

# GUJARAT TECHNOLOGICAL UNIVERSITY

## MECHANICAL (I.C. ENGINE & AUTOMOBILE ENGINEERING) (11)

### AUTOMOTIVE AERODYNAMICS & SAFETY

**SUBJECT CODE: 2731104**

M.E. SEM-III

**Type of course:** Advanced/ Application

**Prerequisite:** Basics of Aerodynamics at under graduate level.

**Rationale:** Explain the concept of bluff body; Analysis of aerodynamics in automotives.Utilizing appropriate safety procedures with maintenance & service

#### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

#### Course Content:

Sr. No.	Course Content	Total Hrs	% Weightage
<b>1</b>	The concept of bluff body; Analysis of aerodynamic drag force; types of drag force; drag coefficient of cars; strategies for aerodynamic development; low drag profiles for vehicle	<b>8</b>	<b>17</b>
<b>2</b>	Aerodynamic shape analysis; Front and modification; front and rear wind shield angle; boat tailing; hatch back, fast back and square back; dust flow patterns at the rear; effect of gap configuration	<b>08</b>	<b>17</b>
<b>3</b>	The concept of vehicle safety; Need of safety; active safety: driving safety; conditional safety; perceptibility safety; operating safety- passive safety: exterior safety, interior safety, deformation behavior of vehicle body.	<b>12</b>	<b>27</b>
<b>4</b>	Regulations, automatic seat belt Tightener system; Collapsible steering column; Tilttable steering wheel.	<b>6</b>	<b>13</b>
<b>5</b>	Electronic system for activating air bags; Bumper design for safety; antiskid braking system.	<b>6</b>	<b>13</b>
<b>6</b>	Speed control devices; Causes of rear end collision; Frontal object detection; Rear vehicle object detection system; Object detection system with braking system interactions.	<b>6</b>	<b>13</b>

#### Reference Books:

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1997.
2. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.
3. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-HillInc., -1999.
4. ARAI Safety standards

**Course Outcome:**

- Understand the concept of bluff body and aerodynamic drag force analysis.
- Do Analysis of Aerodynamic Shape
- Understand Concept of Vehicle Safety
- Understand Working of Various safety equipment and safety regulations.

**List of Experiments:**

1. Study of bluff body, aerodynamic drag in automobile and safety considerations while designing the automobile body
2. Study of wind tunnel and determination of drag coefficient of any model of automotive vehicles.
3. Study of dust flow patterns at the rear in automotive vehicles.
4. Study of Bumper design for safety
5. Study of advanced automobile seat belts and Air bag systems.
6. Study of advanced steering wheel and steering system.
7. Study anti-skid braking system and antilock brake system.
8. Study rear vehicle object detection system.
9. Study of central door locking systems

**Design based Problems (DP)/Open Ended Problem:**

To analyze the stability, safety and comfort of the vehicles, Wind tunnels and its testing techniques with application of CFD for aerodynamic design of vehicle.

**Review Presentation (RP):** The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.