



Course Outline

MATS2007

Sustainable Materials Processing

Materials Science and

Engineering

T3, 2022

1. Staff

Position	Name	Email	Consultation times and locations	Contact Details
Lecturer (Week 1-5)	Dr Ben Pace	b.pace@unsw.edu.au	Room 347, School of Materials Science and Engineering (Building E10) by appointment	Phone: 9385 4837
Course Convenor (Week 7-9)	Dr Rakesh Joshi	r.joshi@unsw.edu.au	Room 448, School of Materials Science and Engineering (Building E10) by appointment	Phone: 9385 6726

2. Course information

Units of credit: 6

Pre-requisite(s): None

Timetabling website: <http://timetable.unsw.edu.au/2022/MATS2007.html>

Online Lectures

	Lecture	Lecture	Lecture
Day	Tuesday	Wednesday	Thursday
Time	13:00 - 15:00	9:00 - 10:00	12:00 - 14:00
Location	Law Theatre G23	Law Theatre G23	Michael Hintze Theatre
Weeks	1-5, 7-10	1-5, 7-10	1-5, 7-10

2.1 Course summary

This is a capstone course, topics include: Sustainability of materials processing, energy utilisation and recovery, energy analysis of industrial processes, waste recycling and pollution minimization, life cycle assessment, carbon tax and product stewardship, environmental trends, sustainable materials and selection, products and processing technologies.

2.2 Course aims

To develop an awareness and understanding of sustainability issues in materials and their processing in relation to design and application of materials and their effects on energy requirements and environment. By studying this course, students will develop analysis and problem-solving skills, particularly in energy recovery, saving and reduction, materials selection, and recycling of waste materials.

2.3 Course learning outcomes (CLO)

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

1. Solve problems in a systematic, analytical manner
2. Identify the distinguishing features of different types of energy, their conversion and appropriate measures in energy recovery and utilisation.
3. Assess the energy consumption and greenhouse gas emission for the life cycle period.
4. Identify the environmental issues and the opportunities to reduce or eliminate energy consumption, wastes and greenhouse gases in materials processing, design and application

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	Solve...	2.1, 2.2 & 2.3	2 & 4
CLO 2	Identify...	1.1, 1.2, 1.3 1.4, 1.5, 3.2 & 3.6	1 & 2
CLO 3	Assess...	1.1, 1.2, 1.3, 1.4 & 1.5	2, 3 & 4
CLO 4	Identify...	1.1, 3.3, 3.4 & 3.6	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.

Guest speakers: Guest speakers will provide first-hand insights on how materials science is used in industry and provide real-world context to the concepts taught in class. Students will also have the opportunity to develop professional skills.

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 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
- Students are expected to think critically and in decision making and problem-solving
- Students are expected to communicate with correct terminology
- Students are expected to conduct online research
- Students are expected to work effectively in a team to solve problems

4. Course schedule and structure

This course consists of 54 hours of class contact hours. You are expected to take an additional 96 hours of non-class contact hours to complete assessments, readings and exam preparation spread over the term.

Week	Topics	Activity
1	Introduction to course, Introduction to sustainability concepts. Sustainability of Materials Processing – Introduction	
2	Sustainable energy - energy utilisation and recovery, forms of energy, energy efficiency, low-carbon energy	
3	Renewable energy, co and tri generation, energy by-products, energy market, emerging technologies	
4	Sustainability in materials selection and key strategies. Case studies in material selection by industry	
5	Materials efficiency, circular economy	Mid Term Quiz
6	Break + Sustainable Material Reprocessing Excursion - Bus Tour	
7	Environmental footprint – production, maintenance, and end-of-life disposal Green House Effect, carbon tax pollution minimization	LCA Lab
8	Sustainable Materials Processing Guest Lecture: Waste to Value: Green Manufacturing, and processing technologies	
9	Electronic Waste Guest Lecture (SMART Center)	Team Based
10	N/A or time for practice case studies (TBC)	Interviews

Note that the end of term exam will be held in the main university exam period

5. Assessment

5.1 Assessment tasks

Assessment task	Description	Weight	Due date
Group report:	<p>Students are placed into groups and must select a topic in one of the metal/materials production, processing, recycling and reprocessing industries (ironmaking, steelmaking, cement, aluminium, copper, etc.). They investigate major sustainability challenges in these areas, and consider solutions driven by innovation, waste management and the application of new materials. Each group submits a major group report on their investigation.</p> <p>A bus tour in week 6 will provide additional information useful for this assignment</p>	20%	Week 7
Mid Term Quiz	<u>Topics covered in weeks 1-4</u>	30%	Week 5
Activity SMaRT Centre (Virtual Tour) + Team Based Interview	<p>Team based interview: Students will be asked to identify an environmental materials-based issue and then organise a Q&A style presentation where details of the problems and their solutions will be identified. Students will be assessed on the identification of the problem, proposed solutions, presentation style and demonstrated teamwork</p>	10%	Presentation Week 9/10
Final exam:	<p>The exam will be of 2hrs in duration. You will be assessed in understanding and ability to apply theory and technology learnt throughout the course to energy, materials, and environmental sustainability problems</p> <p><u>Topics covered in weeks 5-9</u></p>	40%	UNSW end-of-term 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.

NOTE: 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>

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 5% of maximum grade penalty for every day late, or part thereof, up to a maximum of 5 days, and a grade of zero thereafter.
- 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 within 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 group performed will be given.

Midsession exams: Students will receive their marked exams indicating what questions were answered correctly and incorrectly. Overall comments will 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>

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

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

- Michael F. Ashby, *Materials and the Environment*, Elsevier, 2nd Edition, 2012.
- Michael F. Ashby, *Materials and Sustainable Development*, Elsevier, 1st Edition, 2016.
- Mark Diesendorf, *Sustainability and sustainable development*. Chapter 2, St Leonards, N.S.W.: Allen and Unwin 2000
- Jatin Nathwani and Artie W. Ng: *Paths to sustainable energy*. InTech, Croatia, 2010.
- *Sustainable Development Handbook--2nd edition* / by Stephen A. Roosa. CRC Press, 2010.
- Jan Harmsen, Joseph B. Powell, *Sustainable Development in the Process Industries*, John Wiley & Sons, Inc., Hoboken, New Jersey, 2010.
- Krishnan Sankaranarayanan, Hedzer J. van der Kooi, and Jakob de Swaan Arons, *Efficiency and Sustainability in the Energy and Chemical Industries: Scientific Principles and Case Studies*, Second Edition. CRC Press, New York, 2010

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>