



SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF AEROSPACE ENGINEERING

Faculty Name : **Mr. N.Venkatesh,** Academic Year : **2024-2025**
AP/ Aero **(Even)**
 Year & Branch : **I Aero** Semester : **II**
 Course : **23AST101 Fundamentals of Aerospace Engineering**

TWO MARKS UNIT-2 AERODYNAMICS

Aerodynamic Forces on Aircraft

1. What are the primary aerodynamic forces acting on an aircraft?

The four primary aerodynamic forces are:

Lift: Acts perpendicular to the relative wind, opposing gravity.

Drag: Acts parallel to the relative wind, opposing thrust.

Thrust: Acts forward, generated by engines or propellers.

Weight: Acts downward due to gravity.

2. How does lift generation occur on an aircraft wing?

Lift is generated due to the pressure difference between the upper and lower surfaces of the wing. The curved shape (airfoil) of the wing causes air to move faster over the top surface, reducing pressure (Bernoulli's principle), while the lower surface experiences higher pressure, creating an upward force.

Drag Types

3. What is parasite drag, and what are its components?

Parasite drag is the drag caused by the aircraft's shape and surface roughness. It includes:

Form drag: Due to the shape of the aircraft.

Skin friction drag: Due to the friction between air and the aircraft's surface.

Interference drag: Due to the interaction of airflow between different parts of the aircraft.

4. What is induced drag, and how is it related to lift?

Induced drag is caused by the generation of lift. It occurs due to the vortices created at the wingtips, which result from the pressure difference between the upper and lower surfaces of the wing. It increases with higher angles of attack.

NACA Airfoils

5. What does NACA stand for, and what is its significance?

NACA stands for the National Advisory Committee for Aeronautics, which developed standardized airfoil shapes. NACA airfoils are widely used in aircraft design due to their predictable aerodynamic properties.

6. What do the numbers in a NACA airfoil designation represent?

For a 4-digit NACA airfoil (e.g., NACA 2412):

- The first digit (2) represents the maximum camber as a percentage of the chord.
 - The second digit (4) indicates the location of maximum camber from the leading edge (40% of the chord).
 - The last two digits (12) represent the maximum thickness as a percentage of the chord (12%).
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Mach Number

7. What is Mach number, and how is it calculated?

Mach number is the ratio of the speed of an object to the speed of sound in the surrounding medium. It is calculated as:

Mach number = Speed of object / Speed of sound

8. What are the different flight regimes based on Mach number?

- Subsonic: Mach < 0.8
 - Transonic: 0.8 < Mach < 1.2
 - Supersonic: 1.2 < Mach < 5.0
 - Hypersonic: Mach > 5.0
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Center of Pressure and Aerodynamic Center

9. What is the center of pressure (CP) on an airfoil?

The center of pressure is the point on an airfoil where the resultant aerodynamic force (lift and drag) acts. Its location changes with the angle of attack.

10. What is the aerodynamic center (AC), and why is it important?

The aerodynamic center is the point on an airfoil where the pitching moment remains constant regardless of the angle of attack. It is important for stability analysis and control.

Components of an Airplane

11. What are the primary components of an airplane?

- **Fuselage:** Main body, houses crew and payload.
- **Wings:** Generate lift.
- **Empennage (Tail):** Provides stability and control.
- **Engines:** Provide thrust.
- **Landing Gear:** Supports the aircraft during takeoff, landing, and taxiing.

12. What is the function of the empennage?

The empennage consists of the horizontal and vertical stabilizers, which provide

pitch and yaw stability, respectively. It also includes control surfaces like elevators and rudders.

Helicopter

13. How does a helicopter generate lift?

A helicopter generates lift using rotating blades (rotors). The angle of attack of the rotor blades is adjusted to create a pressure difference, producing lift.

14. What is the role of the tail rotor in a helicopter?

The tail rotor counters the torque produced by the main rotor, preventing the helicopter from spinning uncontrollably. It also provides yaw control.

Missiles

15. What are the main components of a missile?

- **Warhead:** Contains explosives or payload.
- **Guidance System:** Directs the missile to the target.
- **Propulsion System:** Provides thrust.
- **Control Surfaces:** Adjust the missile's trajectory.

16. What is the difference between a guided and unguided missile?

A guided missile uses a guidance system to adjust its trajectory, while an unguided missile follows a ballistic path without active control.

Space Vehicles

17. What are the stages of a space vehicle's flight?

- **Launch:** Powered ascent through the atmosphere.
- **Orbital Insertion:** Achieving stable orbit.
- **Mission Operations:** Conducting the intended mission.
- **Re-entry:** Returning to Earth (if applicable).

18. What is the function of a heat shield on a space vehicle?

A heat shield protects the vehicle from extreme temperatures during re-entry by dissipating heat and preventing structural damage.

General Aerodynamics

19. What is the significance of the Reynolds number in aerodynamics?

The Reynolds number determines whether the flow is laminar or turbulent. It is calculated as:

$$Re = \text{Inertial forces} / \text{Viscous forces} = \rho v L / \mu$$

where ρ is density, v is velocity, L is characteristic length, and μ is dynamic viscosity.

20. What is the critical angle of attack, and what happens when it is exceeded?

The critical angle of attack is the angle at which airflow over the wing becomes separated, causing a sudden loss of lift (stall). Exceeding this angle leads to a stall, reducing lift and increasing drag.