

1152AU110

AUTOMOTIVE AERODYNAMICS**L T P C****3 0 0 3****1. Preamble**

The course is meant to give the learners an introduction and an enhancement of their knowledge in the field of vehicle aerodynamics. It includes: overview of fundamentals of fluid mechanics, Boundary layers and Vorticity, Bluff body aerodynamics, Aerodynamic forces on road vehicles; their evaluation and possible strategies for their control. Design aspects of external and internal flows in vehicles.

2. Pre-requisite:

1151AU214 AutomotiveChassis

3. Links to other courses

- Vehicle Body Engineering
- Automotive Safety

4. Course Educational Objectives

Students undergoing this course are expected to

- Provide guidance to industry on reducing the aerodynamic drag in heavy truck vehicles
- Develop innovative drag reducing concepts that are operationally and economically sound
- Establish a database of experimental, computational, and conceptual design information
- Demonstrate the potential of new drag-reduction concepts

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)
CO1	Evaluate basic fluid theory.	K3
CO2	Apply CFD to a range of problems.	K3
CO3	Understand lift, drag and down force definitions and calculations.	K2
CO4	Demonstrate a knowledge and understanding of aerodynamics in automotive field.	K3
CO5	Explain the principles and functions of wind tunnel.	K2

(K2-understand, K3-Apply, K4-Analysis)

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	M	L					L	L		H	M
CO2	H	H	H	M	L					L	L		H	M
CO3	H	H	H	M	L					L	L		M	M
CO4	H	H	H	M	L					L	L		M	L
CO5	H	H	H	M	L					L	L		M	M

H- High; M-Medium; L-Low

7. Course Content

UNIT I - INTRODUCTION

L-9

Scope and Historical Development Trends - Fundamental of Fluid Mechanics - Flow Phenomenon Related To Vehicles - External & Internal Flow Problem - Resistance To Vehicle Motion - Performance - Fuel Consumption And Performance - Potential of Vehicle Aerodynamics.

UNIT II - AERODYNAMIC DRAG OF CARS

L-9

Cars as a Bluff Body - Flow Field Around Car - Drag Force - Types of Drag Force - Analysis of Aerodynamic Drag - Drag Coefficient of Cars - Strategies for Aerodynamic Development - Low Drag Profiles, Lift, Body Styling

UNIT III - SHAPE OPTIMIZATION OF CARS

L-9

Front End Modification - Front And Rear Wind Shield Angle - Boat Tailing - Hatch Back, Fast Back And Square Back - Dust Flow Patterns at the Rear - Effects of Gap Configuration - Effect of Fasteners.

The Origin of Forces and Moments on Vehicle - Side Wind Problems - Methods to Calculate Forces and Moments - Vehicle Dynamics Under Side Winds - The Effects of Forces and Moments.

UNIT IV- VEHICLE HANDLING

L-9

Characteristics of Forces and Moments - Dirt Accumulation on the Vehicle - Wind Noise - Drag Reduction in Commercial Vehicles.

UNIT V - WIND TUNNELS FOR AUTOMOTIVE AERODYNAMIC

L-9

Introduction – Principle of Wind Tunnel Technology – Limitation of Simulation – Stress with Scale Models – Full Scale Wind Tunnels – Measurement Techniques – Equipment and Transducers – Road Testing Methods – Numerical Methods.

Total: 45 Periods

8. Text Book

1. Wolf – Heinrich Hucho, Aerodynamics of Road Vehicles, SAE, **ISBN No:** 978-0-7680-0029-0, 1998.
2. Heinz Heisler, “Advanced Vehicle Technology”, second edition, Butterworth – Heinemann, New York, 2002

9. Reference Books

1. Pope. A., Wind Tunnel Testing, John Wiley & Sons, 2nd edition, New York, 1974.
2. Sumantran. V, Gino Sovran, Vehicle Aerodynamics, SAE, 1994