UNSW SYDNEY | Australia's Global University

Mechanical and Manufacturing Engineering

Course Outline

Term 2 2020

MMAN2300

ENGINEERING MECHANICS 2

Contents

1. Staff contact details

Contact details and consultation times for course convenor and lecturers

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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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Annabelle Burns	
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Daniel Wong	
Joshua Townsend	
Katherine Yuan	
Harrison Low	
Shantanu Kumthekar	

Please see the course Moodle.

2. Important links

- Moodle
- Lab Access
- Health and Safety
- 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 scheduled online 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 10-12 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**	Delivery Mode
Lectures	Monday (Part A) (weeks 1, 3-11)	3pm – 5pm	Microsoft Teams Recorded Lectures
	Tuesday (Part B) (weeks 1-10)	2pm – 4pm	Microsoft Teams Recorded Lectures
Demonstrations			
Part A - Dynamics	Monday* (Class no: 8018) (weeks 1, 3-11)	5pm – 6pm	Collaborate Ultra on Moodle
	Monday* (Class no: 8019) (weeks 1, 3-11)	5pm – 6pm	Collaborate Ultra on Moodle
	Monday* (Class no: 8020) (weeks 1, 3-11)	5pm – 6pm	Collaborate Ultra on Moodle
	Tuesday (Class no: 8024) (weeks 1-10)	10am – 11am	Collaborate Ultra on Moodle
	Tuesday (Class no: 8025) (weeks 1-10)	10am – 11am	Collaborate Ultra on Moodle
	Tuesday (Class no: 8026) (weeks 1-10)	10am – 11am	Collaborate Ultra on Moodle

	Day	**Time**	Delivery Mode
	Tuesday (Class no: 8027) (weeks 1-10)	11am – 12pm	Collaborate Ultra on Moodle
	Tuesday (Class no: 8028) (weeks 1-10)	11am – 12pm	Collaborate Ultra on Moodle
Part B - Vibration	Thursday (Class no: 8018) (weeks 1-10)	10am – 11am	Collaborate Ultra on Moodle
	Thursday (Class no: 8019) (weeks 1-10)	10am – 11am	Collaborate Ultra on Moodle
	Thursday (Class no: 8020) (weeks 1-10)	10am – 11am	Collaborate Ultra on Moodle
	Thursday (Class no: 8024) (weeks 1-10)	11am – 12pm	Collaborate Ultra on Moodle
	Thursday (Class no: 8025) (weeks 1-10)	11am – 12pm	Collaborate Ultra on Moodle
	Thursday (Class no: 8026) (weeks 1-10)	11am – 12pm	Collaborate Ultra on Moodle
	Thursday (Class no: 8027) (weeks 1-10)	3pm – 4pm	Collaborate Ultra on Moodle
	Thursday (Class no: 8028) (weeks 1-10)	2pm – 3pm	Collaborate Ultra on Moodle
Lab 1	Week 5	1 hour	See Moodle for details
Lab 2	Week 8	1 hour	See Moodle for details

All classes in T2 2020 will be online. Please consult this course's Moodle module for details about delivery.

**To ensure all students are on the same course schedule (see Section 5), students who will miss Monday's tutorial classes in week 2 can either join one of the Tuesday classes in week 2 or watch the video recording. Tutorial time, Monday 5-6pm in week 11, may be used for consultation.

Summary and Aims of the course

This course follows MMAN1300 Engineering Mechanics 1 and covers engineering mechanics (Part A) and mechanical vibrations (Part B). These two parts are complementary in covering different aspects of motion in mechanical systems, with part A emphasising on large motion of bodies (*plane dynamics of rigid bodies*), and part B focussing on small motion around equilibrium (*mechanical vibrations*).

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 of rigid bodies.
- Equations of motion, work and energy for rigid bodies.
- Single degree-of-freedom systems, free and forced vibration, undamped/damped responses.
- Two degree-of-freedom systems, free and forced vibration.
- Fundamentals of vibration in 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
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 online. Full participation in the online 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 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 online lectures.
- Problem-solving classes to help students to understand and solve problems.
- Laboratory exercises through video demonstrations and virtual labs to assist in understanding the fundamentals taught in lectures.
- Weekly online tutorials and quizzes to reinforce the content of the weekly topics.

5. Course schedule

This schedule is an overall plan for the weekly split of the course content and subject to changes to adapt to the learning progress of the class.

Week	Topics	Location	Suggested Readings
1	**Part A: Rigid Body Dynamics** Velocity analysis (review) **Part B: Vibration Analysis** Introduction to mechanical vibration and SDOF vibration modelling	Online	Chapter 5/1-5/4 Meriam et al. Week 1 vibration notes Chapter 8/1-8/2 Meriam et al. Chapters 1-2 Rao
2	**Part B: Vibration Analysis** Solution of the SDOF free vibration problem and identification of SDOF systems	Online	Week 2 vibration notes Chapter 8/1-8/2 Meriam et al. Chapter 2 Rao
3	**Part A: Rigid Body Dynamics** Velocity analysis of rigid bodies to rotating axes **Part B: Vibration Analysis** Forced harmonic vibration: modelling and solution	Online	Chapter 5/7 Meriam et al. Week 3 vibration notes Chapter 8/3-8/4 Meriam et al. Chapter 3 Rao
4	**Part A: Rigid Body Dynamics** Instant centre method 1 **Part B: Vibration Analysis** Forced harmonic vibration: analysis Rotating unbalance	Online	Chapter 5/5 Meriam et al. Chapter 4 Waldron & Kinzel Week 4 vibration notes Chapter 3 Rao

Week	Topics	Location	Suggested Readings
5	**Part A: Rigid Body Dynamics** Instant centre method 2 **Part B: Vibration Analysis** Base excitation and base isolation Summary of SDOF vibration analysis	Online	Chapter 5/5 Meriam et al. Chapter 4 Waldron & Kinzel Week 5 vibration notes
6	**Flexibility Week**		
7	**Part A: Rigid Body Dynamics** Acceleration analysis (review) **Part B: Vibration Analysis** Free vibration of a 2-DOF system	Online	Chapter 5/6 Meriam et al. Week 7 vibration notes Chapter 5 Rao
8	**Part A: Rigid Body Dynamics** Acceleration analysis - "Coriolis type" problems **Part B: Vibration Analysis** Forced harmonic vibration of a 2-DOF system and vibration absorbers	Online	Chapter 5/7 Meriam et al. Week 8 vibration notes Chapter 5 Rao
9	**Part A: Rigid Body Dynamics** Kinetics of rigid bodies 1 **Part B: Vibration Analysis** Fundamentals of vibration in continuous systems	Online	Chapter 6 Meriam et al. Week 9 vibration notes Chapter 8 Rao
10	**Part A: Rigid Body Dynamics** Kinetics of rigid bodies 2 **Mock exam** During the scheduled lecture time for part B, there will be a mock exam for both part A and part B.	Online	Chapter 6 Meriam et al.

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**
Moodle tutorials (weeks 1-5,7-10)	No	2 hours	5%*	1, 2, 3, 5	Understanding of lecture material	Monday 5pm, week 11 (10 August 2020)	No late submission allowed. Zero marks for late submission.	Friday, week 11
7 x Moodle quizzes (weeks 3-5, 7-10)	No	1 hour each	21% (3% each quiz)	1, 2, 3, 5	Understanding of lecture material	One hour per week** in weeks 3–5, 7–10	No late submission allowed. Zero marks for late submission.	Monday in the following week
2 x Individual Laboratory Assignments/Reports	No	See assignment/report description on Moodle	30% (15% each)	1, 2, 4, 5	Correctness, completeness and professionalism of report	Lab 1 (Friday 5pm, week 7) Lab 2 (Friday 5pm, week 9)	5 calendar days after the specified deadlines	Two weeks after submission deadline
Final exam	No	2 hours	44%	1, 2, 3, 4	All course content	Exam period, date TBC	N/A	Upon release of final results

*Full marks will be awarded if all tutorial questions for all weeks are attempted and answered correctly by 10 August 2020. Four (4), three (3), two (2) and one (1) mark(s) will be awarded if 90%, 80%, 70% and 60% of all tutorial questions for all weeks are correctly answered, respectively.

**Each online quiz will be open from Monday 8am to Friday 5pm for that week. For each quiz, once you start to attempt the quiz questions, you are given 1 hour to complete the quiz. This time limit is to help you prepare for the final exam.

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 be available for all quizzes 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.

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 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.

7. Expected resources for students

Reference textbooks

Meriam, J.L., Kraige, L.G. and J.N. Bolton, *Engineering Mechanics - Dynamics*, SI Version, 9th 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, implementation of weekly online Moodle quizzes and redesign of the two laboratory exercises.

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
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning 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