Subject Description Form

Subject Code	ME41003
Subject Title	Principles of Sound and Vibration
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: ME34002 Engineering Thermodynamics
Objectives	To provide students with the fundamental knowledge of generation and measurement of sound and vibration and the sound propagation.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Understand the physics of the vibration of simple structure and sound propagation in the acoustic medium, in duct and in room. b. Formulate and solve the sound and vibration problem relating to vibration of string, beam and plate, sound radiation from the source, sound reflection and transmission through a junction and a flat interface of acoustic media by applying knowledge in noise mitigation method. c. Understand the mechanisms of basic measurement devices for sound and vibration, analyze and interpret the measured data from the experiments of noise and vibration.
Subject Synopsis/ Indicative Syllabus	***Fundamentals of Sound*** **-** Fluid compressibility, wave equation, sound pressure level and sound power, addition of sounds of different frequencies, octave bands and one-third octave bands, conservation of acoustic energy flux at the absence of a mean flow. ***Vibration of Continuous Systems*** **-** Vibration of string, rod, beams and plates; energy transmission through structures, natural modes, free and forced vibrations. ***Sources of Sound*** **-** Radiation of sound by pistons (1D, 2D), impedance, radiation efficiency, monopole and dipole, critical frequency, sound radiation by 2D structures. ***Sound Propagation*** **-** Single travelling wave and properties of standing wave, reflection of sound at pipe junctions and at interface of two media. ***Sound and Vibration Measurement*** **-** Measuring systems, microphones, sound level meters, background noise, measurement of sound intensity, reverberation time and absorption coefficient; accelerometers, calibration and mounting of accelerometers; shakers, hammers, force transducers and amplifiers; damping measurement, experimental modal analysis. **Laboratory Measurement** 1. Sound propagation in anechoic chamber 2. Impedance tube measurement 3. Experimental modal analysis of a vibrating beam 4. Traffic noise measurement

Teaching/Learning Methodology

Lectures are aimed at providing students with the knowledge of acoustics and vibration. (Outcomes a to c).

Tutorials are aimed at enhancing students' skills necessary for analyzing the physics of sound and vibration system (Outcomes a and b).

Laboratory experiments are conducted to improve students' ability to apply their knowledge to implement real engineering systems (Outcomes b and c).

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lecture	√	√	√
Tutorial	√	√	
Experiment		√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)		
		a	b	c
1. Class test	20%	√	√	√
2. Homework	20%	√	√	√
3. Laboratory report	10%		√	√
4. Examination	50%	√	√	√
Total	100%			

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Overall Assessment:

$0.50 \times$ End of Subject Examination + $0.50 \times$ Continuous Assessment

Examination is used to assess students on the overall understanding and the ability of applying the knowledge. It is supplemented by tests, assignments and laboratory reports which provide timely feedbacks to both lecturers and students.

Student Study Effort Expected

Class contact:	
▪ Lecture	32 Hrs.
▪ Tutorial/Laboratory	7 Hrs.
Other student study effort:	
▪ Reading and review	43 Hrs.
▪ Homework assignment	10 Hrs.
▪ Laboratory report	10 Hrs.
Total student study effort	102 Hrs.

Reading List and References	1. L.E. Kinsler, et al., Fundamentals of Acoustics, Wiley, latest edition. 2. M.P. Norton, Fundamentals of Noise and Vibration Analysis for Engineers, Cambridge University Press, latest edition. 3. H. Benaroya, Mechanical Vibration: Analysis, Uncertainties and Control, Prentice-Hall, latest edition. 4. A.P. Dowling and J.E. Ffowcs Williams, Sound and Sources of Sound, Chichester: E. Horwood, latest edition. 5. L.L. Beranek, Noise and Vibration Control Engineering: Principles and Applications, Wiley, latest edition.

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