VIT
Vellore Institute of Technology

Final Assessment Test – November 2025

Course: **BMEE414L - Vehicle Body and Aerodynamics Engineering**

Class NBR(s): **3135** Slot: **F2+TF2**

Time: **Three Hours** Max. Marks: **100**

- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

COs	CO Statements
CO1	Acquire knowledge of the various design principles.
CO2	Describe the importance of materials selection for body and trim.
CO3	Explicate the concepts of aerodynamics.
CO4	Develop the methods of improving the stability, safety and comfort associated with a vehicle from an aerodynamics view point.
CO5	Propose suitable simulation technique for aerodynamic analysis of vehicle.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions

(10 X 10 = 100 Marks)

1.	Explain the intricate relationship between chassis design and visibility, and apply that knowledge to improve the visibility of a truck driver.	CO1	BL3
2.	Outline the techniques for measuring visibility, such as photometry. Apply those methods by designing tests to improve visibility.	CO1	BL3
3.	Sketch a typical dump truck (tipper truck) body layout, listing the key components such as the engine, floor, passenger seats, doors, and emergency exits. Apply those design principles to a typical commercial truck design.	CO2	BL3
4.	Outline the design and construction of a tanker truck. Analyze the design from the perspective of strength and torsional rigidity.	CO2	BL4
5.	Explain the significance of mass reduction materials like magnesium or composites for chassis manufacturing. Analyze the impact of various light-weight materials on the mass reduction potential, chassis strength, and durability.	CO2	BL2
6.	Review the technique of electroplating and analyze its significance in reducing corrosion on a sedan, thereby improving its longevity and durability.	CO2	BL4
7.	Highlight the significance of the 3-dimensional vortex structures created at the "A" and "C" pillar regions on a sedan's performance. Analyze their impact on the fuel consumption and vehicle stability.	CO3	BL4
8.	Suggest and evaluate the various strategies for reducing dirty airflow behind a race car that impedes drafting.	CO3	BL5

9.a)	In order to compete in a race, lifting surfaces were added (at negative angle) to create downforce. At the front, two triangular (AR = 1) dive plates of area 300 cm^2 each, were added at a negative angle of 30°. At the back, a 1.8-wide rectangular wing with a chord of 0.2 m was used (α = -3°, α_{L0} = 3°). Estimate the increase in downforce at a speed of 150 kmph and evaluate the design. Formulae: Dive plates $C_L = (0.963 + 1.512AR)sin\alpha$ AR: Aspect ratio = width/chord length Rear wing $C_L = \frac{2\pi(\alpha - \alpha_{LO})}{1+\frac{2}{AR}}$	CO4	BL5
	OR		
9.b)	Suggest various flow spoilers for stabilizing a race car by increasing the downdraft. Evaluate the techniques on their drag reduction and stabilization potential.	CO4	BL5
10.a)	Outline and evaluate a strategy for simulating the rotary motion of wheels in a wind tunnel.	CO5	BL5
	OR		
10.b)	Evaluate the suitability of a vortex-lattice method strategy, such as the Ramm and Hummel method, for rear wake simulation of a race car.	CO5	BL5

⇔⇔⇔ **B/L/TY** ⇔⇔⇔