# C. U. SHAH UNIVERSITY
## Wadhwan City

**FACULTY OF**: - Technology and Engineering
**DEPARTMENT OF**: - Automobile Engineering
**SEMESTER**: -VII
**CODE**: - 4TE07AAD1
**NAME**: – Automotive Aerodynamics

**Teaching and Evaluation Scheme:-**

| Subject Code | Name of the Subject | Teaching Scheme (Hours) | | | | Credits | Evaluation Scheme | | | | | | | |
| | | | | | | | Theory | | | | Practical (Marks) | | | |
| | | | | | | | Sessional Exam | | University Exam | | Internal | | University | Total |
| | | Th | Tu | Pr | Total | | Marks | Hrs | Marks | Hrs | Pr/Viva | TW | Pr | |
| 4TE07AAD1 | Automotive Aerodynamics | 3 | 0 | 2 | 5 | 4 | 30 | 1.5 | 70 | 3 | --- | 20 | 30 | **150** |

**Objectives:**

- To familiarize the learner with non-aeronautical uses of aerodynamics such as road vehicle and aerodynamics problems.
- To make the students understand the design concept of automobile bodies and to determine their drag coefficients and optimize their shapes. The use of wind tunnel for the same will be illustrated.

**Prerequisite:**

- Basics of Fluid Mechanics and Fundamental of aerodynamics

**Course Outline:**

| Sr. No. | Course Content | Hours |
| --- | --- | --- |
| 1 | **Fundamental of aerodynamics:** Introduction , Aerodynamics forces and terms– streamlines, attached and separated flow, velocity distribution, Laminar and turbulent flow, skin friction coefficient, transition and laminar bubble, pressure distribution on automobile shape, wakes, Drag, lift and side forces and their coefficients for various road vehicles, source of drag and lift, Drag reduction techniques | **7** |
| 2 | **Aerofoils and wings:** Lift coefficient of an aerofoil, effect of Reynolds number, desirable pressure distribution, wing aspect ratio and taper ratio, lift coefficient of a finite wing, Induced drag | **6** |
| 3 | **Shape optimization of cars:** The origin of forces and moments, effects, Front end modification. Front and rear windshield angles, vehicle dynamics under side wind, force moment coefficients. Dirt accumulation on vehicle, wind noise, air flow around individual components, boat failing. Hatch back, fast back & square back dust flow pattern at rear, effect of gap configuration, effect of fastener. | **7** |
| 4 | **Wind Tunnels For Automotive Aerodynamics:** Introduction, Principles 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. | **7** |

| 5 | **Application of CFD:** Introduction, method of solve Navier stoke equation, forces acting in fluid element, compressibility effect in flow field, inviscide flow, governing equations, irrotational, Flow field and consequences, potential flows, boundary layer methods, numerical modeling of fluid flow around vehicle body. | **10** |
|---|---|---|
| 6 | **Vehicle Styling:** Vehicle body types - body styles, front grill shapes. Headlight shapes, side vent, rear side shapes, overall profiles. Visual features, aesthetic preference, specific brand image. Vehicle color - color codes. Introduction to computer-aided concept design system. | **8** |

**Learning Outcomes:**
- The knowledge of this subject is understand to design aerodynamics shapes of car body, to calculate equivalent weight and maximum acceleration, desired power to propel the vehicle.

**Books Recommended:**
1. Aerodynamics of Road vehicles by **Hucho,W.H**.,  Butterworths Co. Ltd., 1987.
2. Wind Tunnel Testing by John **Wiley & Sons**, 2nd Edn., New York, 1974.
3. Fundamentals of CFD by **Anderson** McGraw-Hill, International Edition, Mechanical Engineering Series

**Reference Books:**-

1. T. K. Garrett, Motor Vehicle by **K. Newton and W. Seeds** 13th Edition, Elsevier publications
2. Automotive Mechanic by **William H. Crouse** - Tata McGraw Hill Publishing House