Physics of Metals Laboratory (MET-330L)
Class Syllabus Fall Semester 2007
Instructor: Dana J. Medlin, Ph.D., P.E., FASM
Office: Mineral Industries 104
Phone: 605-394-5133
Email: dana.medlin@sdsmt.edu

Course Description
1 Credit. The fundamental principles of physical metallurgy with an emphasis on the mathematical description of mechanisms that control the structure of materials. Topics covered are the structure of metals, x-ray diffraction, elementary theory of metals, dislocation theory, slip phenomena, grain boundaries, vacancies, annealing, and solid solutions.

Reference Textbooks (Recommended)

Instructor
Dr. Dana J. Medlin
Office: MI 104
Office Hours: 2:00pm – 3:00pm, M-W-F and other selected hours as posted on office door. Individual appointments may be scheduled at other times. Sending questions or comments via email will get the fastest response.
Office Phone: 605-394-5133
Email: dana.medlin@sdsmt.edu

Course Schedule
Laboratory meets every Thursday from 1:00pm – 4:00pm in Mineral Industries 124, 320 and various laboratories on campus from September 6 to December 13, 2007. One required field trip may be scheduled as a laboratory session.

Prerequisites
Students are required to understand the materials covered in MET 231/232 or equivalent. In addition students are required to have successfully completed calculus-2, general chemistry-1, general physics-1, or equivalent.

Course Objectives
A professional understanding of the relationship between microstructure and mechanical and physical properties of metals and alloys. Students that successfully complete the course requirements will understand and be able to explain the structure of metals, analytical measurement methods, crystallography, dislocation theory, elastic and plastic deformation, strengthening mechanisms, phase diagrams, and diffusion mechanisms of metals and alloys. A
basic understanding of the functionality of several metallurgical related laboratory testing and evaluation systems will be expected.

**Course Evaluation**
Laboratory Reports and Problems: 85%
Laboratory notes: 10%
Class attendance and participation/discussion: 5%

**Final Grade Assignment (%)**

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<th>Score Range</th>
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<tr>
<td>90 - 100</td>
<td>A</td>
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<td>80 - 89</td>
<td>B</td>
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<td>70 - 79</td>
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<td>&lt;60</td>
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**Attendance**
Attendance is mandatory for all laboratories due to the importance of open class discussions and explanations of laboratory equipment. Students who are ill should not attend class; however, it is necessary to contact the instructor prior to the absence via a telephone message or email to avoid penalties. Missed laboratory sessions will not be rescheduled. A student that has an excused absence will need to meet with the instructor and obtain the necessary data from other students.

**Late Policy**
Late assignments not submitted on the required day and time of day will be penalized 10% per weekday (not counting weekends and holidays), unless prior arrangements have been made with the instructor or by excused absence. Assignments should be submitted to me directly or to another appointed instructor. Do not slide assignments under my door or place them in my campus mailbox. If you are unable to locate me, please submit your assignment to the department secretary and ask her to date stamp the assignment.

**Cellular Telephones and Pagers**
In order to minimize distractions during lectures, please turn-off all cellular telephones and pagers or put them on a no-ring (vibrate) mode.

**Integrity Policy**
Everyone is required to do their own work, however many students can learn more efficiently by consulting with other students. Working together in study groups on homework assignments is acceptable when everyone is participating equally. Students involved with copying and plagiarism will receive no credit for that assignment.

**Special Needs**
Students with special needs or requiring special accommodations should contact the instructor (Dr. Medlin, contact information is above) and the campus ADA coordinator (Jolie McCoy, 394-1924) as soon as possible.
Archiving Assignments and Examinations
Some students may be asked to submit copies of their assignments and examinations for the department archival system for ABET evaluations. All submitted information is confidential.

Freedom in Learning Statement
Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Students who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should contact the dean of the college which offers the class to initiate a review of the evaluation.

Tentative Outline
X-Ray Diffraction Part-1: Fundamentals
X-Ray Diffraction Part-2: Quantitative Measurements (2 weeks)
Metallography Principles
Phase Identification Part-1
Scanning Electron Microscopy
Grain Size Refinement (2 weeks)
Heat Treatment of Steel and Hardenability (2 weeks)
Precipitation Hardening of Aluminum Alloys
Phase Identification Part-2 (2 weeks)
Semester Project (2 weeks)

Formal Industrial Reports
Write the report for readers with a broader background than what is expected for memorandum reports (see next section below).

Covering letter
Letter of transmittal will contain details of teaming efforts. Who on the team was in charge of the literature research and writing the introduction, which person was responsible for data reduction and preparation of data for publication, which person prepared the discussion and conclusion? If all were not in involved in editing, state whom in the team took responsibility for proof reading and preparing the final draft. All team members should be involved in the final review before submitting the report to the professor.

Summary
Be concise, 200 words or less, present primary objectives, how objectives were accomplished and the most important conclusions.

Introduction
Background information developed, usually from the literature research, to acquaint reader with the problem and the purpose for carrying out the work.

Experimental Procedure
Discuss the equipment used and any relevant details. For example, calibration of the equipment.
Experimental Results
Present the results in the appropriate form. For example, present the data as computations, as tabulated data or in figures (photographs or graphs).

Discussion of Results
The main point of the discussion is to determine if your experimental measurements have any correlation to measurements made by others. Are the results valid? Why? Were any problems encountered with the experiment design? Any relevant questions asked in the laboratory description should be addressed in this section.

Conclusions
Prepare very concise statements about the experiment. Possibilities are; what was learned, quality of the engineering data, problems with the experimental study and what improvements could be made if the experiment were repeated.

References
List reference in the order they are used in to report. Identify in the report where references are used. See examples below.

Appendices
Use an appendix for any computations or lengthy discussions that is important to the knowledge base, but would detract from the main flow of ideas in the report.

Tables
Tabulated Data. Tables may be embedded within the Experimental Results section.

Figures
Photographs, graphs or other artwork. Figures may be embedded within the Experimental results section.

Reference Examples
Place the references at the end of the written report. There are three types of references. There are several accepted formats. The goal is to assure the reader can find the reference in the library.

Technical Journals
Author: Journal, year, ser., vol., pp.

Books
Author: Book, edition, vol., page, Publisher, Place, Date.

Private Communications
Name: Date, Place, Address.