

**1. Preamble**

This course provides a sound knowledge in identifying, measuring and controlling strategies to control the Noise, Vibration and Harshness in automotive applications.

**2. Pre-requisite**

1150PH101 Engineering Physics

**3. Links to Other Courses**

NIL

**4. Course Educational Objectives**

Students undergoing this course are expect to

- Understand the role of NVH in automotive industry
- Explain the facilities and instrumentations in measuring the NVH levels in automotive applications.
- Acquire knowledge in controlling NVH levels in automobiles and improving comfort for the users.

**5. Course Outcomes**

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
C01	Describe the sources and common problems in automotive industry to control NVH.	K2
C02	Explain the theory of vibration and sound measurement for the automotive applications.	K2
C03	Discuss the facilities and instrument to measure the NVH levels in automobiles.	K2
C04	Explain the signal processing analysis	K2
C05	Describe the strategies to control Noise, Vibration and Harshness for the comfort of the passengers.	K2

**6. Correlation of COs with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H	M	L		L	L		M	L	M	L
CO2	H	H	H	H	M	L		L	L		M	L	L	M
CO3	H	H	H	H	M	L		L	L		M	L	M	H
CO4	H	H	H	H	M	L		L	L		M	L	L	M
CO5	H	H	H	H	M	L		L	L		M	L	M	H

H- Strong; M-Medium; L-Low

**7. Course content****UNIT I NVH IN THE AUTOMOTIVE INDUSTRY**

Sources of Noise and Vibration - Design Features - Common Problems - Marque Values - Noise Quality - Pass-By Noise Requirements. Target Vehicles and Objective Targets - Development Stages in a New Vehicle Programme and the Altering Role of NVH Engineers.

**UNIT II SOUND AND VIBRATION THEORY** **L-9**

Sound Measurement - Human Sensitivity and Weighting Factors. Combining Sound Sources - Acoustical Resonances - Properties of Acoustic Materials - Transient and Steady State Response of One Degree of Freedom System Applied to Vehicle Systems – Transmissibility - Modes of Vibration.

**UNIT III TEST FACILITIES AND INSTRUMENTATION** **L-9**

Laboratory Simulation - Rolling Roads (Dynamometers), Road Simulators, Semi-Anechoic Rooms, Wind Tunnels, Etc., Transducers, Signal Conditioning and Recording Systems - Binaural Head Recordings, Sound Intensity Technique, Acoustic Holography, Statistical Energy Analysis

**UNIT IV SIGNAL PROCESSING** **L-9**

Sampling, Aliasing and Resolution - Statistical Analysis - Frequency Analysis - Campbell's Plots, Cascade Diagrams, Coherence and Correlation Functions.

**UNIT V NVH CONTROL STRATEGIES & COMFORT** **L-9**

Source Ranking - Noise Path Analysis - Modal Analysis - Design of Experiments, Optimisation of Dynamic Characteristics - Vibration Absorbers and Helmholtz Resonators - Active Control Techniques.

**8. Text Books:**

1. Norton M P, Fundamental of Noise and Vibration, Cambridge University Press, 1989
2. Munjal M.L., Acoustic Ducts and Mufflers, John Wiley, 1987

**9. Reference Books:**

1. Baxa, Noise Control of Internal Combustion Engine, John Wiley, 1984.
2. Ewins D. J., Model Testing: Theory and Practice, John Wiley, 1995.
3. Boris and Kornev, Dynamic Vibration Absorbers, John Wiley, 1993.
4. McConnell K, "Vibration Testing Theory and Practice", John Wiley, 1995.