School of Engineering

CIVL6170: Steel Design

Callaghan
Semester 1 - 2024

COURSE OUTLINE

OVERVIEW

Course Description
This course covers the structural design of steel members and connections. Topics include design loads and the structural design of steel beams, columns, tension members, and bolted and welded connections.

Academic Progress Requirements
Nil

Requisites
This course has similar content to CIVL3170. If you have completed CIVL3170, you cannot enrol in this course.

Assumed Knowledge
Content from CIVL2130 Theory of Structures 1 including:
Basic assumptions of theory of structures: ideal materials and small deflections
Stress, strain, extension of bars
Bending moment and shear force diagrams for simple frames
Properties of areas
Stresses due to bending: normal and shear
Beam deflection
Stability: column buckling

Contact Hours
Callaghan
Lecture
Face to Face On Campus
4 hour(s) per week(s) for 13 week(s) starting Week 1

Tutorial
Face to Face On Campus
1 hour(s) per week(s) for 12 week(s) starting Week 2

Unit Weighting Workload
10
Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.

CONTACTS

Course Coordinator

Callaghan
Dr Robert Petersen
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Consultation: Open door policy: EA127

Teaching Staff

Lecturer: John Mullard
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School Office

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9.00am-1.00pm and 2.00pm-5.00pm (Monday to Friday)

SYLLABUS

Course Content

- Limit states and design loading
- Outline of types of steel and steel structures
- Methods of structural analysis
- Flexural members (ie, beams)
- Columns (ie, compression members)
- Tension members
- Combined actions (ie, beams/columns)
- Bolted, pinned and welded connections
- Composite beams
- Example design drawings and steel schedule

Course Learning Outcomes

On successful completion of this course, students will be able to:
1. Evaluate wind loads as per the Australian Standards for steel framed structures

2. Optimise structural steel sizes in simple and complex structures

3. Demonstrate an advanced level of steel design skills

Course Materials

Other Resources:

- Multiframe, Structural Analysis Software (access details are provided via Canvas)

- The Australian Steel Institute (ASI) Website: https://www.steel.org.au/
  1. Membership is free for students studying Engineering at University. See website for benefits.
  2. The ASI's Design Capacity Tables may be used to check your answers in tutorial questions, as a design aid for the Design Project, some exam questions and next year in Structural Engineering Design.
  3. As an alternative to ASI membership, extracts of relevant Design Capacity Tables for Structural Steel and Bluescope Lysaght purlin/girt design information is provided on Canvas.

- Engineers Australia (EA): Website: https://www.engineersaustralia.org.au
  Membership is free for students

Recommended Reading:

- AS4100 Supplement 1 - 1998 - Steel Structures - Commentary - Supplement to AS4100-1998.
- Australian Steel Institute - Worked Examples for Steel Structures

Recommended Text:

- Gorenc, B.E., Tinyou, R., Sayam, A. (2012) Steel Designers Handbook.

Required Text:

- Stewart, M.G. CIVL3170 Course Notes (available on Course Canvas Site)
- AS4100:2020 Steel Structures (free via the Auchmuty Library's database site)
- AS/NZS1170 Structural Design Actions (free via the Auchmuty Library's database site)

COMPULSORY REQUIREMENTS

In order to pass this course, each student must complete ALL of the following compulsory requirements:

Course Assessment Requirements:

- Assessment 3 - Formal Examination: Pass requirement - Must pass this assessment item to pass the course. If unsuccessful in only this component of the course and having demonstrated a reasonable attempt (a mark >40% in this item), students will be given one more attempt to complete this assessment satisfactorily (achieving > 50% in the supplementary paper). Students sitting a supplementary exam will have their overall mark capped at 64%.

SCHEDULE

Week	Week Begins	Topic	Tutorial	Assessment Due
1	26 Feb	Introduction, design actions, AS1170	No tutorial	
2	4 Mar	Design actions, wind loads	Revision BMD and SFD	
3	11 Mar	Design actions, wind loads (cont.)	Design actions - permanent and imposed actions	
4	18 Mar	AS4100 Introduction, tension members	Wind loads	
5	25 Mar	Flexure	Tension	Wind load assignment. Due Friday Week 5.
6	1 Apr	Flexure (cont.)	Flexure - effective lengths	
7	8 Apr	Flexure (cont.)	Flexure - sizing members	
Mid-Semester Recess				
Mid-Semester Recess				
8	29 Apr	Compression members	Worked example on flexure	
9	6 May	Combined Actions	Compression - effective lengths	
10	13 May	Combined Actions (cont.)	Combined actions - section capacity	
11	20 May	Connections	Connections - in-plane bolt group	Portal Frame Design Project. Due Friday Week 11.
12	27 May	Connections (cont.)	Connections - out of plane bolt group	
13	3 Jun	Review	Review	
Examination Period				
Examination Period				

ASSESSMENTS

This course has 3 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Design Actions Assignment	Friday, Week 5 @ 5 pm.	Group	20%	1, 3
2	Portal Frame Design Project	Friday, Week 11 @ 5 pm	Group	30%	2, 3
3	Final Exam*	Set during the formal exam period	Individual	50%	2, 3

* This assessment has a compulsory requirement.

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

Assessment 1 - Design Actions Assignment

Assessment Type Written Assignment

Purpose This assessment item meets the course objectives of knowledge acquisition and demonstrated assimilation of data, upon reflection and analysis, to produce articulate and concise documents which convey evidence-based understanding of the concepts and topics taught in the course.
The purpose of group activity is to enable peer-to-peer learning; develop oral communication skills and the ability to record data, synthesise an opinion and convey this clearly in a well presented and articulate manner.

Description This assessment item is designed so that students can show:
(1) their knowledge acquisition and demonstrated assimilation of data,
(2) that they can determine appropriate loads, and
(3) that they can produce articulate and concise documents which convey evidence-based understanding of structural steel design-concepts.
(4) that they can perform the above at an advanced level.
The deliverable is the calculation of various Design Actions and Design loads, associated with a contrived steel structure.
You are to work in groups of 2 for this assessment item.
You are to use the Course's Canvas area to sign up for your group.
The project's brief will be posted via Canvas.

Weighting 20%
Length As per the project brief
Due Date Friday, Week 5 @ 5 pm.
Submission Method Online
Assessment Criteria As per the marking rubric
Return Method Online
Feedback Provided Online - .

Assessment 2 - Portal Frame Design Project

Assessment Type Written Assignment

Purpose This assessment item meets the course objectives of knowledge acquisition and demonstrated assimilation of data, upon reflection and analysis, to produce articulate and concise documents which convey evidence-based understanding of the concepts and topics.

Description This assessment item is designed so that students can show:
(1) their knowledge acquisition and demonstrated assimilation of data,
(2) that they can determine appropriate loads,
(3) that they can design appropriate structural steel elements, and
(4) that they can produce articulate and concise documents which convey evidence-based understanding of structural steel design-concepts.

	(5) that they can perform the above at an advanced level. Your deliverable will be in accordance with AS1170 and AS4100, and will include: (1) The calculation of design actions and the associated structural response of a contrived steel structure, and (2) Other structural information as required by the brief. (3) You are to work in groups of 3 for this assessment item. (4) The project's brief will be posted via Canvas.
Weighting	30%
Length	As per the project brief.
Due Date	Friday, Week 11 @ 5 pm
Submission Method	Online
Assessment Criteria	As per the marking rubric.
Return Method	Online
Feedback Provided	Online -.

Assessment 3 - Final Exam

Assessment Type	Formal Examination
Purpose	This assessment item is designed to test the individual student's knowledge of the course's material and their ability to describe, analyse, design and hypothesise from this material.
Description	The exam will test these elements of steel design (in accordance with AS4100 and AS1170, current versions): Design Actions, Flexure, Compression, Tension, Combined Actions and Connections.
Weighting	50%
Compulsory Requirements	Pass requirement - Must pass this assessment item to pass the course.
Length	2 hours
Due Date	Set during the formal exam period
Submission Method	Formal Exam
Assessment Criteria	As per the Course Coordinator's listed criteria. Full marks for correct answers. Part marks awarded for incorrect calculation, but where the design process is mostly correct. Part marks will not be given for any calculation relating to design actions and effective lengths. These must be calculated with 100 % accuracy to score any marks at all.
Return Method	Not Returned
Feedback Provided	No Feedback -. Feedback is via final mark.
Opportunity to Reattempt	Students WILL be given the opportunity to reattempt this assessment.

ADDITIONAL INFORMATION

Grading Scheme

This course is graded as follows:

Range of Marks	Grade	Description
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.
0-49	Fail	Failure to satisfactorily achieve learning outcomes. If all

	(FF)	compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.

*Skills are those identified for the purposes of assessment task(s).

Communication Methods

Communication methods used in this course include:

- Canvas Course Site: Students will receive communications via the posting of content or announcements on the Canvas course site.

Course Evaluation

Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas)

As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the Oral Examination (viva) Procedure. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the Student Conduct Rule.

Academic Misconduct

All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment. Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to https://policies.newcastle.edu.au/document/view-current.php?id=35.

Adverse Circumstances

The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where:

1. the assessment item is a major assessment item; or
2. the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;
3. you are requesting a change of placement; or
4. the course has a compulsory attendance requirement.

Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at:
https://policies.newcastle.edu.au/document/view-current.php?id=236

Important Policy Information

The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at https://www.newcastle.edu.au/current-students/respect-at-uni/policies-and-procedures that support a safe and respectful environment at the University.

Other Information

Attendance

- Students are strongly advised to attend ALL lectures in order to gain a full understanding of the theoretical, practical and conceptual skills required in the safe design of steel structures.
- A significant amount of contextual material (additional to the Canvas site and Course notes) will be delivered in lectures.
- Students who miss lectures may not be able to satisfactorily complete the assignments.
- Students who experience timetable clashes should see the course coordinator

Group Work

- You are required to work in groups for Assessments 1 & 2.
- You are to use the University's Canvas system to select and identify your work group.

Repeating students and credit for previous assignments?

- Credit for any assessment item from previous enrolment(s) in CIVL6170 will not be given. This means that students who are currently enrolled in CIVL6170 (Steel Design) are expected to attempt all of the assessment items.
- Notwithstanding, if you had an adverse circumstance associated with your previous enrolment you may discuss your request for credit with me (ONLY in the first 2 weeks of semester).

VERY IMPORTANT (Final) NOTES ON COURSE CONTENT:

- Something that you must understand in CIVL6170 (if you are to pass this course at all) is the concept of effective length. This essential concept will be discussed repeatedly in lectures, and particularly in these parts of the course: Flexural members and Columns. You will be required to understand effective lengths with 100 % accuracy. The basis of this compulsory component is that incorrect effective lengths lead to unsafe structures.
- Please keep in mind that engineering design is both theory and Problem Based Learning. There are many practical solutions to a design problem, some better than others, some more economical.
- There is no single 'perfect' solution. In some aspects of an Assessment Item you may be expected to refer to design texts, look at structures around you, and apply common-sense and brain-storming at times to determine how best to solve a practical problem.
- Our role is to allow you the freedom to come up with your own solution, and to justify it. So at times we will not simply tell you the 'answer', as this would just be our opinion, and part of the learning exercise is for you to develop your own solutions using your own resources as this is what happens in design environments in practice.

Graduate Profile Statements

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-6)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability	x	x	x	3
12	3.2. Effective oral and written communication in professional and lay domains.	x	x	x	3
13	3.3. Creative, innovative and pro-active demeanour.	x	x	x	3
14	3.4. Professional use and management of information.	x	x	x	3
15	3.5. Orderly management of self, and professional conduct.	x	x	x	3
16	3.6. Effective team membership and team leadership.	x	x	x	3
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	x	x	x	6
8	2.2. Fluent application of engineering techniques, tools and resources.	x	x	x	6
9	2.3. Application of systematic engineering synthesis and design processes.	x	x	x	6
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.	x	x	x	3
	Knowledge Base				
1	1.1. Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	x	x	x	6
2	1.2. Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.	x	x	x	6
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	x	x	x	3
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.	x	x	x	3
5	1.5. Knowledge of contextual factors impacting the engineering discipline.	x	x	x	3
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.	x	x	x	3

This course outline was approved by the Head of School on the 30/01/2024. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.