| Reg. No. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

## SECOND SEMESTER M.TECH. (AUTOMOBILE ENGINEERING & ELECTRICAL VEHICLE TECHNOLOGY)

## END SEMESTER EXAMINATIONS, APR/MAY 2024

## VEHICLE DYNAMICS [AAE 5214]

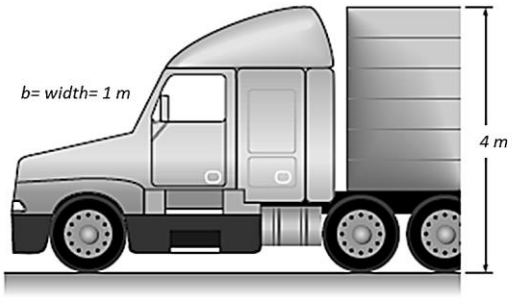
REVISED CREDIT SYSTEM

**Time: 3 Hours** **Date: 03/05/2024** **Max. Marks: 50**

**Instructions to Candidates:**

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

| Q.NO | Questions | Marks | CO | BTL |
|---|---|---|---|---|
| 1A. | Utilizing clear diagrams, contrast Lange's low-drag design with Jaray's combination form approach in integrating aerodynamics into vehicles. | (04) | CO3 | 3 |
| 1B. | Derive the expression for tire forces for a car parked on a level road with the necessary diagram | (03) | CO1 | 2 |
| 1C. | Explain how the C-pillar vortices in fastback cars influence aerodynamic performance? | (03) | CO3 | 3 |
| 2A. | Describe the flow and pressure distribution over the shape of a sedan vehicle. | (04) | CO3 | 3 |
| 2B. | How does the airflow differ over various shaped sections such as flat plate, circular, and lobe? | (03) | CO4 | 3 |
| 2C. | With a neat plot, explain how the engineers design the brake distribution forces between front and rear tires in a passenger car. | (03) | CO1 | 3 |
| 3A. | The drag coefficient of a car at the design conditions of 1 atm, 25°C, and 90 km/h is to be determined experimentally in a large wind tunnel in a full-scale test. The height and width of the car are 1.25 m and 1.65 m, respectively. If the horizontal force acting on the car is measured to be 220 N, determine the total drag coefficient of this car. | (04) | CO4 | 4 |
| 3B. | What are the primary sources of physical wind noise in automobiles? | (03) | CO3 | 3 |
| 3C. | Briefly explicate the different deceleration sources in a vehicle other than braking. | (03) | CO1 | 3 |

| | | | | |
|---|---|---|---|---|
| **4A.** | Using wind deflectors in trucks is found to reduce the drag from 0.96 to 0.7 as shown in Figure 1. What is the reduction in the power associated with this drag reduction in kW? Assume the average velocity of the truck to be 65 kmph.<br>  <br><br>(a) $C_D = 0.70$<br>  <br>(b) $C_D = 0.96$<br>Figure 1 | ***(03)*** | ***CO4*** | ***4*** |
| **4B.** | Explain the body-to-body interference for slender bodies. | ***(03)*** | ***CO4*** | ***3*** |
| **4C.** | Interpret the phenomenon of longitudinal slip between the tire and the road surface using necessary diagrams. | ***(04)*** | ***CO2*** | ***3*** |
| | | | | |
| **5A.** | What are the different elements of the wind tunnel? Explain with neat sketches. | ***(04)*** | ***CO4*** | ***3*** |
| **5B.** | Elucidate the phenomenon of conicity and plysteer in passenger car tires | ***(03)*** | ***CO2*** | ***3*** |
| **5C.** | Explain any two on board excitation sources which affect the ride characteristics of a passenger car | ***(03)*** | ***C02*** | ***3*** |