



MUFFLER ACOUSTICS

APPLICATION TO AUTOMOTIVE EXHAUST NOISE CONTROL

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Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 12 Weeks (18 Jan' 21 - 09 Apr' 21)

EXAM DATE : 24 Apr 2021

PRE-REQUISITES : Background in Mechanical Vibrations and Engineering Mathematics
Fundamental course in Acoustics (Desirable)

INTENDED AUDIENCE : Any Interested Learners

INDUSTRIES APPLICABLE TO : Tata Motors, Maruti Udyog, Hyundai, Mahindra & Mahindra - automobile and heavy-duty vehicle manufacturing companies, and possibly defense equipment manufacturing companies.

COURSE OUTLINE :

Engine exhaust noise being one of the major contributors towards environmental noise pollution, the design and analysis of exhaust mufflers has been a crucial area of research in the field of engineering noise control. Additionally, there exists significant literature towards designing silencers for reducing fan noise in ventilation and air-conditioning systems. This NPTEL course presents for the first time, a set of dedicated lectures on the theory of exhaust mufflers used for reciprocating internal combustion engines as well as ventilation ducts, and so on. While a basic background in Acoustics is desirable, the course begins with fundamentals including the detailed derivation of the 1-D wave equation before moving to the more involved case of 3-D propagation in waveguides and associated concepts. This is followed by an introduction to the terminologies common in mufflers as well as the basic elements constituting acoustic filters including electro-acoustic circuit analogies and 1-D or plane-wave analysis.

ABOUT INSTRUCTOR :

AKHILESH MIMANI is an Assistant Professor's at the Department of Mechanical Engineering, Indian Institute of Technology Kanpur (IITK) India. Akhilesh received his PhD (2012) in Mechanical Engineering from the prestigious Indian Institute of Science, Bangalore specializing in the area of Muffler and Duct acoustics. He has completed research associate positions at The University of Adelaide (2016), University of New South Wales Sydney (2017) and University of Technology Sydney (2018) before joining IITK. Akhilesh has over 10 years of experience in the analysis and design of mufflers for automotive and industrial applications which includes the monograph (Springer Nature) and consultancy.

COURSE PLAN :

Week 1: Introduction and Basic Concepts

Week 2: Three-dimensional acoustic field: Solution of the Helmholtz equation

Week 3: Terminologies and Theory of Acoustic Filters..1

Week 4: Theory of Acoustic Filters..2

Week 5: Acoustic propagation in one-dimensional ducts with gradually varying area

Week 6: Flow-acoustic analysis of perforated element mufflers

Week 7: Network analysis of multiply-connected mufflers: Non-unique wave propagation paths

Week 8: Three-dimensional analysis of mufflers: Analytical approach

Week 9: Three-dimensional analysis of mufflers: Analytical approach (Cont'd)

Week 10: Dissipative ducts and Parallel Baffle Mufflers

Week 11: Experimental techniques based on use of an impedance tube

Week 12: Muffler Design: Practical considerations