CVEN3303

Steel Structures

Term 1, 2023
Course Overview

Staff Contact Details

Convenors

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Availability</th>
<th>Location</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof Hamid Valipour</td>
<td><a href="mailto:h.valipour@unsw.edu.au">h.valipour@unsw.edu.au</a></td>
<td>By Appointment</td>
<td>No. 710, Level 7, School of Civil &amp; Environmental Engineering</td>
<td>2 9385 6191</td>
</tr>
</tbody>
</table>

Lecturers

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Availability</th>
<th>Location</th>
<th>Phone</th>
</tr>
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</table>

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:

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>EA Stage 1 Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Practically employ design concepts of structural steel members such as tension members, compression members, flexural members and beam columns and connections in practice.</td>
<td>PE1.1, PE1.5, PE2.1</td>
</tr>
<tr>
<td>2. Describe steel design principles with respect to advanced theory of stability and solid mechanics.</td>
<td>PE1.1, PE1.3</td>
</tr>
<tr>
<td>3. Interpret the requirements of a design brief and identify the potential design problems presented by the objectives of the brief.</td>
<td>PE1.2, PE1.5, PE2.2</td>
</tr>
<tr>
<td>4. Communicate design in written and graphical form.</td>
<td>PE3.2</td>
</tr>
<tr>
<td>5. Change CLO5: Design structural steel members, connections, and braced and unbraced framed systems, under combined actions using AS4100.</td>
<td>PE1.1, PE1.5, PE2.3</td>
</tr>
</tbody>
</table>
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
- Watch screencasts

Lectures

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

Workshops

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

Assessments (multiple choice, tests, examinations, assignments, hand-in workshops, 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.

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.

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

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Weight</th>
<th>Due Date</th>
<th>Course Learning Outcomes Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assignment 1</td>
<td>10%</td>
<td>03/03/2023 05:00 PM</td>
<td>1, 3, 4, 5</td>
</tr>
<tr>
<td>2. Assignment 2</td>
<td>15%</td>
<td>24/03/2023 05:00 PM</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>3. Assignment 3</td>
<td>15%</td>
<td>14/04/2023 05:00 PM</td>
<td>1, 2, 3, 4, 5</td>
</tr>
<tr>
<td>4. Final Exam</td>
<td>60%</td>
<td>Not Applicable</td>
<td>1, 2, 3, 4, 5</td>
</tr>
</tbody>
</table>

**Assessment 1: Assignment 1**

**Start date:** 17/02/2023 05:00 PM  
**Assessment length:** 2 weeks  
**Due date:** 03/03/2023 05:00 PM  
**Deadline for absolute fail:** 08/03/2023 5:00 PM  
**Marks returned:** 10/03/2023

Assignment work: Design of steel members subjected to tension

Additional details

**Note:** This target assessment timetable is indicative and subject to change. Every effort will be made to inform students of variations to the above program.

**Assessment 2: Assignment 2**

**Start date:** 10/03/2023 05:00 PM  
**Assessment length:** 2 weeks  
**Due date:** 24/03/2023 05:00 PM
Deadline for absolute fail: 29/03/2023 5:00 PM
Marks returned: 03/04/2023

Assignment work: Design of steel members (columns) subjected to compression

Additional details

Note: This target assessment timetable is indicative and subject to change. Every effort will be made to inform students of variations to the above program.

Assessment 3: Assignment 3

Start date: 31/03/2023 05:00 PM
Assessment length: 2 weeks
Due date: 14/04/2023 05:00 PM
Deadline for absolute fail: 05/04/2023 5:00 PM
Marks returned: 24/04/2023

Assignment work: Design of steel members (beams) subjected to bending

Additional details

Note: This target assessment timetable is indicative and subject to change. Every effort will be made to inform students of variations to the above program.

Assessment 4: Final Exam

Assessment length: 2 hours

Students are required to answer two questions (2 hour exam) that involve different aspects of steel structures such as analysis and design of beam-columns and connections.
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

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Lecture Content</th>
<th>Watching Screencasts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>(1) Introduction</td>
<td>Introduction, general principles, limit state design principles, actions, and action effects.</td>
<td>Before first lecture, watch Summary Screencast (1)-General Principles available in Lecture Week 1 folder</td>
</tr>
<tr>
<td></td>
<td>(2) Steel tension members</td>
<td>Design of steel members under tension, including fracture &amp; yielding</td>
<td>Before the Demonstration on Week 1 watch screencast Videos 1 to 5 provided in the Additional Materials folder on Moodle</td>
</tr>
<tr>
<td>Week 2</td>
<td>(3) Steel compression members</td>
<td>Design of steel members subjected to compression &amp; effect of buckling on the capacity of steel sections and members</td>
<td>Before the Demonstration on Week 2 watch screencast Videos 6 &amp; -7 provided in the Additional Materials folder on Moodle</td>
</tr>
<tr>
<td>Week 3</td>
<td>(4) Effective length and 2nd order effects</td>
<td>Braced and sway frames, and effective length of columns in frames and trusses</td>
<td>Before the Demonstration on Week 3 watch screencast Videos 8 &amp; 9 provided in the Additional Materials folder on Moodle</td>
</tr>
<tr>
<td>Week 4</td>
<td>(5) Steel flexural members: (Part 1)</td>
<td>Elastic and plastic section modulus, lateral-torsional buckling, effective section modulus and effective length of flexural members,</td>
<td>Before the Demonstration on Week 4 watch screencast Videos 10 &amp; 11 provided in the Additional Materials folder on Moodle</td>
</tr>
<tr>
<td></td>
<td>(6) Steel flexural members: (Part 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 5</td>
<td>(7) Steel flexural members: (Part 3)</td>
<td>Bending moment distribution and slenderness effects and design of steel beams with and without lateral restraints.</td>
<td>Before the Demonstration on Week 5 watch screencast Videos 12 &amp; 13 provided in the Additional Materials folder on Moodle</td>
</tr>
<tr>
<td>Week 6</td>
<td></td>
<td>Non-teaching week for all courses.</td>
<td></td>
</tr>
<tr>
<td>Week 7</td>
<td>(8) Shear and compression bearing effect</td>
<td>Principles of flexural-shear and compression bearing and design of stiffeners</td>
<td>Before the Demonstration on Week 7 watch screencast Videos 14 &amp; 15 provided in the Additional Materials folder on Moodle</td>
</tr>
<tr>
<td>Week 8</td>
<td>(9) 3-Plate Girders</td>
<td>General requirements for the design of plate girders</td>
<td>Before the Demonstration on Week 8 watch screencast Video 16 provided in the Additional Materials folder on Moodle</td>
</tr>
<tr>
<td></td>
<td>(10) Connections (Part 1)</td>
<td>An introduction to connections and fastener types in steel structures.</td>
<td></td>
</tr>
<tr>
<td>Week 9</td>
<td>(11) Connections (Part 2)</td>
<td>Design of bolted and welded connections subjected to in- and</td>
<td>Before the Demonstration on Week 9 watch screencast Video 17 provided</td>
</tr>
</tbody>
</table>
### (12) Beam-columns (Part 1)
- **Out-of-plane actions.**
- In-plane versus out-of-plane design of beam-columns: general requirements
- In the **Additional Materials** folder on Moodle

### (13) Beam-columns (Part 2)
- **Design of beam-column for combination and bending and axial compression**
- **Deflection control in the design of steel structures**
- Before the Demonstration on Week 10 watch screencast *Video 18* provided in the **Additional Materials** folder on Moodle

### Timetable

<table>
<thead>
<tr>
<th>Date</th>
<th>Type</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 3: 27 February - 3 March</td>
<td>Assessment</td>
<td>Assignment 1</td>
</tr>
<tr>
<td>Week 6: 20 March - 24 March</td>
<td>Assessment</td>
<td>Assignment 2</td>
</tr>
<tr>
<td>Week 9: 10 April - 14 April</td>
<td>Assessment</td>
<td>Assignment 3</td>
</tr>
</tbody>
</table>

*View class timetable*
Resources

Prescribed Resources

AS4100-2020 Steel Structures. Standards Australia, Sydney, 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


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 2023 will be held on campus between the 28th of April and the 11th of May, and Supplementary Exams between the 22nd of May and the 26th of May. You are required to be available on these dates. Please do not 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
- 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

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