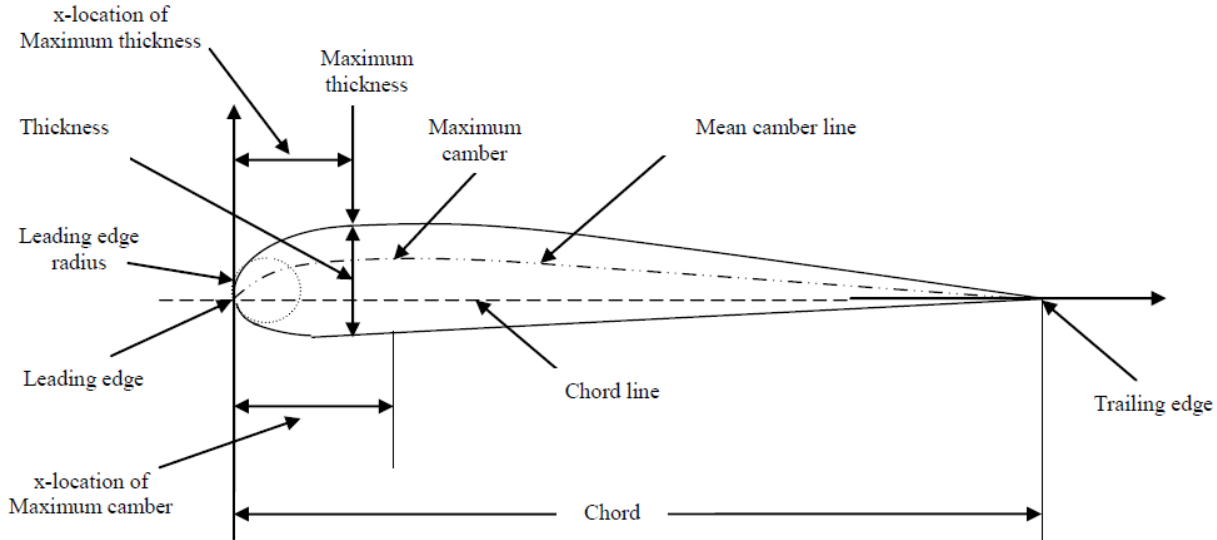


1. Nomenclature of an airfoil



Airfoil: the cross sectional shape is obtained by intersection of wing at perpendicular direction

Mean camber line: the locus of points halfway between the upper and lower surfaces as measured perpendicular to mean camber line itself.

Chord line: the straight line between the leading edge and trailing edge

Chord: the precise distance from the leading edge and trailing edge measured along the chord line.

Camber: the maximum distance between the mean camber line and chord line measured perpendicular to the chord line.

2. define aerodynamic centre

A particular point about which the moments are independent of angle of attack. This point is defined as the *aerodynamic center* for the wing.

3. define angle of attack (AOA):

The angle between centre line of an airfoil and relative wind or wind direction

4. define Mach Number

The ratio between velocity of the aircraft (object) and velocity of sound

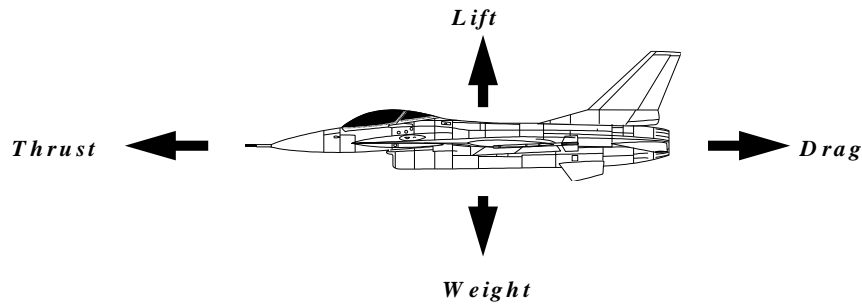
$$M = V/a$$

where

a = Velocity of sound

V = Velocity of the object

5. What are the aerodynamic forces acting on airplane?



Thrust – produced by engine or power plants

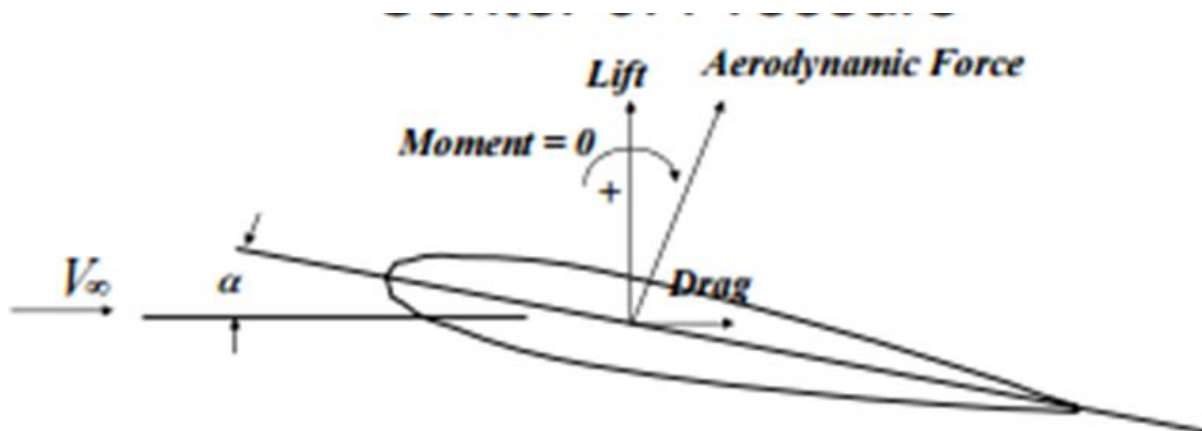
Drag – produced by atmospheric air

Lift – The component of the total aerodynamic force that acts at right angles to the resultant relative wind and generated by wings

Weight – produced by Aircraft

6. define centre of pressure

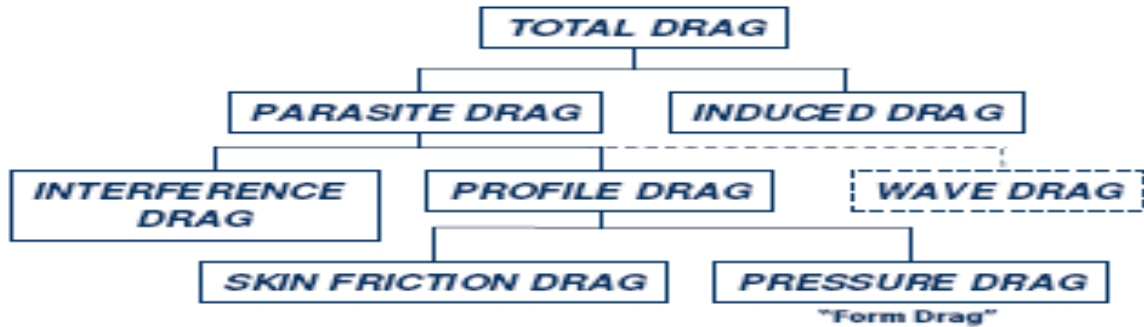
The point on the airfoil where the total moment due to aerodynamic forces is zero



7. what are the types of drag

a. **FORM DRAG--**

- ❖ The portion of drag that is generated because of the shape of the airplane.
- ❖ Generated in the turbulent areas of airflow where slipstream does not conform to aircraft shape.
- ❖ Varies directly with the airspeed



b. SKIN-FRICTION DRAG--

- ❖ The boundary layer air creates stagnant layer of air molecules.
- ❖ Drag is created when the slipstream comes in contact with this stagnant flow.
- ❖ Varies directly with the airspeed

c. INTERFERENCE DRAG--

- ❖ Created by the collision of airstreams.
- ❖ Causes eddy currents, restrictions, and turbulence to smooth flow.
- ❖ Varies directly with the airspeed.

d. INDUCED DRAG

- ❖ Drag created as a result of the production of lift.
- ❖ Induced drag creates wingtip vortices and vertical velocities.
- ❖ Varies inversely with the airspeed.

8. define Bernoulli's theorem

pressure is inversely proportional the velocity

9. define aspect ratio (AR):

The ratio between the wing area and the chord

$$AR = \frac{b^2}{s}$$

Where b^2 – wing area

s- Chord of the wing

10. How to choose the materials of the aircraft?

- ❖ strength
- ❖ stiffness
- ❖ density
- ❖ cost
- ❖ corrosion

11. What are the materials used for the aircraft?

- ❖ Aluminium
- ❖ composites
- ❖ steel
- ❖ titanium

12. define Boundary layer

The layer of air over the wing surface, which is slowed down or stopped by viscosity. The layer from the wing surface to a small height of the layer is called boundary layer.

13. Define international standard atmosphere (ISA)

The values of pressure, temperature and density at different altitudes are assumed to be constant. These assumptions based on established meteorological and physical observations, theories, and measurements and so the standard atmosphere is accepted internationally.

The assumptions are

1. the atmospheric pressure at mean sea level is equal to 14.7 psi
2. the temperature at mean sea level is 15⁰C
3. The temperature decreases by 1.98⁰C for every 1000ft.

14. what is the difference between service ceiling and absolute ceiling

Service ceiling:

That altitude where maximum R/C=100 ft/minute. it represents the practical upper limit of steady level flight.

Absolute Ceiling:

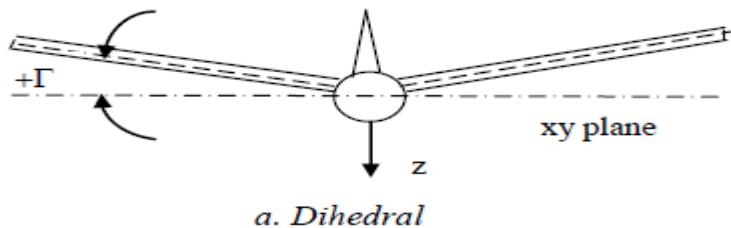
That altitude where maximum R/C = 0

15. Define stall angle.

the angle of attack at which the airfoil stalls; i.e. the lift coefficient will no longer increase with increasing angle of attack. The maximum lift coefficient that corresponds to stall angle is the maximum angle of attack. The stall angle is directly related to the flight safety

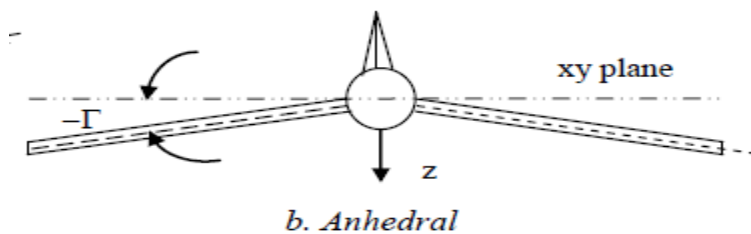
16. define Dihedral angle

The angle between the chord-line plane of a wing with the “xy” plane is referred to as the wing dihedral. Dihedral is to improve the lateral stability of the aircraft. The role of the wing dihedral angle is to induce a positive increase in angle of attack



17. define Anhedral angle

Fighter aircraft have Anhedral angle



18. what are the different types rocket engine

1. solid rocket engine
2. liquid rocket engine
3. Hybrid Rocket engine
4. Nuclear Rocket engine
5. Electrical rocket engine

19. what is the difference between Range and Endurance

Range – the total distance travelled by the airplane on a tank of fuel

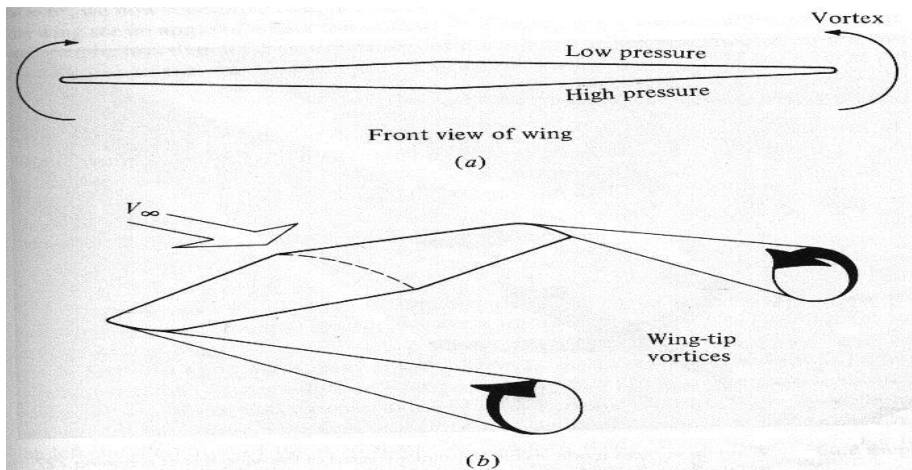
Endurance – the total time that an airplane stays in the air on a tank of fuel.

20. What are the classifications of Mach number?

- ❖ $M < 1$ Subsonic
- ❖ $M = 1$ Sonic
- ❖ $M > 1$ Supersonic
- ❖ $0.8 \leq M \leq 1.2$ Transonic
- ❖ $M > 5$ Hypersonic

21. define wing tip vortices

High pressure on the lower surface creates a natural airflow that makes its way to the wingtip and curls upward around it to the area of low pressure. When flow around the wingtips streams out behind the airplane, a vortex is formed. These twisters represent an energy loss and are strong enough to flip airplanes that blunder into them.'



22. What are the main components of structural members?

- ❖ Longerons
- ❖ Bulkhead
- ❖ spar
- ❖ Ribs
- ❖ Stringers
- ❖ Frame
- ❖ Strut
- ❖ empennage

23. what is the difference between stream line body and bluff body (refer class note)
24. what is the difference between symmetrical and cambered airfoil (refer class note)
- 25.

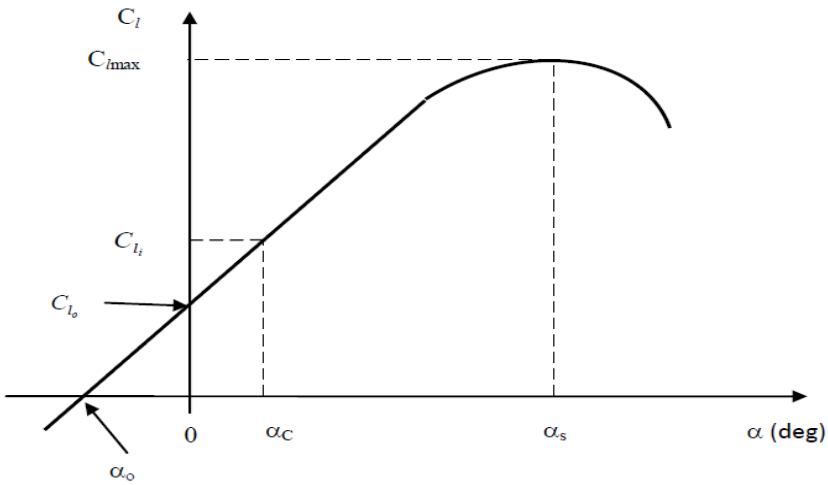


Figure 5.11. The variations of lift coefficient versus angle of attack

- 26.

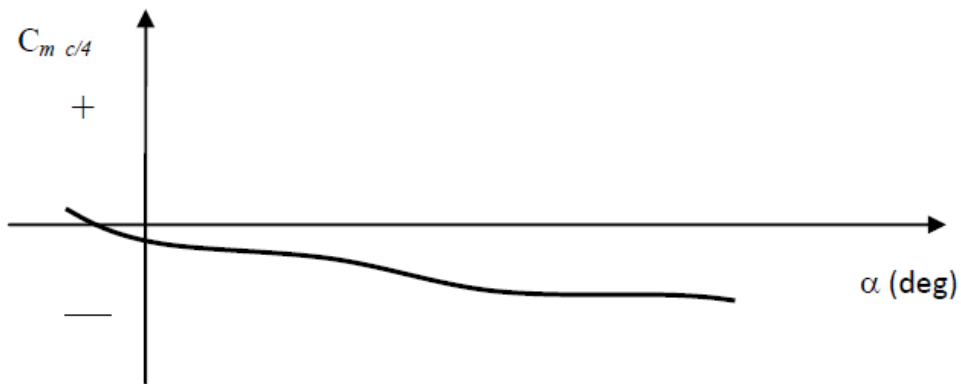


Figure 5.13. The variations of pitching moment coefficient versus angle of attack

- 27.

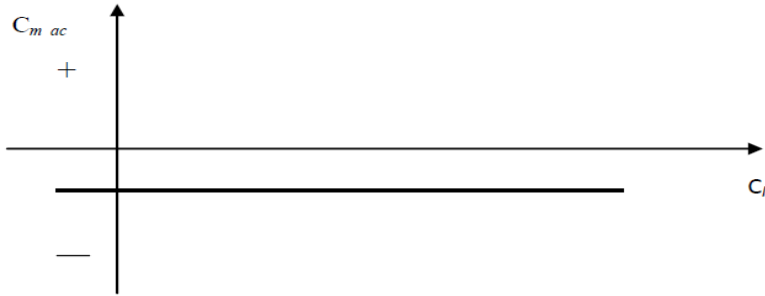


Figure 5.14. The variations of pitching moment coefficient versus lift coefficient

28.

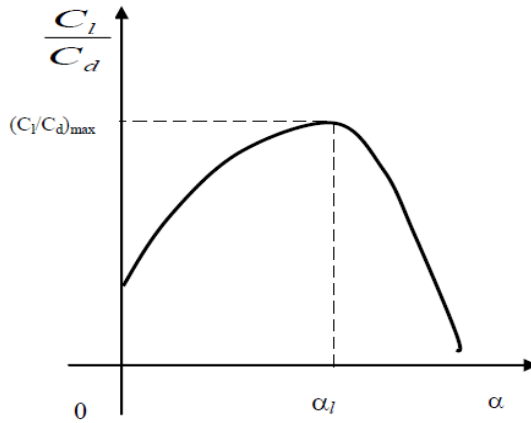


Figure 5.17. The typical variations of lift-to-drag ratio versus angle of attack

As it is noted, this graph has one maximum point where the value of the lift-to-drag ratio is the highest at this point. The angle of attack corresponding to this point is an optimum candidate for a loitering flight. The application of these four graphs and twelve parameters in the airfoil selection process will be introduced in the later sections.

29. The lift coefficient (C_L) =
$$\frac{L}{1/2\rho V^2 S}$$

30. The Drag Coefficient (C_D) =
$$\frac{D}{1/2\rho V^2 S}$$

31. The moment Coefficient (C_M) =
$$\frac{M}{1/2\rho V^2 S}$$

AE6302 ELEMENTS OF AERONAUTICS

UNIT –I

1. Development of aerodynamics over the years
2. Development of aircraft materials over the years
3. Development of aircraft structures over the years
4. evolution of the aircraft

UNIT –II

1. derive the relationship between P, T and Density
2. problem based on the above derivations
3. atmospheric properties

4. explain briefly the NACA Airfoils

UNIT – III

1. explain the major parts of an aircraft
2. explain the operation of powered and power assisted flight control systems and compare with conventional control system
3. classifications of flight vehicles
4. explain the operation flying instruments

UNIT-III

1. explain briefly the aircraft fuselage structures
2. explain briefly the aircraft wing structures
3. explain the aircraft materials like aluminium, titanium, composites, metallic and nonmetallic materials
4. explain the materials used in major components of an airplane

UNIT -V

1. explain the operation of turbojet engine with neat sketch
2. explain the operation of turbofan engine with neat sketch
3. explain the operation of Ramjet and Pulsejet engine with neat sketch
4. explain the operation of solid propellant and Liquid propellant Rocket system with neat sketch

