



Mechanical and Manufacturing Engineering

Course Outline

Semester 2 2018

MMAN2300

ENGINEERING MECHANICS 2

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1. Staff contact details

Contact details and consultation times for course convenors

Prof Nicole Kessissoglou
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Consultation time: Thursday 12-1pm

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Consultation time: Thursday 12-1pm

Contact details for demonstrators

| Name | Contact email address |
|--|--|
| Daniel Egger (lead demonstrator) | mman2300@unsw.edu.au |
| Mitchell Kazmierczak (lead demonstrator) | |
| Jacky Chin | |
| David Liu | |
| Samim Ozyurteri | |
| Matthew Brand | |
| Jake Bradbury | |
| Joseph Kim | |
| Yani Zhang | |
| Harrison Low | |
| Briscoe Kerferd | |
| Eugenia Simoes | |
| Gyani Shankar Sharma | |
| Monica Chi | |
| Muhammad Danish Haneef | |
| Samir Mustavi | |
| Bradley Pascoe | |
| James Qin | |
| Peter Scott | |
| Moustafa Ali | |
| Nader Sawalhi | |

2. Important links

- [Moodle](#)
- [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 (h/w) 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 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 | 10am – 12noon | Ainsworth G03 |
| | Wednesday | 12noon – 1pm | Ainsworth G03 |
| | (Web) | Any | Moodle |
| Demonstrations | Thursday | 4pm – 6pm | Webster 256 |
| | Thursday | 4pm – 6pm | Ainsworth 202 |
| | Thursday | 4pm – 6pm | CivEng 101 |
| | Friday | 12noon – 2pm | OMB G32 |
| | Friday | 2pm – 4pm | OMB G31 |
| | Friday | 2pm – 4pm | OMB G32 |
| | Friday | 2pm – 4pm | Webster 256 |
| | Friday | 4pm – 6pm | OMB G31 |
| | Friday | 4pm – 6pm | OMB G32 |
| | Friday | 4pm – 6pm | Webster 256 |
| | | | |
| Lab 1 | Weeks 5 – 6 | 1 hour (tbc) | UTL |
| Lab 2 | Weeks 10 – 11 | ½ hour (tbc) | UTL |
| | | | |
| Tests | Monday | 6pm – 7pm | Mathews Theatre A |
| | Weeks 4, 7, 11, 13 | | Keith Burrows Theatre |

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 emphases of this course is the *plane dynamics of rigid bodies and practical applications*. Another part of the course aims on building your understanding of *mechanical vibrations*. You will develop an understanding of the concept of vibration 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 |
| 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 may have 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
- Series of four class tests which require students to regularly study their lecture material

5. Course schedule

| Week | Topics | Location | Suggested Readings |
|---------------------------|---|---------------|---|
| 1 | Part A: Vibration Analysis Introduction to mechanical vibration Free vibration of a single DOF spring-mass-damper Logarithmic decrement | Ainsworth G03 | Chapter 2 Rao |
| 2 | Forced harmonic vibration Rotating unbalance Base excitation | Ainsworth G03 | Chapter 3 Rao |
| 3 | Free vibration of a 2-DOF system | Ainsworth G03 | Chapter 5 Rao |
| 4 | Forced harmonic vibration of 2-DOF systems Vibration absorbers | Ainsworth G03 | Chapters 5, 9 Rao |
| 5 | Continuous systems Transverse vibration of strings | Ainsworth G03 | Chapter 8 Rao |
| 6 | Continuous systems Longitudinal vibration of bars | Ainsworth G03 | Chapter 8 Rao |
| 7 | Part B: Plane kinematics of rigid bodies Velocity analysis | Ainsworth G03 | Chapter 5/1-5/4, 5/7 Meriam & Kraige |
| 8 | Method of instant centres | Ainsworth G03 | Chapter 5/5 Meriam & Kraige Chapter 4 Waldron & Kinzel |
| 9 | Acceleration analysis - Review of acceleration - "Coriolis type" problems | Ainsworth G03 | Chapter 5/6-5/7 Meriam & Kraige |
| <i>Mid-semester break</i> | | | |
| 10 | Kinetics of rigid bodies | Ainsworth G03 | Chapter 6/2 -6/9 Meriam & Kraige |
| 11 | Gears | Ainsworth G03 | Chapter 10.1-10.5 Waldron & Kinzell |
| 12 | Gear analysis Industry guest speaker | Ainsworth G03 | Chapter 12.1-12.5 Waldron & Kinzell |
| 13 | Revision | Ainsworth G03 | |

6. Assessment

Assessment Overview

| Assessment | Length | Weight | Learning outcomes assessed | Assessment criteria | Due date and time | Deadline for absolute fail | Marks returned |
|-----------------------------------|----------------------------------|----------------------|----------------------------|---|--|----------------------------|-------------------------------|
| 4 x tests | 1 hour each | 20% (5% each) | 1, 2, 3, 4 | Understanding of lecture material | Monday 6-7pm in weeks 4, 7, 10, 13 class tests on | N/A | One week after submission |
| 12 x Moodle quizzes | N/A | 24% (2% per week) | 1, 2, 3, 4 | Understanding of lecture material | Friday 5pm weeks 2–13 | N/A | Immediate |
| 2 x Individual Laboratory Reports | See report description on Moodle | 16% (8% 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 | 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 per cent (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, which are June for Semester 1 and November for Semester 2. There will a 2-hour formal exam at the end of the semester, covering all material for the entire semester.

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. Expected resources for students

Reference textbooks

Meriam, J.L. and Kraige, L.G. *Engineering Mechanics - Dynamics*, SI Version, 7th 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

Further information on School policy and procedures in the event of plagiarism is available on the [intranet](#).

10. Administrative matters and links

All students are expected to read and be familiar with School guidelines and policies, 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)
- [Exams](#)
- [Approved Calculators](#)
- [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 |