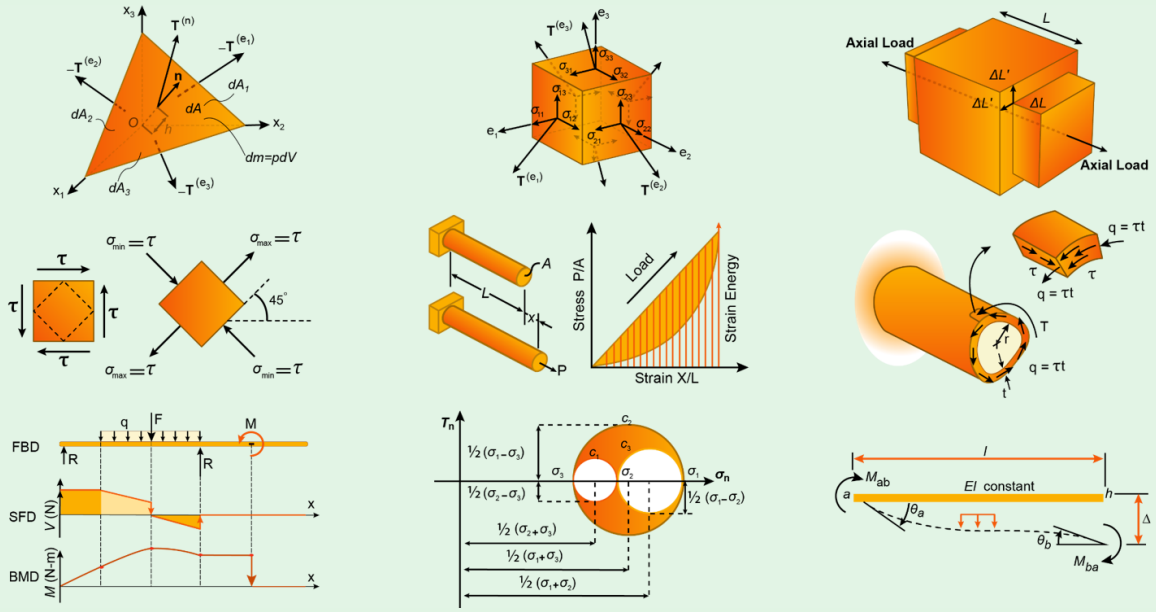
ENGG2400

Mechanics of Solids 1

Term 2, 2022



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
David Kellermann	d.kellermann@unsw.edu.au	Post in the Teams Channels for general questions, and for personal queries message me 24/7 on Teams using Chat.	Room 208J, Ainsworth Bldg	9385 7233

Tutors

Name	Email	Availability	Location	Phone
Harrison Low	h.low@unsw.edu.au	Post in the Teams Channels for general questions, and for personal queries message me 24/7 on Teams using Chat.	Roaming around the Ainsworth Building	

School Contact Information

Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

Hours

9:00–5:00pm, Monday–Friday*

*Closed on public holidays, School scheduled events and University Shutdown

Web

School of Mechanical and Manufacturing Engineering

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

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)

(+61 2) 9385 4097 – School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, 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

School Office – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries. The School will only be able to refer students on to the relevant team if contacted

Important Links

- Student Wellbeing
- Urgent Mental Health & Support
- Equitable Learning Services
- Faculty Transitional Arrangements for COVID-19
- Moodle
- Lab Access
- Computing Facilities
- Student Resources

- Course Outlines
- Makerspace
- UNSW Timetable
- UNSW Handbook

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; and elasticity, 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; torsion of circular shafts and box sections.

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, PE2.1, PE2.2
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.	PE1.1, PE1.2, PE1.5, PE2.1, PE2.2, PE2.3
3. Demonstrate an ability to communicate clearly and precisely about technical matters related to the Mechanics of Solids	PE1.5, PE2.4, PE3.2, PE3.4
4. Accomplish practical tasks that require the application of knowledge of the Mechanics of Solids	PE1.5, PE2.2
5. Demonstrate professional communication, both written and oral, that includes mathematical, graphical and diagrammatic elements.	PE1.5, PE3.2, PE3.4

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.	PE3.5, PE3.6

Teaching Strategies

The teaching strategies that will be used include:

- **Live classes** 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 Solving Sessions (PSS)** will concentrate on strategies for solving such problems. Students will be encouraged to solve problems on their own during class and, from time to time, to work in small groups to solve problems.
- **Moodle Course Page** is used minimally, with most activity, classes and assessment happening in **Teams**.

Suggested approaches to learning in this course include:

- Regular participation in live classes and problem solving sessions. *Review theory material from class. Follow worked examples. Reflect on class problems and quizzes.*
- Complete all the required tasks in the Teams 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.

Additional Course Information

ENGG1300 Engineering Mechanics 1 is assumed knowledge, particularly including the development and application of free body diagrams and equilibrium equations. Furthermore, we assume competency in Engineering Mathematics, particularly including the formulation and solution of equations using calculus and algebra. Basic mechanics from physics is also assumed.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Weekly Tasks	16%	Weekly	1, 5
2. Online Assignments and Labs	20%	Friday 5pm, Weeks 5 and 9	1, 3, 4, 5, 6
3. Block Tests	24%	Week 5 and Week 9	1, 2, 6
4. Final Examination	40%	See Exam Timetable	1, 2, 3, 6

Assessment 1: Weekly Tasks

Assessment length: 1 week
Submission notes: PSS via Teams Assignments.
Due date: Weekly
Deadline for absolute fail: 2 weeks after due date
Marks returned: 1 week later

Weekly tasks

This is not a Turnitin assignment

Assessment criteria

Tutorial work, marks assigned each week of session to show work has been completed. Correctness is not essential, but attempting each question is required for full marks. Each topic week has 2 mark for the PSS hand-ins and tasks related to the live classes. 8 weeks total.

• Students will get 1 mark in the first 15 minutes of class for each week that they show their demonstrators a complete and reasonable attempt at all hand-in questions, and another mark related to either the PSS work or a task related to the live theory class or "lecture".

• An incomplete set of solutions, late arrival or unreasonable attempt will score 0.5 marks. Students must be present either in-person or onlline for the duration of the PSS to attain the full mark.

• If a student comes late, does not attend or join the the PSS or leaves late, their demonstrator will only give them 0.5 for submitted work.

• If the student brings the PSS Hand-in a week late, they will receive a maximum of 0.5 marks

• Zero marks will be awarded for work more than one week late

Assessment 2: Online Assignments and Labs

Start date: Weeks 3 and 6
Assessment length: Max 10 pages
Submission notes: Submit final answers into Forms and written working as PDF upload into Teams

Assignments.
Due date: Friday 5pm, Weeks 5 and 9
Deadline for absolute fail: 2 mark penalty per day
Marks returned: 2 weeks later

Lab work or online assignments

This is not a Turnitin assignment

Assessment criteria

The lab assignments will be assessing students' ability to apply their theoretical knowledge of solid mechanics to experimental results then document their work in a professionl report. Assignment and Lab report. Expectations for marks to be awarded included professional documentation of description, equations, diagrams, figures and referencing. 10% each.

Assessment 3: Block Tests

Start date: Week 4, 7 and 10
Assessment length: 45 minutes + 15 mins tech buffer + 15 minute scan and upload times.
Submission notes: Submit final answers into Forms and written working as PDF upload into Teams Assignments.
Due date: Week 5 and Week 9

High integrity mid-session or block test to assess progress in learning under exam-like conditions.

This is not a Turnitin assignment

Assessment criteria

The block tests will have one question on each of the weekly topics preceeding that week. Expectations include mathematical correctness, sufficient desciption of mathematical and technical process such that the marker can follow the procedure taken.

• Use the basic concepts such as stress, strain, and solution of these using theory of axial, torsion, shear and bending loads

• Systematic approach to outline the steps for a problem and use the necessary fundamental concepts covered in the lectures and problem solving sessions

• Correctness of the solution with the aid of necessary diagrams/sketches and the use of appropriate units

• There are no supplementary block tests. If you miss the block test, you must apply for Special Consideration through the University

• All special considerations lodged more than 48 hours after the test date will be rejected without exception

• If Special Consideration is granted, the student will be given a calculated mark that is 80% of the mark calculated based on their performance in the other three block tests. For example, if you score 100% in

the two block tests you attend, you would be given 80% for the Block Test you missed

Assessment 4: Final Examination

Start date: See Exam Timetable
Assessment length: 2 hours plus technical buffer and upload time.
Submission notes: Submit final numerical answers via Forms and written work as PDFs from images via Teams assignments.
Due date: See Exam Timetable
Deadline for absolute fail: At end of examination time slot
Marks returned: Release of final course results

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.

This is not a Turnitin assignment

Assessment criteria

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. One question directly testing each of the eight weekly topics of the course.

• Use the basic concepts from each of the eight topics across eight exam questions with equal weighting

• Systematic approach to outline the steps for a problem and use the necessary fundamental concepts covered in the lectures and problem solving sessions

• Correctness of the solution with the aid of necessary diagrams/sketches and the use of appropriate units

• A pass in this course requires a mark of 40% in the final examination and 50% in the course overall

Hurdle requirement

This course will include the following hurdle requirements that are closely linked to a set of learning outcomes which demonstrate that you have acquired the required skills and competencies within this discipline:

- Students must demonstrate understanding of the core ENGG2400 curriculum. A minimum mark of 40% must be obtained for the final exam in order to pass this subject. Failure to achieve this minimum mark will result in an unsatisfactory fail (UF) grade, regardless of the performance in the rest of the course.

According to the UNSW Assessment Policy and Procedure, no assessment can influence the course grade disproportionate to the assigned weighting. However, an exemption for allowing “hurdle” assessments can be used if the failure of an individual assessment task clearly demonstrates a failure to attain a professional competency from the course. If you have a hurdle assessment/requirement in your course, you may use the following paragraph and adjust the blue text as needed. Otherwise, please delete. For it to be a valid hurdle assessment, it has to be 1) an assessment which is a majority

contributor to a particular learning outcome (i.e. in many cases there is a learning outcome which is only assessed by one assessment task) and 2) the learning outcome must be closely linked to a professional competency (i.e. EA competencies).

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: 30 May - 3 June	Topic	Stress and Strain: Equilibrium of deformable bodies. Normal and shear stress and strain
Week 2: 6 June - 10 June	Topic	Mechanical properties of materials
Week 3: 13 June - 17 June	Topic	Axial loading, statically indeterminate loading
Week 4: 20 June - 24 June	Topic	Geometric properties of sections. Second moment of area, polar moment of inertia
	Assessment	Block Test 1
Week 5: 27 June - 1 July	Topic	Torsion, angular deformation, torque, transverse shear
	Assessment	Lab report 1 due
Week 6: 4 July - 8 July	Topic	Flex Week
Week 7: 11 July - 15 July	Topic	Beam bending, flexural rigidity of beams
	Assessment	Block Test 2
Week 8: 18 July - 22 July	Topic	Stress and strain transformation, plane stress/strain, Mohr's circle, rosettes
Week 9: 25 July - 29 July	Topic	Deflection of beams, statically indeterminate beam bending
	Assessment	Lab report 2 due
Week 10: 1 August - 5 August	Topic	Exam revision
	Assessment	Block Test 3

Resources

Prescribed Resources

Textbook: "Mechanics of Materials: Tenth Edition in SI Units" - RC Hibbeler, Pearson Education. Free access for students via Kortext.

UNSW Library website: https://www.library.unsw.edu.au/

Microsoft Teams: https://teams.microsoft.com

Recommended Resources

Other resources are provided digitally. You may choose to get additional textbooks.

Course Evaluation and Development

The Faculty of 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

Assessment submission and marking criteria

Should the course have any non-electronic assessment submission, these should have a standard School cover sheet.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Late policy

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For example:

- Your course has an assessment task worth a total of 100 marks.
- You submit the assessment 2 days (or part thereof) late (i.e. from 24-48 hours after the deadline).
- The submission is graded and awarded a mark of 65/100.
- A late penalty of 10 marks is deducted from your awarded mark (2 days @ 5% of 100 marks).
- Your adjusted final score is 55/100.

For some assessment items, a late penalty may not be appropriate. These are clearly indicated in the course outline, and such assessments receive a mark of zero if not completed by the specified date. Examples include:

1. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
2. Online quizzes where answers are released to students on completion, or
3. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
4. Pass/Fail assessment tasks.

Examinations

You must be available for all quizzes, tests and examinations. For courses that have final examinations,

these are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates. For further information on exams, please see the Exams webpage.

Special Consideration

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to submitting an assessment or sitting an exam.

UNSW now has a Fit to Sit / Submit rule, which means that if you attempt an exam or submit a piece of assessment, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

Please note that students will **not** be required to provide **any** documentary evidence to support absences from any classes missed **because of COVID-19 public health measures such as isolation**. UNSW will **not** be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration **will** be required for assessment and participation absences – but no documentary evidence **for COVID-19 illness or isolation** will be required.

Special Consideration Outcomes

Assessments have default Special Consideration outcomes. The default outcome for the assessment will be advised when you apply for Special Consideration. Below is the list of possible outcomes:

Outcome	Explanation	Example
Time extension	Student provided more time to submit the assessment	e.g. 1 more week of time granted to submit a report
Supplementary assessment	Student provided an alternate assessment at a later date/time	e.g. a supplementary exam is scheduled during the supplementary exam period of the term
Substitute item	The mark for the missed assessment is substituted with the mark of another assessment	e.g. mark for Quiz 1 applied also applied as mark for Quiz 2, meaning if a student achieved a mark of 20/30 for Quiz 1 and was granted Special Consideration for Quiz 2, a mark of 20/30 would be applied for Quiz 2, etc
Exemption	All course marks are recalculated excluding this assessment and its weighting	e.g. The course has an assessment structure of: - Assignments 30%, - Lab report 30%, - Final Exam 40%. If the Lab report is missed and student is granted Special Consideration, then the assessment structure may be reweighted as follows: - Assignments 50% - Final Exam 50% as though the Lab report did not exist
Non-standard	Course Coordinator is contacted for the outcome when special consideration is granted as the outcome differs on a case-by-case basis	e.g. typical for group assessments where time extension supplementary assessment could be granted to the group member, time extension could be granted to the whole group, etc. Clarify with your Course Convenor for

Academic Honesty and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Academic Information

Credit points

Course credit is calculated in Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete, for both regular and intensive terms. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Guidelines

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism

Note: This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up-to-date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

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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	✓