

# CVEN2303

Structural Analysis and Modelling

Term 2, 2023



## Course Overview

### Staff Contact Details

#### Convenors

Name	Email	Availability	Location	Phone
Ehab Hamed	<a href="mailto:e.hamed@unsw.edu.au">e.hamed@unsw.edu.au</a>			

#### Lecturers

Name	Email	Availability	Location	Phone
Ehab Hamed	<a href="mailto:e.hamed@unsw.edu.au">e.hamed@unsw.edu.au</a>			

### School Contact Information

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

#### Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

## Course Details

### Units of Credit 6

### Summary of the Course

This course introduces students to structural analysis and computer modelling of structures. It explains the theory and physics behind existing computer software that are used for the analysis of complicated structures. It also provides students with a better understanding of the structural behaviour of beams, frames and trusses under different loading conditions. The tools and knowledge gained in this course are inevitable for the design of structures. The topics that are covered in this course include revision of statics with emphasise on drawing internal forces diagrams; conjugate beam method, energy of structures, principles of virtual work; the force (flexibility) method; stiffness method; and moment distribution method applied to continuous beams.

### Course Aims

The aim of this course is to introduce students to the fundamental concepts and principles applied by engineers in the analysis and design of structures. We will build upon the mathematics, physics, statics and mechanics of solids courses to address and understand the behaviour of trusses, beams and frames. Also, the course aims to engage students in the formulation and resolution of open-ended, design-type exercises, thereby bridging the divide between scientific theories and engineering practice.

### Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Understand structural behaviour and structural indeterminacy	PE1.1, PE1.2, PE2.1
2. Apply principles of work and energy in structural analysis to estimate deformations of structures	PE1.1, PE1.2, PE1.3
3. Analyse statically indeterminate structures such as continuous beams, trusses, and frames using force and displacement methods and moment distribution method.	PE1.5, PE2.1, PE2.2
4. Draw internal forces and moments diagrams in statically indeterminate structures	PE2.2
5. Solve large degree of freedom systems using stiffness method implemented in computer codes	PE2.1

### Teaching Strategies

Following are our suggested approaches to learning in the course.

#### Private Study

- Review lecture material and textbook

- Do set problems on Moodle
- Reflect on class problems and practicing problems
- Download materials from Moodle
- Keep up with notices and find out marks via Moodle

### **Lectures**

- Find out what you must learn
- See methods that are not in the textbook
- Follow worked examples
- Listen for announcements on course changes

### **Workshops**

- Be guided by Demonstrators
- Practice solving set problems
- Ask questions
- Teamwork

### **Assessments (multiple choice, tests, examinations, assignments, hand-in tutorials, laboratory reports etc.)**

- Demonstrate your knowledge and skills
- Demonstrate higher understanding and problem solving

## Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Lab assignment	8%	Week 10	1, 2, 3, 4
2. Weekly Assignments	27%	Not Applicable	1, 2, 3, 4
3. Quiz	15%	Not Applicable	1, 2
4. Final Exam	50%	Not Applicable	1, 2

### Assessment 1: Lab assignment

**Due date:** Week 10

Only a lab simulation will be conducted followed by a video that describes the test. You will not do the test yourself but would need to submit an assignment related to the lab simulation.

This assignment would give you the chance to see actual testing of a truss, and to compare theoretical calculations with experimental measurements taken in the laboratory.

A video of the test will be available to view at your convenience. The assignment will be assessed on the basis of technical accuracy of calculations and evidence of good engineering judgment with assumptions and problem simplification.

### Assessment 2: Weekly Assignments

9 Assignments will be available online on moodle. They need to be submitted online by the due date shown on moodle.

These assignments will keep you up-to-date with the course material, and will encourage you to practice some problems on a weekly basis. Each assignment includes a number of questions. Only final answer is needed and it is checked online. You have the chance to attempt the solution as much as you want to get a full mark of each assignment.

#### Additional details

If you do not submit any of the Weekly Assignments, you will lose the 3 marks allocated to that assignment.

### Assessment 3: Quiz

The mid-term exam will be assessed on the basis of technical accuracy of calculations and evidence of good engineering judgment. The mid-term exam will be held under open book conditions.

#### Additional details

The mid-term exam will be on Week 5 during the lecture (Announcement will be made closer to the date on the exact timing)

## **Assessment 4: Final Exam**

The final exam will be held under open book conditions.

### **Hurdle requirement**

A mark of at least 40% in the final examination is required before the class work is included in the final mark.

## Attendance Requirements

For courses with Workshops and/or Labs, attendance for those classes is a necessary part of the course. You must attend at least 80% of the workshop/lab in which you are enrolled for the duration of the session.

## Course Schedule

[View class timetable](#)

### Timetable

Date	Type	Content
O-Week: 22 May - 26 May		
Week 1: 29 May - 2 June	Topic	Introduction. Structural analysis and design. Revision of internal forces diagrams. Statically determinate structures. Statically indeterminate structures.
Week 2: 5 June - 9 June	Topic	Conjugate beam method.
Week 3: 12 June - 16 June	Topic	The principle of work – Deformations in statically determinate structures.
Week 4: 19 June - 23 June	Lecture	Force/Flexibility method for statically indeterminate trusses.
Week 5: 26 June - 30 June	Topic	Force/Flexibility method for statically indeterminate frames.
Week 6: 3 July - 7 July	Topic	<b>Mid-Term break</b>
Week 7: 10 July - 14 July	Topic	Principles of stiffness analysis in trusses.
Week 8: 17 July - 21 July	Topic	Temperature, and Fit loads in stiffness analysis of trusses.
Week 9: 24 July - 28 July	Topic	Stiffness analysis in Frames.
Week 10: 31 July - 4 August	Topic	Moment Distribution Method.
	Assessment	Lab assignment

# Resources

## Recommended Resources

- **Textbooks:** Any “Structural Analysis” textbook; Online resources
- **Reference textbook :** Structural Analysis: Principles, Methods and Modelling, CRC Press, Gianluca Ranzi, Raymond Ian Gilbert

Print:

<https://www.bookshop.unsw.edu.au/details.cgi?ITEMNO=9780415526449>

Digital:

<https://unswbookshop.vitalsource.com/products/-v9781482223545>

## **Submission of Assessment Tasks**

Please refer to the Moodle page of the course for further guidance on assessment submission.

**UNSW has a standard late submission penalty of:**

- 5% per day, for all assessments where a penalty applies, capped at five days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

## Academic Honesty and Plagiarism

Beware! An assignment that includes plagiarised material will receive a 0 fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

<https://student.unsw.edu.au/plagiarism>

## Academic Information

### Final Examinations:

Final Exams in T2 2023 will be held on campus between Friday 11th and Thursday 24th August (inclusive), and Supplementary Exams between Monday 4th and Friday 8th September (inclusive). You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

For students enrolled in the distance offering of a postgraduate course, and who reside further than 100km from UNSW Kensington campus, will be contacted regarding sitting an external exam. The school's External Exam Policy can be found on the Intranet.

### ACADEMIC ADVICE

- Key Staff to Contact for Academic Advice (log in with your zID and password): <https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw>
- [Key UNSW Dates](#) - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.
- CVEN Student Intranet (log in with your zID and password): <https://intranet.civeng.unsw.edu.au/student-intranet>
- Student Life at CVEN, including Student Societies: <https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life>
- Special Consideration: <https://student.unsw.edu.au/special-consideration>
- General and Program-Specific Questions: [The Nucleus: Student Hub](#)
- Book an Academic Advising session: <https://unswengacademicadvising.as.me/schedule.php>

## Disclaimer

*This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.*

## Image Credit

Mike Gal.

## CRICOS

CRICOS Provider Code: 00098G

## Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

## Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	
PE3.2 Effective oral and written communication in professional and lay domains	
PE3.3 Creative, innovative and pro-active demeanour	
PE3.4 Professional use and management of information	
PE3.5 Orderly management of self, and professional conduct	
PE3.6 Effective team membership and team leadership	