

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3170209

Date: 29/05/2026

Subject Name: Automotive Aerodynamics and Aesthetics

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

- Q.1**
- (a) Explain the Boundary layer thickness in context with Vehicle aerodynamics. 03
 - (b) Draw the neat sketch of vehicle SAE axis system and explain the forces and moments produce with respect to them. 04
 - (c) Draw a neat sketch and explain the mechanics of air flow and pressure distribution around the vehicle body in detail. 07
- Q.2**
- (a) Define : (i) Aerodynamic Drag (ii) Vehicle lift (iii) After flow Wake 03
 - (b) Explain various Resistance to moving vehicle with neat sketch. 04
 - (c) Explain with neat sketch : (i) Base Drag (ii) Trainling vortices 07
- OR
- Q.2**
- (c) Explain with neat sketch : (i) Attached Transverse vortices (ii) Effect of underbody floor height on lift coeeficient 07
- Q.3**
- (a) Explain the under body dam to control the lift of vehicle 03
 - (b) A car of mass **1200 kg** is moving at a constant speed of **72 km/h** up a road with a gradient of **5%**. Calculate the total resistance to motion acting on the car if the engine is delivering just enough tractive effort to maintain speed. Assume the following: 04
 - Rolling resistance coefficient $\mu_r=0.015$
 - Air density $\rho=1.225 \text{ kg/m}^3$
 - Drag coefficient $C_d=0.32$
 - Frontal area $A=2.2 \text{ m}^2$
 - Acceleration due to gravity $g=9.81 \text{ m/s}^2$
 - (c) enlist the various drag reduction techniques and explain any two techniques with neat sketch in detail. 07
- OR
- Q.3**
- (a) explain the function of the spoiler 03
 - (b) Explain the Hatch back and Fast back shape of the car. 04
 - (c) Enlist the various vehicle lift force control techniques and explain any two in detail. 07
- Q.4**
- (a) explain the effect of fasteners on passenger car aerodynamic in details. 03
 - (b) Explain the effect of rounding sharp front cab body edges on commercial vehicle aerodynamics 04

	(c) explain the steps for the digital aesthetic design process for vehicle in detail	07
	OR	
Q.4	(a) Explain the importance of Aesthetics of vehicle in context to vehicle aerodynamics.	03
	(b) Discuss the cab roof deflector effectiveness versus yaw angle effectiveness	04
	(c) Enlist the various devices used to reduce drag for commercial vehicle.	07
Q.5	(a) explain the importance of Clay modeling in vehicle design	03
	(b) Explain Any flow visualisation technique for wind tunnel testing.	04
	(c) Draw and explain the construction and working of suction type wind tunnel in details	07
	OR	
Q.5	(a) Give the function of wind tunnel and give its importance.	03
	(b) Explain any on-road aerodynamic testing method for vehicle in detail.	04
	(c) Explain the comparison of drag resistance with various 06 commercial vehicle cab arrangement relative to trailer body height,	07
