# MECH9325

## Fundamentals of Acoustics & Noise

Term Two // 2021

School of Mechanical and Manufacturing Engineering // UNSW Engineering

# Course Overview

## Staff Contact Details

### Convenors

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Nicole Kessissoglou | n.kessissoglou@unsw.edu.au | Teams | Room 408G, Level 4, Ainsworth building J17 | |

### Demonstrators

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Cikai Lin | cikai.lin@unsw.edu.au | | | |
| Roman Kisler | r.kisler@unsw.edu.au | | | |
| Gyani Shankar Sharma | gyanishankar.sharma@unsw.edu.au | | | |
| Jeffrey Peng | jeffrey.peng@unsw.edu.au | | | |

## School Contact Information

## Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

## Hours

9:00–5:00pm, Monday–Friday*

*Closed on public holidays, School scheduled events and University Shutdown

## Web

School of Mechanical and Manufacturing Engineering

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

## Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

(+61 2) 9385 4097 – School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

## Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries

- e.g. admissions, fees, programs, credit transfer

School Office – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries. The School will only be able to refer students on to the relevant team if contacted

# Course Details

## Credit Points 6

## Summary of the Course

This course focuses on the fundamental concepts and measurement of sound. It begins with an introduction to basic features of sound and noise including pure tones, loudness of sound and weighting networks. The decibel scales and octave band frequency scales for noise are described. Measurement of sound is described. The effect of noise on people and acceptable limits for industrial and community noise are identified. The course presents important parameters including pressure, acoustic impedance, characteristic impedance, acoustic energy density, acoustic intensity and acoustic power. Transmission phenomena including transmission of plane waves between different media, through walls and along pipes, mufflers and pipe side-branches are investigated.

## 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. It is of particular value to students who are undertaking noise and vibration thesis projects. A laboratory component is included in this course.

## Course Learning Outcomes

After successfully completing this course, you should be able to:

| Learning Outcome | 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. | PE1.1, PE1.2, PE1.3, PE1.6 |
| 2. Perform frequency analysis of acoustic signals to determine how the strengths of the components of the sound pressure are distributed as a function of frequency. | PE1.1, PE1.2, PE1.3 |
| 3. Calculate the sound power of a source based on octave band sound pressure levels and reverberation times. | PE1.1, PE1.2, PE1.3, PE2.1 |
| 4. Calculate the sound transmission loss through a barrier and for various arrangements of an expansion chamber reactive muffler. | PE1.1, PE1.2, PE1.3, PE2.1, PE2.2 |

## Teaching Strategies

The lectures are designed to cover the core concepts and background theory in acoustics and noise. Topics covered by this course are separated into eight 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 pre-recorded lectures. Non-assessed tutorial exercises are provided for each unit to reinforce the lecture material. Students are required to work through these exercises during the tutorial class and also during their own personal study time. The assessment is divided into a range of activities to reinforce the lecture material.

This course will provide awareness of noise and its generation. This course is also intended to give you the skills to meet the needs of those embarking on a career in acoustics. The lecture material, tutorial exercises and a variety 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.

# Assessment

## Assessment Tasks

| Assessment task | Weight | Due Date | Student Learning Outcomes Assessed |
|---|---|---|---|
| Moodle Quizzes | 40% | Friday 4-5pm in weeks 2, 3, 4, 5, 7, 8, 9, 10, | 1, 2, 3, 4 |
| Labs | 20% | Lab 1 report is due Tuesday 29 June 5pm. Lab 2 report is due Tuesday 20 July 5pm. | 2, 3 |
| Assignment | 20% | Preliminary poster due Tuesday 13 July 5pm. Final poster due Tuesday 3 August 5pm. | 4 |
| Final Examination | 20% | Examination period at the end of term. | 1, 2, 3, 4 |

## Assessment Details

**Assessment 1: Moodle Quizzes**

**Start date:** 11/06/2021 04:00 PM

**Length:** 1 hour

**Details:**

(a) The quizzes will cover the lecture material covered to date in the course.

(b) There are eight (8) Moodle quizzes. The duration of each quiz is 1 hour. The quizzes will be held on Friday from 4-5pm in weeks 2, 3, 4, 5, 7, 8, 9, 10.

(c) The quizzes are to be done individually by all students. Each quiz is worth 5% worth.

(d) The quizzes are marked online.

(e) There is no special consideration for the quizzes. If you miss a quiz, you will not receive a mark for that quiz.

(f) Marks for each quiz are returned immediately when the quiz ends.

**Submission notes:** via Moodle

**Turnitin setting:** This is not a Turnitin assignment

**Assessment 2: Labs**

**Start date:** Not Applicable

**Length:** Refer to the handout for each lab.

**Details:**

(a) Lab 1 will compare different descriptors for time varying noise. Lab 2 will calculate the sound power levels of a sound source from sound pressure level measurements.

(b) There are two labs.

(c) The labs are to be conducted individually.

(d) A marking rubric will be provided for each lab.

(e) The deadline for absolute fail is one week after the due date for each lab.

(f) Marks for each lab will be returned within 2 weeks of the due date.

Two labs will be given in this course. Each lab is worth 10%. Lab 1 is due Tuesday 29 June 5pm. Lab 2 is due Tuesday 20 July 5pm.

**Submission notes:** via Moodle

**Turnitin setting:** This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

**Assessment 3: Assignment**

**Start date:** Not Applicable

**Details:**

(a) The assignment is the numerical design of a sonic crystal noise barrier.

(b) The assessment has two parts. A preliminary poster worth 5% is due in week 7. The final poster worth 15% is due week 10.

(c) The assignment is an individual assessment.

(d) A marking rubric will be provided for the assignment.

(e) The deadline for absolute fail is one week after the due date for each part of the assignment.

(f) Marks for the assignment will be returned within 1 week of the due date.

**Submission notes:** via Moodle

**Turnitin setting:** This is not a Turnitin assignment

**Assessment 4: Final Examination**

**Length:** 2 hours

**Details:**

(a) The final exam is based on the lecture material covered throughout the course.

(b) There is one final exam to be held during the examination period at the end of term.

(c) The final exam is an individual exam.

(d) The final exam will be marked online.

**Submission notes:** via Moodle

**Turnitin setting:** This is not a Turnitin assignment

### Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

## Course Schedule

View class timetable

### Timetable

| Date | Type | Content |
|---|---|---|
| O Week: 25 May - 28 May | | |
| Week 1: 31 May - 4 June | Lecture | Unit 1 - Introduction to acoustics: noise and sound, pure tones, decibel scales, frequency analysis, loudness of sound, weighting networks |
| Week 2: 7 June - 11 June | Lecture | Unit 2 - Measurement and analysis of sound pressures, sound level meters, microphones. Frequency analysis, frequency bands, decibel scales, descriptors for time varying noise levels |
| Week 3: 14 June - 18 June | Lecture | Unit 3 - Sound sources, sound fields, semi-reverberant field techniques, sound in large spaces, absorption, reverberation time |
| Week 4: 21 June - 25 June | Lecture | Unit 4 - Measurement of sound power |
| Week 5: 28 June - 2 July | Lecture | Unit 5 - Effects of noise on people: human ear, loudness, weighted sound levels, masking, sound rating, hearing loss |
| Week 6: 5 July - 9 July | | Term break |
| Week 7: 12 July - 16 July | Lecture | Unit 6 - One dimensional plane acoustic waves: wave equation, standing waves, acoustic energy |
| Week 8: 19 July - 23 July | Lecture | Unit 7 - Applications of the wave equation: transmission between media, transmission through a wall |
| Week 9: 26 July - 30 July | Lecture | Unit 8 - Applications of the wave equation: transmission in pipes |
| Week 10: 2 August - 6 August | | Revision |

# Resources

## Recommended Resources

Recommended texts 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.

Useful links:

UNSW Library website: https://www.library.unsw.edu.au/

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

Teams: https://teams.microsoft.com/l/team/19%3a07123fa00cfd43e7805ff6fcfe109f1f%40thread.tacv2/conversations?groupId=487e4fd1-e70e-4589-99b1-40b117b45f3b&tenantId=3ff6cfa4-e715-48db-b8e1-0867b9f9fba3

## Course Evaluation and Development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in class, and at the School student/staff meetings. Your feedback is taken seriously. Continual improvements are made to the course based, in part, on your feedback.

# Submission of Assessment Tasks

## Assessment submission and marking criteria

Should the course have any non-electronic assessment submission, these should have a standard School cover sheet.

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.

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.

## Late policy

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:

1. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
2. Online quizzes where answers are released to students on completion, or
3. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
4. Pass/Fail assessment tasks.

## Examinations

You must be available for all quizzes, tests and examinations. For courses that have final examinations, these 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

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.

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.

**Please note** that students will **not** be required to provide **any** documentary evidence to support absences from any classes missed **because of COVID-19 public health measures such as isolation**. UNSW will **not** be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration **will** be required for assessment and participation absences – but no documentary evidence **for COVID 19 illness or isolation** will be required.

## 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

# Academic Information

## Credit points

Course credit is calculated in Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete, for both regular and intensive terms. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

## On-campus class attendance

Public distancing conditions must be followed for all face-to-face classes. To ensure this, only students enrolled in those classes will be allowed in the room. No over-enrolment is allowed in face-to-face classes. Students enrolled in online classes can swap their enrolment from online to a **limited** number of on-campus classes by Sunday, Week 1. Please refer to your course's Microsoft Teams and Moodle sites for more information about class attendance for in-person and online class sections/activities.

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by NSW health or government authorities. Current alerts and a list of hotspots can be found here. **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate.** We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed. Further information is available on any course Moodle or Teams site.

In certain classroom and laboratory situations where physical distancing cannot be maintained or there is a high risk that it cannot be maintained, face masks will be considered **mandatory PPE** for students and staff.

For more information, please refer to the
FAQs: https://www.covid-19.unsw.edu.au/safe-return-campus-faqs

## Guidelines

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

## Important Links

- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Faculty Transitional Arrangements for COVID-19
- Makerspace
- UNSW Timetable
- UNSW Handbook
- Equitable Learning Services

## Image Credit

Synergies in Sound 2016

## CRICOS

CRICOS Provider Code: 00098G

## Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

# Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

| **Program Intended Learning Outcomes** | |
|---|---|
| Knowledge and skill base | |
| PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline | ✓ |
| PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline | ✓ |
| PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline | ✓ |
| PE1.4 Discernment of knowledge development and research directions within the engineering discipline | |
| PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline | ✓ |
| PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline | ✓ |
| Engineering application ability | |
| PE2.1 Application of established engineering methods to complex engineering 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 | ✓ |
| Professional and personal attributes | |
| PE3.1 Ethical conduct and professional accountability | |
| PE3.2 Effective oral and written communication in 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 | |