



## UNSW Course Outline

# ZINT2501 Engineering Materials and Chemistry - 2024

Published on the 11 Feb 2024

## General Course Information

**Course Code :** ZINT2501

**Year :** 2024

**Term :** Semester 1

**Teaching Period :** Z1

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

**Faculty :** UNSW Canberra

**Academic Unit :** School of Engineering and Technology

**Delivery Mode :** In Person

**Delivery Format :** Standard

**Delivery Location :** UNSW Canberra at ADFA

**Campus :** UNSW Canberra

**Study Level :** Undergraduate

**Units of Credit :** 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

This course provides the foundation for understanding material and environmental properties and behaviour in engineering and technology. It includes electronic structure of atoms and molecules, intermolecular forces, thermodynamic driving forces for chemical reactions, chemical

equilibria, electrochemistry, corrosion and redox reactions, solution chemistry, acids and bases, kinetics and rates of reactions, complex molecular structures in metals, polymers and ceramics, crystalline lattices, yielding and plastic flow, strengthening mechanisms in metals, phase systems and alloys, ferrous and non-ferrous metallurgy, mechanical behaviour and properties of materials.

## **Relationship to Other Courses**

As the core component of the materials stream courses in the undergraduate engineering programs, this course is a basis for higher-level courses in engineering materials in Year 3 and Engineering Design in year 4.

# Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Professional Engineer (Stage 1)
CLO1 : Apply knowledge of basic science and engineering fundamentals of chemistry and materials	<ul style="list-style-type: none"> <li>• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</li> <li>• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline</li> </ul>
CLO2 : In-depth understanding and technical competence in the discipline of materials science as it applies to engineering practice and an appreciation of sustainability in engineering	<ul style="list-style-type: none"> <li>• PEE1.6 : Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline</li> </ul>
CLO3 : Enhanced ability to undertake problem identification, formulation and solution	<ul style="list-style-type: none"> <li>• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline</li> <li>• PEE2.1 : Application of established engineering methods to complex engineering problem solving</li> </ul>
CLO4 : Ability to work in a group and also independently	<ul style="list-style-type: none"> <li>• PEE3.6 : Effective team membership and team leadership</li> </ul>

Course Learning Outcomes	Assessment Item
CLO1 : Apply knowledge of basic science and engineering fundamentals of chemistry and materials	<ul style="list-style-type: none"> <li>• Class Tests</li> <li>• Final Exam</li> <li>• Laboratory</li> </ul>
CLO2 : In-depth understanding and technical competence in the discipline of materials science as it applies to engineering practice and an appreciation of sustainability in engineering	<ul style="list-style-type: none"> <li>• Class Tests</li> <li>• Final Exam</li> <li>• Laboratory</li> </ul>
CLO3 : Enhanced ability to undertake problem identification, formulation and solution	<ul style="list-style-type: none"> <li>• Class Tests</li> <li>• Final Exam</li> <li>• Laboratory</li> </ul>
CLO4 : Ability to work in a group and also independently	<ul style="list-style-type: none"> <li>• Laboratory</li> </ul>

## Learning and Teaching Technologies

Moodle - Learning Management System

# Learning and Teaching in this course

## The Learning Management System

Moodle is the Learning Management System used at UNSW Canberra. All courses have a Moodle site which will become available to students at least one week before the start of semester.

Please find all help and documentation (including Blackboard Collaborate) at the [Moodle Support](#) page.

UNSW Moodle supports the following web browsers:

- » Google Chrome 50+
  - » Safari 10+
- \*\* Internet Explorer is not recommended

\*\* Addons and Toolbars can affect any browser's performance.

Operating systems recommended are:

Windows 7, 10, Mac OSX Sierra, iPad IOS10

For further details about system requirements click [here](#).

Log in to Moodle [here](#).

If you need further assistance with Moodle:

For enrolment and login issues please contact:

IT Service Centre

Email: [itservicecentre@unsw.edu.au](mailto:itservicecentre@unsw.edu.au)

Phone: (02) 9385-1333

International: +61 2 9385 1333

For all other Moodle issues please contact:

External TELT Support

Email: [externalteltsupport@unsw.edu.au](mailto:externalteltsupport@unsw.edu.au)

Phone: (02) 9385-3331

International: +61 2 938 53331

- Opening hours:

Monday – Friday 7:30am – 9:30 pm  
Saturday & Sunday 8:30 am – 4:30pm

## Other Professional Outcomes

None

## Additional Course Information

### Referencing

In this course, students are required to reference following the APA 7 / Chicago NB referencing style. Information about referencing styles is available at: <https://guides.lib.unsw.adfa.edu.au/c.php?g=472948&p=3246720>

### Study at UNSW Canberra

<https://www.unsw.adfa.edu.au/study>

Study at UNSW Canberra has lots of useful information regarding:

- Where to get help
- Administrative matters
- Getting your passwords set up
- How to log on to Moodle
- Accessing the Library and other areas.

### Additional Information as required

CRICOS Provider no. 00098G

The University of New South Wales Canberra.

# Assessments

## Assessment Structure

Assessment Item	Weight	Relevant Dates	Engineers Australia - Professional Engineer (Stage 1)
Class Tests Assessment Format: Individual	40%	Start Date: Not Applicable Due Date: Week 4: 18 March - 22 March, Week 9: 06 May - 10 May, Week 13: 03 June - 07 June Post Date: 08/06/2024 11:30 PM	<ul style="list-style-type: none"><li>• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</li><li>• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline</li></ul>
Final Exam Assessment Format: Individual	50%	Start Date: Not Applicable Due Date: 22/06/2024 05:00 PM Post Date: 22/06/2024 05:00 PM	<ul style="list-style-type: none"><li>• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</li><li>• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline</li><li>• PEE2.1 : Application of established engineering methods to complex engineering problem solving</li></ul>
Laboratory Assessment Format: Individual	10%	Start Date: Not Applicable Due Date: Week 5: 25 March - 29 March, Week 10: 13 May - 17 May, Week 13: 03 June - 07 June Post Date: 22/03/2024 12:00 AM	<ul style="list-style-type: none"><li>• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</li><li>• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information</li></ul>

			sciences which underpin the engineering discipline <ul style="list-style-type: none"> <li>• PEE3.6 : Effective team membership and team leadership</li> <li>• PEE2.1 : Application of established engineering methods to complex engineering problem solving</li> </ul>
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## Assessment Details

### Class Tests

#### Assessment Overview

There are three class tests during the semester: two for chemistry and one for the materials science part. Feedback will be given in class tutorial and on-line on Moodle.

#### Course Learning Outcomes

- CLO1 : Apply knowledge of basic science and engineering fundamentals of chemistry and materials
- CLO2 : In-depth understanding and technical competence in the discipline of materials science as it applies to engineering practice and an appreciation of sustainability in engineering
- CLO3 : Enhanced ability to undertake problem identification, formulation and solution

#### Detailed Assessment Description

There are three class tests during the semester. Two for chemistry and one for materials. All of the tests have the same weight (40/3%).

#### Assessment Length

1 hour

#### Submission notes

Each test to be submitted on Moodle .

#### Assessment information

Refer to instructions provided by lecturer.

#### Assignment submission Turnitin type

This is not a Turnitin assignment

# **Final Exam**

## Assessment Overview

3 hour final exam, comprehensively examining all theory content of this course.

## Course Learning Outcomes

- CLO1 : Apply knowledge of basic science and engineering fundamentals of chemistry and materials
- CLO2 : In-depth understanding and technical competence in the discipline of materials science as it applies to engineering practice and an appreciation of sustainability in engineering
- CLO3 : Enhanced ability to undertake problem identification, formulation and solution

## Detailed Assessment Description

Exam will be schedule during the final exams week.

## Assessment Length

3hours

## Submission notes

Final exams to be submitted on Moodle.

## Assessment information

Exam will be closed book and will cover the chemistry and materials science topics.

## Assignment submission Turnitin type

This is not a Turnitin assignment

## **Laboratory**

## Assessment Overview

Two chemistry labs.

One engineering materials labs.

Students complete pro-forma. Feedback through computer marked on-line testing and proformas returned to students.

## Course Learning Outcomes

- CLO1 : Apply knowledge of basic science and engineering fundamentals of chemistry and materials
- CLO2 : In-depth understanding and technical competence in the discipline of materials

science as it applies to engineering practice and an appreciation of sustainability in engineering

- CLO3 : Enhanced ability to undertake problem identification, formulation and solution
- CLO4 : Ability to work in a group and also independently

#### **Detailed Assessment Description**

See overview. All the lab reports have the same weight (10/3%).

#### **Assessment Length**

Respective lecturer will provide more information.

#### **Submission notes**

Lab reports must be submitted on Moodle by the deadline set by the respective lecturer.

#### **Assessment information**

Refer to instructions provided by lecturer.

#### **Assignment submission Turnitin type**

This is not a Turnitin assignment

## **General Assessment Information**

Class test 1 will be held in week 4, written feedback and grades will be given to students during week 4, before census date on the 26th March.

#### **Late Submission of Assessment**

No late submission allowed. All requests for special consideration must be formally submitted via MyUNSW prior to the assessment due date.

#### **Use of Generative AI in Assessments**

**NO ASSISTANCE :** *It is prohibited to use any software or service to search for or generate information or answers. If its use is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion.*

#### **Grading Basis**

Standard

#### **Requirements to pass course**

The overall passing mark is set at 50% by the university.

# Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	Lectures in weeks 1-4/5 will be done by Adrian. Topics include: Acids and Bases. The principles of acids and bases are considered with an emphasis on an understanding of strong versus weak acids and bases. Redox Reactions and Corrosion. Balancing redox reactions, electron transfer reactions at electrodes and the chemistry of corrosion Polymers. Polymeric materials, introduction to polymer structures and properties
Week 2 : 4 March - 8 March	Lecture	Lectures in weeks 1-4/5 will be done by Adrian. Topics include: Acids and Bases. The principles of acids and bases are considered with an emphasis on an understanding of strong versus weak acids and bases. Redox Reactions and Corrosion. Balancing redox reactions, electron transfer reactions at electrodes and the chemistry of corrosion Polymers. Polymeric materials, introduction to polymer structures and properties
Week 3 : 11 March - 15 March	Lecture	Lectures in weeks 1-4/5 will be done by Adrian. Note: Monday (11th March) is a holiday. Class session lost. Topics include: Acids and Bases. The principles of acids and bases are considered with an emphasis on an understanding of strong versus weak acids and bases. Redox Reactions and Corrosion. Balancing redox reactions, electron transfer reactions at electrodes and the chemistry of corrosion Polymers. Polymeric materials, introduction to polymer structures and properties
Week 4 : 18 March - 22 March	Lecture	Lectures in weeks 1-4/5 will be done by Adrian. Topics include: Acids and Bases. The principles of acids and bases are considered with an emphasis on an understanding of strong versus weak acids and bases. Redox Reactions and Corrosion. Balancing redox reactions, electron transfer reactions at electrodes and the chemistry of corrosion Polymers. Polymeric materials, introduction to polymer structures and properties
	Assessment	First class test will be in week 4. Lecturer will provide details.
Week 5 : 25 March - 29 March	Lecture	Lectures in weeks 1-4/5 will be done by Adrian. Note: Friday (31st March) is a holiday. Class session lost. Topics include: Acids and Bases. The principles of acids and bases are considered with an emphasis on an understanding of strong versus weak acids and bases. Redox Reactions and Corrosion. Balancing redox reactions, electron transfer reactions at electrodes and the chemistry of corrosion Polymers. Polymeric materials, introduction to polymer structures and properties
	Assessment	Chemistry lab 1
Week 6 : 1 April - 5 April	Lecture	Lectures in weeks 4/5-9 will be done by David. Note: Monday (1st April) is a holiday. Class session lost. Topics include: Electronic Structure of Atoms and Introduction to Bonding. Quantum theory of electrons and chemical bonding Intermolecular Forces. Description of the different types of intermolecular forces and how they apply in different materials. Introduction to Chemical Thermodynamics. Solving simple thermochemical problems and an introduction to entropy and free energy in chemical systems.
Week 7 : 22 April - 26 April	Lecture	Lectures in weeks 4/5-9 will be done by David. Topics include: Electronic Structure of Atoms and Introduction to Bonding. Quantum theory of electrons and chemical bonding Intermolecular Forces. Description of the different types of intermolecular forces and how they apply in different materials. Introduction to Chemical Thermodynamics. Solving simple thermochemical problems and an introduction to entropy and free energy in chemical systems.
Week 8 : 29 April - 3 May	Lecture	Lectures in weeks 4/5-9 will be done by David. Topics include: Electronic Structure of Atoms and Introduction to Bonding. Quantum theory of electrons and chemical bonding Intermolecular Forces. Description of the different types of intermolecular forces and how they apply in different materials. Introduction to Chemical Thermodynamics. Solving simple thermochemical problems and an introduction to entropy and free energy in chemical systems.
Week 9 : 6 May - 10 May	Lecture	Lectures in weeks 4/5-9 will be done by David. Note: Friday (10th May) is a military day. Class session lost. Topics include:

		Electronic Structure of Atoms and Introduction to Bonding. Quantum theory of electrons and chemical bonding Intermolecular Forces. Description of the different types of intermolecular forces and how they apply in different materials. Introduction to Chemical Thermodynamics. Solving simple thermochemical problems and an introduction to entropy and free energy in chemical systems.
	Assessment	Second class test will be in this week. Lecturer will provide details.
Week 10 : 13 May - 17 May	Lecture	Lectures in weeks 10-13 will be done by JP. Topics include: Behaviour of Materials. Response to modes of loading: tension, fatigue, creep and impact. Ductile and brittle fracture, shear and cleavage and fracture transition. Introduction to fracture mechanics Ferrous Metallurgy. Fe-C phase system. Equilibrium and non-equilibrium transformations: annealing and normalising, quench and temper. Transformation diagrams. Alloying of steels and hardenability. Stainless steels. Non-ferrous Metallurgy. Aluminium Alloys: wrought and cast alloys, temper designations, heat treatable alloys and non-heat treatable alloys, ageing. Copper-based alloys.
	Assessment	Chemistry lab 2
Week 11 : 20 May - 24 May	Lecture	Lectures in weeks 10-13 will be done by JP. Topics include: Behaviour of Materials. Response to modes of loading: tension, fatigue, creep and impact. Ductile and brittle fracture, shear and cleavage and fracture transition. Introduction to fracture mechanics Ferrous Metallurgy. Fe-C phase system. Equilibrium and non-equilibrium transformations: annealing and normalising, quench and temper. Transformation diagrams. Alloying of steels and hardenability. Stainless steels. Non-ferrous Metallurgy. Aluminium Alloys: wrought and cast alloys, temper designations, heat treatable alloys and non-heat treatable alloys, ageing. Copper-based alloys.
		Laboratory: Materials labs start this week. Check schedule on Moodle and your timetable.
Week 12 : 27 May - 31 May	Lecture	Lectures in weeks 10-13 will be done by JP. Note: Monday (27th May) is a holiday. Class will be on Tuesday at 1000. Topics include: Behaviour of Materials. Response to modes of loading: tension, fatigue, creep and impact. Ductile and brittle fracture, shear and cleavage and fracture transition. Introduction to fracture mechanics Ferrous Metallurgy. Fe-C phase system. Equilibrium and non-equilibrium transformations: annealing and normalising, quench and temper. Transformation diagrams. Alloying of steels and hardenability. Stainless steels. Non-ferrous Metallurgy. Aluminium Alloys: wrought and cast alloys, temper designations, heat treatable alloys and non-heat treatable alloys, ageing. Copper-based alloys.
		Laboratory: Materials labs continue this week. Check schedule on Moodle and your timetable.
Week 13 : 3 June - 7 June	Lecture	Lectures in weeks 10-13 will be done by JP. Topics include: Behaviour of Materials. Response to modes of loading: tension, fatigue, creep and impact. Ductile and brittle fracture, shear and cleavage and fracture transition. Introduction to fracture mechanics Ferrous Metallurgy. Fe-C phase system. Equilibrium and non-equilibrium transformations: annealing and normalising, quench and temper. Transformation diagrams. Alloying of steels and hardenability. Stainless steels. Non-ferrous Metallurgy. Aluminium Alloys: wrought and cast alloys, temper designations, heat treatable alloys and non-heat treatable alloys, ageing. Copper-based alloys.
	Assessment	The materials class test will be this week. Lecturer will provide details. Materials lab

## Attendance Requirements

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

## General Schedule Information

### Lectures (attend all)

- Monday 1000-1200 (weeks 1-5 Military theatre, B3-MTH; weeks 6-13 Adams 400)

- Tuesday 1200-1400 (Lect Nth LT6)
- Friday 1000-1100 (Lect Nth LT9)

Lectures and laboratories will be delivered by: JP: Dr. Juan Pablo Escobedo Diaz, Adrian: Dr. Adrian Garrido-Sanchis, David: Dr. David Ollis.

See weekly schedule for holidays and lectures on timetable days.

**Laboratory sessions (attend all sessions with your group).** See schedule on Moodle and your timetable

- Chemistry labs in weeks 5 and 9 (B22 -322: PEMS Chem Lab 1)
- Materials lab in weeks 11-12 (B20 -108: Main Lab)

## Course Resources

### Prescribed Resources

#### Compulsory Texts

- Callister Jr, W.D. et al (2021) Materials Science and Engineering: An Introduction, First Australian And New Zealand Edition (1st ed.), John Wiley and Sons Australia, ISBN 9780730382843.
- R. Chang, Chemistry, McGraw-Hill, New York, Edition 13, ISBN: 9781259911156

### Recommended Resources

Provided lecture notes, lab standards and instructions.

### Additional Costs

None

### Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of this course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups. Student opinions really do

make a difference. Refer to the Moodle site for this course to see how the feedback from previous students has contributed to the course development.

**Important note:** Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct Policy

<https://www.unsw.edu.au/planning-assurance/conduct-integrity/conduct-unsw/student-conduct-integrity/student-code-conduct>

## Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Lecturer	Adrian Garrido Sanchis		B22-R218	02 5114 5031	Lecturing staff are available for consultation during normal office hours and via email.	No	No
	David Ollis		B22-R100	02 5114 5031	Lecturing staff are available for consultation during normal office hours and via email.	No	No
Convenor	Juan Pablo Escobedo-Diaz		B26 G04	02 5114 5174	Available for consultation during normal working hours; please phone or e-mail to make an appointment.	Yes	Yes

## Other Useful Information

### Academic Information

### Course Evaluation and Development

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by listening to our own students. Students will be asked to complete the myExperience survey towards the end of each course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the “On-going Student Feedback” link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups (where applicable). Student opinions really do make a difference. Refer to the Moodle site for your course to see how the feedback from previous students has contributed to the course development.

**Important note:** Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct.

## **Equitable Learning Services (ELS)**

Students living with neurodivergent, physical and/or mental health conditions or caring for someone with these conditions may be eligible for support through the Equitable Learning Services team. Equitable Learning Services is a free and confidential service that provides practical support to ensure your mental or physical health conditions do not adversely affect your studies.

Our team of dedicated **Equitable Learning Facilitators (ELFs)** are here to assist you through this process. We offer a number of services to make your education at UNSW easier and more equitable.

Further information about ELS for currently enrolled students can be found at: <https://www.student.unsw.edu.au/equitable-learning>

## **Academic Honesty and Plagiarism**

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct.

Find relevant information at: [Student Code of Conduct \(unsw.edu.au\)](https://student.unsw.edu.au/)

Plagiarism undermines academic integrity and is not tolerated at UNSW. It is defined as using the words or ideas of others and passing them off as your own, and can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

<https://student.unsw.edu.au/plagiarism>

## **Submission of Assessment Tasks**

### **Special Consideration**

Special Consideration is the process for assessing and addressing the impact on students of short-term events, that are beyond the control of the student, and that affect performance in a specific assessment task or tasks.

Applications for Special Consideration will be accepted in the following circumstances only:

- Where academic work has been hampered to a substantial degree by illness or other cause;
- The circumstances are unexpected and beyond the student's control;
- The circumstances could not have reasonably been anticipated, avoided or guarded against by the student; and either:
  - (i) they occurred during a critical study period and was 3 consecutive days or more duration, or a total of 5 days within the critical study period; or
  - (ii) they prevented the ability to complete, attend or submit an assessment task for a specific date (e.g. final exam, in class test/quiz, in class presentation)

Applications for Special Consideration must be made as soon as practicable after the problem occurs and at the latest within three working days of the assessment or the period covered by the supporting documentation.

By sitting or submitting the assessment task the student is declaring that they are fit to do so and cannot later apply for Special Consideration (UNSW 'fit to sit or submit' requirement).

Sitting, accessing or submitting an assessment task on the scheduled assessment date, after applying for special consideration, renders the special consideration application void.

Find more information about special consideration at: <https://www.student.unsw.edu.au/special/consideration/guide>

Or apply for special consideration through your [MyUNSW portal](#).

#### **Late Submission of assessment tasks (other than examinations)**

UNSW has a standard late submission penalty of:

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

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

#### **Electronic submission of assessment**

Except where the nature of an assessment task precludes its electronic submission, all assessments must be submitted to an electronic repository, approved by UNSW or the Faculty, for archiving and subsequent marking and analysis.

### **Release of final mark**

All marks obtained for assessment items during the session are provisional. The final mark as published by the university following the assessment review group meeting is the only official mark.