UNSW AUSTRALIA

Course outline

Semester 2 2016

Never Stand Still | Engineering | Mechanical and Manufacturing Engineering

MMAN2300

ENGINEERING MECHANICS 2

Contents

1. Staff contact details

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2. 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	Tuesday	3pm – 5pm	Ainsworth G03
	Thursday	9am – 10am	Law Theatre G04
Demonstrations	Friday	10am – 12pm	Ainsworth G02
			Ainsworth 102
			Ainsworth 202
			Red Centre Central Wing 1040
		12pm – 2pm	Ainsworth 102
			Ainsworth 202
		2pm – 4pm	Ainsworth 102
			Ainsworth 202

Summary 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.

Aims of the course

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 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
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

3. 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.

Online: The online forum for participation in this class is the Moodle Platform at

https://moodle.telt.unsw.edu.au/login/index.php

4. Course schedule

Week	Topics	References	Assessment
1	**Part A: Vibration Analysis** Introduction to mechanical vibration Free vibration of a single DOF spring-mass-damper Logarithmic decrement	Chapter 2 Rao	
2	Forced harmonic vibration Rotating unbalance Base excitation	Chapter 3 Rao	Quiz 1
3	Free vibration of a 2-DOF system	Chapter 5 Rao	Quiz 2
4	Forced harmonic vibration of 2-DOF systems	Chapters 5, 9 Rao	Quiz 3 Test 1
5	Continuous systems Transverse vibration of strings Longitudinal vibration of bars Continuous systems Torsional vibration of bars Bending vibration of beams	Chapter 8 Rao	Quiz 4 Lab 1
6	**Part B**: **Plane kinematics of rigid bodies** Velocity analysis	Chapter 5/1-5/4, 5/7 Meriam & Kraige	Quiz 5 Lab 1
7	Method of instant centres	Chapter 5/5 Meriam & Kraige Chapter 4 Waldron & Kinzel	Quiz 6 Test 2
8	Acceleration analysis - Review of acceleration - "Coriolis type" problems	Chapter 5/6-5/7 Meriam & Kraige	Quiz 7
9	Kinetics of rigid bodies	Chapter 6/2 -6/9 Meriam & Kraige	Quiz 8
Mid-semester break			
10	Gears	Chapter 10.1-10.5 Waldron & Kinzell	Quiz 9 Test 3 Lab 2
11	Gear analysis	Chapter 12.1-12.5 Waldron & Kinzell	Quiz 10 Lab 2
12	Condition monitoring		Quiz 11
13	Revision		Quiz 12 Test 4

5. Assessment

Assessment task	Length	Weight	Learning outcomes assessed	Assessment criteria	Due date, time	Marks returned
4 x tests	1 hour each	20% (5% each)	1, 2, 3, 4	Understanding of lecture material	During demonstration classes in weeks 4, 7, 10 and 13.	One week after submission
12 x Moodle quizzes		24% (2% per week)	1, 2, 3, 4	Understanding of lecture material	5pm Monday weeks 3–13	Immediate
2 x Individual Laboratory Reports	See report descriptions on Moodle	16% (8% each)	1, 2, 4, 5	Correctness, completeness and professionalism of report	Lab 1 (due Friday 2nd September 11.59pm) Lab 2 (due Friday 14th October 11.59pm)	Two weeks after submission
Final exam	3 hours	40%	1, 2, 3, 4	Understanding of all course content	Exam period, date TBC	After release of results

In order to pass the course, you must achieve an overall mark of at least 50%.

Presentation

Where relevant, all submissions should have a standard School cover sheet which is available from this subject's Moodle page.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work. Presenting them clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

The submission of assignments and lab reports should have a standard School cover sheet. All submissions are expected to be neat and clearly set out. Assignments and lab reports should be submitted directly to the demonstrators in your problem solving classroom by the due date.

Late submissions will be penalised 5 marks per calendar day (including weekends). An extension may only be granted in exceptional circumstances. Where an assessment task is worth less than 20% of the total course mark and you have a compelling reason for being unable to submit your work on time, you must seek approval for an extension from the course convenor ***before the due date***. Special consideration for assessment tasks of 20% or greater must be processed through https://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.

Examinations

You must be available for all tests and examinations. The final examination for this course is held during the University examination period in June. There will a 3-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.

6. Expected resources for students

Textbooks

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

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.

One starting point for assistance is:

http://info.library.unsw.edu.au/web/services/services.html

7. Course evaluation and development

Feedback on the course is gathered periodically using various means, including the Course and Teaching Evaluation and Improvement (CATEI) 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.

8. 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.

9. Administrative matters

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

Nicole Kessissoglou and Zhongxiao Peng
July 2016

Appendix A: Engineers Australia (EA) 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