School of Civil and Environmental

Term 3, 2020

CVEN9802 STRUCTURAL STABILITY

COURSE DETAILS

Units of Credit	**6**	
Contact hours	4	
Class	Thursday, 9:00 – 12:00	Room: online
Workshop	Thursday, 12:00 – 13:00	Room: online
Course Coordinator and Lecturer	Dr. Elena Atroshchenko email: e.atroshchenko@unsw.edu.au office: CE607 phone: 9385 5094	

INFORMATION ABOUT THE COURSE

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 CVEN3301 and CVEN3302.

HANDBOOK DESCRIPTION

Euler strut; uniform and non-uniform cross sections. Eccentric loading; stressing beyond the elastic limit. Struts continuous over several supports. Stability of frames. Energy method and numerical formulations. Finite element analysis.

Refer to Online Handbook available at:

http://www.handbook.unsw.edu.au/postgraduate/courses/2020/CVEN9802.html

OBJECTIVES

Objectives of the course are:

- An in-depth engagement with the disciplinary knowledge in its inter-disciplinary context
- Developing capacity for analytical and critical thinking and for creative problem solving
- Developing ability to engage independent and reflective learning
- Developing skills for effective communication

These objectives will be achieved by active engagement in solving problems of structural analysis of beams, columns, and frames, using analytical and numerical methods taught in the course. The assessment strategy consists in two quizzes, one assignment and final exam, which will assist in developing problem solving skills,

effective communication skills and capacity for analytical and critical thinking.

TEACHING STRATEGIES

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
Q&A sessions	• Ask questions about lecture materials and set problems

EXPECTED LEARNING OUTCOMES

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

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

Learning Outcome		**EA Stage 1 Competencies**
LO1	Understand the concept of structural stability and the approach for design for stability	*PE1.1, PE1.2, PE1.3*
LO2	Determine the buckling loads for simple beams and columns by analytical methods	*PE1.1, PE1.2, PE1.3, PE2.1*
LO3	Understand the concept of effective length and its use in design	*PE1.3, PE1.5, PE2.3*
LO4	Design a frame	*PE1.5, PE2.3*
LO5	Apply advanced numerical techniques to bucking analysis of structures	*PE1.5, PE2.1, PE2.2, PE2.3*
LO6	Communicate your analysis in written and graphical form	*PE3.2*

COURSE PROGRAM

Term 3 2020

Date	Topic	Lecture Content	Demonstration Content
17/09/2020 (Week 1)	Introduction, Bar and Spring Systems		
24/09/2020 (Week 2)	Elastic Column Buckling		
01/10/2020 (Week 3)	Elastic Column Buckling (continued)	**Quiz 1**	
08/10/2020 (Week 4)	Column Bracing		
15/10/2020 (Week 5)	Beam Column Analysis		
22/10/2020 (Week 6)	No class	***Flexibility week***	
29/10/2020 (Week 7)	Frame Buckling	**Quiz 2**	
05/11/2020 (Week 8)	Energy Methods and Numerical Formulations	Assignment set	
12/11/2020 (Week 9)	Introduction to Finite Element Method for Buckling Analysis		
19/11/2020 (Week 10)	Introduction to Finite Element Method for Buckling Analysis (continued)	Assignment due	

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

ASSESSMENT

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks: two quizzes, one assignment and final exam. The assessment breakdown and dates are as follows:

1.	Quiz 1		held: Week 3	value: 15%
2.	Quiz 2		held: Week 7	value: 20%
3.	Assignment	issued: Week 8	due: 5:00pm, Fri., Week 10	value: 15%
4.	Exam		held: Final exam period	value: 50%
	Total			**100%**

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

- Correct interpretation of and compliance with assessment requirements
- Correct interpretation of and compliance with assessment requirements
- Demonstration of understanding of subject matters and problem solving ability
- Clear and logic 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

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. ***A mark of at least 40% in the final exam is required before the marks for the quizzes and assignment are included in the final mark.*** *The formal exam scripts will not be returned but you can request to view the marked script.*

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

Please keep a copy of all your submissions in case that they are misplaced.

When an assignment is to be submitted on Moodle, it is your responsibility to ensure that all the electronic files are submitted in the requested format, and your submission is recorded in the system.

Supplementary Examinations for Term 3 2020 will be held on Monday 11 to Friday 15 January 2020 (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

PENALTIES

Assignment: Please note that late work will be penalised at the rate of 10% per day after the due time and date have expired. The deadline for absolute fail of the assignment is 5 days after the due time and date.

Quizzes: Late work will be penalised at the rate of 10% per 5 min after the due time and date have expired. The deadline for absolute fail of the assignment is 15 min after the due time and date.

ASSESSMENT OVERVIEW

Item	Length	Weighting	Learning outcomes assessed	Assessment Criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
1. Quiz 1	1 hr	15%	*LO1, LO2, LO6*	*Students are expected to demonstrate ability to solve bars and springs systems and column stability problems by analytical method*	01/10/2020(week 3)		08/10/2020(week 4)
2. Quiz 2	1 hr	20%	*LO3, LO4, LO6*	*Students are expected to demonstrate ability to solve beam-column and frames stability problems by analytical method*	29/10/2020(week 7)		05/11/2020(week 8)
3. Assignment 1	2 weeks	15%	*LO5, LO6*	*Students are expected to demonstrate ability to apply numerical methods and software to complex problems*	5p.m. 19/11/2020(week 10)	5p.m. 24/11/2020	29/11/2020(week 11)
4. Final Exam	2 hr	50%	*LO1, LO2, LO3, LO4, LO6*	*Students are expected to demonstrate ability to apply analytical methods to stability analysis of bars and springs systems, beams, columns and frames.*	TBA		

RELEVANT 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

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

https://student.unsw.edu.au/dates

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 ADVICE

(Formerly known as Common School Information)

For information about:

- Notes on assessments and plagiarism,
- School policy on Supplementary exams,
- Special Considerations: student.unsw.edu.au/special-consideration
- Solutions to Problems,
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC.

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

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex 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
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (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