Course Outline

MATS6002
Fundamentals of Materials Design
Materials Science and Engineering
Science
T3, 2019
1. Staff

<table>
<thead>
<tr>
<th>Position</th>
<th>Name</th>
<th>Email</th>
<th>Consultation times and locations</th>
<th>Contact Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course Coordinator, Lecturer</td>
<td>A/Prof Dewei Chu</td>
<td><a href="mailto:d.chu@unsw.edu.au">d.chu@unsw.edu.au</a></td>
<td>Room 244, School of Materials Science and Engineering (Building E10), by appointment</td>
<td>Phone: 9385 5090</td>
</tr>
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<td>Lecturer</td>
<td>Dr Samane Maroufi</td>
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<td>Room 439, School of Materials Science and Engineering (Building E10), by appointment</td>
<td>Phone: 9385 4471</td>
</tr>
</tbody>
</table>

2. Course information

Units of credit: 6

Pre-requisite(s):


Teaching times and locations:

<table>
<thead>
<tr>
<th>Day</th>
<th>Lecture</th>
<th>Lecture</th>
<th>Lecture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tuesday</td>
<td>Thursday</td>
<td>Friday</td>
</tr>
<tr>
<td>Location</td>
<td>Colombo Theatre C</td>
<td>Webster Theatre A</td>
<td>Law Theatre G02</td>
</tr>
<tr>
<td>Time</td>
<td>03:00PM - 05:00PM</td>
<td>04:00PM - 06:00PM</td>
<td>Fri 11:00AM - 01:00PM</td>
</tr>
<tr>
<td>Weeks</td>
<td>1-10</td>
<td>2,4,6,8</td>
<td>1-10</td>
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</tbody>
</table>

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. Gain an understanding of the basic concepts of material structure and properties
2. Have an understanding of how to select the optimal method and conditions
3. Be familiar with different approaches taken to processing a specific component
4. Understand the economic drivers in materials processing

2.4 Relationship between course and program learning outcomes and assessments

<table>
<thead>
<tr>
<th>Course Learning Outcome (CLO)</th>
<th>LO Statement</th>
<th>Program Learning Outcome (PLO)</th>
<th>Related Tasks &amp; Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLO 1</td>
<td>Gain…</td>
<td>3</td>
<td>1, 3 &amp; 4</td>
</tr>
<tr>
<td>CLO 2</td>
<td>Have…</td>
<td>3</td>
<td>2, 3 &amp; 4</td>
</tr>
<tr>
<td>CLO 3</td>
<td>Be familiar…</td>
<td>2 &amp; 3</td>
<td>1, 2, 3 &amp; 4</td>
</tr>
<tr>
<td>CLO 4</td>
<td>Understand…</td>
<td>3</td>
<td>2, 3 &amp; 4</td>
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</table>

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.

*Indicate the learning and teaching activities used in the course (e.g. lectures, seminars, tutorials, studios, practicum) and describe how you expect the students to participate and learn in these various components, whether face-to-face, online or in blended learning mode. Specify any learning activities that engage students in using resources and working on tasks, creating experiences that lead them to achieve the intended learning outcomes e.g. experiments, research-integrated learning, problem solving or project work.*

**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

*Indicate the course-specific expectations of students, including:*

- level of engagement during class and outside of class
- attendance at lectures and tutorials/seminars/studio classes, labs or technical workshops
- online component requirement
- protocols governing email, social networks and discussion forums.
4. Course schedule and structure

This course consists of 52 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.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction&lt;br&gt;Atomic structure and interatomic bonding (SM)</td>
<td></td>
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<tr>
<td>2</td>
<td>The structure of crystalline solids (SM)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Imperfections in solids (SM)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mechanical properties of metals (SM), Dislocation and strengthening mechanisms</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Dislocation and strengthening mechanisms, Fast fracture (SM)</td>
<td>Assignment</td>
</tr>
<tr>
<td>6</td>
<td>Fatigue (DC), Mid-term exam, Figure design</td>
<td>Mid-term exam</td>
</tr>
<tr>
<td>7</td>
<td>Fatigue, creep and creep fracture (DC)</td>
<td></td>
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<tr>
<td>8</td>
<td>Kinetic theory of diffusion&lt;br&gt;Oxidation of materials (DC)</td>
<td></td>
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<tr>
<td>9</td>
<td>Wet corrosion of materials&lt;br&gt;Friction and wear (DC)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Case study: materials and energy design/Revision&lt;br&gt;Presentations for Assessment Task (DC)</td>
<td>Group Report/Student Presentation</td>
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</tbody>
</table>
5. Assessment

5.1 Assessment tasks

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Description</th>
<th>Weight</th>
<th>Due date</th>
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<tbody>
<tr>
<td>Assignment:</td>
<td>Students are required to</td>
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<td></td>
<td>- write two short essays (500 word each) on the factors which influence the</td>
<td>20%</td>
<td>Week 1-5</td>
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<tr>
<td></td>
<td>development of materials design over time and also a case study of a failure</td>
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<td></td>
<td>in proper selection of materials in design a product</td>
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<td></td>
<td>- Solve questions and examples which will be provided in Moodle on electronic</td>
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<td></td>
<td>configuration and crystallinity</td>
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<td></td>
<td>- Be active in Moodle group discussion</td>
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<tr>
<td>Report and</td>
<td>Students will be required to conduct research on a topic involving materials,</td>
<td>20%</td>
<td>Week 10</td>
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<tr>
<td>Presentation:</td>
<td>properties, design parameters, performance, and/or failure. Requirements</td>
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<td></td>
<td>- A formal document, written to professional standard</td>
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<td></td>
<td>- A formal presentation</td>
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<tr>
<td>Mid-term exam:</td>
<td>1 hr exam, held in class covering the following topics atomic structure and</td>
<td>15%</td>
<td>Week 6</td>
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<tr>
<td></td>
<td>bonding, structure of crystalline solids, imperfections, mechanical properties</td>
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<td></td>
<td>(weeks 1-4)</td>
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<td></td>
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<tr>
<td>Final exam:</td>
<td>2 hr exam covering the following: dislocations, strengthening, fracture, creep</td>
<td>45%</td>
<td>Final exam</td>
</tr>
<tr>
<td></td>
<td>deformation and fracture, oxidation and corrosion, friction, abrasion and</td>
<td></td>
<td>period</td>
</tr>
<tr>
<td></td>
<td>wear</td>
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</table>

Further information

UNSW grading system: [https://student.unsw.edu.au/grades](https://student.unsw.edu.au/grades)


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](https://student.unsw.edu.au/grades)

Rules governing conduct during exams are given at: [https://student.unsw.edu.au/exam-rules](https://student.unsw.edu.au/exam-rules)
Assessment criteria are statements of performance attributes or qualities that guide students to see what is important in undertaking each component of assessment in a program or course, and that guide assessors when they are judging students’ responses to the assessment component.

You could provide a rubric for each assessment task to explain expectations in relation to various marking criteria in either the course outline or via Moodle. More information is available on the Teaching Gateway:

- An example of a generic learning rubric
- More information on assessment rubrics

### 5.3 Submission of assessment tasks

- Students unable to submit assignments on time or attend the mid-session quizzes or final exams on health grounds should make a request for special consideration. Information on this process can be found here: [https://student.unsw.edu.au/special-consideration](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](https://student.unsw.edu.au/disability). Early notification is essential to enable any necessary adjustments to be made.

Provide procedural advice for submitting work and indicate the policy on late submission, extension of deadlines and special consideration. Include extracts from the relevant school policy or indicate where students can obtain this information.

Normally UNSW requires all assessments that can be submitted online to be submitted online with no paper versions submitted.

### 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

Include a strategy for giving feedback to students on their assessment preparation, activities and/or marked submissions for each task. Tell students when, where and how they will receive feedback for this assessment.

More information is available on the Teaching Gateway:

- Grading and Giving Feedback
6. Academic integrity, referencing and plagiarism

Indicate the preferred referencing style with links to resources on how to use it.

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. 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


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