



Course Outline

MATS6006

Recycling of Wastes

Materials Science and Engineering

(T2, 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	Wednesday
	Lecture	Lecture	lecture
Location	online	online	online
Time	11 AM-1 PM	11 AM-1 PM	2-4 PM
Weeks	1-3, 5, 7-10	1-3, 5, 7-10	8

	Tuesday	Tuesday	Wednesday	Thursday
	workshop (Group 1)	Workshop (Group 2)	workshop (Group 3)	Workshop (Group4)
Location	CompLabMSE	CompLabMSE	CompLabMSE	CompLabMSE
Time	11 AM-1 PM	2-4 PM	2-4 PM	11AM-1 PM
Weeks	4	4	4	4

2.1 Course summary

Did you know that one tonne of mobile phones contains up to 240 g of gold which is 240 times more than what can be found in a gold mine? The stockpile of such precious metals in the discarded waste of our society is considered as urban mines and what we refer to as “waste recycling” is in fact “urban mining”.

The course will give you an overview of a range of complex wastes arising from rapid urbanization and growing populations and will evaluate the impacts of these wastes on the environment if not treated properly. You will be introduced to a range of conventional approaches and new emerging techniques to recycle wastes and unlock valuable materials from waste.

You will explore the different methods and approaches for treatment, management and recycling of wastes in detail and gain knowledge of the latest science and technology related to the recycling of wastes. As part of this you will conduct a life cycle assessment and discuss the effect of waste on a circular economy.

2.2 Course aims

This course will aim to enable you to comprehensively understand wastes of different categories (from daily wastes such as food packaging, textile and plastic to electronic waste, automotive and biomass wastes) and examine the principles of recycling and assess various recycling approaches including mechanical, chemical and thermal processing. Through this course, you will be able to identify the limitation of the conventional approaches in regard with recycling of new generation of waste.

This course will aim to teach you, the concept of circular economy and enable you to apply life cycle assessment (LCA) to evaluate the impact of new recycling approaches on environment and compare it with conventional techniques. This course will also help you to build your research capability and presentation and communication skill.

2.3 Course learning outcomes (CLO)

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

1. **Understand** and **categorise** different waste streams and **evaluate** their environmental impacts if not treated properly;
2. **Assess** different conventional recycling approaches and their limitations compared to new generation of complex waste and **develop** new emerging recycling techniques;
3. **Apply** the life cycle assessment framework to **evaluate** the impact of different recycling methods on environmental and circular economy;
4. **Build** professional written and oral presentation skills and critical thinking.

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	Categorise...	1, 3, 4, 5	Assignment , 2 &4
CLO 2	Assess...	1, 2, 3, 4, 5	Assignments 2&4, and Mid-term exam
CLO 3	Apply...	1, 3, 4, 5	Assignment 4
CLO 4	Build...	5	All assignments

3. Strategies and approaches to learning

3.1 Learning and teaching activities

The detailed 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 10 hours of non-class contact hours to complete assessments, readings and exam preparation.

Week	Topics	Activity	Related CLO
1	Waste generation, current situation with different	<ul style="list-style-type: none">• Activity 1 (Forum)	1 & 5

	categories of waste, the complexity of the new generation of waste Characterisation of wastes-first step to recycling (how characterization helps to select the right recycling approach)	<ul style="list-style-type: none"> discussion) Lecture 	
2	Different Techniques of waste treatment (i.e., Mechanical, Electrical, Chemical and Thermal processing)	<ul style="list-style-type: none"> Lecture 	1, 2 & 3
3-4	Life Cycle Assessment (LCA)	<ul style="list-style-type: none"> Lecture Workshop (computer lab) Assessment 1 group report in forum 	1, 2, 3 & 5
5	Daily waste (i.e., food packaging, textile, glass and plastic) recycling Electronic waste recycling	<ul style="list-style-type: none"> Lecture Assignment 1 presentation 	1, 2, 3 & 5
6			
7	Electronic waste recycling	<ul style="list-style-type: none"> Lecture Mid-term exam 	1, 2, 3 & 5
8	Automotive waste recycling (Tyre, automotive shredder residue and Windscreen glass)	<ul style="list-style-type: none"> Lecture Assignment 2 submission 	
9	Biomass recycling		
10	Converting waste to value-added products	<ul style="list-style-type: none"> Lecture Assessment 4 (during exam period) 	1, 2, 3, 4 & 5

5. Assessment

5.1 Assessment tasks and activities

Assessment task	Description	Weight	Due date
Activity 1	<ul style="list-style-type: none"> Forum discussion and self-introduction (get to know your classmates, talk about yourself, explain why you chose this course, how environmentally friendly is your lifestyle, etc.?) Choose your group (4 students in each group) Allocating the role of each student in group 	0	Week 1

	(facilitator, reflector, reporter and representor)		
Activity 2	Quick feedback quiz will be performed at the end of each session to review the contents which have been taught.	0	Week1-10
Assessment 1 <u>Formative</u> Discussion, peer assessment and group presentation	<p>Students will be given a specific case study (waste).</p> <p>In a group of 4, each student need to discuss one of the characterisation techniques used in their case study. What was the characterisation technique? How was the result of the characterisation used in developing the recycling technique?</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>Group report and presentation: 10%</p>	15%	Week 2-4
Assessment 2 <u>Formative</u> Discussion, peer assessment, individual written essay	<p>In a group of 4, each student needs research and evaluate one recycling technique (mechanical, thermal and chemical) associated with a specific waste which has been already commercialised in large scale and discusses in their group.</p> <p>The role of students should be changed from previous assignment. After group discussion, the summary of the discussion needs to be shared with class via Forum (5%).</p> <p>Students need to fill peer review assessment form online (5%).</p> <p>Students need to submit an individual report. (10%)</p> <p>Each student will receive feedback.</p>	20%	Week4- Week 8

<p>Assessment 3: <u>Summative</u> Mid-term exam</p>	<p>The aim of this exam is to assess student's skills in solving problems and their understanding of the wastes, their challenge, limitations and opportunities. In-class exam covering the content taught in lectures 1-6.</p>	30%	Week 7
<p>Assessment 5: <u>Formative</u> Written essay & oral presentation (individual)</p>	<p>Students will be asked to select one type of the problematic waste of their own interest. They are required to:</p> <ol style="list-style-type: none"> i. Categorise the waste, ii. Discuss their environmental impacts and the issue/challenge associated with their recycling, iii. Identify and justify a suitable approach and methods to recycle the waste, iv. Apply the life cycle assessment framework to evaluate the environmental impacts of using the recycling method (s) compare it to non-treated disposal of the waste and their impact on circular economy, v. Propose strategies to policy makers to introduce and/or reinforce the implementation of the recycling methods in a national or an Australian state or a local context of their choice. <p>Oral presentation 5% Written project 30%</p>	35%	Week 4- Week 10

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.

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.

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

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/>

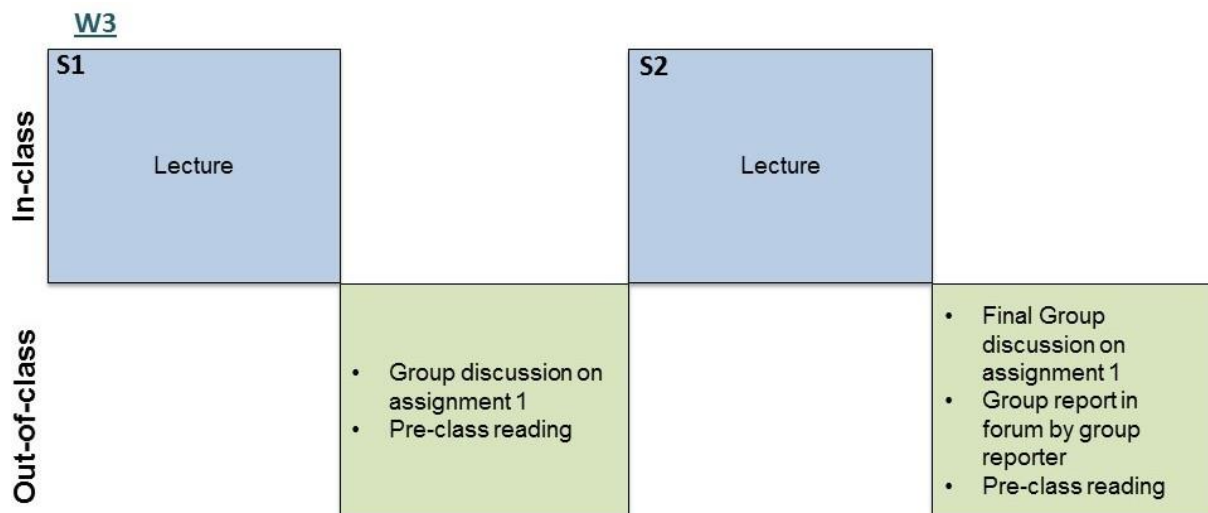
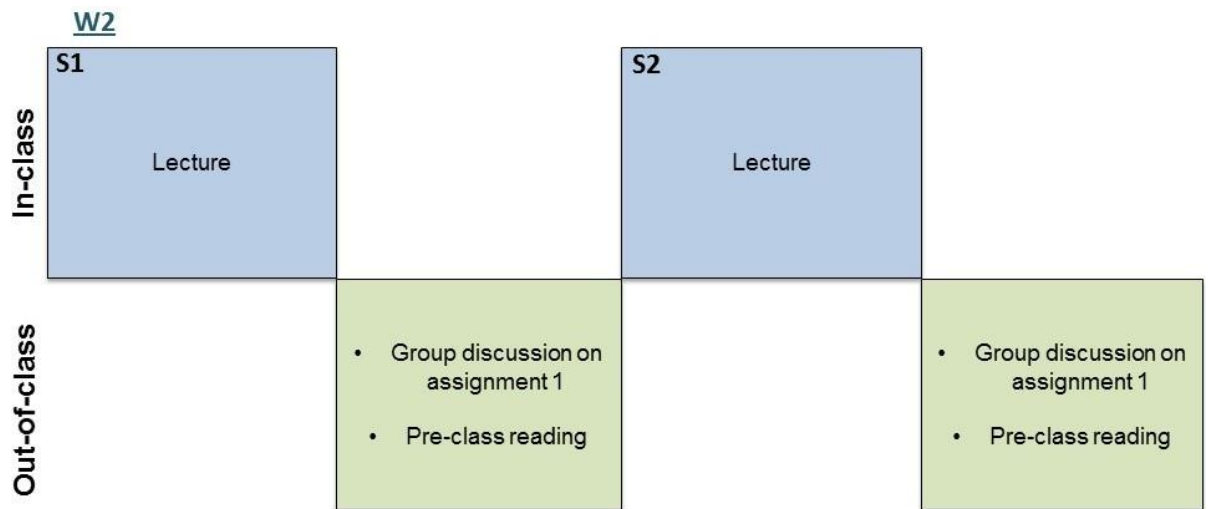
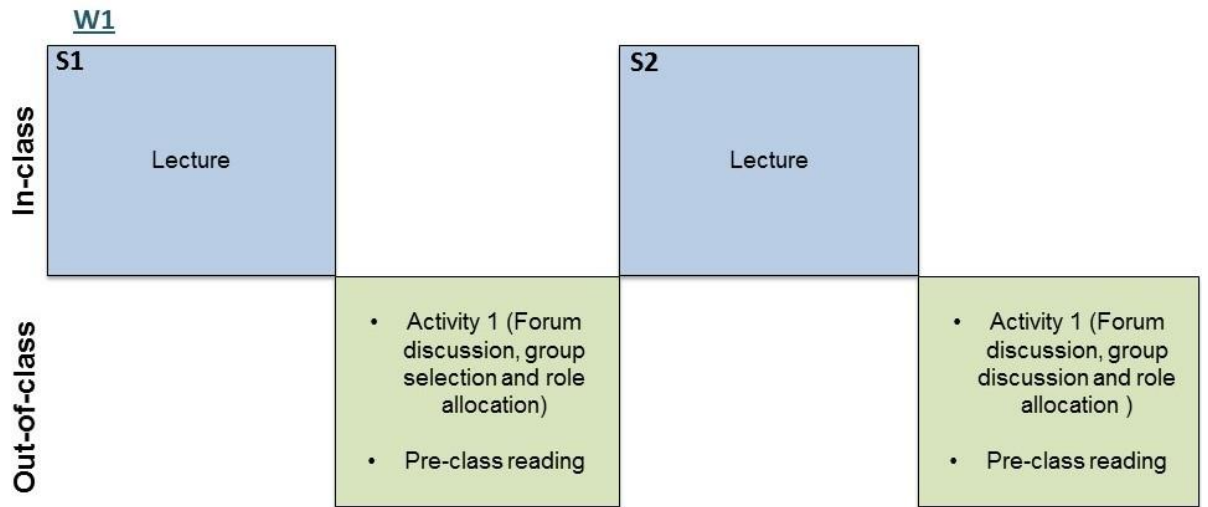
Faculty Office: Robert Webster Building, Room 128

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>

Appendix



W4

In-class	S1 Workshop (Computer lab)	S2 Workshop (Computer lab)	
Out-of-class			<ul style="list-style-type: none"> • Group discussion on assignment 2 • Pre-class reading • Preparation for 5 min presentation of assignment 1 (presenters of the groups)

W5

In-class	S1 <ul style="list-style-type: none"> • Presentation by presenters of groups (assignment 1) • Lecture 	S2 Lecture	
Out-of-class			<ul style="list-style-type: none"> • Group discussion on assignment 2 • Selection of topic for final project • Pre-class reading

W7

In-class	S1 Lecture	S2 Mid-term exam	
Out-of-class			<ul style="list-style-type: none"> • Pre-class reading • working on final project

W8

In-class	S1 Lecture	S2 Lecture	
Out-of-class	<ul style="list-style-type: none"> • Pre-class reading • Working on final project 		<ul style="list-style-type: none"> • Individual submission of assignment 2 • Submission of peers marks • Pre-class reading • Working on final project

W9

In-class	S1 Lecture	S2 Lecture	
Out-of-class	<ul style="list-style-type: none"> • Pre-class reading • Working on final project 		<ul style="list-style-type: none"> • Pre-class reading • Quick Feedback Quiz • Working on final project

W10

In-class	S1 Lecture	S2 Lecture	
Out-of-class	<ul style="list-style-type: none"> • Pre-class reading • Working on final project 		<ul style="list-style-type: none"> • Working on final project