UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 3 2019

ENGG2400

Mechanics of Solids

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr David C. Kellermann
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Email: d.kellermann@unsw.edu.au (but I prefer Teams chat)

Contact details for Head Demonstrator

Name: Michael Ling
Office location: Ainsworth 208, open area
Email: m.z.ling@unsw.edu.au

Queries and consultation

For queries and consultation, proceed in the following order:

1) Ask your peers
2) Post to Teams*: ENGG2400 2019 T3 - Mechanics of Solids*
3) Ask your demonstrators during the PSS
4) Use Teams chat or email to contact your head demonstrator
5) See your lecturer after the scheduled lectures
6) Use Teams chat to contact your lecturer
7) Arrange for a consultation time with your lecturer

If you email/message your head demonstrator or lecturer, please include all information in the message: for example, rather than saying “in Question 5 of the problem set”, take a screenshot or photo of Question 5 so we can answer your question on the spot.

Contact details and consultation times for additional demonstrators:

Name	Contact email address
Michael Ling	m.z.ling@unsw.edu.au
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2. Important links

- ENGG2400 2019 T3 - Mechanics of Solids
- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering

3. Course details

Credit points

This is a 6 unit-of-credit (UoC) course and involves 6-7 hours per week (h/w) of face-to-face contact.

The normal workload expectations of a student are approximately 25 hours per term for each UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work.

You should aim to spend about 10 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

Contact hours

	Day	**Time**	**Location**
Lectures	Monday (Week 1-3, 5-10)	9:00am – 11:00am	*Lecture:* Ainsworth G03 *Web:* Microsoft Teams livestream
	Tuesday	11:00am – 1:00pm	*Lecture:* Ainsworth G03 *Web:* Microsoft Teams livestream
Problem Solving Session (PSS) Weeks 1-10	Friday	10:00am – 12:00pm	Bioscience G07
	Friday	10:00am – 12:00pm	Electrical Engineering G03
	Friday	10:00am – 12:00pm	John Goodsell LG19
	Friday	12:00pm – 2:00pm	Bioscience G07
	Friday	12:00pm – 2:00pm	Electrical Engineering G03
	Friday	12:00pm – 2:00pm	John Goodsell LG19
	Friday	2:00pm – 4:00pm	Bioscience G07

	Day	Time	Location
	Friday	2:00pm – 4:00pm	Electrical Engineering G03
	Friday	2:00pm – 4:00pm	Electrical Engineering G10
	Friday	4:00pm – 6:00pm	Bioscience G07
	Friday	4:00pm – 6:00pm	Electrical Engineering G03
	Friday	4:00pm – 6:00pm	Quadrangle 1043
Block Tests Weeks 4,7,10	Friday	6:00pm - 7:00pm	Weeks 4, 7, 10 – Keith Burrows Theatre and Physics Theatre
Moodle Quiz	Tuesday	6:00pm – 7:00pm	Online

Please refer to your class timetable for the learning activities you are enrolled in and attend only those classes.

Summary and Aims of the course

Mechanics of Solids is a foundational subject for all engineers- essentially, it is the extension of engineering mechanics from rigid bodies to deformable bodies and the associated stress, strain and deformations. This is a second-year undergraduate course, worth 6 Units of credit. It builds on the statics component of ENGG1300 Engineering Mechanics 1, and some of the concepts from that course are amplified here. This course, together with its successor, MMAN3400 Mechanics of Solids 2, provide the foundations for subsequent structural design courses MECH3110 Mechanical Design 1, MECH4100 Mechanical Design 2, AERO4410 Advanced Aerospace Structures and Vibrations and so on.

Aims of the course

The aim of this course is to study the relationships between the *external* loads applied to deformable body and the intensity of *internal* forces or *stresses* acting within the body. It also involves the study of deformations or *strains* caused by external loads.

Based on linear elastic material behaviour, you will be given sufficient understanding of the relationships between stress and strain in two and three dimensions.

The yield criteria for static loading and fatigue and fracture under repetitive loading will be covered to enable you to design structures, machines and components.

Student learning outcomes

This course is designed to address the below learning outcomes 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
LC1.	Recognise the fundamentals of Solid Mechanics	PE1.1, 1.2
LC2.	Demonstrate the fundamentals of stresses and strains	PE1.3
LC3.	Identify and express the principles of Solid Mechanics in obtaining the solutions for applications in real life engineering problems	PE1.3
LC4.	Identify and express the principles of Solid Mechanics in obtaining the solutions for applications in real life engineering problems	PE1.3
LC5.	Create and Develop “engineers’ eyes”	PE2.1, 2.2, 2.3

4. Teaching strategies

This course will be delivered both in the classroom and online. Full participation in the class means that you will participate fully in both arenas. That is, you will be held accountable for all content, instructions, information, etc. that is delivered either in class or online. There will also be laboratory or practical exercises that you may have to complete during your self-study time.

Online: The online forum for participation in this class is the Moodle Platform. All official online interactions will take place or be linked clearly and appropriately from this site.

In class: There are three in-class activities in a typical week, which we refer to as the Monday Lecture, Tuesday Lecture and Problem Solving Session based on the timetable above.

Both the online and in-class segments of this course are organised on the following principles:

1. **Learning:** Student learning is the first priority - teaching and assessment are secondary concerns. Learning here is defined as gaining new ways of seeing the world, not as being filled with information. We are trying to transform you into engineers and critical thinkers in the discipline.
2. **Peer Interaction:** Learning is a social activity, and research shows that you will learn most and best when you are actively taught by your peers and, in turn, when you teach them.
3. **Authenticity:** We will have as much authenticity of engineering practice as is possible within the constraints of the course and where it does not restrain your learning.
4. **High standards:** We will have high standards for achievement in the course, and everyone (including staff) will be accountable for putting in the effort to get you to the standard.
5. **Openness:** As much of the course as possible will be conducted in the open where all participants can be aware of it and comment upon it.
6. **Process:** The focus of the course will be on processes, not outcomes. The right outcomes will be a by-product of following the correct processes.

5. Course schedule

	Week	Topic	Quiz	Assignment, Lab work or Block Test	Suggested Readings
Block 1	1	Stress and Strain: Equilibrium of deformable bodies. Normal and shear stress and strain			Hibbeler Ch.1-2
	2	Mechanical properties of materials and geometric properties	Quiz 1	Beam stress lab	Hibbeler Ch.3, Appendix
	3	Axial loading, statically indeterminate loading	Quiz 2	Torsion lab	Hibbeler Ch.4
Block 2	4	Torsion, angular deformation, torque	Quiz 3	**Block Test 1**	Hibbeler Ch.5
	5	Beam bending, flexural rigidity of beams	Quiz 4	*Beam stress report due*	Hibbeler Ch.6
	6	Transverse shear and shear flow Combined loading, thin-walled pressure vessels	Quiz 5	Beam deflection lab	Hibbeler Ch.7-8
Block 3	7	Stress and strain transformation, plane stress/strain, Mohr's circle, rosettes	Quiz 6	**Block Test 2**	Hibbeler Ch.9-10
	8	Deflection of beams, statically indeterminate beam bending	Quiz 7	*Torsion report due*	Hibbeler Ch.11,12
	9	Energy Methods, strain energy functions	Quiz 8	*Beam deflection report due*	Hibbeler Ch.14
	10	Exam revision	Quiz 9	**Block Test 3**	

6. Assessment

Assessment overview

Assessment task	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date, time	Deadline for absolute fail	Marks returned
3 x Block Tests	45 mins each	27% (9 marks each)	1, 2, 3, 4	Demonstrating ability under exam conditions	Friday 6-7pm in weeks 4, 7, 10	N/A	Within 2 weeks after each test
9 x Weekly PSS and Moodle quiz	Weekly	19% (1+1 marks each week) +1 activity	1, 2, 3, 4	Weekly problem solving attempts, continued learning.	PSS: WK X+1 Quiz: 7pm Tuesday after, weeks 2-10	PSS: WK X+2 Quiz: No late submissions	Same day
3 x Individual Laboratory Reports	8 pages max	18% (6 marks each)	1, 3, 4, 5	Correctness, completeness, professionalism of report	5pm Friday, weeks 5, 8, 9.	5pm the Monday after	Within 2 weeks after the due date
Final exam	2 hours	36%	1, 2, 3, 4	Understanding of all course content	Exam period, date TBA.	N/A	Upon release of final results

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 theoretical basis for each topic. A minimum mark of 50% 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.

Assessment Criteria

PSS Hand-ins

- 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
- An incomplete set of solutions, late arrival or unreasonable attempt will score 0.5 marks
- If a student comes late to the PSS or leaves late, their demonstrator will only give them 0.5
- 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

Block Tests and Final examination

- Use the basic concepts such as Free-Body Diagrams (FBD) and Equations of Equilibrium (EoE)
- 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 Considerations are 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

Laboratory Reports

- Interpretation of the experimental results for the required information described in the hand-out for each experiment
- Understanding the relationship between the theory covered during the lectures to experimental results in the laboratory
- Presentation of report in accordance with the MECHENG guidelines
- Attendance and participation during the laboratory experiments.

Final examination

- Use concepts taught throughout weeks 1-10
- 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 50% in the final examination and overall

Assignments

Presentation

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.

Submission

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 20 percent (20%) 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.

Work submitted after the 'deadline for absolute fail' is not accepted and a mark of zero will be awarded for that assessment item.

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:

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

Marking

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.

Examinations

You must pass the final exam in order to pass the course.

Inability to attend the block tests on one of these times for reasons such as work commitments, holidays etc. cannot, unfortunately, be accommodated with a class of this size. Of course, arrangements will be made for emergencies such as illness. Arrangements for each type of assessment are tabulated below.

Type of Assessment	Notes
Block tests 1-3	No supplementary
Weekly assessment	PSS one week late, 0.5 marks and Moodle, no late submissions
Laboratory	Reports submission via Microsoft Teams
Final Examination	Standard UNSW special consideration for supplementary

You must be available for all tests and examinations. Final examinations for each course 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.

Calculators

You will need to provide your own calculator of a make and model approved by UNSW for the examinations. The list of approved calculators is available at student.unsw.edu.au/exam-approved-calculators-and-computers

It is your responsibility to ensure that your calculator is of an approved make and model, and to obtain an "Approved" sticker for it from the Engineering Student Supper Services Centre prior to the examination. Calculators not bearing an "Approved" sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

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.

Please note that UNSW now has a Fit to Sit / Submit rule, which means that if you sit 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.

Attendance

For ENGG2400 we will be recorded through lecture attendance for lecture students and viewing of livestream/recordings for web students; students who have demonstrated a minimum of 50% attendance will be offered a supplementary exam if a UF grade is given. Please see the UNSW attendance page for more information.

7. Expected resources for students

Recommended Textbooks:

Hibbeler, Mechanics of Materials SI 10th edition
Study Pack - Prusty

UNSW Library website: https://www.library.unsw.edu.au/
Moodle: https://moodle.telt.unsw.edu.au/login/index.php
Microsoft Teams: ENGG2400 2019 T3 - Mechanics of Solids

8. Course evaluation and development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include improved everything! PSS booklet answers on page, bot improvements, faster marking times, better solutions.

9. 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

10. Administrative matters and links

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
- Computing Facilities
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Disability Support Services
- Health and Safety
- Lab Access

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