's grade. Grades awarded based on above scale. A C<sup>-</sup> will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C<sup>-</sup> average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>
18. Make-up Exam Policy: No exam make-up without **prior approval of instructor**.
19. Web Site: <https://lss.at.ufl.edu/>

The following will be posted on this site

- a. Power point files of the lecture materials
- b. Homework assignments and due dates
- c. Homework solutions
- d. Test dates and test solutions

- e. Important information about class schedule and revised schedule
  - f. Course syllabus
20. Honesty Policy – All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.
21. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.
22. UF Counseling Services –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
  - Career Resource Center, Reitz Union, 392-1601, career and job search services.
23. Software Use – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.