UNSW AUSTRALIA

Course Outline

Semester 1, 2015

Never Stand Still | Faculty of Engineering | School of Mechanical and Manufacturing Engineering

MECH 9325

FUNDAMENTALS OF ACOUSTICS AND NOISE

Contents

1. COURSE STAFF

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2. COURSE DETAILS

Units of Credit

This is a six (6) unit of credit course.

Course Aims

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

At the conclusion of this course, it is expected that you will be able to:

- Describe the basic features of sound and noise including cause of sound, pure tones, decibel scales, loudness, and Australian standards for occupational noise management.
- Describe the measurement and analysis of sound pressures using sound level meters and microphones.
- Perform elementary frequency analyses to determine how the strengths of the components of the sound pressure are distributed as a function of frequency.
- Calculate the total root mean square value of sound pressure based on its octave band and one-third octave band components.
- Calculate the equivalent continuous sound levels, sound exposure levels, and percentile exceeded sound levels for different noise events.
- Calculate noise exposure per day for a person based on the A-weighted sound pressure level and the time on task.

- Calculate the speech interference level and voice effort required for communication.
- Calculate the performance of hearing protectors using the quoted mean and standard deviation of the attenuation in octave bands.
- Calculate the sound power of a source based on octave band sound pressure levels and reverberation times.
- Calculate the absorption coefficient of a material.
- Calculate the sound transmission coefficient from one medium to another.
- Calculate the sound transmission loss through a barrier.
- Describe a range of methods to attenuate noise depending on the type of application and characteristics of the source.
- Calculate the input acoustic impedance of a side branch.
- Calculate the sound transmission loss for various arrangements of an expansion chamber reactive muffler.

Graduate Attributes

In this course, you will be encouraged to develop graduate attributes indicated by a tick ✓ from the list below by undertaking the selected activities and knowledge content. The attributes will be assessed within the prescribed assessment tasks, as shown in the assessment on page 6.

UNSW's graduate attributes are shown at:
https://my.unsw.edu.au/student/atoz/GraduateAttributes.html

UNSW graduates will be

1.	Scholars who are:		
	(a)	understanding of their discipline in its interdisciplinary context	✓
	(b)	capable of independent and collaborative enquiry	✓
	(c)	rigorous in their analysis, critique, and reflection	✓
	(d)	able to apply their knowledge and skills to solving problems	✓
	(e)	ethical practitioners	
	(f)	capable of effective communication	✓
	(g)	information literate	✓
	(h)	digitally literate	
2.	Leaders who are:		
	(a)	enterprising, innovative and creative	
	(b)	capable of initiating as well as embracing change	
	(c)	collaborative team workers	
3.	Professionals who are:		
	(a)	capable of independent, self-directed practice	✓
	(b)	capable of lifelong learning	

(c) capable of operating within an agreed Code of Practice

4. Global Citizens who are:
   (a) capable of applying their discipline in local, national and international contexts ✓
   (b) culturally aware and capable of respecting diversity and acting in socially just/responsible ways
   (c) capable of environmental responsibility

3. RATIONALE FOR INCLUSION OF CONTENT AND TEACHING APPROACH

This course is intended to give you the skills to meet the needs of those embarking on a career in Acoustics. This course will provide awareness of noise and its generation. This course will also provide hands-on experience with use of relevant instrumentation in laboratory classes, and develop students' written communication and research skills. Lecture material and exercises have been carefully selected and a wide range of assessment activities will be given. Invited industry acoustic consultants will give guest lectures to demonstrate the relevance of acoustics and noise in a range of applications.

4. 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. 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.

5. ASSESSMENT

- Assignments (x2 @ 5% each) 10%
- Laboratory exercises (x2 @ 10% each) 20%
- Test 10%
- Literature review essay 10%
- Final exam (open book) 50%

Late submission of work will incur a 10% penalty per day unless a medical certificate is provided. Failure to submit or attend at least 80% of on-course assessment (assignments, laboratory exercises and reports, test, essay) may result in failure of this course. The award of a supplementary exam (if requested) will not be granted unless 100% of on-course assessment has been submitted by the required due date.

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

https://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.

Due dates for assessment activities

Assessment activity	Due date
Assignment 1	Friday 17 April
Assignment 2	Friday 15 May
Lab 1	Friday 1 May
Lab 2	Friday 29 May
Literature review essay	Monday 13 April
Test	Tuesday 26 May

All assessments should be submitted to the MECH9325 assignment box at the School office by 5pm of the due date.

6. RECOMMENDED READING

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.

7. 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 it regularly.

8. COURSE SCHEDULE

Lectures: Tuesday 2-5pm (OMB 232)

Laboratory 1: Descriptors for time varying noise levels

Laboratory 2: Measurement of sound power levels by the direct and the comparison methods

Enclosed footwear must be worn for the laboratories. Lab bookings for the laboratories will become available during lecture time.

The following course schedule is an *indication* only and may change during the semester.

Week 1	3 March	Unit 1	Introduction to acoustics: noise and sound, pure tones, decibel scales, frequency analysis, loudness of sound, weighting networks
Week 2	10 March	Unit 2	One dimensional plane acoustic waves: wave equation, standing waves, acoustic energy
Week 3	17 March	Unit 3	Measurement and analysis of sound pressures: sound level meters, microphones
Week 4	24 March	Unit 4	Frequency analysis, frequency bands, decibel scales, descriptors for time varying noise levels
Week 5	31 March	Unit 5	Effects of noise on people: human ear, loudness, weighted sound levels, masking, sound rating, hearing loss
Week 6	14 April		Laboratory 1
Week 7	21 April	Unit 6	Sound sources, sound fields, semi-reverberant field techniques, sound in large spaces, absorption, reverberation time
Week 8	28 April	Unit 7	Measurement of sound power
Week 9	5 May	Unit 8	Applications of the wave equation: transmission between media, transmission through a wall
Week 10	12 May		Laboratory 2
Week 11	19 May	Unit 9	Applications of the wave equation: transmission in pipes
Week 12	26 May		Test
Week 13	2 June		Revision

9. ACADEMIC HONESTY AND PLAGIARISM

Plagiarism is using the words or ideas of others and presenting them 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 booklet which provides essential information for avoiding plagiarism: https://my.unsw.edu.au/student/academiclife/Plagiarism.pdf

There is a range of resources to support students to avoid 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. Information is available on the dedicated website Plagiarism and Academic Integrity website: http://www.lc.unsw.edu.au/plagiarism/index.html

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 a honours thesis) even suspension from the university. The Student Misconduct Procedures are available here: http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Further information on School policy and procedures in the event of plagiarism is presented in a School handout, *Administrative Matters*, available on the School website.

10. 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 during 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.

11. ADMINISTRATIVE MATTERS

Information about each of the following matters is presented in a School handout, *Administrative Matters*, available from the School website https://www.engineering.unsw.edu.au/mechanical-engineering/sites/mech/files/u41/S1-2015_Admin-Matters.pdf

It is essential that you obtain a copy, read it carefully and become familiar with the information, because it applies to this course and to each of the other courses in which you are enrolled.

Expectations of students (including attendance at lectures and laboratory classes/seminars; and computer use, for example, in the use of email and online discussion forums)

Procedures for submission of assignments and the School's policy concerning late submission

Information on relevant Occupational Health and Safety policies and expectations: www.ohs.unsw.edu.au

Examination procedures and advice concerning illness or misadventure

Equity and disability

Students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convenor prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Student Equity and Disability Unit (SEADU) by phone on 9385 4734, email seadu@unsw.edu.au or via the website www.studentequity.unsw.edu.au

Their office is located on the Ground Floor of the John Goodsell building (F20).

Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

N Kessissoglou
February 2015