UNSW Course Outline

ZEIT4603 Finite Element Method - 2024

Published on the 12 Feb 2024

General Course Information

Course Code : ZEIT4603
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

These days the analysis of all but the simple structures is carried out with the aid of computer programs based on the finite element method (FE). The user of the FE method has to decide what kind of elements should be used, and how many of them? Where should the mesh be fine

and where may it be coarse? Can the model be simplified? How accurate will the answers be, and how can they be checked? One need not understand all the mathematics of the finite element to answer these questions. However a competent user must have an understanding of the preliminary mathematics and must be able to understand how elements behave in order to choose suitable kinds, sizes and shapes of elements, and to guard against misinterpretations and unrealistically high expectations. This course is a balanced theoretical and practical introduction to the use of the FE method. The first part deals with mathematical preliminaries such as the weighted residual methods, finite element approximation and numerical integration. The second part is an application of the finite element method to linear plane elasticity problems. The third part deals with heat transfer. All the lectures include computational work in which problems are to be solved using Matlab and ABAQUS.

Course Aims

This course aims to provide a balanced theoretical and practical introduction to the use of the FE method.

Relationship to Other Courses

Pre-requisites: ZEIT3600 (Civil Eng.) or ZEIT3500 (Aero. and Mech. Eng.)

Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Professional Engineer (Stage 1)
CLO1 : Apply the theory of weighted residual methods to discretise a continuous differential equation to an algebraic one.	• PEE2.1 : Application of established engineering methods to complex engineering problem solving
CLO2 : To understand the theory of finite element approximation and numerical integration	• PEE2.2 : Fluent application of engineering techniques, tools and resources
CLO3 : To write MATLAB codes to analyse continuum elasticity problems	• PEE2.3 : Application of systematic engineering synthesis and design processes
CLO4 : To use a commercial finite element software to carry out finite element analysis in solid mechanics and heat transfer.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline

Course Learning Outcomes	Assessment Item
CLO1 : Apply the theory of weighted residual methods to discretise a continuous differential equation to an algebraic one.	• Assignment x2
CLO2 : To understand the theory of finite element approximation and numerical integration	• Assignment x2
CLO3 : To write MATLAB codes to analyse continuum elasticity problems	• Class Test 1 • Assignment x2
CLO4 : To use a commercial finite element software to carry out finite element analysis in solid mechanics and heat transfer.	• Class Test 1 • Assignment x2

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

This is a highly interactive course. Teaching face-to-face through lectures, tutorials, and practical activities in the PC lab. Lectures will be also made available on Moodlle as well as the recordings.

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

LO1 Apply the theory of weighted residual methods to discretise a continuous differential equation to an algebraic one.

LO2 Understand the theory of finite element approximation and numerical integration

LO3 Write MATLAB codes to analyse continuum elasticity problems

LO4 Use commercial finite element software to carry out finite element analysis.

Additional Course Information

This course, comprising 6 Units of Credit (UoC), delves into the theory and application of the finite element method (FE). In contemporary structural analysis, the finite element method, executed through computer programs, is essential for intricate structures. Users must make critical decisions regarding the type and quantity of elements, mesh refinement, model simplification, and accuracy verification without necessitating a deep dive into the intricacies of finite element mathematics.

While a comprehensive grasp of finite element mathematics is not mandatory, proficiency in preliminary mathematical concepts is crucial. Competent users must comprehend the fundamental mathematics and understand how elements behave to make informed choices about element types, sizes, and shapes. This course strikes a balance between theory and practical application, offering a well-rounded introduction to the FE method.

The initial segment covers mathematical foundations, encompassing weighted residual methods, finite element approximation, and numerical integration. The subsequent section applies the finite element method to linear plane elasticity problems. Throughout the lectures, computational exercises using Matlab and commercial software are integrated, providing hands-on experience in problem-solving.

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.

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

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 - Engineering Technologist (Stage 1), Engineers Australia - Professional Engineer (Stage 1)
Class Test 1 Assessment Format: Individual	20%	Start Date: End of week 6 Due Date: Not Applicable	• ET1.1 : Systematic, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the technology domain • PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline
Class Test 2 Assessment Format: Individual	40%	Start Date: Not Applicable Due Date: Not Applicable	• ET1.3 : In-depth understanding of specialist bodies of knowledge within the technology domain • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline
Assignment x2 Assessment Format: Individual	40%	Start Date: Not Applicable Due Date: Week 6 and Week 13	• ET1.2 : Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the technology domain • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline

Assessment Details

Class Test 1

Assessment Overview

The Class test 1 covers the mathematical fundamentals of the finite element method

Course Learning Outcomes

- CLO3 : To write MATLAB codes to analyse continuum elasticity problems
- CLO4 : To use a commercial finite element software to carry out finite element analysis in solid mechanics and heat transfer.

Detailed Assessment Description

Students are required to sit a class test carrying 20 % of the mark at the end of week 6.

Assessment Length

Two hours

Submission notes

Class test

Assignment submission Turnitin type

Not Applicable

Hurdle rules

To be assured of receiving a passing grade a student must achieve a minimum of 30% in each assessment item and an overall score of at least 50%.

Class Test 2

Assessment Overview

Class test 2 covers the practical aspects of the finite element method

Detailed Assessment Description

This a final exam to be scheduled during exam week.

Assessment Length

Two hours

Assessment information

To be scheduled during exam week

Hurdle rules

To be assured of receiving a passing grade a student must achieve a minimum of 30% in each assessment item and an overall score of at least 50%.

Assignment x2

Assessment Overview

This assignment is made of two part. The first part covers the mathematical fundamentals of the finite element. The second part is a project where students conduct finite element analysis of real structures.

Course Learning Outcomes

- CLO1 : Apply the theory of weighted residual methods to discretise a continuous differential equation to an algebraic one.
- CLO2 : To understand the theory of finite element approximation and numerical integration
- CLO3 : To write MATLAB codes to analyse continuum elasticity problems
- CLO4 : To use a commercial finite element software to carry out finite element analysis in solid mechanics and heat transfer.

Detailed Assessment Description

There are two parts in this assignment. Each part carries a weight of 20 %

Assessment information

A non graded test will be carried out before the cesus date so students can get written feedback.

Assignment submission Turnitin type

Not Applicable

Hurdle rules

To be assured of receiving a passing grade a student must achieve a minimum of 30% in each assessment item and an overall score of at least 50%.

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.**

An ungraded test will be carried out before week 4 so students can get written feedback before the census date.

Students are required to sit a class test carrying 20% of the mark at the end of week 6. The final exam will be during the exam week and will carry a weight of 40%. It will be held in a PC lab.

Students are also required to submit an assignment made of two parts, each carrying a weight of

20%.

Late Submission of Assessment

- *Unless prior arrangement is made with the lecturer or a formal application for special consideration is submitted, a penalty of 5% of the total available mark for the assessment will apply for each day that an assessment item is late up to a maximum of 5 days (120 hours) after which an assessment can no longer be submitted and a grade of 0 will be applied.*

Generative AI

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

To be assured of receiving a passing grade a student must achieve a minimum of 30% in each assessment item and an overall score of at least 50%.

Supplementary assessment in the event of failure of the course is generally not available, and should not be expected. Exceptions may be made for students in the final year of their program where there is a single failure preventing graduation.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	Weighted Residual methods
Week 2 : 4 March - 8 March	Lecture	Weighted Residual methods
	Laboratory	
Week 3 : 11 March - 15 March	Lecture	Finite element approximations
Week 4 : 18 March - 22 March	Lecture	Finite element approximations
Week 5 : 25 March - 29 March	Lecture	Finite element approximations
	Laboratory	Programming using Matlab
Week 6 : 1 April - 5 April	Lecture	Numerical integration
	Laboratory	Programming using Matlab
Week 7 : 22 April - 26 April	Lecture	Finite element implementation Plane problems
	Laboratory	Programming using Matlab
Week 8 : 29 April - 3 May	Lecture	Finite element implementation Plane problems
	Laboratory	Programming using Matlab
Week 9 : 6 May - 10 May	Lecture	Finite element implementation Plane problems
	Laboratory	Solving FE problems using professional software
Week 10 : 13 May - 17 May	Lecture	Finite element implementation Plane problems
Week 11 : 20 May - 24 May	Lecture	Plates
Week 12 : 27 May - 31 May	Lecture	Plates
	Laboratory	Solving FE problems using professional software

Attendance Requirements

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

General Schedule Information

Students are expected to attend all classes in the course in which they are enrolled. All requests for exemption from attendance or absence should be addressed to the Course Authority and where applicable, be accompanied by a medical certificate.

See University Rules at: https://student.unsw.edu.au/attendance

All Defence and Defence-funded students must also seek approval from the relevant Defence authority for exemption from attendance or absence.

Canberra Day	Mon 11 Mar	Monday lost
Good Friday	Fri 29 Mar	Friday lost

Easter Monday	Mon 1 Apr	Monday lost
Military Training Day	Wed 24 Apr	Wednesday lost
ANZAC Day Holiday	Thu 25 Apr	Thursday lost
Military Training Day	Fri 10 May	Friday lost
Reconciliation Day	Mon 27 May	Compensation Day: Monday 27 May classes to be delivered on Tuesday 28 May. Tuesday 28 May lost.
King's Birthday	Mon 10 Jun	No compensation (Study week)

Course Resources

Prescribed Resources

The presentation will follow the contents of the required textbook "Introduction to Finite Element Analysis Using MATLAB® and Abaqus". By Amar Khennane, CRC-Press, 2013.

A Matlab licence is required. Licences of ABAQUS (teaching edition) and Matlab are available in the PC lab.

Additional Costs

NA

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	Amar Khennane		Bld. 20, 131	(02) 5114 5165	Monday-Friday	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.

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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.