

# GANPAT UNIVERSITY

## FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Bachelor of Technology	Branch/Spec.	Automobile Engineering						
Semester	VIII	Version	1.0.0.0						
Effective from Academic Year	2020-21	Effective for the batch Admitted in	July 2017						
Subject code	2AE803	Subject Name	Automobile Aerodynamics and Ergonomics						
Teaching scheme			Examination scheme (Marks)						
(Per week)	Lecture(DT)	Practical(Lab.)	Total	CE	SEE	Total			
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50

Pre-requisites:

None

Objectives of the Course:

After completion of this course, student will be able to

1. Discuss aerodynamics drag and its effect on a vehicle at different conditions of operation.
2. Describe strategies to reduce aerodynamic drag
3. Analyse cabs for better aerodynamics
4. Analyse of vehicle body considering the forces and moments caused by the aerodynamics of a car.
5. Discuss wind tunnel and its application for simulating aerodynamics in a real time scenario

Theory syllabus

Unit	Content	Hrs
1	<p><b>Introduction:</b> Scope – Historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles Types of aerodynamic drag. Forces and moments influencing drag. Effects of forces and moments. Various body optimization techniques for minimum drag. – External &amp; Internal flow problems. Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.</p>	9
2	<p><b>Aerodynamic drag of cabs</b> Car 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.</p>	7
3	<p><b>Shape optimization of cabs</b> 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 – effect of fasteners</p>	8
4	<p><b>Vehicle handling</b> The origin of force and moments on vehicle – side wind problems – methods to calculate forces and moments – vehicle dynamics under side winds – the effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.</p>	7
5	<p><b>Wind tunnels for automotive aerodynamics:</b> Introduction – Principles of wind tunnel technology Flow visualization techniques. Testing with wind tunnel balance (scale models).– Limitation of simulation – Stress with scale models – full scale wind tunnels – measurement techniques – Equipment and transducers – road testing methods – Numerical methods</p>	7
6	<p><b>Automotive ergonomics:</b> Introduction to Automotive Ergonomics, Anthropometric and biomechanical data in automotive design, Occupant Packaging, Automobile control and displays, In vehicle and external visibility of the driver, Entry and exit by drivers and passengers, Driver distraction and driving performance measurement, Driver Workload Measurement, Virtual Ergonomics evaluation technique and its application in automotive design, Automotive craftsmanship</p>	7

Practical content

Practical assignments and tutorials are based on above syllabus.	
<b>Text Books</b>	
1	Hucho W H, "Aerodynamic of Road vehicles ", Butterworth Co. Ltd., 1997.
2	S.P. Taylor C.M. Haslegrave; Vision in Vehicles VI. Publisher: North Holland; 1 edition, 1998
<b>Reference Books</b>	
1	Vehicle Aerodynamic, SP-1145, SAE, 1996.
2	Pope A, "Wind Tunnel Testing ", John Wiley & Sons, New York, 1974.
<b>ICT/ MOOCs references</b>	
1.	Automotive Ergonomics <a href="https://nptel.ac.in/courses/107103084/">https://nptel.ac.in/courses/107103084/</a>
<b>Course Outcomes:</b>	
<ol style="list-style-type: none"> <li>1. Understand the concept of bluff body and aerodynamic drag force analysis.</li> <li>2. Do Analysis of Aerodynamic Shape.</li> <li>3. Understand Concept of Vehicle Safety.</li> <li>4. Understand Working of Various safety equipment and safety regulations.</li> </ol>	