UNSW AUSTRALIA

Course Outline

Semester 1 2016

Never Stand Still | Engineering | Mechanical and Manufacturing Engineering

MECH 9325

FUNDAMENTALS OF ACOUSTICS AND NOISE

Contents

1. Staff Contact Details

Contact details and consultation times for course convenor

Assoc. Prof. Nicole Kessissoglou
Room 408C, Ainsworth Building J17, Level 4
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Consultation time: Thursday 2-3pm (face-to-face)

Contact details for demonstrator

Samaneh Fard
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2. Course details

Credit Points:

This is a 6 unit-of-credit (UoC) course, and involves 3 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**
Lecture	Thursday	12noon - 2pm	Electrical Engineering G25
Demonstration	Thursday	2pm –3pm	Electrical Engineering G25

Summary of the Course

This course will focus on the fundamental concepts and measurement of sound. It begins with the development of the acoustic plane wave equation and introduction of important parameters including acoustics pressure, acoustic impedance, characteristic impedance, acoustic energy density, acoustic intensity and acoustic power. The decibel scales and octave band frequency scales for noise are described. In this course, the effect of noise on people and acceptable limits for industrial and community noise are identified. Transmission phenomena including transmission of plane waves between different media, through walls and along pipes are investigation. This includes the basic analysis of expansion chamber mufflers and pipe side-branches. A basic energy approach to room acoustics is derived.

Aims of the Course

This course is intended to provide an introduction to acoustics and noise. It constitutes a self-contained and practically useful body of knowledge in the field of acoustics. Important matters such as the measurement of sound and the effect of noise on people are considered. It is of particular value to students who are undertaking noise and vibration thesis projects. A laboratory component is included in this course.

Student learning outcomes

This course is designed to address the learning outcomes listed in the following table and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers. The full list of Stage 1 Competency Standards may be found in Appendix A.

Learning Outcomes		**EA Stage 1 Competencies**
1.	Describe the basic features of sound and noise including cause of sound, pure tones, decibel scales, loudness, and Australian standards for occupational noise management.	1.1, 1.2, 1.3, 1.5, 1.6, 2.1, 2.2
2.	Describe the measurement and analysis of sound pressures using sound level meters and microphones.	1.1, 1.3, 1.6, 2.1, 2.2, 3.2
3.	Perform elementary frequency analyses to determine how the strengths of the components of the sound pressure are distributed as a function of frequency.	1.1, 1.2, 1.3, 1.5, 1.6, 2.1, 2.2
4.	Calculate the equivalent continuous sound levels, sound exposure levels, and percentile exceeded sound levels for different noise events.	1.1, 1.2, 1.3, 1.5, 1.6, 2.1, 2.2
5.	Calculate noise exposure per day for a person based on the A-weighted sound pressure level and the time on task.	1.1, 1.2, 1.3, 1.5, 1.6, 2.1, 2.2
6.	Calculate the performance of hearing protectors using the quoted mean and standard deviation of the attenuation in octave bands.	1.1, 1.2, 1.3, 2.1, 2.2
7.	Calculate the sound power of a source based on octave band sound pressure levels and reverberation times.	1.1, 1.2, 1.3, 2.1, 2.2
8.	Calculate the sound transmission coefficient from one medium to another.	1.1, 1.2, 1.3, 2.1, 2.2
9.	Calculate the sound transmission loss through a barrier and for various arrangements of an expansion chamber reactive muffler.	1.1, 1.2, 1.3, 2.1, 2.2
10.	Describe a range of methods to attenuate noise depending on the type of application and characteristics of the source.	1.1, 1.3, 2.1, 2.2, 2.3, 3.2

3. Teaching strategies

Lectures in the course are designed to cover the core concepts and background theory in acoustics and noise. The assessment is divided into a range of activities to reinforce the lecture material. Topics covered by this course are separated into ten units. A range of texts in acoustics were used to develop the lecture material. The lecture material is available to students electronically before each class via the UNSW online learning management system (Moodle). The lecture material will be delivered using powerpoint or pdf notes. Non-assessed exercises are embedded within each unit to reinforce the lecture material. Students are required to work through these exercises during the class and also during their own personal study time. Solutions to the exercises for a given unit are uploaded to the online learning management system two weeks after the lecture for that unit.

4. Course schedule

Date	Topic	Location	Lecture Content
3/3/16 Week 1	Unit 1	Electrical Eng G25	Introduction to acoustics: noise and sound, pure tones, decibel scales, frequency analysis, loudness of sound, weighting networks
10/3/16 Week 2	Unit 2	Electrical Eng G25	One dimensional plane acoustic waves: wave equation, standing waves, acoustic energy
17/3/16 Week 3	Unit 3	Electrical Eng G25	Measurement and analysis of sound pressures: sound level meters, microphones
24/3/16 Week 4	Unit 4	Electrical Eng G25	Frequency analysis, frequency bands, decibel scales, descriptors for time varying noise levels
7/4/16 Week 5	Unit 5	Electrical Eng G25	Effects of noise on people: human ear, loudness, weighted sound levels, masking, sound rating, hearing loss
14/4/16 Week 6		Willis Annexe J18	Laboratory 1
21/4/16 Week 7	Unit 6	Electrical Eng G25	Sound sources, sound fields, semi-reverberant field techniques, sound in large spaces, absorption, reverberation time
28/4/16 Week 8	Unit 7	Electrical Eng G25	Measurement of sound power
5/5/16 Week 9	Unit 8	Electrical Eng G25	Applications of the wave equation: transmission between media, transmission through a wall

12/5/16 Week 10		Willis Annexe J18	Laboratory 2
19/5/16 Week 11	Unit 9	Electrical Eng G25	Applications of the wave equation: transmission in pipes
26/5/16 Week 12		Electrical Eng G25	Test
2/6/16 Week 13		Electrical Eng G25	Revision

5. Assessment

Assessment Overview

Assessment	Weight	Learning outcomes assessed	Due date	Marks returned
Assignment 1	5%	1, 3, 4, 5	Wednesday 13th April 5pm	Two weeks after submission
Assignment 2	5%	1, 8, 9, 10	Wednesday 18th May 5pm	Two weeks after submission
Lab 1	10%	2, 3, 4	Wednesday 27th April 5pm	Two weeks after submission
Lab 2	10%	2, 3, 4, 7	Wednesday 25th May 5pm	Two weeks after submission
Literature review essay	10%	1, 2, 3, 4	Wednesday 4th May 5pm	Three weeks after submission
Test	10%	1, 3, 4, 5, 6, 7, 8, 9	Thursday 26th May 12pm	During the revision class in week 13
Final exam	50%	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Exam period, date TBC	Upon release of final results

With the exception of the test, all assessments should be submitted to the MECH9325 assignment box at the School office by 5pm of the due date.

The assessment tasks will be placed on Moodle at least two weeks prior to the due date and an announcement for each assessment task will be made in Moodle and emailed to all students. The assessment tasks will also be announced in class.

Assignments

The assignment cover sheet can be downloaded from Moodle.

Presentation

All 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. Presenting them clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Submission

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 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

The final examination for this course will be a 3-hour open book exam that is worth 50% of the course mark. As an open book examination, you may bring in text books and lecture material to the examination.

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.

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

All material corresponding to the units (lecture material), unit exercise solutions, assignments and practical handouts will be provided in UNSW Moodle. Extra handouts and further useful material will be posted periodically in Moodle. You are advised to check Moodle regularly.

Recommended texts

Recommended texts for reading for this course which are available in the UNSW bookshop as well as the UNSW library are listed below:

Smith, B.J., Peters, R.J. and Owen, S. Acoustics and noise control, 2nd edition, Addison Wesley Longman, 1996.

Norton, M.P. and Karczub, D. Fundamentals of noise and vibration analysis for engineers, 2nd Edition, Cambridge University Press, Cambridge, 2003.

Bies, D. A. and Hansen C.H. Engineering Noise Control: Theory and Practice, 3rd Edition, E&FN Spon, 2003.

Link to the UNSW Library website: http://www.library.unsw.edu.au/

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 are more worked examples during class time have been included in the course.

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
February 2016

Appendix A: Engineers Australia (EA) Professional Engineer Competency Standards

	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