



Course Outline

MATS6007

Sustainable Materials Engineering
Materials Science and Engineering

Science

(T3, 2022)

1. Staff

Position	Name	Email	Consultation times and locations
Course Convenor	Samane Maroufi	s.maroufi@unsw.edu.au	Room 439, School of Materials Science and Engineering (Building E10), by appointment
Lecturer	Samane Maroufi	s.maroufi@unsw.edu.au	Room 439, School of Materials Science and Engineering (Building E10), by appointment

2. Course information

Teaching times and locations:

	Tuesday	Thursday
	Lecture	Lecture
Location	online	online
Weeks	1-5	7-10
Time	10 AM-12:00	10 AM-12:00

2.1 Course summary

Did you know that if we carry on using the earth's resources at our current rate of consumption, **we'd need 1.7 planets to support the demand on the earth's ecosystems?**

This course will give an overview of the materials footprint on environment during their life cycle, from extraction to disposal. You will be introduced a range of different sustainable systems and shown how different approaches can be taken to improve sustainability and minimise environmental impact of different types of materials in different sectors (i.e., transportation, infrastructure, and energy generation/storage).

2.2 Course aims

This course aims to enable you to gain in-depth understanding of sustainability, the root causes of unsustainability, the environmental impacts, and how to create a sustainable system through applying suitable technologies and materials. This course aims to teach you different sustainable materials systems and introduces latest approaches towards sustainable energy production and storage, transportation, infrastructure, water treatment, soil remediation and carbon management. One of the aims of this course is to enable you to understand the concept of life cycle assessment (LCA) and circular economy and apply it in evaluation of the impact of a sustainable material system on environment and economy.

2.3 Course learning outcomes (CLO)

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

1. **evaluate** the impacts of main groups of materials on the environment at different stages of their life cycle;
2. **examine** key principles underpinning a sustainable system and critique current strategies towards creating a sustainable system in different sectors (i.e., transportation, infrastructure, energy production/storage and etc);
3. **apply** the life cycle assessment framework to **evaluate** the use of sustainable technologies and materials;
4. **build** an awareness of waste generated by human activities and explain appropriate approaches to minimise human footprint on environment;

2.4 Relationship between course and program learning outcomes and assessments

Using the table below specify clearly how the course contributes to the program's learning outcomes. Complete the table with your own course and program learning outcomes, tasks and assessments.

Course Learning Outcome (CLO)	LO Statement	Program Learning Outcome (PLO)	Related Tasks & Assessment
CLO 1	Evaluate...	1, 2, 4 & 5	Assignment 1
CLO 2	Examine...	1, 2, 3, 4 & 5	Assignment 2&3 and final exam
CLO 3	Apply...	1, 2, 4 & 5	Assignment 3
CLO 4	Build...	1, 2, 3, 4 & 5	All assignment

3. Strategies and approaches to learning

3.1 Learning and teaching activities

The roadmap of weekly activities in-class and out-of-class are listed in the Appendix (please refer to page 10).

(Students are actively engaged in the learning process.

- It is expected that, in addition to attending classes, students read, write, discuss, and be engaged 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, 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 context.
- 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.

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 40 hours of class contact hours. You are expected to take an additional y hours of non class contact hours to complete assessments, readings and exam preparation.

Wk	Topics	CLO
1	Definition of sustainable development in materials science and engineering Sustainable consumption and production Materials and the environment <ul style="list-style-type: none"> • Materials life cycle, and their impact on the environment from extraction to disposal • Constrains (economic, availability and legislation) Materials selection	1&5
2	Influence of chemical composition and processing condition on the structure and properties of materials in view of sustainability	1, 2, & 4
3/4	Sustainable materials system through five material-focused transformative strategies: <ul style="list-style-type: none"> • Lifetime extension • Dematerialisation • Manufacturing efficiency • Substitution Recovery	1, 2, & 4
4/5	<ul style="list-style-type: none"> • Life cycle assessment (LCA) and circular economy 	1, 2, 3, 4 & 5
6	Break	
7	Sustainability and sustainable material in: <ul style="list-style-type: none"> • Infrastructure development • Transportation development 	1, 2, 3, 4 & 5
8	A sustainable pathway to produce nanomaterials via converting waste	1, 2, 3, 4 & 5
9	Carbon management and reducing carbon footprint in carbon-intensive industries such as steelmaking	1, 2, 3, 4 & 5
10	<ul style="list-style-type: none"> • Water treatment • Soil remediation 	1, 2, 3, 4 & 5

5. Assessment

5.1 Assessment tasks

Assessment task	Description	Weight	Due date
Activity 1	<ul style="list-style-type: none"> • Padlet self-introduction (please introduce yourself through the below QR code, get to know your classmates, with a photo show what your favourite activity is ;) • In Moodle forum choose your group and groupmate (4 students are allowed in each group) • In Moodle Allocate the role of each student (facilitator, reflector, reporter and representor) • Bring your lunch and let's have a group lunch together in front of Hilmar building 	0	Week 1
Activity 2	Quick feedback quiz will be performed at the end of each session to review the contents which have been taught.	0	Weeks1-10
Assessment 1: <u>Formative</u> Discussion, peer feedback and group report	<p>Select one materials of your interest and explain if that materials is sustainable <u>environmentally, socially and economically</u>? Why yes or no?</p> <p>Please discuss it with your groupmate.</p> <p>In each group:</p> <p>Facilitator (manage the group, arrange the time for the group discussion, facilitate the discussion, seek guidance/ask questions from other groups or teacher in the case of ambiguity)</p> <p>Reflector (carefully observe members during discussion, make sure discussion is on track and all members are actively involved),</p> <p>Reporter (take note of discussion and share the summary of the discussion and what they have learned from group discussion with class via Forum in week 3).</p> <p>Presenter (give 5 min presentation of what they have learned in their group discussion to the class in week 4).</p> <p>Students needs to provide feedback to their groupmate.</p> <p>Group report and presentation:10 and 5%</p>	15%	Weeks 2-4

<p>Assessment 2: <u>Formative</u> Discussion, peer assessment, individual written essay</p>	<p>In your group, each student need to find one real-world example related to one of the five material-focused transformative strategies which have been taught in the class.</p> <p>In your group discussions you need to discuss and assess how the strategy can contribute to creating a sustainable system. Based on your assessment, you will propose recommendations for improvement and draw implications for efforts to create a sustainable system more broadly.</p> <p>In each group:</p> <p>Facilitator (manage the group, arrange the time for the group discussion, facilitate the discussion, seek guidance/ask questions from other groups or teacher in the case of ambiguity)</p> <p>Reflector (carefully observe members during discussion, make sure discussion is on track and all members are actively involved),</p> <p>Reporter (take note of discussion and share the summary of the discussion and what they have learned from group discussion with class via Forum in week 3).</p> <p>Presenter (give 5 min presentation of what they have learned in their group discussion to the class in week 4).</p> <p>Students needs to fill peer review assessment form (5%).</p> <p>Individual submission: 10%</p> <p>Group submission:5%</p>	20%	Weeks 4-8
<p>Assessment 3: <u>Formative</u> Written essay & oral presentation (individual)</p>	<ol style="list-style-type: none"> i. You need to select a sustainable product, as an alternative to a less sustainable one that is currently in use and justify you choice. ii. You will then apply the LCA framework to compare these two in terms of environmental impact. iii. Based on your evaluation, you will propose strategies to policy makers to introduce and reinforce the use of the sustainable material in a national or an Australian state or a local context of your choice. 	30%	Weeks 5-10
<p>Assessment 4</p>	<p>Final exam (2 hours exam, long/short answer,</p>	35%	

	essay)		
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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.

Mid-term exam: As the mid-term exam is the formal exam for Part 1 of the course, with the content not examinable in Part 2, students will receive their final mark.

Final exam: Students will receive their final mark

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.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

Provide a list of required and/or useful 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>

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

Course activity roadmap

