Exam Date & Time: 02-Jun-2023 (02:30 PM - 05:30 PM)

# MANIPAL ACADEMY OF HIGHER EDUCATION

IV SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY/JUNE 2023

**INTRODUCTION TO AEROSPACE ENGINEERING [AAE 4303]**

**Marks: 50** **Duration: 180 mins.**

**A**

**Answer all the questions.**

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Identify the key design features that contribute to the extended flight capabilities of a glider. (2)

A)

B) Explain the various types of drag encountered by an airplane and create a graph that depicts the change in drag force as the airplane transitions from subsonic to supersonic speeds. (3)

C) Describe the significance of wings in aircraft design and demonstrate how different wing planform shapes and arrangements on the fuselage are employed based on varying applications. (5)

2) Select an appropriate engine suitable for achieving a Mach number between 1.5 and 3 in aircraft flight. Create a labelled schematic of the engine, indicating its various components. (4)

A)

B) Explain the concept of the Magnus effect and provide example of its utilization in the propulsion of ships. (3)

C) Describe how helicopters maintain stability during flight while the main rotor is rotating at high speeds. (3)

3) Explain the purpose and operation of high lift devices in an aircraft. Utilizing a schematic, depict the functionality of two commonly employed high lift devices. (3)

A)

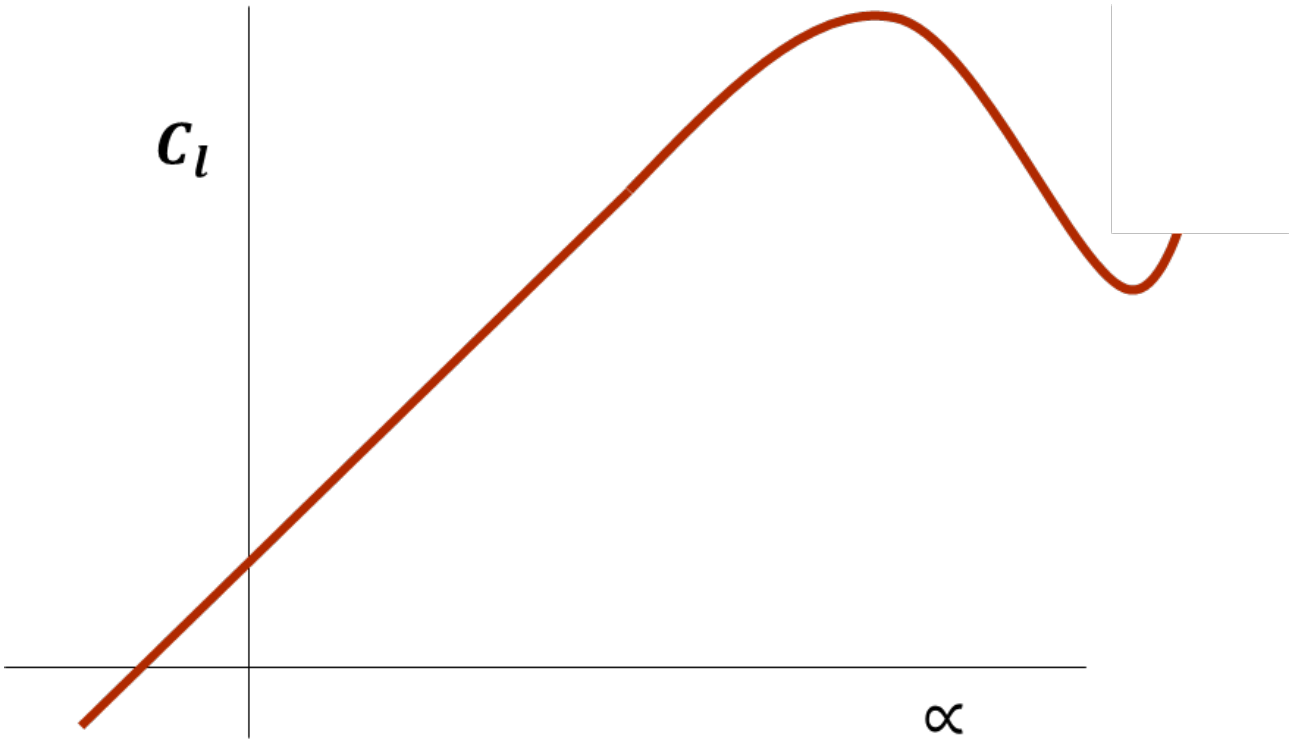
B) Distinguish between flight level, elevation, and altitude in relation to altimeter settings. Provide an instance where altitude and flight level are equivalent. (3)

C) Compare commercial and military aircraft, specifically focusing on their propulsion systems, structural characteristics, and aerodynamics, highlighting the points of differentiation. (4)

4) Explain the significance of the atmospheric entry phase for spacecraft, emphasizing its importance in light of the tragic event involving the space shuttle Columbia's explosion during re-entry, resulting in the loss of all astronauts on board. (3)

A)

B) Examine the lift curve provided in the figure for an infinite wing and discuss its performance characteristics. (4)




C) Identify several advanced materials that have replaced traditional metals in aircraft and describe their respective characteristics that make them suitable alternatives. (3)

5) There are several types of orbits around earth to which satellites are launched to. Provide an overview of two main earth orbits, their importance and characteristics. (4)

A)

B) Classify aircraft fuselage structures based on their weight carrying capabilities and stress loadings. (3)

C) Explain the impact of viscosity on fluid flow and the concept of the d'Alembert paradox. (3)

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