UNSW Course Outline

ZEIT4006 Structural Integrity Assessment - 2024

Published on the 11 Feb 2024

General Course Information

Course Code : ZEIT4006
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 is an Engineering elective course, specially designed for students wishing to specialise in the Aircraft or Ground/Marine Vehicle Maintenance. The aim of this course is to introduce you to the basic principles, theory and applications of the major non-destructive inspection (NDI)

techniques employed in the manufacturing and maintenance environments in industry, and the application of the information gained from NDI, i.e. size and location of flaws, to structural integrity assessment.
The first part of the course will provide an exposure to various traditional NDI techniques including liquid penetrant, ultrasonics, magnetic particle, radiography and eddy current testing, as well as an introduction to new and emerging health monitoring techniques. The second part of the course will focus on damage tolerance, durability assessment and fatigue life estimation, using failure criteria, fracture mechanics, stress life and fatigue crack growth theories.

Course Aims

The aim of this course is to introduce you to the basic principles, theory and applications of the major non-destructive inspection (NDI) techniques employed in the manufacturing and maintenance environments in industry, and the application of the information gained from NDI, ie. size and location of flaws, to structural integrity assessment.

Relationship to Other Courses

ZEIT 3500 - Engineering Structures is a prerequisite for this course. It can be waved on a case-by-case basis.

Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Professional Engineer (Stage 1)
CLO1 : On successful completion of this course, the student will have a comprehensive understanding of the underpinning natural and physical principles involved in the application of NDT techniques.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline
CLO2 : On successful completion of this course, the student will have an in-depth understanding of the principles and theories of Strength Criteria, and Fracture Mechanics.	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline
CLO3 : On successful completion of this course, the student will be able to apply the techniques of Fracture Mechanics and Fatigue analysis for assessing the structural integrity of components with crack like defects.	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving
CLO4 : On successful completion of this course, the student will be able to communicate effectively their understanding of the principles of NDT techniques and knowledge of strength criteria, fracture mechanics and fatigue.	• PEE3.2 : Effective oral and written communication in professional and lay domains

Course Learning Outcomes	Assessment Item
CLO1 : On successful completion of this course, the student will have a comprehensive understanding of the underpinning natural and physical principles involved in the application of NDT techniques.	• Class Test One
CLO2 : On successful completion of this course, the student will have an in-depth understanding of the principles and theories of Strength Criteria, and Fracture Mechanics.	• Laboratory Reports • Final Examination • Class Test One
CLO3 : On successful completion of this course, the student will be able to apply the techniques of Fracture Mechanics and Fatigue analysis for assessing the structural integrity of components with crack like defects.	• Class Test Two • Final Examination
CLO4 : On successful completion of this course, the student will be able to communicate effectively their understanding of the principles of NDT techniques and knowledge of strength criteria, fracture mechanics and fatigue.	• Class Test Two • Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System

Learning and Teaching in this course

This course is primarily taught through lectures, laboratory work and class tests. The lectures will provide you with the basic principles, theory and applications of the major NDI techniques (LO 1) and the theoretical knowledge required for damage tolerance and durability assessment (LO 2). This learning is further
reinforced with laboratory sessions which will involve demonstrations of the applications of the NDI techniques as well as hands-on experiments.

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
Phone: (02) 9385-1333
International: +61 2 9385 1333

For all other Moodle issues please contact:
External TELT Support
Email: 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

This course is primarily taught through lectures, laboratory work and class tests. The lectures will provide you with the basic principles, theory and applications of the major NDI techniques (LO 1)

and the theoretical knowledge required for damage tolerance and durability assessment (LO 2). This learning is further
reinforced with laboratory sessions which will involve demonstrations of the applications of the NDI techniques as well as hands-on experiments.
The class tests will be summative and formative; it will assess the knowledge you have gained in the topics covered and uncover areas in which you need to make improvements (LOs 3 and 4).

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)
Laboratory Reports Assessment Format: Individual	15%	Start Date: Labs start in week 8. Due Date: Week 8: 29 April - 03 May, Week 9: 06 May - 10 May, Week 10: 13 May - 17 May, Week 11: 20 May - 24 May Post Date: 27/05/2024 05:00 PM	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE3.2 : Effective oral and written communication in professional and lay domains
Class Test One Assessment Format: Individual	15%	Start Date: 21/03/2024 11:00 AM Due Date: Week 4: 18 March - 22 March Post Date: 22/03/2024 01:00 PM	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline
Class Test Two Assessment Format: Individual	25%	Start Date: 23/05/2024 11:00 AM Due Date: Week 11: 20 May - 24 May Post Date: 24/05/2024 05:00	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information

		PM	sciences which underpin the engineering discipline • PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline
Final Examination Assessment Format: Individual	45%	Start Date: Final exam week Due Date: Final exam week Post Date: 29/01/2024 02:00 PM	• PEE3.2 : Effective oral and written communication in professional and lay domains • PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline • PEE2.1 : Application of established engineering methods to complex engineering problem solving

Assessment Details

Laboratory Reports

Assessment Overview

There are a total of 4 labs of the most important NDI techniques. All of them have the same weight

Course Learning Outcomes

- CLO2 : On successful completion of this course, the student will have an in-depth understanding of the principles and theories of Strength Criteria, and Fracture Mechanics.

Detailed Assessment Description

Reports are due on the Sunday after each lab at 2359. The total for all reports is 15% and all of them have the same weight.

Assessment Length

As provided.

Submission notes

Each lab to be submitted on Moodle by the deadline.

Assessment information

Refer to instruction provided by the instructor.

Assignment submission Turnitin type

This is not a Turnitin assignment

Hurdle rules

A minimum of 50% is to be obtained in each type of assessment (class tests, lab reports and final exam) to pass the course.

Class Test One

Assessment Overview

This is a closed-book class test focused on the fundamentals and application of NDI techniques.

Course Learning Outcomes

- CLO1 : On successful completion of this course, the student will have a comprehensive understanding of the underpinning natural and physical principles involved in the application of NDT techniques.
- CLO2 : On successful completion of this course, the student will have an in-depth understanding of the principles and theories of Strength Criteria, and Fracture Mechanics.

Detailed Assessment Description

Test will be computer-based, multiple choice and brief answers. It will cover the first topics: Intro to NDI, Materials Technology and liquid penetrant.

Assessment Length

1 hour

Submission notes

Tests to be submitted on Moodle.

Assessment information

To be provided by the lecturer.

Assignment submission Turnitin type

This is not a Turnitin assignment

Hurdle rules

A minimum of 50% is to be obtained in each type of assessment (class tests, lab reports and final exam) to pass the course.

Class Test Two

Assessment Overview

This is a closed-book class test focused on the fundamentals fracture mechanics and fatigue.

Course Learning Outcomes

- CLO3 : On successful completion of this course, the student will be able to apply the techniques of Fracture Mechanics and Fatigue analysis for assessing the structural integrity of components with crack like defects.
- CLO4 : On successful completion of this course, the student will be able to communicate effectively their understanding of the principles of NDT techniques and knowledge of strength criteria, fracture mechanics and fatigue.

Detailed Assessment Description

Test will be computer-based, multiple choice and brief answers. It will cover the rest of the NDI topics: Mag particle, Eddy current and ultrasound.

Assessment Length

1 hour

Submission notes

Test to be submitted on Moodle.

Assessment information

To be provided by lecturer.

Assignment submission Turnitin type

This is not a Turnitin assignment

Hurdle rules

A minimum of 50% is to be obtained in each type of assessment (class tests, lab reports and final exam) to pass the course.

Final Examination

Assessment Overview

This is a comprehensive examination of NDI techniques and fundamentals of fatigue and fracture mechanics

Course Learning Outcomes

- CLO2 : On successful completion of this course, the student will have an in-depth understanding of the principles and theories of Strength Criteria, and Fracture Mechanics.
- CLO3 : On successful completion of this course, the student will be able to apply the techniques of Fracture Mechanics and Fatigue analysis for assessing the structural integrity of components with crack like defects.
- CLO4 : On successful completion of this course, the student will be able to communicate effectively their understanding of the principles of NDT techniques and knowledge of strength criteria, fracture mechanics and fatigue.

Detailed Assessment Description

Exam will be during exam week. It will be a two hour exam, multiple choice, brief answers and numerical problems.

Assessment Length

2 hours

Submission notes

Final to be submitted on Moodle.

Assessment information

More details to be provided by Convenor.

Assignment submission Turnitin type

This is not a Turnitin assignment

Hurdle rules

A minimum of 50% is to be obtained in each type of assessment (class tests, lab reports and final exam) to pass the course.

General Assessment Information

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.

The assessments will consist of:

- 2 class tests worth 15% (Class test 1) and 25% (Class test 2) (50mins)
- 4 Laboratory Reports (weighing 15%, all of them are same weight)
- Final Examination (weighing 45%)

Class test 1 will be held in week 4, feedback, grades and worked solutions will be given to students by the census date (24 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

All components of assessment are Compulsory. A minimum of 50% is to be obtained in each type of assessment (class tests, lab reports and final exam) to pass the course.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Intro to course and knowledge test (JP). • Thursday: Intro to NDI techniques (JP)
Week 2 : 4 March - 8 March	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Materials Technology (Hongxu) • Thursday: Materials Technology/ Liquid penetrant (Hongxu)
Week 3 : 11 March - 15 March	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: OFF- Canberra Day • Thursday: Liquid penetrant (Hongxu)
Week 4 : 18 March - 22 March	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Liq. penetrant/Magnetic particle (Hongxu) • Thursday: Class test (Hongxu)
	Assessment	Class Test 1
Week 5 : 25 March - 29 March	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Magnetic particle • Thursday: Magnetic particle
Week 6 : 1 April - 5 April	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: OFF- Easter Monday • Thursday: Magnetic particle (Hongxu)
Week 7 : 22 April - 26 April	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Ultrasound (JP) • Thursday: OFF-ANZAC Day
Week 8 : 29 April - 3 May	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Ultrasound (JP) • Thursday: Ultrasound (JP) Labs start this week. Refer to your timetable.
	Assessment	Lab report 1
Week 9 : 6 May - 10 May	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Eddy current (JP) • Thursday: Eddy current (JP) Labs continue this week. Refer to your timetable.
	Assessment	Lab report 2
Week 10 : 13 May - 17 May	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Eddy current (JP) • Thursday: Eddy current (JP) Labs continue this week. Refer to your timetable.
	Assessment	Lab report 3
Week 11 : 20 May - 24 May	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Thermography (JP) • Thursday: Class test (JP) Labs continue this week. Refer to your timetable.
	Assessment	Lab report 4 Class test 2
Week 12 : 27 May - 31 May	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Reconciliation Day • Tuesday: (Compensation Day - Monday Timetable) Fatigue (JP) • Thursday: Fatigue (JP)
Week 13 : 3 June - 7 June	Lecture	Topics for a given week are tentative and will be adjusted depending how fast or slow we go through the content. • Monday: Fracture mechanics (JP) • Thursday: Fracture mechanics (JP)

Attendance Requirements

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

General Schedule Information

Lectures (attend all)

- Monday 1200-1400 (Lect Sth 2)
- Thursdays 1000-1100 (Lect Sth 2)

Labs start in week 8 and are on Monday 1500-1800 and Thursday 1500-1800. You need to attend all sessions with your group. See schedule Moodle and your timetable

- Week 8 : Liquid penetrant and magnetic particle.
- Week 9: Ultrasound
- Week 10: Eddy current
- Week 11: Thermography

Course Resources

Prescribed Resources

Prescribed Text

Grandt, Jr. A. F., Fundamentals of Structural Integrity: Damage Tolerant Design and Nondestructive Evaluation, Wileys, October 2003, ISBN: 978-0-471-21459-5.

Recommended Resources

Course Notes and Powerpoint slides will be provided through Moodle.

Recommended Reading

- Anderson, T.L., Fracture Mechanics: Fundamentals and Applications, Edition 3, Taylor & Francis, Inc., 1995, ISBN-13: 9780849316562.
- Halmshaw R., Non-destructive Testing, Edward Arnold, London, 1987.
- NONDESTRUCTIVE TESTING HANDBOOKS, Second Edition, Published in nine volumes by the American Society for Non-Destructive Testing.

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.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
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
Lecturer	Hongxu Wang		B16-R227	02 5114 5145	Available for consultation during normal working hours; please phone or e-mail to make an appointment.	No	No

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.

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

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 Equitible 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 Plagarism

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)

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.