UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 1 2019

MMAN3400

MECHANICS OF SOLIDS 2

Contents

1. Staff contact details

Contact details and consultation times for course convenor

Name: Dr Kana Kanapathipillai
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Moodle: https://moodle.telt.unsw.edu.au/login/index.php

Generally, problem-solving class time should be used for direct consultation. Following problem-solving class if you need further consultation, then you may use phone or email for making an appointment for further consultation.

Contact details and consultation times for additional lecturers/demonstrators/lab staff

Name: Mr Daniel Eggler
Office location: J17/AW408
Email: d.eggler@unsw.edu.au
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

You may make an appointment for consultation through email.

Please see the course Moodle.

2. Important links

- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Engineering Student Support Services Centre

3. Course details

Credit points

This is a 6 unit-of-credit (UoC) course, and involves 3 hours per week of face-to-face contact.

Contact hours

	Day	Time	Location
Lectures	Monday	1pm - 3pm	Ritchie Theatre
	Thursday	1pm - 2pm	Law Theatre G04
Problem Solving Sessions	Wednesday (Session 1)	2pm – 3pm/3pm - 4pm/5pm - 6pm	Quad G44/45/Mat 103
	Friday (Session 2)	9am – 10am/10am – 11am/11am – 12pm	Webster 256/Elec Eng G03
Lab	Monday	3pm – 5pm	UTL
Weeks 3 - 4	Tuesday	9am – 11am, 11am – 1pm & 4pm – 6pm	UTL
	Wednesday	9am – 11am	UTL
Quiz (Weeks 4, 9)	Monday	6pm – 7pm	Sir John Clancy Auditorium

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

This course will continue the development of a systematic approach to problem-solving that commenced in earlier courses. It will focus on Membrane stresses in axisymmetric shells, simple bending, bending of composite and reinforced concrete beams, principal and cross moments of area, unsymmetrical bending, transverse shear stresses in beams, shear centre, column buckling, theory of elasticity: compatibility – equilibrium – constitutive equations – plane stress and strain, torsion of multiply connected thin-walled sections, deflection analysis based on the principle of virtual work, various modes of fracture, crack-tip stresses, stress intensity factor, fracture toughness, and crack growth due to fatigue.

The course follows on from the basis of statics in MMAN1300 and elementary topics in MMAN2400 Mechanics of Solids 1 and applies the knowledge obtained to the analysis of thin shells, beams and columns as well as introduces you to some advanced topics in mechanics of solids, such as mechanics of fracture and fatigue. The lecture topics relate closely to mechanical engineering applications with a balance between theory and practice. Assessments will have a strong emphasis on problem-solving skills to address practical applications.

Student 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
1.	Determine stresses in axisymmetric shells/vessels, unsymmetrical bending, shear and column buckling	PE 1.1, 1.2,1.3, 2.1
2.	Analyze deflection of trusses and beams using principle of virtual work	PE 1.1, 1.2,1.3, 2.1
3.	Investigate mechanics of fracture and fatigue	PE 1.1, 1.2,1.3, 2.1
4.	Develop further your skill of technical problem-solving	PE 1.1, 1.2,1.3, 2.1, 2.3, 3.1

4. Teaching strategies

Effective learning is supported when you are actively engaged in the learning process and by a climate of enquiry, and these are best achieved through learning activities like lectures and problem-solving classes using practical examples combined with laboratory demonstrations and hands-on activities.

You become more engaged in the learning process if you can see the relevance of your studies to professional, disciplinary and/or personal contexts. This relevance is shown in all parts of the course through lectures by way of examples drawn from industry.

Discussions are encouraged between you, others in the class and the lecturer. The diversity of experiences is acknowledged. Your experiences are drawn on to illustrate various aspects, and this helps to increase motivation and engagement.

The teaching strategies that will be used include:

- Presentation of the material in weekly lectures so that the students develop the understanding of the underlying concepts of the various topics covered in the course.
- Provision of weekly supervised problem-solving classes where students can obtain assistance and develop their skill in solving technical problems.
- Provision of laboratory classes where students work in teams to perform physical experiments, analyse data and produce pertinent reports about which students will receive timely feedbacks.

5. Course schedule

Block 1				
Week	**Topic**	**Suggested Readings**	**Ref & Questions**	**Problem Solving/Lab/Quiz**
1	Membrane stresses in axisymmetric shells/vessels.	Moodle Notes + Hibbeler: Ch 8.1	Moodle -Web Questions + Hibbeler: 8-3, 8-4,8-5,8-8,8-12	Problem Solving Class
2	Product of Inertia of an Area.	Hibbeler: Appendices A.1 to A.5	Hibbeler: Examples A.1 to A.6	Problem Solving Class
2	Unsymmetric bending	Hibbeler: Ch 6.5	Hibbeler: 6-108, 6-112, 6-114, 6-115,6-116	Problem Solving Class
3	Composite Beams	Hibbeler: Ch 6.6 & 6.7	Hibbeler: 6-120,6-121,6-124,6-128,6-132,6-135	Laboratory/Problem Solving Class
3	Shear Flow	Hibbeler: Ch 7.4	Hibbeler: 7- 50,7-52,7-53,7-55,7-56,7-59	Problem Solving Class
4	Shear Centre	Hibbeler: Ch 7.5	Hibbeler: 7-60,7-63,7-64,7-66,7-68,7-69, 7-70	Laboratory/Problem Solving Class
4	Column buckling	Hibbeler: Ch 13.1 to 13.3	Hibbeler: 13-1,13-2,13-4,13-6,13-12,13-13,13-14,13-16,13-20,13-23	Problem Solving Class Quiz 1
5	Column buckling	Hibbeler: Ch 13.4 to 13.5	Hibbeler 13-35,13-36,13-40, 13-41,	Problem Solving Class
6	Column buckling	Hibbeler: Ch 13.6	Hibbeler: 13-46, 13-48, 13-56, 13-110,13-118	Problem Solving Class

Block 2				
7	Torsion of thin-walled tubes having closed cross-sections	Hibbeler: Ch 5.7	Hibbeler: 5-103, 5-109 to 5-119	Block 1 Test Problem Solving Class
7	Principle of virtual work	Hibbeler: Ch 14.1 to 14.3	Hibbeler: 14-25 to 14-30	Problem Solving Class
8	Principle of virtual work	Hibbeler: Ch 14.1 to 14.3	Hibbeler: 14-31 to 14-36	Problem Solving Class
8	Principle of virtual work	Hibbeler: Ch 14.3, 14.5	Hibbeler: 14-31 to 14-36	Problem Solving Class
9	Fracture Mechanics	Moodle Notes	Moodle Questions	Problem Solving Class
9	Fracture Mechanics	Moodle Notes	Moodle Questions	Quiz 2
10	Revision			Problem Solving Class

All the lecture notes and in-class problems along with the relevant information about laboratory experiments will be available on Moodle.

6. Assessment

Assessment overview

Assessment	Group Project?	If Group, # Students per group	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
Quizzes (2)	No	N/A	50 minutes	16% (2x8%)	1 and 4	Quiz 1 (Lectures in membrane stress and unsymmetric bending) Quiz 2 (Torsion and Virtual wok	Monday Week 4 & 9	N/A	One week after each quiz
Lab Assignments (2)	No	N/A	2000 words	14% (2x7%)	1 and 4	Pressure Vessel and unsymmetric bending of beams	11 pm Friday 5th April 2019 (Week 8) through Moodle	11 pm Friday 12th April 2019	Two weeks after the submission deadline
Block 1 Test	No	N/A	1 hour and 45 minutes	30%	1,2,3 and 4	Block 1 contents	Week 7 Monday during lecture time	N/A	Two weeks after the block test
Final exam	No	N/A	2 hours	40%	1, 2 and 3	All course contents from weeks 1-10 inclusive.	Exam period, date TBC	N/A	Upon release of final results

You will be assessed by way of in-semester quizzes, Block 1 test, laboratory assignments and a final examination. The topics covered in all assessments are directly related to the student learning outcomes listed above. All examinations are closed-book. The laboratory reports are to be submitted through a drop box in Moodle.

Assignments

Presentation

All non-electronic submissions should have a standard School cover sheet, which is available from this course's Moodle page.

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

There will be one two-hour final examination at the end of the semester, based on the material covered in Lectures from Week 1 to 10.

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 has interfered with your assessment performance, you are eligible to 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.

7. Expected resources for students

Recommended Textbook and Notes

(1) R. C. Hibbeler, "Mechanics of Materials", 9th Ed. In SI Units, 2013, Pearson/Prentice Hall (Book Store).
(2) Notes on the Membrane Stresses in Thin Axisymmetric Shells – see Moodle.
(3) Notes on the Mechanics of Fracture and Fatigue – see Moodle.
(4) Supplementary in-class problems some of which are based on past exam questions – see Moodle.

Suggested Readings

There are numerous valuable resources available on the web, and additional sources will be provided in lectures and problem-solving sessions.

UNSW Library website: https://www.library.unsw.edu.au/
Moodle: https://moodle.telt.unsw.edu.au/login/index.php

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 more emphasis in highlighting the relevance of the theory to mechanical engineering practice.

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 School guidelines and polices, available on the intranet. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Computing Facilities
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Student Equity and Disabilities Unit
- Health and Safety
- Lab Access
- Makerspace
- UNSW Timetable
- UNSW Handbook
- UNSW Mechanical and Manufacturing Engineering

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