UNSW Course Outline

MATS1101 Engineering Materials and Chemistry - 2024

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General Course Information

Course Code : MATS1101
Year : 2024
Term : Term 3
Teaching Period : T3
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
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course introduces the fundamentals of Materials Science and Chemistry used in engineering. The different classes of materials used in engineering designs are introduced, and their basic structural, mechanical and functional properties are defined, and the mechanical

properties are measured in laboratory activities. The relationships between a material's underlying structure and its properties are explored. The ways in which materials fail within engineering settings are identified.

The chemistry part of the course builds on an elementary knowledge of chemistry (equivalent to one year of high school chemistry, such as Year 11 chemistry, or CHEM1001 at UNSW) to explore the structure of atoms leading to an understanding of the properties of materials at an atomic and molecular level. This knowledge is applied to understanding chemical bonding and intermolecular forces which determine the engineering properties of materials. General principles of chemical equilibrium are developed and applied to chemical reactions involving acids and bases and organic molecules to understand the reaction materials can undergo.

The course will consist of lectures, laboratories and tutorials split between the two disciplines: Materials Science and Engineering and Chemistry. This course is intended for engineering students to take early in their programs.

Course Aims

This course aims to introduce students to the field of Materials Science and Engineering with a particular focus on structure-property relationships of common engineering materials. The course also aims to provide students with an understanding of the necessary fundamental chemistry for future engineering studies.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe relationship between a materials structure, properties and processing.
CLO2 : Solve numerical problems related to mechanical behaviour and explain the mechanical properties of different types of materials.
CLO3 : Connect chemical concepts to real-world applications through a firm foundation in the fundamentals of chemistry for materials science.
CLO4 : Conduct laboratory experiments in a safe manner and manipulate apparatus, perform quantitative and qualitative materials and chemical analyses, evaluate the accuracy and precision of measurements, and interpret results and observations.
CLO5 : Interpret information and numerical data to explain and/or rationalise real-world phenomena by integrating multiple chemical principles.

Course Learning Outcomes	Assessment Item
CLO1 : Describe relationship between a materials structure, properties and processing.	• Materials Laboratory Reports • Mid-Term Test • Final Exam
CLO2 : Solve numerical problems related to mechanical behaviour and explain the mechanical properties of different types of materials.	• Mid-Term Test • Final Exam
CLO3 : Connect chemical concepts to real-world applications through a firm foundation in the fundamentals of chemistry for materials science.	• Chemistry Laboratory work • Mid-Term Test • Final Exam
CLO4 : Conduct laboratory experiments in a safe manner and manipulate apparatus, perform quantitative and qualitative materials and chemical analyses, evaluate the accuracy and precision of measurements, and interpret results and observations.	• Chemistry Laboratory work • Materials Laboratory Reports
CLO5 : Interpret information and numerical data to explain and/or rationalise real-world phenomena by integrating multiple chemical principles.	• Chemistry Laboratory work

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Chemistry Laboratory work Assessment Format: Individual	15%	Start Date: Through out term, see your Lab Manual Due Date: Through out term, see your Lab Manual
Materials Laboratory Reports Assessment Format: Individual	15%	Start Date: Date of lab class Due Date: One week after lab class
Mid-Term Test Assessment Format: Individual	30%	Start Date: Not Applicable Due Date: Not Applicable
Final Exam Assessment Format: Individual	40%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Chemistry Laboratory work

Assessment Overview

The laboratory classes are designed to provide you with practical experience in the lab as well as develop your observational and data analysis skills. You will be provided with feedback on your progress from your demonstrator during lab classes as well as through personalised feedback on lab reports.

Labs are held every second week and a lab report, consisting of observations, calculations and short answer questions, is completed during class and submitted at the end of each class.

You must complete the pre-lab work before entering each lab class.

You are expected to obtain every core lab skill before the end of term; once completed you are granted half of the laboratory mark. Achievement of all non-core skills grants you the second half of the chemistry lab mark.

You must attend at least 3 out of 4 laboratory classes to be able to obtain all core skills. You must be on time for the start of each lab class.

You will be provided with feedback on your progress from your demonstrator during lab classes as well as through a personalized feedback web page that allows you to track and visualize your skill development within two weeks of the submitted report.

Course Learning Outcomes

- CLO3 : Connect chemical concepts to real-world applications through a firm foundation in the fundamentals of chemistry for materials science.
- CLO4 : Conduct laboratory experiments in a safe manner and manipulate apparatus, perform quantitative and qualitative materials and chemical analyses, evaluate the accuracy and precision of measurements, and interpret results and observations.
- CLO5 : Interpret information and numerical data to explain and/or rationalise real-world phenomena by integrating multiple chemical principles.

Detailed Assessment Description

Refer to your myUNSW timetable to see the time and location of your labs.

Assignment submission Turnitin type

Not Applicable

Hurdle rules

You must attend at least 3 out of 4 laboratory classes to be able to obtain all core skills.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Materials Laboratory Reports

Assessment Overview

You will complete 4 materials laboratory experiments, spread throughout the term. Each laboratory activity will consist of gathering data in the lab, completing a worksheet of numerical and short answer questions and an online quiz.

You must attend the lab to obtain the data for the worksheet. The worksheets will be due 1 week after the laboratory activity.

The laboratories cover the following topics:
• Tensile testing
• Fracture of materials
• Casting and recrystallisation

• Composite mechanical testing

Each laboratory report is worth 2.5% of the course mark.

Each online quiz is worth 1.25% of the course mark and is to be completed the same week as your lab.

Feedback: Students will receive their mark and individualised feedback on the areas they excelled at and which areas of the reports were not answered correctly. Feedback will be provided two weeks after submission.

Course Learning Outcomes

- CLO1 : Describe relationship between a materials structure, properties and processing.
- CLO4 : Conduct laboratory experiments in a safe manner and manipulate apparatus, perform quantitative and qualitative materials and chemical analyses, evaluate the accuracy and precision of measurements, and interpret results and observations.

Detailed Assessment Description

For each laboratory report, you will be expected to analyse the data provided and answer short answer questions related to each topic. Your submission must be a single document (Word or PDF), any calculation working needs to be added to the end of the report.

Assessment Length

1-5 pages

Submission notes

Submit via Moodle

Assessment information

The laboratory manual will be available on Moodle, as well as the submission sheets. You are expected to take notes during the laboratory activity to help complete your laboratory report. The online lab quiz will be available through Moodle.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Generative AI Permission Level

Simple Editing Assistance

In completing this assessment, you are permitted to use standard editing and referencing functions in the software you use to complete your assessment. These functions are described

below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.
If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

Mid-Term Test

Assessment Overview

The mid-term test is designed to summarise you learning of the content taught in the first 5 weeks of the course, through lectures, tutorials and laboratories. Details on exact topics will be provided in class.

The test typically runs for 90 minutes and will consist of questions such as multiple choice, numerical, graphing/drawing and short answer questions.

The test will be held in Week 7.

Feedback: Students will receive their tesrt result within two weeks of completing the task. Overall comments may be provided to the class.

Course Learning Outcomes

- CLO1 : Describe relationship between a materials structure, properties and processing.
- CLO2 : Solve numerical problems related to mechanical behaviour and explain the mechanical properties of different types of materials.
- CLO3 : Connect chemical concepts to real-world applications through a firm foundation in the fundamentals of chemistry for materials science.

Assessment Length

90 mins

Assignment submission Turnitin type

Not Applicable

Hurdle rules

You must achieve a combined grade ≥40% on the mid-term and final exams and a final mark ≥50% to pass the course.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Final Exam

Assessment Overview

The final exam is designed to summarise your learning and problem-solving skills on topics delivered from Weeks 4 to 10 inclusive, including material from lectures, tutorials and labs. Details on exact topics will be provided in class.

The exam is typically 2hrs 10 minutes and consists of multiple choice, graphing/drawing, numerical and short answer questions - details will be confirmed during the course.

The examination will occur during the official university examination period.

Feedback is available through inquiry wih the course convenor.Hurdle requirement: you must achieve at least 40% in the final exam to receive a passing grade in the course.

Course Learning Outcomes

- CLO1 : Describe relationship between a materials structure, properties and processing.
- CLO2 : Solve numerical problems related to mechanical behaviour and explain the mechanical properties of different types of materials.
- CLO3 : Connect chemical concepts to real-world applications through a firm foundation in the fundamentals of chemistry for materials science.

Assessment Length

2 hrs 10 min

Assignment submission Turnitin type

This is not a Turnitin assignment

Hurdle rules

You must achieve a combined grade ≥40% on the mid-term and final exams and a final mark ≥50% to pass the course.

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

General Assessment Information

Short Extensions:

The School of Materials Science and Engineering has reviewed its range of assignments and projects to determine their suitability for automatic short extensions as set out by the UNSW Short Extension Policy. After consultation with teaching staff and examination of our course offerings, we consider our current deadline structures already accommodate the possibility of unexpected circumstances that may lead students to require additional days for submission. Consequently, the School does not offer the Short Extension provision in its MATS courses but students, if needed, can apply for formal Special Consideration via the usual procedure.

Grading Basis

Standard

Requirements to pass course

Hurdle requirement: You must achieve a combined grade ≥40% on the mid-term and final exams and a final mark ≥50% to pass the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	Materials • Introduction to the course and Materials Science and Engineering • Bonding between atoms Chemistry • Atoms • Molecules • Ions
Week 2 : 16 September - 22 September	Lecture	Materials • Young's modulus • Packing of atoms in solids Chemistry • Chemical Reactions
Week 3 : 23 September - 29 September	Lecture	Materials • Yield and tensile strength • Dislocations strengthening methods Chemistry • Chemical reactions • Molecular Structure
Week 4 : 30 September - 6 October	Lecture	Materials • Fracture Toughness and micromechanisms of fast fracture • Fatigue mechanisms Chemistry • Molecular Structure
Week 5 : 7 October - 13 October	Lecture	Materials • Creep (Pre-recorded) • Phase Diagrams Chemistry • States of Matter • Intermolecular forces
Week 7 : 21 October - 27 October	Lecture	Materials • Diffusion and Kinetics • Steels Chemistry • Equilibria • Acid-Base Equilibra
	Assessment	Mid-term exam
Week 8 : 28 October - 3 November	Lecture	Materials • Ceramics • Polymers Chemistry • Organic Compounds
Week 9 : 4 November - 10 November	Lecture	Materials • Composites • Dry Corrosion Chemistry • Organic Compounds
Week 10 : 11 November - 17 November	Lecture	Materials • Wet Corrosion • Revision Chemistry • Organic reactions and polymers

Attendance Requirements

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

General Schedule Information

This course comprises two parts taught side-by-side: Materials Science and Chemistry. For each

part, there are lectures, tutorials and laboratories. The course schedule contains information on the lectures only. Please see your UNSW timetable for the schedule of your tutorials and laboratories. Your tutorial and lab sessions are not recorded, you must attend in person to take part in those learning activities.

Course Resources

Prescribed Resources

There are no prescribed respurced for this course.

Recommended Resources

The following textbooks are recommended for the Materials Science section of this course. They are avlaialve online through the library and in the bookshop as hard copies.

Engineering Materials 1, 5th edition, Jones & Ashby

Engineering Materials 2, 4th edition, Jones & Ashby

Course Evaluation and Development

Each year we take feedback from the Myexperience surveys to develop ways to improve the course. This year we have a new tutorial format and schedule to better align with the content and have updated the process for completing the Materials Lab reports.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Caitlin Healy		Room 401, Hilmer Building (E10)	(02) 9065 0450	Email for availability	Yes	Yes
Lecturer	Nicole Rijs				Email for availability	No	No
Lab director	Ron Haines		Room 128, Dalton Building (F12)		Email for availibility	No	No

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 Plagarism

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