ME 41300
NOISE CONTROL

Course Outcomes [Related ME Program Outcomes in brackets]

1. Provide a basic understanding of f*undamental concepts* in engineering noise control. [1, 2]
2. Apply these concepts to the solution of practical problems. [1, 2, 4, 6, 7]
3. Provide means to identify and correct potentially hazardous *sound levels* in the workplace. [1, 4, 6]
4. Teach sound and vibration *measurement techniques* and computer programming skills. [1, 2, 6, 7]
5. Develop *problem solving*, *reporting*, *communications* and *teamwork sills*. [3, 4, 5, 7]

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Analysis and design of mufflers/silencers

1. Sound transmission through an expansion chamber in a long pipe
2. Acoustic performance of mufflers/silencers; insertion loss, transmission loss and noise reduction
3. Design of mufflers/silencers: length and area ratio

Fundamentals of Acoustics

1. Simple harmonic motion
2. Wave equation
3. Energy variables
4. Solution of 1-D wave equation; fluctuating pressure and density; particle velocity
5. Sound pressure, sound intensity and sound power levels
6. Decibels
7. Concept of spherical waves
8. Resonance
9. Duct acoustics-standing waves vs. travelling wave

Techniques of sound measurements

1. Introduction to digital Fourier analysis
2. Octave band analysis
3. Noise metrics: Leq, LDN, L10, L90, SEL, Lmax, Lmin
4. Sound level meters, microphones, accelerometers, tape recorders
5. Standing wave apparatus: acoustical characterization of sound absorption materials

Control on noise at workplace

1. Control of machinery noise
2. Control of flow noise
3. Basic principles of vibration isolation
4. Sound transmission through panels: resonant frequency and co-incidence frequency
5. Sound insulation by enclosures

Evaluation of noise impacts

1. Commonly used noise scales and indices
2. Metris for assessment of environmental noise
3. Metrics for assessment of industrial noise
4. Case Study: Boston Central Artery/Tunnel project

Human response to noise

1. Anatomy and operation of human ears
2. Threshold of hearing; equal loudness contours- MAP and MAF
3. Noise induced hearing loss
4. Speech interference and sound quality
5. Perceived noise level (PNL) and EPNL

Regulations

1. Noise regulating agencies
2. OSHA noise regulations
3. Other regulations for control of environmental noise

COURSE NUMBER: ME 41300

COURSE TITLE: Mechanics of Materials

REQUIRED COURSE OR ELECTIVE COURSE: Elective

TERMS OFFERED: Typically offered in the Spring

TEXTBOOK/REQUIRED MATERIAL:

Leo Beranek, *Noise & Vibration Control*, INCE

PRE-REQUISITIES:

PHYS 17200 – Modern Mechanics or equivalent
MA 26200 – Linear Algebra and Differential Equations or
MA 26600 – Ordinary Differential Equations or Equivalent

COORDINATING FACULTY: K. M. Li

COURSE DESCRIPTION: Fundamentals: acoustic waves, reflection, scattering, absorption, and tones, noise. Psychoacoustics: voice, ear, theories of hearing, loudness, deafness. Environmental acoustics: sound in buildings, acoustic tiles, sound insulation, and sound absorption. Measurement: microphones, accelerometers, sound level meters, data acquisition and reduction, frequency analysis, and Fourier analysis. Noise control: use of absorbing and damping materials, vibration isolation and enclosures. Machinery noise: gear, bearing, fan, compressor, heating, and ventilation system noise, automobile and aircraft noise. Community reaction. Legal aspects.

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ASSESSMENTS TOOLS:

1. Homework
2. Quizzes and Exams

PROFESSIONAL COMPONENT:

1. Engineering Topics: Engineering Science – 3 credits (100%)

RELATED ME PROGRAM OUTCOMES:

1. Engineering fundamentals
2. Engineering design
3. Communication skills
4. Ethical/Prof. responsibilities
5. Teamwork skills
6. Experimental skills
7. Knowledge acquisition

COMPUTER USAGE: None

COURSE STRUCTURE/SCHEDULE:

Lecture - 3 days per week at 50 minutes for 16 wks.

PREPARED BY: K. M. Li (Updated by J.M. Gibert)

REVISION DATE: December 9, 2018