ENGG2400

Mechanics of Solids 1

Term 1, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Daniel O'Shea	d.oshea@unsw.edu.au	Email for appointment	Room 108, H20	

Lecturers

Name	Email	Availability	Location	Phone
Elena Atroshchenko	e.atroshchenko@unsw.edu.au		Room 607, H20	

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

This course provides an introduction to the fundamentals to the mechanics of solids. The topics include properties of plane cross-sectional shapes including centroid & principal second moment of area; concepts of stress and strain; 2D transformation of stresses and strains under axis rotation; principal stresses and strains; Mohr's circle of stress and strain; stress-strain relationships; elasticity, thermal strain, Poisson's ratio and Hooke's Law; bars under axial force; Indeterminate axial force systems; elastic bending stress formula; composite beams; deflections due to bending; step functions; simple indeterminate beams; shear flow; shear centre; torsion of circular shafts.

Course Aims

The objectives of this course are:

To reinforce knowledge of statics and to expand this knowledge in the areas of strain and stress analysis, thus enabling student to deal with more complex and integrated engineering problems involving Mechanics of Solids;
To introduce students to the basic principles and laws underlying Mechanics of Solids;
To familiarize students with the modelling and analysis techniques when formulating and solving problems for predicting the states of stress and strain for bodies in static equilibrium;
To give students an opportunity to develop and reflect on graduate attributes such as critical thinking and problem solving, lifelong learning skills and collaborative skills.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Represent physical systems in a manner to sufficiently capture the structural elements required to perform an engineering stress/strain analysis.	PE1.1, PE1.2
2. Discern the relevant principles that must be applied to ascertain stress/strain or load/deflection states of engineering systems and discriminate between relevant and irrelevant information in the context.	PE1.3
3. Demonstrate an ability to communicate clearly and precisely about technical matters related to the Mechanics of Solids	PE1.3, PE1.5
4. Accomplish practical tasks that require the application of knowledge of the Mechanics of Solids	PE1.3, PE1.5, PE2.1
5. Demonstrate professional communication, both written and oral, that includes mathematical, graphical and diagrammatic elements.	PE1.2, PE1.3

Learning Outcome	EA Stage 1 Competencies
6. Produce individual work by leveraging a collaborative environment, helping and and recieving help from peers in a professional and ethical manner.	PE1.2, PE1.3, PE2.2

Teaching Strategies

The teaching strategies that will be used include:

- **Lectures** that will focus on the development and application of generalised problem-solving processes for the stress, strain and deformation analysis of structures. Lectures will also emphasise the relationship of the content to engineering practice and will provide an opportunity for reflection on learning. The lectures are recorded and should be available on the Moodle course page.
- **Problem** classes will concentrate on strategies for solving such problems. Students will be encouraged, from time to time, to work in small groups to solve problems.
- **Moodle Course Page** provides a step by step guide on the course. There is a discussion forum to help provide interaction and help from peers. Links to video recordings and learning modules to help students learn the solution techniques for many of the subject areas.
- **Microsoft Teams** - delivery of online lectures and demonstrations, and discussion forum to ask questions of lecturers and peers

Suggested approaches to learning in this course include:

- Regular participation in lectures and class problem sessions. *Review lecture and class problem material. Follow worked examples. Reflect on class problems and quizzes.*
- Complete all the required tasks in the Moodle course page for this course.
- Weekly reading and recording of your learning.
- Appropriate preparation for class problem activities.
- Planning time to achieve all assessment requirements (see assessment).
- Students who perform poorly in the quizzes are strongly encouraged to discuss their progress with the lecturers during the semester.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Online Learning Modules	15%	Not Applicable	3, 4, 5, 6
2. Progress Quizzes	35%	Wednesday 6pm (Week 4, Week 7, Week 10)	3, 4, 5, 6
3. Final Examination	50%	See Exam Timetable	3, 4, 5, 6

Assessment 1: Online Learning Modules

Weekly online learning modules which are done either at home, library or on campus. The online learning modules step you through solving a problem for each topic, and there is a brief weekly assignment on Moodle to complete applying your learning to engineering problems

Completion of all online learning modules grants 5% mark for the course. All online learning modules may be completed any time before 11.55pm Friday Week 10

Each weekly assignment is worth 1% for the course (10% in total). You will be given 1 week to complete each weekly assignment

Assessment 2: Progress Quizzes

Due date: Wednesday 6pm (Week 4, Week 7, Week 10)

High integrity online block tests to assess progress in learning under exam-like conditions. Each of the three quizzes has equal weighting.

Assessment 3: Final Examination

Due date: See Exam Timetable

The final exam is given because the course learning outcomes include a significant level of technical learning that can be effectively assessed in an exam environment and because exams have high reliability.

Students must receive 40% in the final exam to pass the course

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	Topic	Introduction, Geometric Properties of Cross-Sections
Week 2: 21 February - 25 February	Topic	Concept of Stress, Transformation of Stresses
Week 3: 28 February - 4 March	Topic	Concept of Strain, Transformation of Strains
Week 4: 7 March - 11 March	Topic	Axial Deformations, Mechanical Properties of Materials
	Assessment	Progress Quiz 1 - See Moodle for details
Week 5: 14 March - 18 March	Topic	Elastic Beam Bending, Bending of Composite Sections
Week 6: 21 March - 25 March		FLEXIBILITY WEEK - NO CLASSES
Week 7: 28 March - 1 April	Topic	Inelastic Beam Bending, Deflections due to Bending
	Assessment	Progress Quiz 2 - See Moodle for details
Week 8: 4 April - 8 April	Topic	Transverse Shear Stresses and Shear Flow
Week 9: 11 April - 15 April	Topic	Torsion
Week 10: 18 April - 22 April	Topic	Advanced Mechanics of Materials - Failure Theories, Combined Loadings, Buckling of Columns
	Assessment	Progress Quiz 3 - See Moodle for details
Study Week: 25 April - 28 April	Topic	STUDY WEEK

Resources

Prescribed Resources

Textbook: "Mechanics of Materials: Tenth Edition in SI Units" - RC Hibbeler, Pearson Education

Course Evaluation and Development

The School of Civil and Environmental Engineering evaluates each course each time it is run through (i) the MyExperience Surveys, and (ii) Focus Group Meetings. As part of the MyExperience process, your student evaluations on various aspects of the course are graded; the Course Coordinator prepares a summary report for the Head of School. Any problem areas are identified for remedial action, and ideas for making improvements to the course are noted for action the next time that the course is run. Focus Group Meetings are conducted by the four-Year Managers (academic staff) for any students who wish to attend, in each year of the civil and/or environmental engineering programs. Student comments on each course are collected and disseminated to the Lecturers concerned, noting any points which can help improve the course.

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

CRICOS Provider Code: 00098G

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	