

MODULE TITLE	ADVANCED NOISE AND VIBRATION CONTROL
Nominal Duration	One module
Module Code or Number	EB147
Module Purpose	This module provides the student with the knowledge and skills necessary to identify and analyse problems associated with sound and vibration, recommend methods of control for ductborne and transmitted noise and prepare acoustic specifications for various air conditioning applications, all in accordance with OH&S regulations. Students will also be able to carry out noise and vibration analysis using appropriate computer software packages. This module builds on the knowledge gained in module EA137, <i>"Noise and Vibration Control"</i> .
Relationship to Competency Standards	This module will be modified in line with the requirements of the National Metals and Engineering Standards When they become available. The module contains the knowledge and skills identified and agreed by all States and Territories. It has been developed on the assumption that these will be reflected in the Standards.
Prerequisites	EA137Noise and Vibration Control.
Summary of Content	<p>Fundamentals of Sound</p> <p>Frequency Decibels Octave Bands Direct Sound Velocity Sound pressure level Sound power level Sound Meters</p> <p>Noise and People</p> <p>Physical measurement of sound Weighting networks NR curves Noise damage to hearing Evaluate daily noise exposures Peak noise levels Attenuation for hearing protectors Excess noise levels permissible Noise Abatement Act</p>

Sound in Confined and Unconfined Spaces

Inverse square laws
Direct and reflective sound
Define reverberation time
Sabine's formula
Absorption coefficients of surfaces
Types of absorbers and their operation
Insulation performances of partitions

Sound Insulation

Plantroom breakout
Controlling plantroom noise

Ductborne Noise

Sound power spectra for fans
Noise attenuation in ducts and fittings
Reducing fan noise transmission
Regeneration noise
Sources of regenerated noise
Use tables to estimate regenerative noises
Breakout situations
Fan noise breakout
List methods of controlling breakout

Controlling the Cost

Economical use of attenuation

Vibration

SHM (Simple Harmonic Motion)
Period
Frequency
Amplitude
Estimate frequencies for fans, pumps and refrigeration plant
Estimate transmission of vibration
Vibration control for building structures
Use transmissibility graphs to select springs, vibration eliminators and pads
Types of isolation materials and mounting devices
Select isolation and mounting devices
Inertia blocks

Noise and vibration analysis

computer software packages.

Delivery

This module contains learning outcomes that will require both theory and practical instruction. As such, it will require resources to facilitate both on and off the job delivery strategies.

These strategies may involve:

*co-operative registered off-the-job provider/
employer delivery sharing available resources.

*delivery by an employer who is sub-registered as an off-the-job provider, with qualified trainers in-house using resources to facilitate on and off-the-job delivery.

*off-the-job objectives should focus on the industry context while on-the-job objectives should reflect application within enterprise operations.

Assessment instruments will need to be developed by the module provider. These instruments will need to reflect consistency with stated module learning outcomes and related assessment criteria.

Student records will be the responsibility of the off-the-job provider and where more than one off-the-job provider is involved, formal processes for transfer of student information must be established.

Learning outcomes On completion of this module the learner will be able to:

Learning outcome 1 **Review the physical properties of sound waves and restate the reasons for measuring sound and the methods used to reduce noise levels**

Assessment criteria

1.01 State the physical properties of waves and their classification as detailed in Learning Outcome 1 of EA137 Noise and Vibration Control.

1.02 Identify the reasons for measuring sound and the methods used to reduce noise levels as detailed in Learning Outcome 2 of EA137 Noise and Vibration Control.

Conditions

Normally learning will take place in classroom or other suitable study environments
Relevant extracts and material will be made available to students for reference during lessons

Assessment method

written short answer questions

Learning outcome 2 **Calculate the sound pressure levels within rooms and the transmission between rooms**

Assessment criteria

2.1 Define "Inverse Square Law" as applied to sound propagation

2.2 Differentiate between direct and reflected sound

2.3 Define reverberation time, RT for rooms

2.4 Calculate RT for selected octave bands, using Sabine's formula for straightforward room configuration

2.5 State the importance of, and the factors which influence the mean absorption coefficient of surfaces

2.6 List the common types of absorbers and describe how effectively they operate

2.7 Complete typical calculations for an uncomplicated room showing the effect of room conditions on the sound pressure levels within, and the transmission of sound between rooms

2.8 Outline the transmission and insulation performance characteristics of partitions

Conditions Normally learning will take place in classroom or other suitable study environments
Relevant extracts and material will be made available to students for reference during lessons

Assessment method written short answer questions

Learning outcome 3

Demonstrate plantroom breakout and methods used to control plantroom noise

Assessment criteria 3.1 Show typical straightforward examples of plantroom breakout and determine the amount of breakout using standard procedures

3.2 List and describe the methods by which plantroom noise may be controlled

Conditions Normally learning will take place in classroom or other suitable study environments
Relevant extracts and material will be made available to students for reference during lessons

Assessment method written short answer questions
practical assignment

Learning outcome 4

Calculate sound power for fans and recommend methods of control for ductborne and transmitted noise in accordance with OH&S regulations.

Assessment criteria

- 4.1 Analyse sound power spectra for fans given tabulated sound data,
- 4.2 Outline the methods of attenuating noise in ducting, fittings and calculate attenuation for straightforward duct sections
- 4.3 Describe the techniques employed for reducing fan noise transmission and estimate the effects of reducing it
- 4.4 State what is regenerated noise
- 4.5 List the most likely sources of regenerated noise
- 4.6 List and estimate from tables in typical cases the regeneration contributed by the various duct fittings namely: diffusers, grilles, dampers, attenuators and bends
- 4.7 List three common situations in which breakout sound may occur
- 4.8 List the circumstances under which fan noise breakout may occur
- 4.9 Describe four methods of controlling breakout from ductwork without undue costs

Conditions

Normally learning will take place in classroom or other suitable study environments
Relevant extracts and material will be made available to students for reference during lessons

Assessment method

written short answer questions
practical assignment

Learning outcome 5

Carry out noise and vibration analysis using appropriate computer software packages.

Assessment criteria

5.1 For various given air conditioning applications, carry out noise and vibration analysis using appropriate computer software packages.

Conditions

Normally learning will take place on-the-job in the design office and in the classroom or other suitable study environment.

During learning, access to appropriate references, Australian standards, codes, and regulations as well as appropriate computer software.

Assessment method

Projects/Assignments.

Learning outcome 6

State where attenuation can be economically applied to plant and equipment

Assessment criteria

6.1 Determine where attenuation is required and when it may be most economically applied using simple examples

Conditions

Normally learning will take place in classroom or other suitable study environments
Relevant extracts and material will be made available to student for reference during lessons

Assessment method

written short answer questions

Learning outcome 7

Identify the characteristics of vibration and methods used to select springs and pads

Assessment criteria

- 7.01 List and state the meaning of:
 - SHM (Simple Harmonic Motion)
 - Period
 - Frequency
 - Amplitude
- 7.02 Estimate the characteristic and predominant frequencies for:
 - fans
 - pumps
 - reciprocating plant
- 7.03 Estimate transmission of vibration through joints and similar devices
- 7.04 Define transmissibility
- 7.05 Outline the way in which transmissibility is used to assess vibration transmission
- 7.06 Determine how much vibration can be tolerated for equipment, personnel and for building structures generally
- 7.07 Develop and make use of the transmissibility graphs to select springs
- 7.08 Outline the modes of damping
- 7.09 State the conditions necessary for vibration isolation and select suitable vibration devices (springs/pads) to achieve realistic results
- 7.10 List the types of isolation materials and mountings in general use
- 7.11 Select isolation materials and mountings in appropriate examples
- 7.12 Apply vibration isolation techniques to pipes and ducts
- 7.13 Outline the fundamental concepts of inertia blocks
- 7.14 Show the methods of using mounting devices on a vibrating machine

Conditions

Normally learning will take place in classroom or other suitable study environments
Relevant extracts and material will be made available to students for reference during lessons

Assessment method	written short answer questions practical assignment
<i>Learning outcome 8</i>	Prepare acoustic specifications for various air conditioning applications, in accordance with OH&S regulations.
Assessment criteria	8.1 For various given air conditioning applications, prepare acoustic specifications in accordance with HOS&W regulations.
Conditions	Normally learning will take place on-the-job in the design office and in the classroom or other suitable study environment. During learning, access to appropriate references, application manuals, Australian standards, codes, and regulations as well as appropriate computer software.
Assessment method	Project/Assignments.

Suggested Learning Resources

All references used be latest

AIRAH 1989. AIRAH Handbook.

AIRAH. Application Manuals - DA2 Noise Control, Parts 1 & 2.

AIRAH. Application Manuals - A7 Noise Control, Part 3.

ASHRAE, 1993. ASHRAE Handbook, Fundamentals - Sound and Vibration,. SI Version. Atlanta

Berenak, L. Noise Reduction.

Jones. Air Conditioning Engineering.

NEBB. Procedural Standards for Measuring Sound and Vibration.

Standards Australia-Latest Editions to be used:

AS1055 parts 1,2 & 3. Acoustics-Description and Measurement of Environmental Noise.

AS1259

AS1269

AS1277 Acoustics - Measurement procedures for ducted silencers.

AS1359.51 Noise Level Limits.

AS1366 Rigid Cellular Plastic Sheets for Thermal Insulation.

AS2991 parts 1 & 2. Acoustics - Method for the Determination of Airborne Noise emitted by household and similar appliances.

Sound Attenuators Ltd, Noise Control in Mechanical Services

Stoecker W.F., Jones J.W., 1982. Refrigeration and Air Conditioning, McGraw-Hill.

The Trane Company 1986. Trane Air Conditioning Manual.

Woods, Practical Guide to Noise Control

Additionally further information may be sourced from;

Journal Articles.