UNSW Course Outline

MATS1192 Design and Application of Materials in Science and Engineering - 2024

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General Course Information

Course Code : MATS1192
Year : 2024
Term : Term 1
Teaching Period : T1
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 is a first-year core course for Materials Science and Engineering and Materials Science

students. Students will learn about the structure and properties of materials for applications in industry and society including, for example, structural, medical and transport applications. Topics covered include microstructure and structure-property relationships of the main types of engineering materials (metals, ceramics, polymers and composites); micromechanisms of elastic and plastic deformation; fracture mechanisms for ductile and brittle materials, and phase equilibria of alloys. Students will gain an insight into current research conducted by academics in the school and visit major industrial materials companies in NSW. Introductory materials laboratories will allow students to test and characterise materials and analyse data related to material properties. A knowledge of high-school level chemistry and physics (NSW HSC Year 11 or equivalent) will provide a strong foundation for the course. The course content will be delivered through a series of standard and flipped lectures and tutorials.

Course Aims

The aim of this course is to introduce students to fundamental materials property-structure relationships pertinent to the design and application of components. The course material and activities place materials science and engineering in context within the discipline and society.

This course will provide students with a foundation for future studies in materials science and engineering courses.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe basic property-structure relationships in materials.
CLO2 : Explain the mechanical behaviour of different types of materials and how it relates to their atomic and microstructure.
CLO3 : Identify the key application areas of different materials classes and explain the reasons underlying the suitability of the material class for each application.
CLO4 : Perform experiments and analyse data relating to materials property structure relationships.
CLO5 : Communicate the application and context of materials science and engineering within industry and society using written and oral formats

Course Learning Outcomes	Assessment Item
CLO1 : Describe basic property-structure relationships in materials.	• Laboratory reports • Professional experience portfolio • Online quizzes • Final exam
CLO2 : Explain the mechanical behaviour of different types of materials and how it relates to their atomic and microstructure.	• Laboratory reports • Professional experience portfolio • Online quizzes • Final exam
CLO3 : Identify the key application areas of different materials classes and explain the reasons underlying the suitability of the material class for each application.	• Laboratory reports • Professional experience portfolio • Online quizzes • Final exam
CLO4 : Perform experiments and analyse data relating to materials property structure relationships.	• Laboratory reports
CLO5 : Communicate the application and context of materials science and engineering within industry and society using written and oral formats	• Professional experience portfolio

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Laboratory reports Assessment Format: Individual	9%	Start Date: Not Applicable Due Date: One week after each lab class
Professional experience portfolio Assessment Format: Individual	30%	Start Date: Not Applicable Due Date: Not Applicable
Online quizzes Assessment Format: Individual	16%	Start Date: Not Applicable Due Date: Not Applicable
Final exam Assessment Format: Individual	45%	Start Date: Final exam period Due Date: Final exam period

Assessment Details

Laboratory reports

Assessment Overview

You will attend three laboratories, which will give you practice measuring material properties and analysing data collected from material testing. The laboratory exercises will also demonstrate some of the concepts covered in the classes to help develop your understanding of these concepts. You will work in a group to collect data which will be collated by the lab demonstrator and sent to you to complete an individual laboratory report.

Each report will be worth 3% and consist of completing data tables, transforming and graphing data, and answering short-answer questions about the laboratory concepts. The labs will cover materials property-structure relationships, materials selection and mechanical properties.

Feedback will be provided two weeks after submission, through comments and the mark on the submission.

Course Learning Outcomes

- CLO1 : Describe basic property-structure relationships in materials.
- CLO2 : Explain the mechanical behaviour of different types of materials and how it relates to their atomic and microstructure.
- CLO3 : Identify the key application areas of different materials classes and explain the reasons underlying the suitability of the material class for each application.
- CLO4 : Perform experiments and analyse data relating to materials property structure relationships.

Assignment submission Turnitin type

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

Professional experience portfolio

Assessment Overview

The professional experience portfolio is an ongoing assessment designed to

1. introduce you to the range of careers possible at the end of your degree,
2. develop your networking and communication skills and
3. encourage reflection on your progress through the course and your understanding of materials science/engineering within a societal and professional context.

The portfolio is a collection of reflections and reports based on professional experiences completed throughout the term. The portfolio consists of 4 tasks with submission dates spread throughout the term. The complete portfolio is worth 31%.

· Camp reflection 4%
· Industry reflection 4%
· Interview with an academic 4%
· Conference report, presentation 18%

Camp reflection: Attendance at the first-year materials camp is designed to develop your networking skills and build professional and social relationships that will be valuable. You will complete a reflection on how you fit within the larger cohort of science and engineering students at UNSW. If you are unable to attend camp, you will complete the reflection based on in-class networking events and your broader experience as a student at UNSW.

Industry experience: You will attend two industry site visits, which will demonstrate industry applications of materials science and engineering, as well as career opportunities for materials scientists and engineers. You will submit a short reflection on what you learnt during each site visit.

Academic experience: Working in groups of 4-5 students, you will interview a member of academic staff in the School of Materials Science and Engineering to learn about their research

work. You will submit an individual reflection on how you relate to their research and how it relates to society more broadly. You will also reflect on your team work skills developed in order to complete the interview as a team.

Conference experience: You will select a specific application of a material of your choice to research. You will prepare a written report on your chosen topic and give a 5-minute presentation. At the conclusion of the conference, you will provide, receive and reflect on feedback on professional communication skills.

Course Learning Outcomes

- CLO1 : Describe basic property-structure relationships in materials.
- CLO2 : Explain the mechanical behaviour of different types of materials and how it relates to their atomic and microstructure.
- CLO3 : Identify the key application areas of different materials classes and explain the reasons underlying the suitability of the material class for each application.
- CLO5 : Communicate the application and context of materials science and engineering within industry and society using written and oral formats

Assignment submission Turnitin type

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

Online quizzes

Assessment Overview

There will be four online quizzes and six online tutorials to complete, spread throughout the course. Each quiz will be worth 2.5% (10% in total) and completion of the online tutorials will be worth 6% in total.

These quizzes and tutorials will help you to assess your progress in the course and identify topics that require further study.

Quizzes:

1. Phase diagrams and transformations
2. Mechanical behaviour
3. Ferrous and non-ferrous alloys
4. Polymers, ceramics, and composites
   The quizzes are automatically marked with the final mark released to students when the quiz closes and will consist of multiple choice and short numerical questions.

Online tutorials:

1. Phase diagrams and metal alloys
2. Phase transformations
3. Plastic deformation
4. Strengthening mechanisms
5. Fracture
6. Ferrous alloys

You must complete the online tutorial including the quiz at the end. The online tutorial quizzes will typically include short answer, multiple-choice and numerical questions. Students will receive feedback upon completion of each question.

Additionally, you are required to complete a formative quiz on atomic bonding in Week 1; completion by Week 3 is required in order to access the remaining online content for the course.

Course Learning Outcomes

- CLO1 : Describe basic property-structure relationships in materials.
- CLO2 : Explain the mechanical behaviour of different types of materials and how it relates to their atomic and microstructure.
- CLO3 : Identify the key application areas of different materials classes and explain the reasons underlying the suitability of the material class for each application.

Assignment submission Turnitin type

This is not a Turnitin assignment

Final exam

Assessment Overview

The final exam is designed to assess your learning of all topics delivered across all weeks of the term, including material from lectures and tutorials. The examination will consist of multiple-choice and short numerical questions, as well as questions requiring a written response - details will be confirmed during the course. The examination will occur during the official university examination period. Feedback may be available through inquiry with the course convenor.

Hurdle requirement: must achieve 40% to receive a passing grade in the course.

Course Learning Outcomes

- CLO1 : Describe basic property-structure relationships in materials.
- CLO2 : Explain the mechanical behaviour of different types of materials and how it relates to their atomic and microstructure.

- CLO3 : Identify the key application areas of different materials classes and explain the reasons underlying the suitability of the material class for each application.

Assignment submission Turnitin type

This is not a Turnitin assignment

Hurdle rules

To pass the course, you must achieve at least 40% in the final exam.

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

To pass the course, you must:

1) achieve an overall grade of at least 50;

2) achieve at least 40% in the final exam.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	Monday, 9am-11am: Introduction to the course; Atomic bonding Wednesday, 9am-11am: Atomic packing
Week 2 : 19 February - 25 February	Lecture	Monday, 9am-11am: Defects in crystal structures; Introduction to Work Health & Safety Wednesday, 9am-11am: Diffusion; Atomic structure of metals
	Workshop	Friday, 2pm-5pm: Welcome to the School of Materials Science & Engineering
Week 3 : 26 February - 3 March	Lecture	Monday, 9am-11am: Phase diagrams Wednesday, 9am-11am: Elastic deformation
	Laboratory	Wednesday: Energy Materials Lab
Week 4 : 4 March - 10 March	Lecture	Monday, 9am-11am: Plastic deformation; Dislocations Wednesday, 9am-11am: Introduction to fast fracture; Ethics in science and engineering
Week 5 : 11 March - 17 March	Lecture	Monday, 9am-11am: Strengthening mechanisms Wednesday, 9am-11am: Fast fracture
	Laboratory	Wednesday: Tensile Testing Lab
Week 6 : 18 March - 24 March	Lecture	Monday, 9am-11am: Revision
	Other	Wednesday, 9am-3pm: Site visit to ANSTO
Week 7 : 25 March - 31 March	Lecture	Monday, 9am-11am: Steels Wednesday, 9am-11am: Non-ferrous alloys
Week 8 : 1 April - 7 April	Lecture	Monday: Public holiday, no class Wednesday, 9am-11am: Polymers
	Laboratory	Wednesday: Steel Microstructures Lab
Week 9 : 8 April - 14 April	Lecture	Monday, 9am-11am: Ceramics
	Other	Wednesday, 9am-1pm: Site visit to Brickworks (TBC)
Week 10 : 15 April - 21 April	Lecture	Monday, 9am-11am: Composites and nanomaterials Wednesday, 9am-11am: Revision
	Assessment	Conference presentations (TBC) Group 1 - Monday, 2pm-5pm Group 2 - Friday, 10am-1pm Group 3 - Friday, 2pm-5pm

Attendance Requirements

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

Course Resources

Recommended Resources

Engineering Materials 1 and 2, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann, 4th Edition.

Materials Science and Engineering: An Introduction, W.D. Callister, D.G. Rethwisch, Wiley, 1st ANZ Edition.

The Science and Engineering of Materials, D.R. Askerland, PWS Publishing Co.

Introduction to Materials Science for Engineers, J.F. Shackelford, Maxwell Macmillan.

Principles of Materials Science and Engineering, W.F. Smith, McGraw-Hill.

Engineering Materials and Their Applications, R.A. Flinn and P.K. Trojan, Haughton.

Materials for Engineering, L.H. Van Vlack, Addison-Wesley.

Materials for the Engineering Technicians, R.A. Higgins, Edward Arnold.

Materials Science – A Multimedia Approach (electronic resource), John Russ, PWS Publishing Co.
R.E. Smallman and R. Bishop, Metals and Materials, 1996

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Judy Hart		Room 339, Hilmer Building	02 9385 7998	By appointment	Yes	Yes
Lecturer	Kevin Laws		Room 301, Hilmer Building	02 9385 5234	By appointment	No	No
Lab director	Caitlin Healy		Room 241, Hilmer Building	02 9065 0450		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