
# MMAN4410

# FINITE ELEMENT METHODS

# Contents

# 1. Staff Contact Details

**Course Convenor**
Name: Dr Garth Pearce
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**Course Lecturers**
Name: Professor Mark Hoffman
Office Location: Dean's Unit
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**Contact details for Demonstrators**
Jay Sul - Head Demonstrator
Email: j.sul@unsw.edu.au

Others TBA through Moodle

**Consultation**
Consultation concerning this course is available during the software laboratories. Outside of these hours the convenor and demonstrators can be contacted through the Moodle platform; either via a forum or through direct messaging. *Any questions about course content and assessment that are not of a private nature should be directed to the appropriate Moodle forum*. Any *personal* queries about course administration can be directed to Garth via direct email or Moodle direct message.

# 2. Course details

**Credit Points**
This is a 6 unit-of-credit (UoC) course, and involves 4 hours per week (h/w) of face-to-face contact.

The UNSW website states "The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week."

This means that you should aim to spend about 9 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

## 5 Assessment

The final course mark will be determined by the following weightings:

| Task | Assessment Type | Mark | Learning Outcomes Assessed | Assessment Criteria | Task Due | Marks Returned |
|---|---|---|---|---|---|---|
| Ass. 1 | Engineering Report | 10% | 1 | Technical Results, Report writing and communication skills, creative problem solving | Friday Week 4 | Friday Week 6 |
| Ass. 2 | Engineering Report | 10% | 3 | Thorough planning and execution, Report writing and communication skills. | Friday Week 6 | Friday Week 8 |
| FE Exam | Exam (2h) | 30% | 1,2 | Correct answer, Correct working, Logical approach | Week 8 Lecture Time | Monday Week 10 |
| Major Project | Engineering Report | 50% | 3,4 | <See later> | Monday Week 9<br><br>Friday Week 13 | Monday Week 11<br><br>During exam period |
| | **Total** | **100%** | | | | |

**Assignment 1 FE Fundamentals**

Finite Element Analysis is numerically intensive and is exclusively solved by powerful computers for all real engineering problems. Modern software packages hide the majority of complex tasks from the user. Unfortunately, this level of automation can lead to the false belief that FEA is an infallible tool. It is important that you as an engineer understand the computations being conducted on your behalf in order to understand their limitations and possible errors that can appear in your analyses.

This assignment will teach you the fundamentals of the Finite Element Method through hand calculations and simple programming.

**Assignment 2 Good FE Practice**

Proper planning, execution and reporting of analyses are crucial skills for any engineering graduate. When using FE analysis techniques to solve and report on a problem, there are countless opportunities to exercise poor technique. At best, poor technique detracts from the quality of the solution and at worst leads to dangerous or negligent results.

During this assignment you will study a very simple engineering problem using FEM but will learn best practice techniques to ensure you produce high quality results and write an excellent report.

**FE Fundamentals Exam**
A mid-session exam will use a combination of short answer questions, derivations and long form calculations to test your understanding and application of FE fundamentals.

You will need to provide your own calculator, of a make and model approved by UNSW, for the examinations. The list of approved calculators is shown at student.unsw.edu.au/exam-approved-calculators-and-computers

**Major Project**
A flexible major project will be given to you at the beginning of semester and will form the largest component of the assessment for the course.

The topic of the project will be up to you to decide, but must represent a current FE simulation challenge in the scientific literature or from a relevant engineering discipline. The assessment will be broken into pieces to ensure that adequate progress is being made throughout the semester:

- Topic selection guidance and approval (Friday Week 5)
  - A topic title and 200 word outline will be submitted to the demonstrators for approval by Friday Week 5.
  - Must be submitted and passed to progress
- Draft findings (Monday Week 9)
  - A small report will be submitted by Monday Week 9 with preliminary findings, which will be peer assessed.
  - The peer-assessment process will be worth 15 of the 50 marks for the major project.
- Final Report (Friday Week 13)
  - A major report on you FE project will be due in Week 13
  - The final report will be worth 35 of the 50 marks for the major project.

**Presentation**
All submissions should have a standard School cover sheet which is available from this subject's Moodle page.

All submissions are expected to be neat, and clearly set out. Your results are the pinnacle of all your hard work. Presenting them clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect. Calculations, where they are necessary, should be shown professionally in a manner befitting the submission type. S*cans of hand calculations will not be accepted in this course.*

**Submission**
The submission of online material should follow the instructions given on the appropriate Moodle page.

*In this course there are currently no plans to use the school assignment boxes for physical assignments; all assignments will be submitted digitally.* If there are technological difficulties which force the use of physical assignment copies, they must include a School cover sheet which is available from the school intranet and are to be submitted before *11am* on the due date so that they can be processed before close of business.

Online submissions are required to be submitted via Moodle. No cover sheet is required as all assignments will be identified through your Moodle account. *All digital assignments are due by 5pm on the due date.* An additional allowance will be granted automatically to submit assignments until 11:55pm without penalty, but you accept any risk of technical difficulties with submission. *If you try to submit between 5pm and 11:55pm and Moodle does not accept the submission for any reason the assignment will be considered late.*

Late submissions will be penalised 5 marks per calendar day (including weekends). An extension may only be granted in exceptional circumstances. Where an assessment task is worth less than 20% of the total course mark and you have a compelling reason for being unable to submit your work on time, you must seek approval for an extension from the course convenor ***before the due date***. Special consideration for assessment tasks of 20% or greater must be processed through student.unsw.edu.au/special-consideration.

It is always worth submitting late assessment tasks when possible. Completion of the work, even late, may be taken into account in cases of special consideration.

**Assessment Criteria**
This is a final year elective course. We are expecting submissions appropriate to your level as junior engineers. The assessments are intentionally open-ended in their scope to allow you to demonstrate your skills with the Finite Element Method.

If you complete the project and assignments to the basic standard outline in the assignment handouts, you will get a good mark, but not a great one. To excel in this course you need to demonstrate higher order abilities (see the Teaching Strategies section for more info).

It is your responsibility to ensure that your calculator is of an approved make and model, and to obtain an “Approved” sticker for it from the School Office or the Engineering Student Centre prior to the examination. Calculators not bearing an “Approved” sticker will not be allowed into the examination room.

**Special Consideration and Supplementary Assessment**
For details of applying for special consideration and conditions for the award of supplementary assessment, see the School intranet, and the information on UNSW’s Special Consideration page.

## 6. Expected Resources for students

**Learning Management System**
Moodle LMS, https://moodle.telt.unsw.edu.au/ will be used for this course. Lecture notes, software laboratories, assignments, links and forums will be available on Moodle. Moodle is a powerful tool that you are encouraged to use for all course needs.

**Textbooks**
*Recommended Resources (available from the library)*

Cook, R. D., Malkus, D. S., Plesha, M. E., Witt, R. J. (2002). Concepts and Applications of Finite Element Analysis, 4th Ed, John Wiley & Sons.
Chandrupatla, T. R., Belegundu, A. D. (2011) Introduction to Finite Elements in Engineering, 4th Ed, Prentice Hall (Pearson)

**Other Resources**
If you wish to explore any of the lecture topics in more depth, then other resources are available and assistance may be obtained from the UNSW Library. One starting point for assistance is the library website: http://info.library.unsw.edu.au/web/services/services.html.

## 7. Course evaluation and improvement

Feedback on the course is gathered periodically using various means, including the Course and Teaching Evaluation and Improvement (CATEI) process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

Finite Element Methods is a constantly evolving course. This semester, new perspectives will be brought to the course by the Dean of Engineering, Professor Mark Hoffman. There will be more laboratory exercises and more demonstration problems (and solutions) will be added.

The major project structure will remain the same, but we will endeavour to improve the structure for selecting and managing your topic.

## 8. Academic honesty and plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others*

student.unsw.edu.au/plagiarism

## Appendix A: Engineers Australia (EA) Professional Engineer Competency Standards

| | Program Intended Learning Outcomes |
|---|---|
| **PE1: Knowledge and Skill Base** | PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals |
| | PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing |
| | PE1.3 In-depth understanding of specialist bodies of knowledge |
| | PE1.4 Discernment of knowledge development and research directions |