THE UNIVERSITY OF NEW SOUTH WALES

SCHOOL OF MATERIALS SCIENCE AND ENGINEERING

MATS 4133

DEFORMATION AND STRENGTHENING

Course Outline

Session 2, 2009

Course staff

Prof. Paul Munroe	EM Unit – B89	Consultation hours:
Lecturer	Phone: 9385 4435	By appointment
Stream 2	p.munroe@unsw.edu.au	

Timetable

Lecture/Tutorial	Day	Time	Location
Lecture	Monday	9-11AM	Quadrangle G035

Course Outline

1. Introduction
2. Revision of MATS4013
3. Point defects
4. f.c.c. materials
5. c.p.h. materials
6. Ordered alloys
7. Dislocation arrays
8. Temperature-strength relationships
9. Yield point phenomena
10. Solid solution strengthening
11. Second phase strengthening
12. Hall-Petch Effects
13. Work-hardening
14. Creep

The learning and teaching philosophy underpinning the course (based on UNSW Learning Guidelines)

- Students are actively engaged in the learning process.
  It is expected that, in addition to attending classes, students read, write, discuss, and are engaged in solving problems in deformation and strengthening

- **Effective learning is supported by a climate of inquiry where students feel appropriately challenged.**
  Problems involving **deformation and strengthening** are challenging; students will be given assignments that will motivate deep analysis of various phenomena in materials science and engineering.

- **Learning is more effective when students' prior experience and knowledge are recognised and built on.**
  The course is built on prior courses in mathematics, mechanical behaviour, dislocation theory, phase equilibria and crystallography.

- **Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts**
  Students will be asked to analyse the role of strengthening and dislocation theory in understanding the relationship between microstructure and properties in engineering materials

Course information

Units of credit	3
Parallel teaching involved in this course	None
How the course relates to other course offerings and overall program(s) in the discipline	This course will give intellectual framework for a number of materials science courses such as phase equilibria, phase transformation, crystallography, mechanical behaviour, kinetics and diffusion, and others.
Course aims	The aim of the course is to gain a detailed understanding of deformation mechanisms in metallic materials and the mechanisms of strengthening which operate in metals.
Graduate attributes which will be gained through the course	• Research, inquiry and analytical thinking abilities • Capability and motivation for intellectual development • Communication • Information literacy
Expected learning outcomes	*Students should gain:* • Enhanced critical thinking, analytical and problem solving skills in materials science and engineering • An understanding of dislocation theory and its application to a broad range of materials and materials behaviour • An understanding of the principles of strengthening in a range of materials

Teaching strategies	• Core concepts, theories and approaches to numerous problems concerning the dislocation theory, strengthening and phase transformations will be covered in lectures. Examples will be provided to demonstrate these principles in materials science and engineering. Where appropriate, a number of tutorial classes will be conducted to enhance problem solving skills with incomplete problems given as home work. • It is expected that students attending classes are prepared for discussion. • Teaching material, including the course outline, assignments, examples of solutions of problems, and course announcements are available on the Course Vista website.

Assessment	Assignments:	20%
	Combined Mid-session quiz	20%
	Combined final exam:	60%

Assignments will include three (3) problem sheets in stream 1 and 1 problem sheet in stream 2 in order to achieve learning outcomes and develop graduate attributes.

Assignments		**Issue**	**Submission**
Stream 1	Assignment 1	week 9	week 12

Penalties for Late Submission of Assignments

Assignments submitted after the deadline will receive a 10% of maximum grade penalty for every day late, or part thereof.

Note – All assignments must contain a completed student declaration sheet and will be due on the date specified above. Late submissions will not be accepted without adequate reason in writing. Marked assignments will be returned within two weeks of submission. Requests for special consideration must be submitted using the form available from the Student Desk in the Chancellery and must include medical certificates or other appropriate documents.

Mid-session exam – The aim of this exam is to assess students' skills in solving problems concerning deformation and strengthening and the application of these topics to materials science and engineering. It will be conducted in Week 7 or 8.

Final exam – This major exam will cover all aspects of the course consisting of formal lectures, nominated reading material (from course handouts) and assignments and will include a list of equations for stream 1. It will consist of a combination of essay-style answers and calculations. Any derivations will assume knowledge of the material rather than resorting equations to memory with relevant background equations provided.

Academic honesty and plagiarism

What is Plagiarism?

Plagiarism is the presentation of the thoughts or work of another as one's own.* Examples include:

- direct duplication of the thoughts or work of another, including by copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- piecing together sections of the work of others into a new whole;
- presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and
- claiming credit for a proportion a work contributed to a group assessment item that is greater than that actually contributed.†

For the purposes of this policy, submitting an assessment item that has already been submitted for academic credit elsewhere may be considered plagiarism.

Knowingly permitting your work to be copied by another student may also be considered to be plagiarism.

Note that an assessment item produced in oral, not written, form, or involving live presentation, may similarly contain plagiarised material.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does *not* amount to plagiarism.

The Learning Centre website is main repository for resources for staff and students on plagiarism and academic honesty. These resources can be located via:

www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- correct referencing practices;
- paraphrasing, summarising, essay writing, and time management;
- appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.

Individual assistance is available on request from The Learning Centre.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

* Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle

† Adapted with kind permission from the University of Melbourne.

Recommended Reference Materials

D.Hull and D.J.Bacon, *Introduction to Dislocations*, 3rd Ed., 1988
R.W.K.Honeycombe, *The Plastic Deformation of Metals*, 1968
G.E.Dieter, *Mechanical Metallurgy*, 3rd Ed., 1988
R.E.Reed-Hill and R. Abbaschian, *Physical Metallurgy Principles*, 1992
R.E. Smallman and R. Bishop, *Metals and Materials*, 1996
R.E. Smallman, *Modern Physical Metallurgy,* 1985.

Student Feedback and Continual Course Improvement

- We welcome feedback at all times on presentation of course materials and other course-related matters, and will be happy to discuss any issues raised in the lectures.
- You will be asked to provide evaluative feedback through the UNSW's Course and Teaching Evaluation and Improvement (CATEI) Process at the end of the course.
- Feedback from prior assessments will be discussed in lecture 1.

Students with Disabilities

Students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit (9385 4734 or www.equity.unsw.edu.au/disabil.html). Early notification is essential to enable any necessary adjustments to be made. Information on designing courses and course outlines that take into account the needs of students with disabilities can be found at: www.secretariat.unsw.edu.au/acboardcom/minutes/coe/disabilityguidelines.pdf

Administrative Matters

- Students must attend at least 80% of all classes.
- Students unable to attend the mid-session or final exam on the health grounds should make a request for special consideration by submitting the form available from the Student Desk in the Chancellery. Medical certificates or other appropriate documents must be included. Students should also advise the lecturer.