Certificate: Automotive Noise, Vibration and Harshness

This certificate program provides fundamental principles of acoustics and vibration theories, with emphasis on the applications of these principles to practical vehicle NVH problems. It covers basics of vehicle dynamics, free and forced vibration systems, acoustic wave propagations and transmission, acoustic interior trim and floor covering designs and analysis including Statistical Energy Analysis (SEA) technology, plus sound quality issues and vehicle audio system designs. (12 credit hours)

ME 516B Sound Quality and Audio System Design
3 credits
Fundamentals of acoustics and the applications of acoustical technology on audio systems design with emphasis on vehicle audio systems. Human perceived sound and sound quality. Acoustics of room and enclosures on how sound is built-up and decayed in an enclosure plus the standing wave patterns. The interaction between the sound and structure regarding on how sound is radiated from rigid and flexible panels, the impedance and sound transmission loss concept, the Helmholtz equation and Helmholtz resonators. Physchoacoutics regarding musical notes, hearing pitch, hearing notes, tuning system, hearing timbre and deceiving the ear. Processing sound electronically, such as filtering and equalizations, and vehicle audio system design practices.

ME 540 Mechanical Vibrations
3 credits
A study of the linear vibrations of discrete multi-degree-of-freedom systems. Generation of equations of motion using the unit displacement, unit force, and Lagrange methods. Generalized eigenvalue problem. Modal analysis. Effects of damping. Synthesis of forced response by the unit step, unit impulse, and Fourier series methods; response to shock excitation. Numerical techniques.

ME 543 Vehicle Dynamics
3 credits
A treatment of the response, ride, and maneuvering of motor vehicles. Road loads, suspension systems, mechanics of pneumatic tires.

ME 545 Acoustics and Noise Control
3 credits
Fundamentals of acoustical waves, sound propagation and intensity, instruments for vibration and noise, HVAC system noise, automobile and aircraft noise, noise control techniques. Graduate standing or special permission.

Updated 3/05

*Other courses are available for all certificate topic areas with approval of department advisor.

AE 547 Automotive Powertrain I
3 credits
Topics in kinematics and dynamics including engine output and balance; mechanisms and machine theory. Force analysis and design of gears and shaft systems. Analysis of planetary gear trains. Designs and analysis of automotive gear boxes.

ME 548 Automotive Powertrains Systems II
3 credits
Simulation of vehicle performance; dynamics in gear shifting; engine balance, fuel economy, and performance related to powertrains; powertrain arrangements, manual and automatic transmissions, automotive axles, four-wheel-drive systems; design and manufacturing of gearing systems.

AE 565 Design of Automotive Vehicle Acoustic Interior Systems
3 credits
This course presents the technology and methodology of vehicle acoustic interior system design. Design of dash panel, floor panel, roof, door aperture, and trunk as well as the whole vehicle will be covered. Both analytical and experimental methods for transmission loss analysis and validation testing will be discussed in detail. Statistical Energy Analysis (SEA) will be used to calculate the power distribution within the subsystems. Determination of damping loss factors and coupling loss will be discussed. Case studies of optimizing acoustic packages of subsystem and the whole vehicle will be presented. The course also includes computer simulation using commercial software and experimental demonstrations.

*Other courses are available for all certificate topic areas with approval of department advisor.