UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 2 2019

MMAN2300

ENGINEERING MECHANICS 2

Contents

1. Staff contact details

Contact details and consultation times for course convenors

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Consultation time: Thursday 1-2pm

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Contact details for demonstrators

Name	Contact email address
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David Liu (lead demonstrator)	
Alexander Bateman	
Annabelle Burns	
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Runyu Lu	
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Erfan Nobari	
Bradley Pascoe	
Jemima Siddiqui	
Eugenia Simoes	
Joshua Townsend	
Daniel Wong	
Katherine Yuan	
Yani Zhang	

2. Important links

- 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 hours per week (h/w) of face-to-face contact. In addition, there are term-planned contact hours for the two labs running in weeks 5 and 8.

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.

This means that you should aim to spend about 10-12 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 (Part A)	3pm – 5pm	Ainsworth G03
	Tuesday (Part B)	2pm – 4pm	Ainsworth G03
(Web)	Any	Any	Moodle
Demonstrations	Tuesday	4pm – 5pm	RedC M032
	Tuesday	4pm – 5pm	Ainsworth G02
	Tuesday	4pm – 5pm	Ainsworth 102
	Tuesday	5pm – 6pm	RedC M032
	Tuesday	5pm – 6pm	Ainsworth G02
	Tuesday	5pm – 6pm	Ainsworth 102
	Wednesday	3pm – 4pm	Ainsworth G02
	Wednesday	4pm – 5pm	Ainsworth G02
	Wednesday	4pm – 5pm	Ainsworth 202
	Thursday	9am – 10am	Webster 256
	Thursday	9am – 10am	OMB G31
	Thursday	9am – 10am	OMB 230
	Thursday	10am – 11am	OMB 230
	Thursday	10am – 11am	Webster 256
	Thursday	11am – 12noon	Webster 256
Demonstrations	Thursday	11am – 12noon	OMB 230

	Day	Time	Location
	Thursday	12noon – 1pm	OMB 150
	Thursday	12noon – 1pm	Ainsworth G02
Lab 1	Week 5	1 hour (tbc)	UTL
Lab 2	Week 8	½ hour (tbc)	UTL
Tests	Monday Weeks 6 and 10	5pm – 6pm	Rex Vowels Ainsworth G03

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 is a sequel to MMAN1300 Engineering Mechanics. This course covers engineering mechanics and mechanical vibrations. Part of the emphasis of this course is the *plane dynamics of rigid bodies and practical applications*. Another part of the course aims to build your understanding of *mechanical vibrations*. You will develop an understanding of the concept of vibration analysis and the main components of vibratory systems. This course constitutes an important component of the basic engineering sciences.

By the end of this course it is expected that you will be familiar with:

- Plane kinematics and kinetics of rigid bodies.
- Equations of motion, work and energy for rigid bodies.
- The principles and functions of gears and gear trains and gear motion analysis.
- Single degree-of-freedom spring-mass-damper systems, free and forced vibration, undamped/damped responses.
- Two degree-of-freedom systems, free and forced vibration.
- Vibration of continuous systems.

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.	Explain, describe and apply principles and components of Engineering Mechanics using a range of techniques.	1.1, 1.2, 2.1, 3.2

Learning Outcome		EA Stage 1 Competencies
2.	Explain and describe principles and components of mechanical vibrations. Principles and components include mass, stiffness, damping, natural frequencies, harmonic excitation, isolation, single and multi-degree-of-freedom systems, continuous systems.	1.1, 1.2, 2.1, 3.2
3.	Discern the relevant principles that must be applied to describe the equilibrium or motion of engineering systems and discriminate between relevant and irrelevant information in the context.	1.1, 1.2, 2.1
4.	Demonstrate an ability to communicate clearly and precisely about technical matters related to Engineering Mechanics.	1.6, 3.2
5.	Accomplish hands on tasks that require the application of knowledge of Engineering Mechanics.	2.1, 2.2

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 exercises that you are required to complete during your self-study time.

The teaching approaches that will be used include:

- Presentation of the material (derivations and examples) in lectures.
- Problem-solving classes to help students to understand and solve problems.
- Laboratory exercises to assist in understanding the fundamentals taught in lectures.
- Weekly online quizzes to reinforce the content of the weekly topics.
- Class tests which require students to regularly study their lecture material.

5. Course schedule

Week	Topics	Location	Suggested Readings
1	**Part A: Rigid Body Dynamics** Velocity analysis **Part B: Vibration Analysis** Introduction to mechanical vibration Free vibration of a single DOF spring-mass system	Ainsworth G03	Chapter 5/1-5/4 Meriam & Kraige Chapters 1 and 2 Rao
2	**Part A: Rigid Body Dynamics** Velocity analysis of rigid bodies to rotating axes	Ainsworth G03	Chapter 5/7 Meriam & Kraige
3	**Part A: Rigid Body Dynamics** Instant centre method 1 **Part B: Vibration Analysis** Free vibration of a spring-mass-damper system Logarithmic decrement	Ainsworth G03	Chapter 5/5 Meriam & Kraige Chapter 4 Waldron & Kinzel Chapter 2 Rao
4	**Part A: Rigid Body Dynamics** Instant centre method 2 **Part B: Vibration Analysis** Forced harmonic vibration Rotating unbalance	Ainsworth G03	Chapter 5/5 Meriam & Kraige Chapter 4 Waldron & Kinzel Chapter 3 Rao
5	**Part A: Rigid Body Dynamics** Acceleration analysis (review) **Part B: Vibration Analysis** Forced harmonic vibration Base excitation Vibration Absorbers	Ainsworth G03	Chapter 5/6-5/7 Meriam & Kraige Chapter 3 Rao
6	**Part A: Rigid Body Dynamics** Acceleration analysis - "Coriolis type" problems **Part B: Vibration Analysis** Free vibration of a 2-DOF system	Ainsworth G03	Chapter 5/6-5/7 Meriam & Kraige Chapter 5 Rao
7	**Part A: Rigid Body Dynamics** Kinetics of rigid bodies 1 **Part B: Vibration Analysis** Forced harmonic vibration of a 2-DOF system	Ainsworth G03	Chapter 6 Meriam & Kraige Chapters 5, 9 Rao

Week	Topics	Location	Suggested Readings
8	**Part A: Rigid Body Dynamics** Kinetics of rigid bodies 2 **Part B: Vibration Analysis** Forced harmonic vibration of a 2-DOF system	Ainsworth G03	Chapter 6 Meriam & Kraige Chapters 5, 9 Rao
9	**Part A: Rigid Body Dynamics** Gears and gear analysis **Part B: Vibration Analysis** Continuous systems Transverse vibration of strings	Ainsworth G03	Chapters 10-12 Waldron & Kinzel Chapter 8 Rao
10	**Part A: Rigid Body Dynamics** Summary **Part B: Vibration Analysis** Longitudinal vibration of bars Torsional vibration of bars	Ainsworth G03	Chapter 8 Rao

6. Assessment

Assessment Overview

Assessment	**Group Project?** (# Students per group)	**Length**	**Weight**	**Learning outcomes assessed**	**Assessment criteria**	**Due date and time**	**Deadline for absolute fail**	**Marks returned**
2 x tests	No	1 hour each	20% (10% each)	1, 2, 3, 4	Understanding of lecture material	Monday 5-6pm in weeks 6, 10	N/A	One week after submission
10 x Moodle quizzes	No	1 hour each	20% (2% per week)	1, 2, 3, 4	Understanding of lecture material	Friday 5pm weeks 2–11	N/A	Immediate
2 x Individual Laboratory Reports	No	See report description on Moodle	20% (10% each)	1, 2, 4, 5	Correctness, completeness and professionalism of report	Lab 1 (due one week after attendance) Lab 2 (due one week after attendance)	One week after submission	Two weeks after submission
Final exam	No	2 hours	40%	1, 2, 3, 4	All course content	Exam period, date TBC	N/A	Upon release of final results

Assignments

Presentation

Your laboratory report 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% 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 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 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

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.

7. Expected resources for students

Reference textbooks

Meriam, J.L. and Kraige, L.G. *Engineering Mechanics - Dynamics*, SI Version, 8th ed., Wiley

Rao, S.S. *Mechanical Vibrations*, SI Edition, Pearson Prentice Hall, 2011

Waldron, K.J. and Kinzel, G.L. *Kinematics, Dynamics, and Design of Machinery*, 2nd ed., Wiley, 2003

These books are available in the UNSW library and bookshop.

Suggested additional reading

Hibbeler, R.C. *Engineering Mechanics – Dynamics*, Prentice Hall, New Jersey

Beer, F.P. and Johnston, E.R., *Vector Mechanics for Engineers – Dynamics*, McGraw-Hill, New York

Wilson, C.E. and Sadler, J.P. *Kinematics and Dynamics of Machinery*, Prentice Hall, New Jersey

Dimarogonas, A. *Vibration for Engineers*, second edition, Prentice Hall International, 1996

Thomson, W.T. *Theory of Vibration with Applications*, fourth edition, Stanley Thornes, 1998

Inman, D.J. *Engineering Vibration*, Prentice Hall International, 1996

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 worked examples in the lecture material and implementation of weekly online Moodle quizzes.

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: 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

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