Theory of Flight Part I – Oct. 05/2017

4 Forces Acting on an Aircraft – pg. 15

1. **Thrust** → The force exerted by the engine and its propeller which pushes air backward that causes a reaction, or thrust, in the forward direction
2. **Drag** → The resistance to forward motion directly opposed to thrust
3. **Lift** → The upward force which sustains the airplane in flight
4. **Weight** → The downward force due to gravity, directly opposed to lift

*When the aircraft is in a state of **equilibrium**, thrust and drag are *equal and opposite**

Airfoil→ any surface designed to obtain a reaction from the air i.e. lift

Camber→ the curvature of an airfoil

Drag – pg. 17

1. **Parasite Drag** – drag that's created from parts of aircraft that *do not* produce lift ex. landing gear
   a) *Form Drag*→ drag created by the form or shape of a body on the aircraft ex. fuselage
   b) *Skin Friction*→the tendency of air flowing over a body to cling to its surface ex. dirt, dust, water
2. **Induced** Drag→ drag that's created from parts of the aircraft that produce lift ex. wings

Axes of an Aircraft – pg. 23, 24

1. **Longitudinal Axis** → extends length-wise through the fuselage (from nose to tail) → **ROLL - ailerons**
2. **Lateral Axis** → extends crosswise from wing-tip to wing-tip → **PITCH – elevators**
3. **Normal/Vertical Axis**→ passes vertically through the centre of gravity → **YAW – rudders**

*all axes pass through the **centre of gravity** (point which is the centre of the airplane's total weight).

Aerodynamic Couples – pg. 20

When two forces are equal and opposite, but parallel. A couple will cause a turning moment about a given axis.

Planform – pg. 21

The shape of the wing as seen from above

Aspect ratio → Divide the span of the wing (length of wing-tip to wing-tip) by the average chord (the width of the wing)

Flaps – pg. 22

Flaps increase the camber of the wing which, in turn, brings more lift. They give better take-off and landing performance. When used, flaps increase the camber which increases the negative pressure on top of the wing. Then at the same time, there's a greater pressure under the wing (which creates more lift). Flaps do increase drag, but again, they increase lift as well. The steeper the degree setting, the more drag produced (10 degrees – 40 degrees).

Slots and Slats – pg. 22

They are both fitted to the leading edge of the wing. They are used to create a smoother airflow over the wings.

Slats→ At high angles of attack, slats automatically move out ahead of the wing (the low pressure that sits behind the leading edge of the wing pulls the slat out).

Slots→ Passageways built into the wing (does not move).

Spoilers – pg. 22

Spoilers are devices on the wing that increase drag and decrease lift. Some spoilers are linked to ailerons or brake controls.

Speed Brakes – pg.22

Speed brakes are usually used on high performance aircrafts. They create drag without altering the curvature of the wing and are usually fitted far enough back to not disturb too much lift.

Airspeed Limitations – pg. 38

- **V_{NE}**: Never Exceed Speed
- **V_{NO}**: Maximum Structural Cruising Speed or Normal Operating Limit Speed
- **V_{SL}**: Power Off Stalling Speed (clean configuration)
- **V_{FE}**: Maximum Flaps Extended Speed
- **V_{SO}**: Power Off Stalling Speed (flaps and gear down)
- **V_A**: Manoeuvring Speed
- **V_B**: Maximum Gust Intensity Speed
- White arc → Flaps range
- Green arc → Normal range
- Yellow arc→ Caution range
- Red line→ Never exceed