USC

Course Outline

Code: ENG212
Title: Structural Engineering

Faculty of:	Science, Health, Education and Engineering
School of:	Science & Engineering
Teaching Session:	Semester 2
Year:	2018
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:
Competently and confidently 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, Empowered.
Accurately and confidently use the structural principles of strength, stability and serviceability and identify the context of their design limit state.	Tasks 1, 2 and 3	Knowledgeable.
Competently determine the adequate loads and load combinations acting on structures arising from the design actions of gravity, occupation and use, and wind.	Tasks 1, 2 and 3	Knowledgeable.
Competently, adequately and accurately analyse structures of buildings to determine the design actions developing in their structural elements in response to the design load combinations and arrangements.	Tasks 1, 2 and 3	Creative and critical thinkers.
Competently and compliantly design structural elements in steel and timber for strength, stability and/or serviceability: Members such as beams, rafters, columns, etc. Connections with mechanical fasteners such nails, screws, bolts, etc.	Tasks 1, 2 and 3	Empowered.
Collaborate and apply creativity and innovation in a project team to conceive adequate structures ie. most adequate solutions for steel or timber structures.	Task 2	Creative and critical thinkers, Engaged, Ethical.
Collaborate effectively in a project team to competently and compliantly design steel and timber structures, draw construction details and produce engineering reports.	Task 2	Creative and critical thinkers, Engaged, Ethical.
Effectively and clearly communicate (in your group or to an audience) your design procedures, outcomes and recommendations in a manner acceptable to the engineering profession.	Tasks 1, 2 and 3	Ethical, 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 SC383 or SC410, SC425. UU301 or XU301

5.2 Pre-requisites

ENG221

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

In Week 3 Tutorial, a draft copy or progress report of your assessment Task 2a will be peer reviewed.

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	20% (5 x 4%; 5 best marks of 6 Tasks, each Task 4%)	Six short design reports (max. 200 words).	Weeks 3, 5, 6, 9, 10 & 13.	Hardcopy, Lecture room
2	Design Project	Group	40% (2a: 10%, 2b: 15% & 2c: 15%)	Three design reports (max. 1000 words).	Weeks 4, 8 & 12	
3	Final Exam	Individual	40%	2 hr	Centrally scheduled Exam Period	Exam Venue
			100%			

Assessment Task 1 (a – f): Structural engineering

Goal:	Competently explain, demonstrate and apply steel and timber design procedures compliant with AS/NZS 1170.0, 1170.1 & 1170.2; and AS 1720.1 & 4100, and to the adequate design limit states (strength, serviceability, etc.).)
Product:	Short design reports of the relevant limit states, structural material and detailing if applicable.
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 competently in compliance with AS/NZS 1170.0, 1170.1 & 1170.2; and AS 1720.1 & 4100: 1a) Structural engineering, 1b) Steel member under axial actions, 1c) Steel beam under flexural design action, 1d) Timber member under axial actions, 1e) Timber beam under flexural design action, 1f) TBC. 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:	• Accurate explanation of design procedures and principles. • Correct choice of design methods and codes. • Correct application of design methods and procedures through the correct use of formulae and codes to analyse and design a concrete member to limit states. • Inclusion of all workings showing a logical sequence to the problem solution and presentation of design calculations to a professional engineering standard. • Report format and presentation to a professional engineering standard.
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. 3.2 Effective oral and written communication in professional and lay domains.	

Assessment Task 2 (a – c): Design Project

Goal:	Effectively and professionally collaborate with your peers to undertake the detailed engineering design of steel and timber structures (buildings, bridges, etc.) or aspects of these to relevant limit states in compliance with Australian Design Codes: AS/NZS 1170.0, 1170.1 & 1170.2; and AS 1720.1 & 4100.
Product:	Design reports of the relevant limit states, structural material and detailing if applicable.
Format:	Engineers work in project teams! This challenging 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) Structural engineering 2b) Steel design and construction 2c) Timber design and construction Site details, architectural drawings and full project description will be supplied on Blackboard and/or discussed in class. In your group (**3-4 members**), you collaborate effectively and professionally to write three design reports that adhere to the conventions of 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 – Structural engineering** Your team determine the design parameters of the Limit State Design of a proposed building. To this end, you investigate and identify the loads (incl. wind load) and design load combinations for ultimate and service limit states applicable to the building in compliance with the Australian Loading Code: AS/NZS 1170 set, you conceive a solution for the structure of the proposed building, including the stability concept, and you complete the pre-analysis of the primary structure (stability members excludes). Note further details about the building/structure will be provided on Blackboard and/or in class. **Task 2b – Steel design and construction** Your team engineer and design a structural solution using steel products. Your steel solution is adapted to your primary structure (refer to Task 2a). Your design must comply with Australian Design Code AS 4100–1998 Steel Structures. Note further details will be provided on Blackboard and/or in class. **Task 2c – Timber design and construction** Your team engineer and design a timber structure adapted to the primary structure of the proposed building (refer to Task 2a). Your design must comply with 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 structural analysis software and design aids such as span tables. Note design capacity tables and aids may be used as a check of your design solutions. *Note: These tools are obviously used in practice but until you have enough experience to appreciate their limitations and/or critically assess their results, eg. whether or not a software output is reasonable, it is best that you design 'manually' and check/discuss your design solutions with your peers.* 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:	• Innovative conceptualisation of the building structure(s). • Correct choice of design methods and codes. • Correct application of design methods and procedures through the correct use of formulae and codes to analyse and design a concrete structures to limit states. • Inclusion of all workings showing a logical sequence to the problem solution to allow a professional review (and sign-off) of the design. • Presentation of design calculations and drawings to a professional engineering standard. • Acting professionally by functioning in teams when carrying out the designs and writing up the reports. • Design reports are prepared for revision ie. review by a senior engineer. You are awarded an individual grade for each Task. Upon request individual marks can be moderated with an algorithm that uses the Reviewer's mark for the task plus a rating of your contribution by your group peers (a self and peer assessment based eveluation). Marks are recorded and made available to you on Blackboard.
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. 3.1 Ethical conduct and professional accountability. 3.2 Effective oral and written communication in professional and lay domains. 3.3 Creative, innovative and pro-active demeanour. 3.5 Orderly management of self, and professional conduct. 3.6 Effective team membership and team leadership.	

Assessment Task 3: Final Exam

Goal:	Demonstrate the competencies and skills to competently and compliantly determine Limit State Design parameters, and to competently and compliantly design steel and timber structural elements.
Product:	Final exam (Sequenced solutions to problems showing all workings).
Format:	The final exam assesses the material (lectures, tutorials and assignments) covered in the course and the self-study material. 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. You will be required to solve a number of typical Structural Engineering design problems similar to the Lecture examples, Tutorial questions and/or those you undertook in your design projects. Past exam papers and/or may be be available on Blackboard.
Criteria:	• Appropriateness and correctness of design solutions; • Correct use of design methods and codes; • Inclusion of all workings showing a logical sequence to the problem solution. • Demonstration of adequate and competent application of design process through use of correct formulae; and • Competent and accurate explanation of design aspects and phenomena.
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. 3.2 Effective oral and written communication in professional and lay domains.	

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.

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	Guest Lecture (TBC)
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).

HB2.2-2003 (Incorporating Amendments 1 and 2), '*Australian Standards for Civil Engineering Students, Part 2: Structural Engineering' (Incorporating Amendments 1 and 2).*

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 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