# CVEN3303

Steel Structures

Term 1, 2022

# Course Overview

## Staff Contact Details

### Convenors

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Scientia Prof Mark Bradford | m.bradford@unsw.edu.au | | | |

### Administrators

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Xinpei Liu | xinpei.liu@unsw.edu.au | | | |

## 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

A course on the design concepts and design of structural elements subject to bending, shear and combined bending and axial compression. Topics include: introduction to limit states design and codes of practice (design objectives; strength and serviceability limit states); loads and load combinations (permanent/dead, imposed/live and wind loads); design of structural steel tension members; Euler column buckling; design of stocky and slender compression members; design of laterally supported steel beams, laterally unsupported steel beams (lateral-torsional buckling in bending and shear strength); steel beam-columns (in-plane and out-of-plane failure); steel members subjected to biaxial bending; design of steel frames, steel connections and detailing (force and moment connections).

## Course Aims

The aim of this course is to introduce  students to the design codes that govern structural design and to extend the understanding of structural behaviour by studying new concepts in the context of design of steel structures.

This course will also provide you with opportunities to develop the following graduate attributes:

- the capacity for analytical and independent critical thinking; and
- skills related to lifelong learning, such as self-reflection (ability to apply theory to practice in familiar and unfamiliar situations); and
- collaborative and teamwork skills;

## Course Learning Outcomes

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

| Learning Outcome | EA Stage 1 Competencies |
|---|---|
| 1. Employ structural design concepts of structural steel members such as tension members, compression members, flexural members and beam columns and connections in practice | PE1.1, PE1.5, PE2.1 |
| 2. Demonstrate an understanding of advanced concepts in structural design | PE2.1 |
| 3. Interpret and understand the requirements of a design brief and identify the potential design problems presented by the objectives of the brief | PE2.3, PE3.3 |
| 4. Use computers to solve engineering problems | PE2.1 |
| 5. Communicate your design in written and graphical form | PE2.1, PE3.4 |

## Teaching Strategies

Following are our suggested approaches to learning in the course.

**Private Study**

- Review lecture material and read textbook
- Do set problems and assignments
- Reflect on class problems and assignments

**Lectures**

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

- Try and understand the principles

**Tutorials**

- Be guided by tutors
- Practice solving set problems
- Ask questions

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

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

# Assessment

The final grade for this course will normally be based on the sum of the scores from each of the assignments (class work) and the Final Examination. The Final Examination is worth 60% of the final grade if the class work is included and 100% if class work is not included. The class work is worth 40% of the final grade if included. A mark of at least 40% in the Final Examination is required before the class work is included in the final grade. The formal exam scripts will not be returned. Students who perform poorly in the workshops are recommended to discuss progress with the lecturer during the term.

**Note:** The coordinator reserves the right to adjust the final scores by scaling if agreed by the Head of School.

| Assessment task | Weight | Due Date | Course Learning Outcomes Assessed |
|---|---|---|---|
| 1. Assignments | 40% | Not Applicable | 1, 2, 3, 4, 5 |
| 2. Examination | 60% | Not Applicable | 1, 2, 3, 4, 5 |

## Assessment 1: Assignments

Assignment work

**Additional details**

Assignment 1: Design/Tension Members - issued end Week 1, due 5pm end Week 3

(Worth 30% of Assignment (Assessment 1)

Assignment 2: Compression Members - issued end Week 3, due 5pm end Week 6

(Worth 25% of Assignment (Assessment 1)

Assignment 3: Flexural Members - issued end Week 5, due 5pm end Week 8

(Worth 30% of Assignment (Assessment 1)

Assignment 4: Connections - issued start Week 8, due 5pm end week 8

(Worth 15% of Assignment (Assessment 1)

## Assessment 2: Examination

Examination

## Attendance Requirements

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

## Course Schedule

View class timetable

### Timetable

| Date | Type | Content |
|---|---|---|
| O-Week: 7 February - 11 February | | |
| Week 1: 14 February - 18 February | Lecture | TOPIC: Introduction to structural design<br><br>LECTURE CONTENT: Introduction, Limit States Design principles, Actions and effects of actions.<br><br>DEMONSTRATION CONTENT: Introduction, Limit States Design principles, Actions and effects of actions. |
| | | |
| Week 2: 21 February - 25 February | Topic | TOPIC: Axially loaded members<br><br>LECTURE CONTENT: Steel tension members<br><br>DEMONSTRATION CONTENT: Steel tension members |
| | | |
| Week 3: 28 February - 4 March | Topic | TOPIC: Axially loaded members<br><br>LECTURE CONTENT: Steel compression members<br><br>DEMONSTRATION CONTENT: Steel compression members |
| Week 4: 7 March - 11 March | Topic | TOPIC: Axially loaded members, Flexurally loaded members<br><br>LECTURE CONTENT: In-plane effective length and second-order effects In-plane effective length and second-order effects. |

| | | |
|---|---|---|
| | | DEMONSTRATION CONTENT: In-plane effective length and second-order effects |
| Week 5: 14 March - 18 March | Topic | TOPIC: Flexurally loaded members<br><br>LECTURE CONTENT: Steel flexural members<br><br>DEMONSTRATION CONTENT: Steel flexural members |
| Week 6: 21 March - 25 March | Topic | No teaching |
| Week 7: 28 March - 1 April | Topic | TOPIC: Flexurally loaded members, Connections<br><br>LECTURE CONTENT: Steel flexural members Welded and bolted connections<br><br>DEMONSTRATION CONTENT: Steel flexural members |
| Week 8: 4 April - 8 April | Topic | TOPIC: Connections<br><br>LECTURE CONTENT: Welded and bolted connections<br><br>DEMONSTRATION CONTENT: Welded and bolted connections |
| Week 9: 11 April - 15 April | Topic | TOPIC: Combined actions<br><br>LECTURE CONTENT: Steel beam-columns<br><br>DEMONSTRATION CONTENT: Steel beam-columns |
| Week 10: 18 April - 22 April | Topic | TOPIC: Combined actions<br><br>LECTURE CONTENT: Steel beam-columns<br><br>DEMONSTRATION CONTENT: Steel beam-columns |
| | | |

# Resources

## Prescribed Resources

*AS4100-2020 Steel Structures*. Standards Australia, Sydney, 2016*AS4100* Supp 1-1999 *Steel Structures – Commentary*. Standards Australia, Sydney, 2020.

*AS/NZS 1170.0-2002 Structural Design Actions: Part 0 General Principles.* SA Sydney / SNZ Wellington, 2016.*AS/NZS 1170.1-2002 Structural Design Actions: Part 1 Permanent, Imposed and Other Actions.* SA Sydney / SNZ Wellington, 2016.

**Australian Standards** may be accessed through the UNSW Library as follows:

1. Go to the library homepage at **www.library.unsw.edu.au**
2. Select “Data Bases”
3. Locate “Australian Standards”
4. Click on “Australian Standards (SAI Global) and enter the relevant standard into the search field.

A very **useful link** is that to the Australian Steel Institute: **www.steel.org.au**

## Recommended Resources

N.S. Trahair and M.A. Bradford. *The Behaviour and Design of Steel Structures to AS4100*. 3rd Australian Edition, E&FN Spon, London, 2017.

M.A. Bradford, R.Q. Bridge and N.S. Trahair. *Worked Examples for Steel Structures*. 4th Edition, Australian Steel Institute, Sydney, 2013.

S.T. Woolcock, S. Kitipornchai, M.A. Bradford and G.A. Haddad. *Design of Portal Frame Buildings.* 4th Edition, Australian Steel Institute, Sydney, 2011.

## 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 T1 2022 will be held online between 29th April - 12th May inclusive, and supplementary exams between 23rd - 27th May inclusive. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

**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
- Refer to Academic Advice on the School website available at: https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

## 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 | |