



**THE OHIO STATE UNIVERSITY**  
COLLEGE OF ENGINEERING

# Mechanical Vibrations

## MECHENG 5240

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**Credit Hours:**

3.00

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**Course Levels:**

Undergraduate (1000-5000 level)

Graduate (5000-8000 level)

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**Course Components:**

Lecture

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**Course Description:**

Free and forced vibration analysis of single-degree-of-freedom systems with various forms of damping, vibration isolation and control methods and devices, vibration sensors, equations of motion of multi-degree of freedom systems using Lagrange's method, Eigen value problem, modal analysis method for free and forced vibration analysis, frequency-domain data analysis fundamentals.

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**Prerequisites and Co-requisites:**

Prereq: 3260 (481). Prereq or concur: 3360 (482), or Grad standing in Engineering.

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**Course Goals / Objectives:**

- Analyze and characterize free and forced vibration responses of single and multi-degree-of-freedom mechanical systems having viscous damping.
  - Apply modal analysis technique for analysis of large system.
  - Design of dynamic absorbers and vibration mounts for vibration isolation and control.
  - Understand frequency-domain techniques for source identification and forced response due to periodic excitations.
  - Familiarize with vibration measurement techniques and sensors
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**Course Topics:**

- Vibration 1. Free vibration of Damped Single Degree of Freedom Systems
  - Vibration 2. Forced Harmonic vibration of Damped Single Degree of Freedom Systems; Periodic Response Using Fourier Series
  - Vibration 3. Design of Vibration Isolators and Vibration Sensors, Systems with Rotating Unbalances
  - Vibration 4. Damped Two-degree of Freedom Systems; Natural frequencies and Modes
  - Vibration 5. Undamped Multi-Degree-of-Freedom Systems. Eigenvalue Solution and Expansion Theorem
  - Vibration 6. Modeling of Real-Life Vibration Problems - Case Studies
  - Acoustics 1. Characteristics of Sound Waves
  - Acoustics 2. Measurement and Subjective Response to Sound
  - Acoustics 3. Description of Sound Fields and Acoustic Design Concepts
  - Acoustics 4. Identification of Noise Sources and Their Control - Case Studies
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**Designation:**

Elective