CVEN3303

Steel Structures

Term 1, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Prof Hamid Valipour	h.valipour@unsw.edu.au	By Appointment	No. 710, Level 7, School of Civil & Environmental Engineering	2 9385 6191

Lecturers

Name	Email	Availability	Location	Phone
Prof Hamid Valipour	h.valipour@unsw.edu.au	By Appointment	No. 710, Level 7, School of Civil & Environmental Engineering	2 9385 6191

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. Practically employ 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. Describe steel design principles with respect to advanced theory of stability and solid mechanics.	PE1.1, PE1.3
3. Interpret the requirements of a design brief and identify the potential design problems presented by the objectives of the brief.	PE1.2, PE1.5, PE2.2
4. Communicate design in written and graphical form.	PE3.2
5. Change CLO5: Design structural steel members, connections, and braced and unbraced framed systems, under combined actions using AS4100.	PE1.1, PE1.5, PE2.3

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.

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

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

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

	(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
Week 10	**(13) Beam-columns (Part 2)** **(14) Serviceability** **(non-examinable)**	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

View class timetable

Timetable

Date	Type	Content
Week 3: 27 February - 3 March	Assessment	Assignment 1
Week 6: 20 March - 24 March	Assessment	Assignment 2
Week 9: 10 April - 14 April	Assessment	Assignment 3

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.

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 the11th 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 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
- 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	