



## UNSW Course Outline

# MATS6006 Recycling of Materials - 2024

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## General Course Information

**Course Code :** MATS6006

**Year :** 2024

**Term :** Term 2

**Teaching Period :** T2

**Is a multi-term course? :** No

**Faculty :** Faculty of Science

**Academic Unit :** School of Materials Science & Engineering

**Delivery Mode :** In Person

**Delivery Format :** Standard

**Delivery Location :** Kensington

**Campus :** Sydney

**Study Level :** Undergraduate, Postgraduate

**Units of Credit :** 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

Students will learn about a range of complex wastes arising from rapid urbanization and growing populations, how to categorise them and evaluate the impacts of these wastes on the environment if not treated properly. This course includes both lectures and laboratory sessions

where students will learn a range of conventional approaches and new emerging techniques to recycle waste and unlock valuable materials from waste and 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 the course they will learn to conduct a life cycle assessment and discuss the effect of waste on a circular economy.

## Course Aims

This course aims to enable students to learn about waste of different categories and examine the principles of recycling, including mechanical, chemical, and thermal processing. The course aims to teach students the concept of circular economy and enable them to apply life cycle assessment (LCA) to evaluate the impact of new recycling approaches on the environment and compare them with conventional techniques. Additionally, the course aims to help students build their research capability, as well as their presentation and communication skills.

## Relationship to Other Courses

For several decades, scientists and engineers have been working through a linear synthesis for design and development of new products and processes in which they have kept feeding the processes with finite virgin resources at one end, without thinking about the products when they reach the end of their useful life. This has resulted in generation of waste crisis world-wide which urges us to comprehensively readjust our way of thinking. This course will give you a holistic view of the recycling solutions and technologies which can be applied in any area of the Materials Science and Engineering and equip you with the knowledge and skills necessary to promote sustainability in your respective fields.

## Course Learning Outcomes

Course Learning Outcomes
CLO1 : Categorise different waste streams and evaluate their environmental impacts if not treated properly.
CLO2 : Assess different conventional recycling approaches and their limitations compared to new generation of complex waste and develop new emerging recycling techniques.
CLO3 : Apply the life cycle assessment framework to evaluate the impact of different recycling methods on environmental and circular economy.
CLO4 : Develop professional written and oral presentation skills and critical thinking.

Course Learning Outcomes	Assessment Item
CLO1 : Categorise different waste streams and evaluate their environmental impacts if not treated properly.	<ul style="list-style-type: none"> <li>• Characterisation Case Study</li> <li>• Recycling Technique Report</li> <li>• Mid-Term Test</li> <li>• Final Project</li> </ul>
CLO2 : Assess different conventional recycling approaches and their limitations compared to new generation of complex waste and develop new emerging recycling techniques.	<ul style="list-style-type: none"> <li>• Recycling Technique Report</li> <li>• Mid-Term Test</li> <li>• Final Project</li> </ul>
CLO3 : Apply the life cycle assessment framework to evaluate the impact of different recycling methods on environmental and circular economy.	<ul style="list-style-type: none"> <li>• Mid-Term Test</li> <li>• Final Project</li> </ul>
CLO4 : Develop professional written and oral presentation skills and critical thinking.	<ul style="list-style-type: none"> <li>• Characterisation Case Study</li> <li>• Recycling Technique Report</li> <li>• Mid-Term Test</li> <li>• Final Project</li> </ul>

## Learning and Teaching Technologies

Moodle - Learning Management System

## Assessments

### Assessment Structure

Assessment Item	Weight	Relevant Dates
Characterisation Case Study Assessment Format: Group	15%	
Recycling Technique Report Assessment Format: Group	20%	
Mid-Term Test Assessment Format: Individual	30%	
Final Project Assessment Format: Individual Short Extension: Yes (7 days)	35%	

## Assessment Details

### Characterisation Case Study

#### Assessment Overview

You will be given a specific case study related to waste.

In a group of 4, each of you need to discuss one of the characterisation techniques used in the

case study.

- What was the characterisation technique?
- How was the result of the characterisation used in developing the recycling technique?`

The final submission of the group report (worth 5%) is due in Week 3, with feedback provided within two weeks.

There will be a peer and self- review activity as part of the task, due in Week 4 worth 5%. Your group will also deliver a presentation (worth 5%) in Week 4.

### **Course Learning Outcomes**

- CLO1 : Categorise different waste streams and evaluate their environmental impacts if not treated properly.
- CLO4 : Develop professional written and oral presentation skills and critical thinking.

### **Detailed Assessment Description**

You will be given a specific case study (waste).

In a group of 4, each of you need to discuss one of the characterisation techniques used in your case study. What was the characterisation technique? How was the result of the characterisation used in developing the recycling technique?`

In each group:

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)

Reflector (carefully observe members during discussion, make sure discussion is on track and all members are actively involved),

Reporter (take note of discussion and share the summary of the discussion and what you have learned from group discussion with class via Forum in week 3), 5%

Presenter (give 5 min presentation of what you have learned in your group discussion to the class in week 4), 5%

You also need to individually comment and give feedback to your peers.

At the end each of you need to assess your peer discussion and submit the mark of your peers.

## Recycling Technique Report

### Assessment Overview

In a group of 4, you need to research and evaluate one recycling technique (mechanical, thermal and chemical) associated with a specific waste which has been already commercialised at a large scale.

Your group will have separate discussion with the convenor before the deadline to provide an update on the group's progress, to seek feedback and report on the levels of group engagement.

At the end of the task, you will complete a peer assessment based on your group members' performance during group discussion (5%) and submit a summary based on group findings and what you have learned as a result of discussion during group activities (5%).

You also need to submit an individual report related to your own case study (10%).

You will receive detailed feedback within two weeks after completion. The comments will be in form of track change on the submitted file in Teams. Individual feedback will be provided to each student.

### Course Learning Outcomes

- CLO1 : Categorise different waste streams and evaluate their environmental impacts if not treated properly.
- CLO2 : Assess different conventional recycling approaches and their limitations compared to new generation of complex waste and develop new emerging recycling techniques.
- CLO4 : Develop professional written and oral presentation skills and critical thinking.

## Mid-Term Test

### Assessment Overview

The aim of this test is to assess your skills in solving problems and your understanding of the wastes, their challenges, limitations and opportunities.

In-class exam covering the content taught in lectures weeks 1-5.

The test will be 70-80 mins in duration and typically held during Week 7.

Feedback will be provided within 2 weeks of the test completion.

## Course Learning Outcomes

- CLO1 : Categorise different waste streams and evaluate their environmental impacts if not treated properly.
- CLO2 : Assess different conventional recycling approaches and their limitations compared to new generation of complex waste and develop new emerging recycling techniques.
- CLO3 : Apply the life cycle assessment framework to evaluate the impact of different recycling methods on environmental and circular economy.
- CLO4 : Develop professional written and oral presentation skills and critical thinking.

## **Final Project**

### Assessment Overview

You will be asked to select one type of problematic waste of your own interest.

You are required to:

- 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.

Oral presentation (10 min) 5%

Written project (typically 2-5 pages) 30%

Written feedback is provided within two weeks of your submission.

### Course Learning Outcomes

- CLO1 : Categorise different waste streams and evaluate their environmental impacts if not treated properly.
- CLO2 : Assess different conventional recycling approaches and their limitations compared to new generation of complex waste and develop new emerging recycling techniques.
- CLO3 : Apply the life cycle assessment framework to evaluate the impact of different recycling methods on environmental and circular economy.
- CLO4 : Develop professional written and oral presentation skills and critical thinking.

## **General Assessment Information**

- 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 5% of maximum grade penalty for every day late, or part thereof.

## Grading Basis

Standard

### Requirements to pass course

Satisfactory completion of the course includes the requirement to achieve >35% in the mid-term exam and >35% in the final project, and >45% weighted average over these two assessment items. Students who fail to achieve this will be awarded an Unsatisfactory Fail (UF) grade for the course regardless if they receive over 50% in total for the course.

# Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 27 May - 2 June	Blended	<p>Topic of week 1:            S1. Waste generation, current situation with different categories of waste, the complexity of the new generation of waste            S2. Characterisation of wastes-first step to recycling (how characterization helps to select the right recycling approach)</p> <p>Activity for week 1 (out of class): Forum discussion and self-introduction</p> <ul style="list-style-type: none"> <li>• (get to know your classmates in PADLET, talk about yourself, explain why you chose this course, how environmentally friendly is your lifestyle, etc.?)</li> <li>• Allocating the role of each student in group (facilitator, reflector, reporter and representor)</li> </ul>
Week 2 : 3 June - 9 June	Blended	<p>Topic of week 2:            Different Techniques of waste treatment (i.e., Mechanical, Electrical, Chemical and Thermal processing)</p> <p>Activity for week 2 (out of class):            Group Discussion on assignment 1</p>
Week 3 : 10 June - 16 June	Blended	<p>Topic of week 3:            Life Cycle Assessment (Theoretical aspect)</p> <p>Activity for week 3 (out of class):</p> <ul style="list-style-type: none"> <li>• Group Discussion on assignment 1</li> <li>• Group report in moodle forum by group reporter</li> </ul>
Week 4 : 17 June - 23 June	Blended	<p>Topic of week 4:            Life Cycle assessment (computer lab)</p> <p>Activity for week 4:</p> <ul style="list-style-type: none"> <li>• Group discussion on assignment 2 and preparation for presentation of assignment 1</li> <li>• 5 minute presentation of assignment 1 by group presenter</li> </ul>
Week 5 : 24 June - 30 June	Blended	<p>Topic of week 5:            • Daily waste (i.e., food packaging, textile, glass and plastic) recycling            • Electronic waste recycling</p> <p>Activity for week 5:            • Group discussion on assignment 2            • selection topic for final project</p>
Week 6 : 1 July - 7 July	Blended	Flexibility week
Week 7 : 8 July - 14 July	Blended	<p>Topic of week 7:            • electronic waste recycling            • Mid-term exam</p> <p>Activity for week 7:            • Group discussion on assignment 2            • working on final project</p>
Week 8 : 15 July - 21 July	Blended	<p>Topic of week 8:            Automotive waste recycling (Tyre, automotive shredder residue and Windscreen glass)</p> <p>Activity for week 8:</p> <ul style="list-style-type: none"> <li>• Working on final project</li> <li>• Individual submission of assignment 2</li> <li>• Submission of peers mark</li> <li>• Submission of group report in moodle forum</li> </ul>
Week 9 : 22 July - 28 July	Blended	<p>Topic of week 9:            Biomass recycling</p> <p>Activity for week 9:            Working on final project</p>
Week 10 : 29 July - 4 August	Blended	<p>Topic of week 10:            Converting waste to value-added products, oral presentation</p> <p>Activity of week 10:            • Working on final project, oral presentation</p>

## Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

# General Schedule Information

For information about this course, please see the Course Outline and the Course Information section. The **News** forum will keep you updated with important course information. You can use the **HELP** forum for asking questions, or if you need to contact an instructor personally please use the **Teaching Staff**.

**ACCESSIBILITY NOTE FOR STUDENTS:** If you have a physical or learning difficulty that affects your access to material or activities in this online course, please advise me so that arrangements can be made to accommodate your needs.

# Course Resources

## Prescribed Resources

The resources for each week will be uploaded in Moodle.

### Textbooks

**"Life Cycle Assessment: Quantitative Approaches for decisions that matter"**

H. Scott Matthews

Chris T. Hendrickson

Deanna H. Matthews

You can download this book from week 5.

# Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Samane Maro ufi		Room 439, level 4, Hilmer Building	+61450019415		No	Yes

# Other Useful Information

## Academic Information

Upon your enrolment at UNSW, you share responsibility with us for maintaining a safe,

harmonious and tolerant University environment.

You are required to:

- Comply with the University's conditions of enrolment.
- Act responsibly, ethically, safely and with integrity.
- Observe standards of equity and respect in dealing with every member of the UNSW community.
- Engage in lawful behaviour.
- Use and care for University resources in a responsible and appropriate manner.
- Maintain the University's reputation and good standing.

For more information, visit the [UNSW Student Code of Conduct Website](#).

## Academic Honesty 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. 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, plagiarism and the use of AI in assessments can be located at:

- The [Current Students site](#),
- The [ELISE training site](#), and
- The [Use of AI for assessments](#) site.

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

## Submission of Assessment Tasks

### Penalty for Late Submissions

UNSW has a standard late submission penalty of:

- 5% per day,
- for all assessments where a penalty applies,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

***Any variations to the above will be explicitly stated in the Course Outline for a given course or assessment task.***

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

### **Special Consideration**

If circumstances prevent you from attending/completing an assessment task, you must officially apply for special consideration, usually within 3 days of the sitting date/due date. You can apply by logging onto myUNSW and following the link in the My Student Profile Tab. Medical documentation or other documentation explaining your absence must be submitted with your application. Once your application has been assessed, you will be contacted via your student email address to be advised of the official outcome and any actions that need to be taken from there. For more information about special consideration, please visit: <https://student.unsw.edu.au/special-consideration>

**Important note:** UNSW has a “fit to sit/submit” rule, which means that if you sit an exam or submit a piece of assessment, you are declaring yourself fit to do so and cannot later apply for Special Consideration. This is to ensure that if you feel unwell or are faced with significant circumstances beyond your control that affect your ability to study, you do not sit an examination or submit an assessment that does not reflect your best performance. Instead, you should apply for Special Consideration as soon as you realise you are not well enough or are otherwise unable to sit or submit an assessment.

### **Faculty-specific Information**

#### **Additional support for students**

- [The Current Students Gateway](#)
- [Student Support](#)
- [Academic Skills and Support](#)
- [Student Wellbeing, Health and Safety](#)
- [Equitable Learning Services](#)
- [UNSW IT Service Centre](#)

- Science EDI Student [Initiatives](#), [Offerings](#) and [Guidelines](#)