

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, December, 2021

Vehicle Aerodynamics

B. Tech. in Mechanical Engineering

Roll No.....

Course Code : ME1213

Time: 2 hours

Max. Marks: 40

Instructions to students:

Do not write anything other than your roll number on question paper.

Assume suitable data wherever required and mention it clearly.

Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

- Q.1 Write a report on the flaps used at the leading and trailing edges of the wings of large commercial aircraft. Discuss how the flaps affect the drag and lift coefficients during takeoff and landing. 5
- Q.2 Many drivers turn off their air conditioners and roll down the car windows in hopes of saving fuel. But it is claimed that this apparent "free cooling" actually increases the fuel consumption of some cars. Investigate this matter and write a report on which practice saves fuel under what conditions. 5
- Q.3 A circular sign has a diameter of 50 cm and is subjected to normal winds up to 150 km/h at 10°C and 100 kPa. Determine the drag force acting on the sign. Also determine the bending moment at the bottom of its pole whose height from the ground to the bottom of the sign is 1.5 m. Disregard the drag on the pole. 10



- Q.4 The passenger compartment of a minivan traveling at 50 km/h in ambient air at 1 atm and 80°F is modeled as a 4.5-ft-high, 6-ft-wide, and 11-ft-long rectangular box. The airflow over the exterior surfaces is assumed to be turbulent because of the intense vibrations involved. Determine the drag force acting on the top and the two side surfaces of the van and the power required to overcome it. 10
- Q.5 The aerodynamic drag of a new sports car is to be predicted at a speed of 60 km/h at an air temperature of 25°C. Automotive engineers build a one-third scale model of the car to test in a wind tunnel. The temperature of the wind tunnel air is also 25°C. The drag force is measured with a drag balance, and the moving belt is used to simulate the moving ground (from the car's frame of reference). Determine how fast the engineers should run the wind tunnel to achieve similarity between the model and the prototype. 10

