Course Outline

MATS6002

Fundamentals of Materials Design

Materials Science and Engineering

Science

T3, 2020

1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	A/Prof Dewei Chu	d.chu@unsw.edu.au	Room 244, School of Materials Science and Engineering (Building E10), by appointment	Phone: 9385 5090

2. Course information

Units of credit: 6

Pre-requisite(s):

Timetabling website: TBA

Teaching times and locations:

	Lecture	Lecture	Lecture
Day	Tuesday	Wednesday	Friday
Location	Online	Online	Online
Time	9:00-11:00	13:00-15:00	11:00-13:00
Weeks	1, 3, 5, 7-10	1-5, 7-10	1-5, 7-10

2.1 Course summary

This course covers a background on the relationship between materials structure and properties and hence the application of advanced engineering materials; including the elastic moduli, yield strength, tensile strength, hardness and ductility, fast fracture, toughness and fatigue, creep deformation and fracture, oxidation and corrosion, friction, abrasion and wear of materials.

2.2 Course aims

Students will gain an understanding of how the structure of a material can be manipulated through variations in processing conditions and how manipulation of structure leads to variations in materials properties.

2.3 Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. Demonstrate an understanding of the basic concepts of material microstructure and properties

2. Select the optimal methods and conditions for producing and processing materials
3. Identify different approaches taken to processing a specific component
4. Describe the economic drivers affect the processing of materials

2.4 Relationship between course and program learning outcomes and assessments

Course Learning Outcome (CLO)	LO Statement	Program Learning Outcome (PLO)	Related Tasks & Assessment
CLO 1	Demonstrate…	3	1, 3 & 4
CLO 2	Select…	3	2, 3 & 4
CLO 3	Identify…	2 & 3	1, 2, 3 & 4
CLO 4	Describe…	3	2, 3 & 4

3. Strategies and approaches to learning

3.1 Learning and teaching activities

(Based on UNSW Learning Guidelines)

- *Students are actively engaged in the learning process.*

  It is expected that, in addition to attending classes, students will read, write, discuss, and engage in analysing the course content.

- *Effective learning is supported by a climate of inquiry where students feel appropriately challenged.*

  Students are expected to be challenged by the course content and to challenge their own preconceptions, knowledge, and understanding by questioning information, concepts, and approaches during class and study.

- *Learning is more effective when students' prior experience and knowledge are recognised and built on.*

  Coursework, tutorials, assignments, laboratories, examinations, and other forms of learning and assessment are intended to provide students with the opportunity to cross-reference these activities in a meaningful way with their own experience and knowledge.

- *Students become more engaged in the learning process if they can see the relevance of their studies to professional and disciplinary contexts*

  The course content is designed to incorporate both theoretical and practical concepts, where the latter is intended to be applicable to real-world situations and contexts.

Lectures: The core concepts will be taught in lectures, students will have access to the lectures notes before class for annotation during the lecture. Students will be engaged in the learning process through class discussions and problem-solving questions independently and working together with partners and groups.

3.2 Expectations of students

- Students must attend at least 80 % of all classes with the expectation that students only miss classes due to illness or unforeseen circumstances
- Students must read through lecture notes and lab sheets prior to class
- During class, students are expected to engage actively in class discussions
- Students should work through lecture, tutorial and textbook questions
- Students should read through the relevant chapters of the prescribed textbook.
- Students should complete all assessment tasks and submit them on time.
- Students are expected to participate in online discussions through the Moodle page

4. Course schedule and structure

This course consists of 54 hours of class contact hours. You are expected to take an additional 98 hours of non-class contact hours to complete assessments, readings and exam preparation spread over the term.

Week	Topics	Activity
1	Introduction Atomic structure and interatomic bonding	
2	The structure of crystalline solids	
3	Imperfections in solids	
4	Mechanical properties of metals Dislocation and strengthening mechanisms	
5	Fast fracture Revision	Portfolio assignment
6		
7	Fatigue, creep and creep fracture	Mid-term exam
8	Kinetic theory of diffusion Oxidation of materials	
9	Wet corrosion of materials Friction and wear	
10	Case study: materials and energy design/Revision Presentations for Assessment Task	Report and Presentation

5. Assessment

5.1 Assessment tasks

Assessment task	Description	Weight	Due date
Portfolio Assignment:	Students are required to submit a revised version of an online portfolio about several activities in weeks 1-5 on mechanical materials design	20%	Week 5
Report and Presentation:	Students will be required to conduct research on a topic involving materials, properties, design parameters, performance, and/or failure. Requirements -A formal document, written to professional standard -A formal presentation	20%	Week 10
Mid-term exam:	1 hr exam, held in class covering the following topics atomic structure and bonding, structure of crystalline solids, imperfections, mechanical properties	15%	Week 7
Final exam:	2 hr exam covering the following topics mechanical properties, dislocations, strengthening, fracture, creep deformation and fracture, oxidation and corrosion, friction, abrasion and wear	45%	Final exam period

Further information

UNSW grading system: https://student.unsw.edu.au/grades

UNSW assessment policy: https://student.unsw.edu.au/assessment

5.2 Assessment criteria and standards

Assessment criteria and standards for each assessment tasks are available on the course Moodle page.

Students who fail to achieve a score of at least 40% for the overall exam component (i.e., mid-session exam and final exam marks combined), but achieve a final mark >50% for the course, will be awarded a UF (Unsatisfactory Fail) for the course.

Please refer to the UNSW guide to grades: https://student.unsw.edu.au/grades

Rules governing conduct during exams are given at: https://student.unsw.edu.au/exam-rules

5.3 Submission of assessment tasks

- UNSW operates under a Fit to Sit/ Submit rule for all assessments. If a student wishes to submit an application for special consideration for an exam or assessment, the application must be submitted prior to the start of the exam or before an assessment is submitted. If a student sits the exam/ submits an assignment, they are declaring themselves well enough to do so. Information on this process can be found here: https://student.unsw.edu.au/special-consideration. Medical certificates or other appropriate documents must be included. Students should also advise the lecturer of the situation.

- Unless otherwise specified in the task criteria, all assignments must be uploaded via Moodle prior to the due date for submission.
- Assignments/lab reports submitted after the due date for submission will receive a 10% of maximum grade penalty for every day late, or part thereof.
- 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 coordinator prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equity and Diversity Unit: https://student.unsw.edu.au/disability. Early notification is essential to enable any necessary adjustments to be made.

5.4. Feedback on assessment

Assignments: Feedback will be given two weeks after submission of the assignment and take the form of the mark for the assignment, overall comments on how the class performed, any common areas that were not answered correctly. Additionally, personal feedback and how each student performed may be given.

Midsession exams: Students will receive their marked exams indicating what questions were answered correctly and incorrectly. Overall comments and worked solutions may be provided to the class.

Final exam: Students will receive their final mark

6. Academic integrity, referencing and plagiarism

Referencing is a way of acknowledging the sources of information that you use to research your assignments. You need to provide a reference whenever you draw on someone else's words, ideas or research. Not referencing other people's work can constitute plagiarism.

Further information about referencing styles can be located at https://student.unsw.edu.au/referencing

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits**:** honesty, trust, fairness, respect, responsibility and courage.[1] At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and **plagiarism** can be located at:

- The *Current Students* site https://student.unsw.edu.au/plagiarism**,** and
- The *ELISE* training site http://subjectguides.library.unsw.edu.au/elise/presenting

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

7. Readings and resources

- Ashby, M.F., 2012, Engineering Materials 1: An Introduction to Properties, Applications, and Design, fourth edition, Elsevier.

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

- Callister, W.D. Jr., Rethwisch, D.G., Materials Science and Engineering: An Introduction, 9th Edition, Wiley 2014
- Ashby, M.F., 2005. Materials selection in mechanical design, third edition. Elsevier.
- Ashby, M.F., Cebon, D., 1996. Case studies in materials selection. Granta Design.
- Ashby, M.F., Johnson, K., 2002. Materials and design—the art and science of material selection in product design. Elsevier.
- A.V. Srinivasan and D. Michael McFarland, *Smart Structures: Analysis and Design, Cambridge* University Press, 2001
- D. Munz, T. Fett, 1999, Ceramics – Mechanical Properties, Failure Behaviour, Materials Selection. Springer-Verlag Berlin Heidelberg.

8. Administrative matters

School Office: Room 137, Building E10 School of Materials Science and Engineering
School Website: http://www.materials.unsw.edu.au/
Faculty Office: Robert Webster Building, Room 128
Faculty Website: http://www.science.unsw.edu.au/

9. Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- Student Wellbeing, Health and Safety: https://student.unsw.edu.au/wellbeing
- Disability Support Services: https://student.unsw.edu.au/disability-services
- UNSW IT Service Centre: https://www.it.unsw.edu.au/students/index.html
- Assessment Implementation Procedure: https://www.gs.unsw.edu.au/policy/documents/assessmentimplementationprocedure.pdf
- Special Consideration: https://student.unsw.edu.au/special-consideration