CVEN9802

Structural Stability

Term 1, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Chongmin Song	c.song@unsw.edu.au	Tuesday 2-4pm; Thursday 2-4pm	CE717B	02 9385 5021

Lecturers

Name	Email	Availability	Location	Phone
Chongmin Song	c.song@unsw.edu.au	uesday 2-4pm; Thursday 2-4pm	CE717B	02 9385 5021

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

Euler strut; uniform and non-uniform cross sections. Eccentric loading; stressing beyond the elastic limit. Struts continuous over several supports. Stability of frames.

Course Aims

You will study fundamental theory of structural stability analysis and its application to the analysis and design of civil engineering structures. This course lays the foundation for other postgraduate courses in structural engineering. You are expected to be familiar with the theories and concepts introduced in the previous structural engineering courses CVEN2303 and CVEN3304.

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Understand the concept of structural stability and the approach for design for stability	PE1.1, PE1.2, PE1.3
2. Determine the buckling loads for simple columns	PE1.1, PE1.2, PE1.3, PE1.4, PE2.1
3. Understand the concept of effective length and its use in design	PE1.5, PE2.3
4. Buckling analysis of frames	PE1.5, PE2.3
5. Apply advanced numerical techniques to buckling analysis of structures	PE1.5, PE2.3
6. Use commercial numerical simulation software.	PE2.1, PE2.2, PE2.3
7. Communicate analyses in written and graphical form.	PE3.2

Teaching Strategies

This subject consists of a mixture of lectures, exercise classes, and one computer session.

Lectures will introduce you to the fundamental theories for the analysis of structural stability, and the principles and techniques for design. A computer software package will be introduced for the analysis of practical engineering problems.

The exercise classes provide you with the opportunity to discuss the lecture material with your demonstrators and to solve the set problems. In order to understand the subject matter well, it is essential to attend the exercise classes and solve the problems by yourself.

For each hour of contact it is expected that a student will put in at least 1.5 hours of private study.

The teaching/learning activities are summarized in the following table:

Private Study	• Review lecture material and textbook • Do set problems and assignments • Reflect on class problems and assignments
Lectures	• Find out what you must learn • See methods that are not in the references • Follow worked examples • Hear announcements on course changes
Exercise classes	• Be guided by demonstrators • Practice solving set problems • Ask questions
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving

Assessment

When an assignment is to be submitted on Moodle, it is your responsibility to ensure that all the electronic files are submitted (you may zip multiple files into one) and your submission is recorded in the system.

Students who perform poorly in the quizzes are recommended to discuss progress with the lecturer during the term.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quiz 1	15%	Not Applicable	1, 2, 7
2. Quiz 2	20%	Not Applicable	1, 2, 3
3. Assignment	15%	22/04/2022 05:00 PM	4, 5, 6, 7
4. Final Examination	50%	Not Applicable	1, 2, 3, 4, 5, 7

Assessment 1: Quiz 1

Start date: 03/03/2022 11:30 AM
Assessment length: 60min

Quiz 1 covers the contents of Weeks 1-2.

Assessment criteria

- Correct interpretation of and compliance with assessment requirements
- Demonstration of understanding of subject matters and problem solving ability
- Clear and logical steps in problem solving
- Correctness of final and other numerical answers
- Appropriate use of engineering drawings, diagrams and figures

Assessment 2: Quiz 2

Start date: 31/03/2022 11:00 AM
Assessment length: 80min

Quiz 2 covers the contents of Weeks 3-5.

Assessment criteria

- Correct interpretation of and compliance with assessment requirements
- Demonstration of understanding of subject matters and problem solving ability
- Clear and logical steps in problem solving
- Correctness of final and other numerical answers
- Appropriate use of engineering drawings, diagrams and figures

Assessment 3: Assignment

Start date: 07/04/2022
Due date: 22/04/2022 05:00 PM

Analysis of frame buckling using Ansys

Assessment criteria

The following criteria will be applied in grading, when appropriate:

- Correct interpretation of and compliance with assessment requirements
- Demonstration of understanding of subject matters and problem solving ability
- Clear and logical steps in problem solving
- Correctness of final and other numerical answers
- Appropriate use of engineering drawings, diagrams and figures
- Clarity of presentation
- Correct referencing and using of source materials
- Completeness of reports and solutions
- Neatness of assignment submissions

Assessment 4: Final Examination

Start date: Final exam period
Assessment length: 120min

The final exam covers all course contents.

Assessment criteria

The following criteria will be applied in grading, when appropriate:

- Correct interpretation of and compliance with assessment requirements
- Demonstration of understanding of subject matters and problem solving ability
- Clear and logical steps in problem solving
- Correctness of final and other numerical answers
- Appropriate use of engineering drawings, diagrams and figures
- Clarity of presentation
- Correct referencing and using of source materials
- Completeness of reports and solutions

Hurdle requirement

A mark of at least 40% in the final examination is required before the class work is included in the final mark.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 14 February - 18 February	Lecture	Introduction to structural stability, bar and spring systems
	Workshop	As above
Week 2: 21 February - 25 February	Lecture	Elastic column buckling
	Workshop	As above
Week 3: 28 February - 4 March	Lecture	Elastic column buckling (continued)
	Assessment	Quiz 1
Week 4: 7 March - 11 March	Lecture	Column bracing
	Workshop	Elastic column buckling and columnbracing
Week 5: 14 March - 18 March	Lecture	Beam column analysis
	Workshop	As above
Week 6: 21 March - 25 March	Lecture	***Flexibility week for all courses (non□teaching)***
Week 7: 28 March - 1 April	Lecture	Frame buckling
	Assessment	Quiz 2
Week 8: 4 April - 8 April	Lecture	Energy methods and numerical formulations
	Workshop	Use of Ansys for frame buckling analysis
	Assessment	Assignment set
Week 9: 11 April - 15 April	Lecture	Introduction to finite element method for bucking analysis
	Workshop	As above
Week 10: 18 April - 22 April	Lecture	Introduction to finite element method for bucking analysis (continued)

	Workshop	As above
	Assessment	Assignment due

Resources

Recommended Resources

Recommend Readings

- Chen and Lui (1987), "*Structural Stability: Theory and implementation*", Prentice-Hall.
- Galambos and Surovek (2008), "*Structural Stability of Steel: Concepts and applications for structural engineers*", Wiley.

Additional Readings

- *Stability of Structures: Elastic, Inelastic, Failure & Damage Theories* by Bazant & Cedolin
- *Buckling Strength of Metal Structures* by Bleich

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 2022 will be held online between 29th April - 12th May inclusive, and supplementary exams between 23rd - 27th May inclusive. 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
- Refer to Academic Advice on the School website available at: https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

Image Credit

Mike Gal.

CRICOS

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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	