USC

Course Outline

Code: ENG212
Title: Structural Engineering

School of: Science & Engineering
Teaching Session: Semester 2
Year: 2020
Course Coordinator: A/Prof Christophe Gerber Email: cgerber@usc.edu.au
Course Moderator: Dr Ayodele Olofinjana

Please go to the USC website for up to date information on the teaching sessions and campuses where this course is usually offered

1. What is this course about?

1.1 Description

In this course you will learn about the design philosophy adopted by the Australian Standards. You will develop the capacity to use design codes to determine the appropriate types of loads and combinations of loads for service and ultimate limit state designs. You will learn to relate the code requirements to the physical behaviour of elements and assemblages and to apply your knowledge of structural analysis and understanding of materials to design fundamental steel and timber structural members and simple structures. You also learn to design structures for stability (bracing).

1.2 Course topics

· Limit state design and load evaluation.
· Concept of stability and bracing
· Influence of functional, environmental, aesthetic and economic factors on structural design.
· Structural applications of steel and timber materials.
· Analysis and design of steel and timber tensile, compression and flexural members.
· The design and detailing of connections for steel and timber structures.
· Use of design codes of practice.

2. What level is this course?

200 level Developing - Applying broad and/or deep knowledge and skills to new contexts. May require pre-requisites and introductory level knowledge/skills. Normally undertaken in the 2nd or 3rd year of an undergraduate program

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

Specific Learning Outcomes On successful completion of this course you should be able to:	**Assessment Tasks** You will be assessed on the learning outcome in task/s:	**Graduate Qualities or Professional Standards mapping** Completing these tasks successfully will contribute to you becoming:
Use Australian Standards: AS/NZS 1170.0, 1170.1 & 1170.2; and AS 1720.1 & 4100 for structural analysis and design with timber and steel.	Tasks 1, 2 and 3	Knowledgeable,
Apply design principles for strength, stability and serviceability incl. identify design limit states and their significance.	Tasks 1, 2 and 3	Knowledgeable.
Identify loads, load combinations and load arrangements, and their effects on structures.	Tasks 1, 2 and 3	Empowered.
Design steel and timber structures and members for strength, stability and serviceability.	Tasks 1, 2 and 3	Empowered.
Work collaboratively in a project team to design steel and timber structures and draw their construction details.	Task 2	Engaged
Produce engineering reports to communicate your design (procedures, outcomes and recommendations).	Tasks 1, 2 and 3	Empowered

5. Am I eligible to enrol in this course?

Refer to the USC Glossary of terms for definitions of "pre-requisites, co-requisites and anti-requisites".

5.1 Enrolment restrictions

Must be enrolled in program SC410, SC425, AB101 UU301 or XU301

5.2 Pre-requisites

ENG221 or MEC221

5.3 Co-requisites

Nil

5.4 Anti-requisites

CIV2503 Structural Design 1

5.5 Specific assumed prior knowledge and skills (where applicable)

N/A

6. How am I going to be assessed?

6.1 Grading scale

Standard – High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL)

6.2 Details of early feedback on progress

The engagement in weekly formative tutorial problems will demonstrate the level of proficiency and understanding of the course material.

6.3 Assessment tasks

Task No.	Assessment Tasks	Individual or Group	Weighting %	What is the duration / length?	When should I submit?	Where should I submit it?
1	Structural engineering	Individual	25% (5 x 5%)	Five short design reports (max. 200 words).	Weeks 4, 6, 7, 10 & 11.	Blackboard
2	Design Project	Group	30% (2 x 15%)	Two design reports (max. 1000 words each).	Weeks 9 & 13.	Blackboard
3	Final Exam	Individual	45%	2 hr	Centrally scheduled Exam Period	Exam Venue
			100%			

Assessment Task 1 (a – e): Structural engineering

Goal:	These assignments (take-home tasks) develop your understanding of core theory of steel and timber design and its application to practical problems and enable you to identify and address gaps in your skills and knowledge.
Product:	Written Piece
Format:	You determine the relevant limit state conditions of structural steel and timber elements, design these elements to these limit states, provide the detailing of these elements if applicable, and discuss the design procedures and/or your design. You complete your designs in compliance with AS/NZS 1170.0, 1170.1 & 1170.2; and AS 1720.1 & 4100: 1a) Design actions, limit states and structural analysis; 1b) Steel member under axial actions; 1c) Steel beam design; 1d) Timber member under axial actions; 1e) Timber beam design. You present your designs in short design reports of max. 200 words each or equivalent. Your reports adhere to the conventions of engineering reports, must be **strictly handwritten** (neat and legible) and ready for review by a senior engineer. If relevant, you may include captioned diagrams, tables of data, graphs, photographs, etc. as Appendices. Calculations must be in adequate significant figures and units throughout the reports. If applicable, your design detailings are complete with adequate specifications, dimensions and units (neat hand sketches are acceptable). Note the word count excludes Appendices. You may collaborate with peers to complete Task 1. Such collaboration will be clearly stated on the task coversheet. You also provide your details (names and student number) and signature on the cover page of each report. A coversheet template will be available on Blackboard.
Criteria:	• Understanding of design principles, procedures and phenomena. • Use of Australian Standards. • Use and application of design methods and procedures to analyse and design steel and timber structures to limit states. • Report.
Engineers Australia competencies assessed in this task:	
1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 2.1 Application of established engineering methods to complex engineering problem solving. 2.2 Fluent application of engineering techniques, tools and resources.	

Assessment Task 2 (a & b): Design Project

Goal:	Collaborate with your peers to design steel and timber structures. This project enables you to advance your skills, competencies and understanding of steel and timber design by undertaking the engineering design of structures to limit states in compliance with Australian Standards; and working towards meeting your Engineers Australia competencies .
Product:	Report
Format:	Engineers work in project teams! This design project will allow you to demonstrate your (structural) design abilities by developing, designing and drawing the structural elements of a building, **and** will contribute to developing and/or improving your collaboration skills. 2a) Steel design and construction 2b) Timber design and construction In your group (**4**-5 **members**), you collaborate to write two design reports (engineering reports)of a maximum of 1000 words or equivalent. Your reports must be ready for review by a senior engineer. Your report may include calculations – ensure calculations are in adequate significant figures and units throughout the reports (scanned copies of hand calculations are acceptable), diagrams, tables of data, graphs and photographs adequately captioned and referenced, and shop drawings of your design (if required). All drawings and detailings (shop drawings) are prepared with AutoCAD or an equivalent CAD program and placed in an Appendix. **Task 2a – Steel design and construction** Using steel products, your team engineers and designs a structural solution for the primary structure of an industrial or commercial building. Your design must comply with all relevant Australian Design Code e.g. AS 4100–1998 Steel Structures. Note further details will be provided on Blackboard and/or in class. **Task 2b – Timber design and construction** Using steel products, your team engineers and designs a structural solution for the primary structure of an industrial or commercial building. Your design must comply with all relevant Australian Design Code AS 1720.1–2010 Timber Structures. Note further details will be provided on Blackboard and/or in class. The design project will be completed without the help of specialised software e.g. structural analysis, and design aids e.g. span tables. The names and student numbers of all team members are listed on the cover page of each report and each team member must sign the cover page. The contributions of each team member will also be clearly stated on the coversheets. Coversheet templates will be available on Blackboard

Criteria:	• Explanation of design principles, procedures and phenomena. • Use of Australian Standards. • Application of design methods and procedures to analyse and design steel and timber structures to limit states. • Report format and presentation. • Collaboration in teams demonstrated by your contribution to the deliverables and feedback activities. Note you are rewarded an individual mark for Task 2, and as part of your group work, you will also be required to actively participate to Peer Assessment, review, feedback and debriefing activities.

Engineers Australia competencies assessed in this task
2.1 Application of established engineering methods to complex engineering problem solving.
3.2 Effective oral and written communication in professional and lay domains.
3.6 Effective team membership and team leadership.

Assessment Task 3: Final Exam

Goal:	The final exam will build your skills and competencies to analyse and design steel and timber structures independently and with confidence within a set time limit and with limited access to additional resources.

Product:	Examination
Format:	The final exam assesses the material (lectures, tutorials and assignments) covered in the course and the self-study material. You will be required to analyse structures and design steel and timber members. With your solutions you will demonstrate your understanding and ability to apply methods of structural analysis and design. The exam will be partially open book. Full details of what may be taken into the exam venue will be explained in class during the semester and posted on Blackboard.
Criteria:	Explanation of design principles, procedures and phenomena. Use of Australian Standards. Application of design methods and procedures through the use of formulae and codes to analyse and design steel and timber structures to limit states. Written presentation of the solutions.

Engineers Australia competencies assessed in this task

1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.

2.1 Application of established engineering methods to complex engineering problem solving.

2.2 Fluent application of engineering techniques, tools and resources.

7. What are the course activities?

7.1 Directed study hours

The directed study hours listed here are a portion of the workload for this course. A 12 unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

This course will be delivered via technology-enabled learning and teaching. All lectures will remain in this mode for Semester 2 2020. When government guidelines allow, students that elected on-campus study via the class selection process will be advised when on campus tutorials and practical sessions will resume.

Location: Specific Campus(es) or online:	**Directed study hours for location:**
USC Sunshine Coast	13 x 2hr Lectures 13 x 2hr Tutorials

7.2 Course content

Week # / Module #	**What key concepts/content will I learn?**
Week 1	Limit States Design, Design Actions – Structure concepts, structural stability (bracing concepts), structural analysis, and loads and load combinations (1).
Week 2	Limit States Design, Design Actions – Structure concepts, structural stability (bracing concepts), structural analysis, and loads and load combinations (2).
Week 3	Limit States Design, Design Actions – Structure concepts, structural stability (bracing concepts), structural analysis, and loads and load combinations (3).
Week 4	Introduction to steel and its structural applications & Steel Design – Tension and Compression members
Week 5	Steel Design – Bending members
Week 6	Steel Design – Combined Actions
Week 7	Steel Design – Connections
Week 8	Introduction to timber and its structural applications & Timber Design – Tension and compression members.
Week 9	Timber Design – Bending members
Week 10	Timber Design – Bending and Combined Actions
Week 11	Timber Design – Connections
Week 12	Durability by Guest Lecture (TBC) & Engineered Wood Products (EWP's).
Week 13	Revision

Note: Course content may be subject to variation.

8. What resources do I need to undertake this course?

Please note that course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Blackboard site. Please log in as soon as possible.

8.1 Prescribed text(s)

Please note that you need to have regular access to the resource(s) listed below as they are required:

AS/NZS 1170.0 Structural design actions - General principles.
AS/NZS 1170.1 Structural design actions - Permanent, imposed and other actions.
AS/NZS 1170.2 Structural design actions - Wind actions.
AS 4100 Steel structures.
AS 1720.1 Timber structures, Part 1: Design methods.

Note: Free downloads of AS/NZS and AS are available via the USC Library portal (SAI Global link at https://libguides.usc.edu.au/engineeringdatabases).

Recommended texts

Brian Kirke and Iyad Hassan Al-Jamel 2004 '*Steel Structures Design Manual To AS 4100*', 1st Edition (https://wiki.csiamerica.com/download/attachments/7636185/Steel%20Structures%20Design%20Manual%20to%20AS%204100.pdf?version=1&modificationDate=1308592778198&api=v2).

SA HB 108–2013 Timber design handbook.

Note: Free download of SA HB 108–2013 is available via the USC Library portal (SAI Global link at https://libguides.usc.edu.au/engineeringdatabases).

8.2 Specific requirements

N/A

9. Risk management

Health and safety risks for this course have been assessed as low.

It is your responsibility as a student to review course material, search online, discuss with lecturers and peers, and understand the health and safety risks associated with your specific course of study. It is also your responsibility to familiarise yourself with the University's general health and safety principles by reviewing the online Health Safety and Wellbeing training module for students, and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1 Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

10.2 Assessment: Additional requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

a) The final mark is in the percentage range 47% to 49.4%
b) The course is graded using the Standard Grading scale
c) You have not failed an assessment task in the course due to academic misconduct

10.3 Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate:

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task.
- 10% (of the assessment task's identified value) for the third day

- 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.
- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.
To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

10.4 Study help

In the first instance, you should contact your tutor, then the Course Coordinator. Additional assistance is provided to all students through Academic Skills Advisers. To book an appointment or find a drop-in session go to Student Hub.

Contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au

10.5 Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website:
http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.6 General Enquiries

In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC South Bank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **USC Gympie** - Student Central, 71 Cartwright Road, Gympie
- USC Moreton Bay - Service Centre, Building A – Ground Floor, 1 Moreton Bay Parade, Petrie
- **USC Fraser Coast -** Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **USC Caboolture -** Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

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Email: studentcentral@usc.edu.au