UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Semester 2 2018

MMAN2400

MECHANICS OF SOLIDS 1

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr. David C. Kellermann
Office location: Ainsworth 208J
Tel: (02) 9385 TBA
Email: d.kellermann@unsw.edu.au (but I prefer Teams chat)
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Contact details for Head Demonstrator

Name: Dr. Muhammad Danish Haneef
Office location: Ainsworth 408, open area
Email: m.haneef@unsw.edu.au

Queries and consultation

For queries and consultation, proceed in the following order:

1) Ask your peers
2) Ask your demonstrators from your own PSS
3) Post to Teams
4) Use Teams chat or email to contact your head demonstrator
5) Use Teams chat to contact your lecturer
6) 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
Muhammad (Danish) Haneef	m.haneef@unsw.edu.au
Mahiuddin (Mac) Chowdhurry	m.chowdhurry@unsw.edu.au
Jonathan (Jono) Dufty	z5018512@student.unsw.edu.au
Matthew Eyles	z5075263@student.unsw.edu.au
Ehsan Khaled	mohammad.khaled@student.unsw.edu.au
James (Jimmy) Pritchard	James.pritchard@unsw.edu.au
Briscoe Kerferd	z5113787@student.unsw.edu.au
Llanthony Xin-Williams	l.xin-williams@unsw.edu.au
Lachlan Webb	Lachlan.webb@unsw.edu.au
Zhan Yie (Jacky) Chin	Zhanyie.chin@unsw.edu.au
Harrison Low	z5059641@unsw.edu.au
Michael Ling	m.z.ling@unsw.edu.au

2. Important links

- Moodle
- https://teams.microsoft.com/
- UNSW Mechanical and Manufacturing Engineering
- Course Outlines
- Student intranet
- UNSW Mechanical and Manufacturing Engineering Facebook
- UNSW Handbook

3. Course details

Credit Points

This is a 6 unit-of-credit (UoC) course, and involves 5 hours per week of face-to-face contact.

The UNSW website states “The normal workload expectations of a student are approximately 25 hours per semester for each UoC, including class contact hours, other learning activities, preparation and time spent on all assessable work. Thus, for a full-time enrolled student, the normal workload, averaged across the 16 weeks of teaching, study and examination periods, is about 37.5 hours per week.”

This means that you should aim to spend about 9 hours per week 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**
Lecture	Monday	11:00pm – 1:00pm	*Lecture:* Law Theatre G04 *Web:* Moodle live stream
	Tuesday	2:00pm – 4:00pm	*Lecture:* Ainsworth G03 *Web:* Moodle live stream
Problem Solving Session (PSS) Wks 1-13	Tuesday	16:00 - 18:00	Red Centre West M010 (T16A)
	Wednesday	09:00 - 11:00	Quadrangle G053 (W09A)
	Wednesday	11:00 – 13:00	Red Centre West M010 (W11A)
	Wednesday	13:00 - 15:00	Red Centre West M010 (W13A)
	Wednesday	15:00 - 17:00	Quadrangle G031 (W15A)
	Thursday	09:00 - 11:00	Ainsworth 101 (H09A)
	Thursday	11:00 – 13:00	Quadrangle G044 (H11A)
	Thursday	13:00 - 15:00	Ainsworth 101 (H13A)
	Thursday	15:00 - 17:00	Pioneer Int. Theatre (H15A)
	Friday	09:00 - 11:00	Red Centre West M010 (F09A)
	Friday	11:00 – 13:00	Red Centre West M010 (F11A)

	Day	Time	Location
	Friday	13:00 – 15:00	Red Centre West M010 (F13A)
Block Tests Wks 4,7,10,13	Monday	6:00pm - 7:00pm	Wks (4,7,10) – Clancy Auditorium Wk 13 – CLB7 and Matthews A
Moodle Quiz	Tuesday	6:00pm – 7:00pm	Online, TBA

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 MMAN1300 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.

The aim of this course is to study the relationships between the *external* loads applied to a 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

Learning Outcome		EA Stage 1 Competencies
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 Teams platform. All official online interactions will take place or be linked clearly and appropriately from this site along with Moodle.

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. Every three weeks there is a block test.

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

6. Assessment

Assessment overview

Assessment task	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date, time	Deadline for absolute fail	Marks returned
4 x Block Tests	45 mins each	24% (6 marks each)	1, 2, 3, 4	Demonstrating ability under exam conditions	Monday 6-7pm in weeks 4, 7, 10 and 13.	N/A	Within 2 weeks after each test
12 x Weekly PSS and Moodle quiz	Weekly	24% (1+1 marks each week)	1, 2, 3, 4	Weekly problem solving attempts, continued learning.	PSS: WK X+1 Quiz: 7pm Tuesday after, weeks 2-13	PSS: WK X+2 Quiz: No late submissions	Same day
3 x Individual Laboratory Reports	8 pages max	12% (4 marks each)	1, 3, 4, 5	Correctness, completeness, professionalism of report	5pm Friday, weeks 6, 8, 12.	5pm the Monday after	Within 2 weeks after the due date
Final exam	2 hours	40%	1, 2, 3, 4	Understanding of all course content	Exam period, date TBA.	N/A	Upon release of final results

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 consideration 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 three 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 handout 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 1-12
- 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

Late submissions will be penalised up to 5 marks per calendar day (including weekends). An extension may only be granted in exceptional circumstances. Special consideration for assessment tasks must be processed through student.unsw.edu.au/special-consideration.

It is always worth submitting late assessment tasks when possible. Completion of the work, even late, may be taken into account in cases of special consideration.

Where there is no special consideration granted, the 'deadline for absolute fail' in the table above indicates the time after which a submitted assignment will not be marked, and will achieve a score of zero for the purpose of determining overall grade in the course.

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	
Block tests 1-4	No supplementary
Weekly assessment	PSS one week late, 0.5 marks; and Moodle, no late submissions
Laboratory	Reports submission online
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, which are June for Semester 1 and November for Semester 2.

Provisional Examination timetables are generally published on myUNSW in May for Semester 1 and September for Semester 2

For further information on exams, please see the Exams section on the intranet.

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 shown 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 School Office or the Engineering Student Centre prior to the examination. Calculators not bearing an "Approved" sticker will not be allowed into the examination room.

Special consideration and supplementary assessment

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

7. Attendance

For MMAN2400 we will be expecting a minimum of 50% attendance, which means that you must attend at least 50% of the lectures, or you may be given a fail grade or denied the opportunity to sit a supplementary should you fail the final exam. Expect a role to be taken by some means, most likely by student card scanner.

8. Expected resources for students

Essential textbooks (available through the UNSW bookshop)

Available through the UNSW bookshop:

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

Students are strongly recommended to purchase both these textbooks as they will be used both in this course and in later mechanics courses.

Moodle site for MMAN2400, access via: http://moodle.telt.unsw.edu.au/my/
Teams site for MMAN2400, access via: https://teams.microsoft.com/

School's website: http://www.engineering.unsw.edu.au/mechanical-engineering/

School student intranet: https://eng-intranet.unsw.edu.au/mech-engineering/coursework_students/SitePages/Home.aspx

Other Resources

If you wish to explore any of the lecture topics in more depth, then other resources are available and assistance may be obtained from the UNSW Library: https://www.library.unsw.edu.au/

9. 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 a restructuring of the course syllabus to more simply follow the order of topics in the prescribed text. Furthermore, a wide number of highly successful technologies introduced in Semester 2, 2017 have been brought to this course for the first time. The loading of labs and assessments has been better spread out.

10. 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: 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

Further information on School policy and procedures in the event of plagiarism is available on the intranet.

11. Administrative matters and links

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

- Attendance, Participation and Class Etiquette
- UNSW Email Address
- Computing Facilities
- Assessment Matters (including guidelines for assignments, exams and special consideration)
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Student Support Services

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