



# Course Outline

MATS4004

Fracture Mechanics and Failure Analysis

Materials Science and Engineering

Science

T2, 2022

# 1. Staff

---

Position	Name	Email	Consultation times and locations	Contact Details
Course Convenor	A/Prof John Daniels	<a href="mailto:j.daniels@unsw.edu.au">j.daniels@unsw.edu.au</a>	Room 338, School of Materials Science and Engineering (Building E10), by appointment	Phone: 9385 5607
Lecturer	Dr Caitlin Healy	<a href="mailto:caitlin.healy@unsw.edu.au">caitlin.healy@unsw.edu.au</a>	Room 401, School of Materials Science and Engineering (Building E10), by appointment	Phone: 9385 4509

# 2. Course information

---

Units of credit: 6

Pre-requisite(s): None

Timetabling website: TBA

Teaching times and locations:

	Lecture	Lecture	Lecture
Day	Monday	Wednesday	Friday
Location	Online	Online	Online
Time	12:00 – 14:00	11:00-13:00	09:00-11:00
Weeks	1,2,4,5, 8-10	1-5, 7-10	1, 3, 5, 7 <sup>#</sup> , 10

\* Note that week 8 timetable is varied to allow for labs

# This lecture time on week 7 is reserved for the midsession quiz

## 2.1 Course summary

Fracture mechanics, remnant life assessment, general practice in failure analysis, fractographic analysis, ductile and brittle fracture, fatigue, stress corrosion cracking, hydrogen embrittlement, fracture criteria in design, fracture toughness and fatigue testing

## 2.2 Course aims

To develop an understanding of fracture mechanics, and the common failure mechanisms and their distinguishing features, so as to be capable of incorporating fracture criteria into design and undertaking failure analysis of engineering structures.

## 2.3 Course learning outcomes (CLO)

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

1. Predict the onset of failure
2. Identify the distinguishing features of different types of service failure
3. Identify the materials and processing features responsible for failure
4. Make informed decisions in recommending remedial action

## 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	Predict...	1.1, 1.2, 1.3 & 3.4	1 & 4
CLO 2	Identify...	1.1, 1.2, 1.3 & 3.4	1, 2, 3 & 4
CLO 3	Identify...	1.3, 2.1, 2.2 & 3.4	1, 3, & 4

CLO 4



## 4. Course schedule and structure

---

This course consists of 50 hours of class contact hours. You are expected to take an additional 100 hours of non-class contact hours to complete assessments, readings and exam preparation spread over the term.

Week	Topics	Activity
1	Revision and clarification of basic concepts: Linear Elastic Analysis Airy stress function Plastic Analysis Hydrostatic stress, deviatoric stress, yield criteria	

## 5. Assessment

---

### 5.1 Assessment tasks

Assessment task	Description	Weight	Due date
<b>Assignment:</b>	Materials failure case study. Students will research and report/present on historic materials failures that caused a major industrial disruption and resulted in legal proceedings. They will prepare a reports and short presentation summarising the case study.	30%	Week 5
<b>Mid-term exam:</b>	The mid-term exam will be held in class time and cover the lecture topics taught in weeks 1-5	20%	Week 7
<b>Laboratory Report:</b>	Detailed investigation of fracture surfaces. Students will use laboratory methods to investigate the fracture surface of a material failure to understand its origins and write a detailed report.	30%	

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, to a maximum of five days after which the assessment cannot be submitted.

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.

Rules governing conduct during exams are given at: <https://student.unsw.edu.au/exam-rules>

## 5.4. Feedback on assessment

Formative in-class test: Students will receive feedback on their understanding of the course in-class prior to the census date.

Assignments: Feedback will be given 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 student performed may be given.

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

Midsession exams: Students will receive their marked exams indicating what questions were answered correctly and incorrectly. Overall comments and worked solutions may 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,

## 7. Readings and resources

---

T.L. Anderson, "Fracture Mechanics: Fundamentals and Applications" NOTE: Available as E-book via UNSW library.

Metals Handbook, 8th edition, Volumes 9 and 10, 9th edition, Volumes 11 and 12, 10th edition Volumes 11 and 19, ASM International.

Practical Failure Analysis (journal) ASM International

Engineering Failure Analysis (journal) Pergamon

## 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 Coo7chool Office: Room 1374 0 594G04 TJET60.004 40 go.08866(7, )-94.96 842.04 reW\* nBT/F1 9.96 T