

SECTION 1.3 AERODYNAMICS (AD)

Unit 1.3.1 CADC: CPL aerodynamics – all aircraft categories

1. Reserved

2. Aerodynamics

2.1 Terminology

2.1.1 Explain the following terms and their effect on lift and drag production:

- (a) aerofoil span, chord, camber, thickness/chord ratio;
- (b) relative airflow and angle of attack;
- (c) laminar and turbulent boundary layers.

2.1.2 Explain the different types of drag and state the effect on total drag resulting from changes in IAS, aircraft weight and height, if any.

2.2 Bernoulli's theorem and Coanda theory

2.2.1 Apply Bernoulli's theorem of constant energy flow to describe how an aerofoil produces lift, limited to the variation of kinetic energy (dynamic pressure) and potential energy (static pressure) as air flows through a venturi or over a aerofoil.

2.2.2 Explain Coanda theory and the effect on lift production.

2.3 Power requirements

2.3.1 Describe the power available and power required curves and best speeds for range and endurance, best rate of climb and best angle of climb.

2.4 Lift and drag

2.4.1 Explain the meaning of the following terms used in the lift and drag formulae viz:

- (a) C_L and C_D – depend on shape and angle of attack of an aerofoil;
- (b) $\frac{1}{2} \rho V^2$ – defines dynamic pressure (IAS);
- (c) S – defines surface area.

2.5 Manoeuvres

2.5.1 Explain the forces of lift, weight, thrust and drag acting on an aircraft in the following cases:

- (a) steady level flight;
- (b) a steady climb;
- (c) a steady descent;
- (d) a balanced level turn.

2.6 Performance considerations

2.6.1 Give reasons for flying for maximum still air range and endurance.

2.6.2 Given that certain flight conditions remain constant, explain the effect of changes in headwind/tailwind component on level flight range and endurance.

2.6.3 List/identify aerodynamic and engine considerations which are required to achieve maximum still air range and endurance when operating an aircraft with the following types of engine:

- (a) normally aspirated engine;
- (b) turbocharged/supercharged engine.

2.6.4 From (theoretical) power required and power available graphs identify the following:

- (a) best still air range speed;
- (b) best endurance speed;
- (c) maximum level flight speed.