

## Toetsmatrijs uitsluitend PPLA en LAPLA: Flight performance and planning (Mass and balance + Performance – aeroplanes) + Principles of flight – aeroplanes + Operational procedures

In deze toetsmatrijs staat wat u moet kunnen en kennen. De toetsmatrijs vormt daarom de basis van de opleiding en het examen.

<b>Opgesteld door:</b>	<b>CBR divisie CCV</b>
Categoriecode:	LVPAFPP (PPLA, LAPLA)
Toetsvorm:	Digitaal
Totaal aantal vragen:	22 meerkeuzevragen
Cesuur:	75% (17 van de 22 vragen goed)
Bijzonderheden:	Geen

Nr	Eindtermen
<b>030 00 00 00</b>	<b>FLIGHT PERFORMANCE AND PLANNING</b>
<b>031 00 00 00</b>	<b>Mass and Balance</b>
031 01 00 00	Purpose of mass-and-balance considerations
031 02 00 00	Loading
031 04 00 00	Mass and balance details of aircraft
031 05 00 00	Determination of cg position
031 06 00 00	Cargo Handling
<b>032 00 00 00</b>	<b>Performance – aeroplanes</b>
032 01 00 00	General
032 02 00 00	CS-23 performance class b (single-engine aeroplanes) - theory
032 03 00 00	CS-23/EU-OPS performance class B – use of aeroplane performance data for single- and multi-engine aeroplanes
<b>080 00 00 00</b>	<b>PRINCIPLES OF FLIGHT</b>
<b>081 00 00 00</b>	<b>Principles of flight – Aeroplanes</b>

081 01 00 00	Subsonic aerodynamics
081 03 00 00	Stall and upset prevention and recovery
081 04 00 00	Stability
081 05 00 00	Control
081 06 00 00	Limitations
081 07 00 00	Propellers
081 08 00 00	Flight mechanics
<b>070 00 00 00</b>	<b>OPERATIONAL PROCEDURES</b>
071 02 00 00	Special operational procedures and hazards (general aspects) → alleen 071 02 08 00 Special operational procedures and hazards (general aspects)

<b>Vastgesteld door:</b>	Technische Commissies Flight Performance and Planning (Mass and balance + Performance – aeroplanes) en Principles of flight – aeroplanes en Operational procedures
<b>Beoordeeld door:</b>	Logistiek, Transport en Personenvervoer raad; kamer 3: Luchtvaart <14 september 2018>
<b>Goedgekeurd door:</b>	Divisiemanager CCV <17 september 2018>
<b>Ingangsdatum:</b>	<1 april 2019>

### Toelichting

Eindtermen: Dit zijn de hoofdonderwerpen die in het examen voorkomen. Hierin staat 'ruim' omschreven wat er in het examen terug kan komen.

Toetstermen: Dit zijn onderdelen van een eindterm. Hierin staat meer uitgebreid omschreven wat er in het examen terug kan komen.

Tax: Dit is de taxonomiecode van Romiszowski. Deze code geeft aan op welk niveau de vragen over een toetsterm gesteld worden.

F = Feitelijke kennis. De kandidaat kan feiten reproduceren (herkennen of herinneren).

B = Begripsmatige kennis. De kandidaat kan begrippen of principes omschrijven.

R = Reproductieve vaardigheden. De kandidaat kan acties uitvoeren die volgens een vastgelegde procedure verlopen.

P = Productieve vaardigheden. De kandidaat kan acties uitvoeren waarbij hij zijn eigen creativiteit en inzicht nodig heeft.

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>030 00 00 00</b>	<b>FLIGHT PERFORMANCE AND PLANNING</b>			
<b>031 00 00 00</b>	<b>MASS AND BALANCE - AEROPLANES/HELICOPTERS</b>			
<b>031 01 00 00</b>	<b>Purpose of mass-and-balance considerations</b>			
<b>031 01 01 00</b>	<b>Mass limitations</b>			
<b>031 01 01 01</b>	<b><i>Importance with regard to structural limitations</i></b>			
(01)	Describe the relationship between aircraft mass and structural stress. <i>Remark - see also 021 01 01 00.</i>	B	X	X
(02)	Describe that mass must be limited to ensure adequate margins of strength.	B	X	X
<b>031 01 01 02</b>	<b><i>Importance with regard to performance</i></b> <i>Remark - see also subjects 032/034 and 081/082</i>			
(01)	Describe the relationship between aircraft mass and aircraft performance.	B	X	X
(02)	Describe that aircraft mass must be limited to ensure adequate aircraft performance.	B	X	X
<b>031 01 02 00</b>	<b>Centre-of-gravity (CG) limitations</b>			
<b>031 01 02 01</b>	<b><i>Importance with regard to stability and controllability</i></b> <i>Remark - see also subjects 081/082</i>			
(01)	Describe the relationship between CG position and stability/controllability of the aircraft.	B	X	X
(02)	Describe the consequences if CG is in front of the forward limit.	B	X	X
(03)	Describe the consequences if CG is behind the aft limit.	B	X	X
<b>031 02 00 00</b>	<b>Loading</b>			
<b>031 02 01 00</b>	<b>Terminology</b>			
<b>031 02 01 01</b>	<b>Mass terms</b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(01)	Define the following mass terms: - basic empty mass; - take-off mass; - landing mass; - ramp/taxi mass; - gross mass (the actual mass of an aircraft at a specified time); - zero fuel mass.	F	X	X
<b>031 02 01 02</b>	<b>Load terms (including fuel terms)</b> <i>Remark - see also subject 033</i>			
(01)	Define the following load terms: - block fuel; - taxi fuel; - take-off fuel; - trip fuel; - reserve fuel (contingency, alternate, final reserve fuel); - extra fuel	F	X	X
(02)	Explain the relationship between the various load-and-mass components listed in 031 02 01 01 and 031 02 01 0f2.	B	X	X
(03)	Calculate the mass of particular components from other given components.	P	X	X
(04)	Convert fuel mass, fuel volume and fuel density given in different units used in aviation.	R	X	X
<b>031 02 02 00</b>	<b>Mass limits</b>			
<b>031 02 02 01</b>	<b>Structural limitations</b>			
(01)	Define the maximum zero-fuel mass (the maximum permissible mass of an aircraft with no usable fuel).	F	X	X
(03)	Define maximum take-off mass.	F	X	X
(05)	Define the maximum landing mass.	F	X	X
<b>031 02 02 03</b>	<b>Baggage compartment limitations</b>			
(p01)	Describe baggage compartment limitations.	B	X	
<b>031 02 03 00</b>	<b>Mass calculations</b>			
<b>031 02 03 01</b>	<b>Maximum masses for take-off and landing</b>			
(03)	Calculate the allowed mass for take-off.	P	X	X

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>031 04 00 00</b>	<b>Mass and balance details of aircraft</b>			
<b>031 04 01 00</b>	<b>Contents of mass-and-balance documentation</b>			
<b>031 04 01 01</b>	<b><i>Datum, moment arm</i></b>			
(01)	State where the datum and moment-arms for aircraft can be found.	F	X	X
(02)	Extract appropriate data from given documents.	R	X	X
(03)	Define 'datum' (reference point), 'moment arm' and 'moment'.	F	X	X
<b>031 04 01 02</b>	<b><i>CG position as distance from datum</i></b>			
(01)	State where the CG position for an aircraft at basic empty mass can be found.	F	X	X
(02)	State where the CG limits for an aircraft can be found.	F	X	X
(03)	Describe the different forms in presenting CG position as distance from datum or other references.	B	X	X
(04)	Explain the meaning of centre of gravity (CG).	B	X	X
<b>031 04 01 04</b>	<b><i>Longitudinal CG limits</i></b>			
(01)	Extract the appropriate data from given sample documents.	R	X	X
<b>031 04 01 05</b>	<b><i>Lateral CG limits</i></b>			
(01)	Extract the appropriate data from given sample documents.	R		X
<b>031 04 01 06</b>	<b><i>Details of passenger and cargo compartments</i></b>			
(01)	Extract the appropriate data (e.g. seating schemes, compartment dimensions and limitations) from given sample documents.	R	X	X
<b>031 04 01 07</b>	<b><i>Details of fuel system relevant to mass-and-balance considerations</i></b>			
(01)	Extract the appropriate data (e.g. fuel-tank capacities and fuel-tank positions) from given sample documents.	R	X	X
<b>031 04 03 00</b>	<b>Extraction of basic empty mass (BEM) and CG data from aircraft documentation.</b>			
<b>031 04 03 01</b>	<b><i>Basic empty mass (BEM)</i></b>			
(01)	Extract values for BEM from given documents.	R	X	X
<b>031 04 03 02</b>	<b><i>CG position and/or moment at BEM</i></b>			
(01)	Extract values for CG position and moment at BEM from given documents.	R	X	X
<b>031 04 03 03</b>	<b><i>Deviations from standard configuration</i></b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(01)	Extract values from given documents for deviation from standard configuration as a result of varying crew, optional equipment, optional fuel tanks etc.	R	X	X
<b>031 05 00 00</b>	<b>Determination of cg position</b>			
<b>031 05 01 00</b>	<b>Methods</b>			
<b>031 05 01 01</b>	<b>Arithmetic method</b>			
(01)	Calculate the CG position of an aircraft by using the formula: $CG\ position = \frac{\text{sum of moments}}{\text{total mass}}$ .	P	X	X
<b>031 05 01 02</b>	<b>Graphic method</b>			
(01)	Determine the CG position of an aircraft by using the loading graphs given in sample documents.	R	X	X
<b>031 05 02 00</b>	<b>Load and trim sheet</b>			
<b>031 05 02 02</b>	<b>Load sheet and CG envelope for light aeroplanes and for helicopters</b>			
(01)	Add loading data and calculate masses in a sample load sheet.	P	X	X
(02)	Calculate moments and CG positions.	P	X	X
(03)	Check CG position at zero fuel mass and take-off mass to be within CG envelope including last minute changes, if applicable.	R	X	X
<b>031 06 00 00</b>	<b>Cargo Handling</b>			
<b>031 06 03 00</b>	<b>Securement of load</b>			
<b>031 06 03 01</b>	<b>Securement of load (reasons and methods)</b>			
(01)	Explain the reasons to restrain or secure cargo and baggage.	B	X	X

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>030 00 00 00</b>	<b>FLIGHT PERFORMANCE AND PLANNING</b>			
<b>032 00 00 00</b>	<b>PERFORMANCE - AEROPLANES</b>			
<b>032 01 00 00</b>	<b>General</b>			
<b>032 01 02 00</b>	<b>General Performance Theory</b>			
<b>032 01 02 01</b>	<b><i>Stages of flight</i></b>			
(p01)	Describe the following stages of flight: - Take off, - Climbing flight, - Level flight, - Descending flight, - Approach and landing	B	X	
<b>032 01 02 02</b>	<b><i>Definitions and terms</i></b>			
(02)	Define the terms 'flight path angle' and 'flight path gradient'.	F	X	
(03)	Define the terms 'descent angle' and 'descent gradient'.	F	X	
(04)	Explain the difference between climb/descent angle (air-mass related) and flight path angle (ground related).	B	X	
(05)	Define 'service ceiling' and 'absolute ceiling' for single engine aircraft.	F	X	
(06)	Describe 'clearway' and 'stopway'.	B	X	
(07)	Describe: - take-off run available (TORA); - take-off distance available (TODA); - accelerate stop distance available (ASDA); - Landing Distance Available (LDA) and determine from given data and/or appropriate aerodrome charts.	B	X	
(09)	Define the terms 'range' and 'endurance',	F	X	
<b>032 01 02 03</b>	<b><i>Variables influencing performance</i></b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(01)	Name and understand the following factors that affect aeroplane performance, particularly: - pressure altitude and temperature; - density altitude; - wind; - aeroplane weight; - aeroplane configuration; - aerodrome runway surface; - aerodrome runway slope.	F	X	
<b>032 01 03 00</b>	<b>Level flight, range and endurance</b>			
<b>032 01 03 01</b>	<b>Steady level flight</b>			
(05)	Describe situations in which a pilot may elect to fly for 'maximum endurance' or 'maximum range'.	B	X	
(p01)	Explain the effects of power setting, wind, altitude and aircraft configuration on range and endurance.	B	X	
<b>032 01 04 00</b>	<b>Climbing</b>			
<b>032 01 04 01</b>	<b>Climbing (climb performance)</b>			
(01)	Resolve the forces during a steady climb.	R	X	
(02)	Define and explain the following terms: - speed for best angle of climb ( $V_x$ ); - speed for best rate of climb ( $V_y$ ).	F	X	
(06)	Define the terms 'climb angle' and 'climb gradient'.	F	X	
(07)	Explain the effect of weight on the climb angle and rate of climb, and on the speed for best angle and best rate of climb.	B	X	
(08)	Explain the effects of pressure altitude and temperature (angle and rate of climb).	B	X	
(09)	Explain the effect of configuration on climb performance (angle and rate of climb and $V_x$ and $V_y$ ).	B	X	
<b>032 01 05 00</b>	<b>Descending</b>			
<b>032 01 05 01</b>	<b>Descending (descent performance)</b>			
(01)	Resolve the forces during steady descent and in the glide.	R	X	
(p01)	Explain the effect of mass, altitude, wind, speed and configuration on the glide descent.	B	X	
<b>032 02 00 00</b>	<b>CS-23 performance class b (single-engine aeroplanes) - theory</b>			
<b>032 02 01 00</b>	<b>Airworthiness requirements</b>			
<b>032 02 01 01</b>	<b>Airworthiness requirements and definitions</b>			



<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(01)	Define the following speeds according to CS-23: - Stall speeds $V_S$ , $V_{S0}$ and $V_{S1}$ ; - Rotation speed $V_{Ri}$ , - Speed at 50 ft above the take-off surface level; - Approach speed (1,3x $V_S$ ).	F	X	
(02)	Describe the limitations on VR and approach speed, and given the appropriate stall speed estimate the values based on these limitations for a single-engine aeroplane.	B	X	
<b>032 02 03 00</b>	<b>Take-off and landing</b>			
<b>032 02 03 01</b>	<b>Take-off and landing (definitions and effects)</b>			
(01)	Define the following distances: – take-off distance; – landing distance; – ground-roll distance.	F	X	
(02)	Explain the effect of flap-setting on the take-off distance and landing ground-roll distance.	B	X	
(03)	Explain the effects of the following runway (RWY) variables on take-off distances: – RWY slope; – RWY surface conditions: dry, wet and contaminated; paved and grass; – RWY elevation.	B	X	
(06)	Explain the effect of wind on take-off and landing distance and determine the actual head/tailwind component given runway direction, and wind speed and direction, by use of wind component graphs, mathematical calculations, and rule of thumb.	B	X	
(07)	Explain why an aeroplane has maximum crosswind limit(s) and determine the crosswind component given runway direction, and wind speed and direction, by use of wind component graphs, mathematical calculations, and rule of thumb.	B	X	
(09)	Explain the effect of runway conditions on the landing distance.	B	X	
(10)	Explain the effects of pressure altitude and temperature on the take-off distance, take-off climb, landing distance and approach.	B	X	
(11)	Describe the landing airborne distance and ground roll distance and estimate the effect on the landing distance when the aeroplane is too fast or too high.	B	X	
(p01)	Explain the use of a safety factor in take-off and landing calculations.	B	X	
<b>032 03 00 00</b>	<b>CS-23/EU-OPS performance class B – use of aeroplane performance data for single -engine aeroplanes</b>			
<b>032 03 03 00</b>	<b>Use of Aeroplane Performance data</b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>032 03 03 01</b>	<b>Take-off</b>			
(p01)	Determine the take-off distance and ground roll distance from given aircraft performance data (graphic or tabular data) and airfield data.	R	X	
<b>032 03 03 04</b>	<b>Landing</b>			
(p01)	Determine the landing distance and ground roll distance from given aircraft performance data (graphic or tabular data) and airfield data.	R	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>080 00 00 00</b>	<b>PRINCIPLES OF FLIGHT</b>			
<b>081 00 00 00</b>	<b>PRINCIPLES OF FLIGHT – AEROPLANES</b>			
<b>081 01 00 00</b>	<b>Subsonic aerodynamics</b>			
<b>081 01 01 00</b>	<b>Basic concepts, laws and definitions</b>			
<b>081 01 01 01</b>	<b>Laws and definitions</b>			
(01)	List the international system of units of measurement (SI) for mass, weight, velocity, density, temperature, pressure, force and power.	F	X	
(02)	Define 'mass', 'force', and 'weight'.	F	X	
(03)	State and interpret Newton's first and second law of motion.	F	X	
(04)	Explain air density.	B	X	
(05)	List the atmospheric properties that effect air density.	F	X	
(06)	Explain how temperature and pressure changes affect air density.	B	X	
(07)	Define 'static pressure'.	F	X	
(09)	State the formula for 'dynamic pressure'.	F	X	
(11)	State Bernoulli's equation for incompressible flow.	F	X	
(12)	Define 'total pressure'.	F	X	
(13)	Apply Bernoulli's equation to flow through a venturi system tube for incompressible flow.	R	X	
(14)	Describe how the IAS is acquired from the pitot-static system.	B	X	
(16)	Explain the equation of continuity and its application to the flow through a stream tube.	B	X	
(17)	Define 'IAS', 'CAS' and 'TAS'.	F	X	
<b>081 01 01 02</b>	<b>Basics of airflow</b>			
(01)	Describe steady and unsteady airflow.	B	X	
(02)	Explain the concept of a streamline.	B	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(04)	Explain the difference between two- and three-dimensional airflow.	B	X	
<b>081 01 01 03</b>	<b><i>Aerodynamic forces on aerofoils</i></b>			
(01)	Describe the originating point and direction of the resultant force caused by the pressure distribution around an aerofoil.	B	X	
(02)	Resolve the resultant force into the components 'lift' and 'drag'.	R	X	
(03)	Describe the direction of lift and drag.	B	X	
(08)	Define 'angle of attack' ( $\alpha$ ) as the angle between the chord line and the undisturbed airflow.	F	X	
<b>081 01 01 04</b>	<b><i>Shape of an aerofoil section</i></b>			
(01)	Describe the following parameter of an aerofoil section: leading edge.	B	X	
(02)	Describe the following parameter of an aerofoil section: trailing edge.	B	X	
(03)	Describe the following parameter of an aerofoil section: chord line.	B	X	
(06)	Describe the following parameter of an aerofoil section: camber line.	B	X	
(07)	Describe the following parameter of an aerofoil section: camber.	B	X	
(09)	Describe a symmetrical and an asymmetrical aerofoil section.	B	X	
<b>081 01 01 05</b>	<b><i>Wing shape</i></b>			
(01)	Describe the following parameters of a wing: span.	B	X	
(02)	Describe the following parameters of a wing: tip and root chord.	B	X	
(04)	Describe the following parameters of a wing: wing area.	B	X	
(08)	Describe the following parameters of a wing: aspect ratio.	B	X	
(09)	Describe the following parameters of a wing: dihedral angle and anhedral.	B	X	
(12)	Describe the following parameters of a wing: angle of incidence (the angle between the aeroplane longitudinal axis and the wing-root chord line).	B	X	
<b>081 01 02 00</b>	<b><i>The two-dimensional airflow around an aerofoil</i></b>			
<b>081 01 02 01</b>	<b><i>Streamline pattern</i></b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(01)	Describe the streamline pattern around an aerofoil.	B	X	
(02)	Describe converging and diverging streamlines, and their effect on static pressure and velocity.	B	X	
(03)	Describe upwash and downwash.	B	X	
<b>081 01 02 02</b>	<b>Stagnation point</b>			
(01)	Describe the stagnation point.	B	X	
(02)	Explain the movement of the stagnation point as the $\alpha$ changes.	B	X	
<b>081 01 02 03</b>	<b>Pressure distribution</b>			
(01)	Describe pressure distribution and local speeds around an aerofoil including effects of camber and $\alpha$ .	B	X	
(02)	Describe where the minimum local static pressure is typically situated on an aerofoil.	B	X	
<b>081 01 02 04</b>	<b>Centre of pressure (CP)</b>			
(01)	Define the centre of pressure.	F	X	
<b>081 01 02 07</b>	<b>Influence of angle of attack (<math>\alpha</math>)</b>			
(01)	Describe the influence of $\alpha$ on lift.	B	X	
<b>081 01 03 00</b>	<b>The coefficients</b>			
<b>081 01 03 02</b>	<b>The lift coefficient (<math>C_L</math>)</b>			
(01)	Explain the lift formula and the factors that affect lift.	B	X	
(02)	Describe the effect of camber on the $C_L - \alpha$ graph (symmetrical and positively cambered aerofoils).	B	X	
(04)	Define $C_{LMAX}$ (maximum lift coefficient) and $\alpha_{CRIT}$ (stalling $\alpha$ ) on the graph.	F	X	
<b>081 01 03 03</b>	<b>Drag</b>			
(01)	Describe the two-dimensional drag formula and the $C_D - \alpha$ curve.	B	X	
(02)	Discuss the effect of the shape of a body, cross-sectional area, and surface roughness on drag coefficient.	B	X	
(p01)	Explain why the $C_L - C_D$ ratio is important as a measure of performance.	B	X	
<b>081 01 04 00</b>	<b>Three-dimensional airflow around an aeroplane</b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>081 01 04 02</b>	<b>Streamline pattern</b>			
(01)	Describe the general streamline pattern around the wing, tail section and fuselage.	B	X	
(02)	Explain and describe the causes of spanwise flow over top and bottom surfaces.	B	X	
(03)	Describe wing tip vortices and the contribution to downwash behind the wing.	B	X	
(04)	Explain why wing tip vortices vary with $\alpha$ .	B	X	
(06)	Describe the causes, distribution and duration of the wake turbulence behind an aeroplane.	B	X	
<b>081 01 04 03</b>	<b>Induced drag</b>			
(01)	Explain the factors that cause induced drag.	B	X	
(03)	Describe the relationship between induced drag and total drag in straight and level flight with variable speed.	B	X	
(04)	Describe the effect of mass on induced drag at a given IAS.	B	X	
(05)	Describe the means to reduce induced drag: - aspect ratio; - winglets; - tip tanks.	B	X	
(10)	Explain the relationship between induced drag and: - speed; - aspect ratio.	B	X	
<b>081 01 05 00</b>	<b>Total drag</b>			
<b>081 01 05 02</b>	<b>Parasite drag</b>			
(01)	Describe the types of drag that are included in parasite drag.	B	X	
(02)	Describe form (pressure) drag and the factors which affect its magnitude.	B	X	
(03)	Describe interference drag and the factors which affect its magnitude.	B	X	
(04)	Describe friction drag and the factors which affect its magnitude.	B	X	
<b>081 01 05 03</b>	<b>Parasite drag and speed.</b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(01)	Describe the relationship between parasite drag and speed.	B	X	
<b>081 01 05 05</b>	<b>Total drag and speed</b>			
(01)	Explain the total drag – speed graph and the constituent drag components.	B	X	
(02)	Indicate the speed for minimum drag.	B	X	
<b>081 01 05 07</b>	<b>Variables affecting the total drag-speed graph</b>			
(01)	Describe the effect of aeroplane gross mass on total drag.	B	X	
(02)	Describe the effect of pressure altitude on total drag.	B	X	
(03)	Describe speed stability from the graph.	B	X	
(04)	Describe non-stable, neutral and stable IAS regions.	B	X	
(05)	Explain what happens to the IAS and drag in the non-stable region if speed suddenly decreases and why this could occur.	B	X	
<b>081 01 06 00</b>	<b>Ground effect</b>			
<b>081 01 06 01</b>	<b>Influence of ground effect</b>			
(01)	Explain the influence of ground effect on wing tip vortices and drag.	B	X	
<b>081 01 06 04</b>	<b>Effect on take-off and landing characteristics of an aeroplane</b>			
(01)	Describe the influence of ground effect on take-off and landing characteristics and performance of an aeroplane.	B	X	
<b>081 01 09 00</b>	<b><math>C_{Lmax}</math> augmentation</b>			
<b>081 01 09 01</b>	<b>Trailing edge flaps and the reasons for their use in take-off and landing</b>			
(01)	Describe or identify the following types of trailing-edge flaps: <ul style="list-style-type: none"> <li>- split flaps;</li> <li>- plain flaps;</li> <li>- slotted flaps;</li> <li>- Fowler flaps.</li> </ul>	B	X	
(02)	Describe how the wing's effective camber increases the $C_L$ and $C_D$ , and the reasons why this can be beneficial.	B	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(03)	Describe their effect on: <ul style="list-style-type: none"> <li>- the location of CP;</li> <li>- pitching moments (due to wing CP movement);</li> <li>- stall speed.</li> </ul>	B	X	
(04)	Compare their influence on the $C_L - \alpha$ graph: <ul style="list-style-type: none"> <li>- indicate the variation in <math>C_L</math> at any given <math>\alpha</math>.</li> <li>- indicate their effect on <math>C_{LMAX}</math>;</li> <li>- indicate their effect on critical <math>\alpha</math>.</li> </ul>	R	X	
(07)	Describe flap asymmetry: <ul style="list-style-type: none"> <li>-explain the effect on aeroplane controllability.</li> </ul>	B	X	
(08)	Describe trailing-edge flap effect on take-off and landing: <ul style="list-style-type: none"> <li>- explain the advantages of lower-nose attitudes;</li> <li>- explain why take-off and landing speeds/distances are reduced.</li> </ul>	B	X	
(09)	Explain the effects of flap-setting errors, such as mis-selection and premature/late extension or retraction of flaps, on: <ul style="list-style-type: none"> <li>- take-off and landing distance and speeds;</li> <li>- climb and descent performance.</li> </ul>	B	X	
<b>081 01 09 02</b>	<b><i>Leading edge devices and the reasons for use in take-off and landing</i></b>			
(01)	Describe slats.	B	X	
(02)	Describe the function of the slot.	B	X	
(04)	Explain the effect of slats on the stall speed, also in comparison with trailing edge flaps.	B	X	
(07)	Describe slat asymmetry: <ul style="list-style-type: none"> <li>- describe the effect on aeroplane controllability.</li> </ul>	B	X	
(08)	Explain the reasons for using leading-edge high-lift devices on take-off and landing: <ul style="list-style-type: none"> <li>- explain the disadvantage of increased nose-up attitudes;</li> <li>- explain why take-off and landing speeds/distances are reduced.</li> </ul>	B	X	
<b>081 01 12 00</b>	<b>Aerodynamic degradation</b>			



<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>081 01 12 01</b>	<b>Ice and other contamination</b>			
(02)	Explain the aerodynamic effects of ice and other contaminants on: <ul style="list-style-type: none"> <li>– lift (maximum <math>C_L</math>);</li> <li>– drag;</li> <li>– stall speed;</li> <li>– <math>\alpha_{crit}</math>;</li> <li>– stability and controllability.</li> </ul>	B	X	
<b>081 03 00 00</b>	<b>Stall and upset prevention and recovery</b>			
<b>081 03 01 00</b>	<b>The stall</b>			
<b>081 03 01 01</b>	<b>Flow separation at increasing <math>\alpha</math></b>			
(01)	Define the 'boundary layer'.	F	X	
(06)	State that the laminar boundary layer separates easier than the turbulent layer does.	F	X	
(08)	Define the 'separation point' and describe its location as a function of $\alpha$ .	F	X	
(09)	Define $\alpha_{CRIT}$ .	F	X	
(10)	Describe in straight and level flight the influence of increasing the $\alpha$ on: <ul style="list-style-type: none"> <li>- the forward stagnation point;</li> <li>- the pressure distribution;</li> <li>- the CP location (straight wing).</li> <li>- <math>C_L</math>.</li> <li>- <math>C_D</math> and D (drag);</li> </ul>	B	X	
(11)	Explain what causes the possible natural buffet on the controls and on the aeroplane in a pre-stall condition.	B	X	
(12)	Describe the effectiveness of the flight controls in a pre-stall condition.	B	X	
(13)	Describe and explain the normal post-stall behaviour of a straight-wing aeroplane.	B	X	
(14)	Describe the effect and dangers of using the controls close to the stall.	B	X	
<b>081 03 01 02</b>	<b>The stall speed</b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(p01)	Define the stall speed.	F	X	
(03)	Describe and explain the influence of the following parameters on the stall speed: - CG; - thrust component ; - propeller slipstream; - mass; - wing contamination; - altitude (neglecting compressibility effects).	B	X	
(04)	Define the 'load factor n'.	F	X	
(05)	Explain why the load factor increases in a turn.	B	X	
(06)	Explain why the load factor increases in a pull-up and decreases in a push-over manoeuvre.	B	X	
(07)	Describe and explain the influence of the load factor 'n' on the stall speed.	B	X	
(08)	Explain the expression 'accelerated stall'.	B	X	
<b>081 03 01 03</b>	<b>The initial stall in span-wise direction</b>			
(01)	Describe the initial stall sequence on a rectangular planform.	B	X	
(02)	Explain the purpose of washout.	B	X	
<b>081 03 01 04</b>	<b>Stall warning</b>			
(01)	Explain why stall warning is necessary.	B	X	
(02)	Describe aerodynamic and artificial stall warnings.	B	X	
(04)	Describe: - buffet; - stall strip; - flapper switch (leading edge stall warning vane).	B	X	
(05)	Describe the recovery after: - stall warning; - stall.	B	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>081 03 01 05</b>	<b>Special phenomena of stall</b>			
(02)	Explain the difference between power-off and power-on stalls and recovery.	B	X	
(03)	Describe stall and recovery in a climbing and descending turn.	B	X	
(04)	Describe the effect on stall and recovery characteristics of a T-tailed aeroplane.	B	X	
(07)	Describe the factors that can lead to the absence of stall warning and explain the associated risks.	B	X	
(12)	Explain the effect of a contaminated wing on the stall speed and $\alpha_{CRIT}$ .	B	X	
<b>081 03 01 06</b>	<b>The spin</b>			
(03)	Describe a spin (including the term 'incipient' spin), how to recognize a spin in terms of aircraft attitude and airspeed, and describe the general recovery technique.	B	X	
<b>081 04 00 00</b>	<b>Stability</b>			
<b>081 04 01 00</b>	<b>Static and dynamic stability</b>			
<i>081 04 01 01</i>	<i>Basics and definitions</i>			
(01)	Define 'static stability': - describe/identify a statically stable, neutral and unstable condition (positive, neutral and negative static stability).	F	X	
(03)	Explain why static stability is the opposite of manoeuvrability, and state that SEP aeroplanes are designed to be statically stable.	B	X	
(04)	Define 'dynamic stability': - describe/identify a dynamically stable, neutral and unstable motion (positive, neutral and negative dynamic stability).	F	X	
<b>081 04 03 00</b>	<b>Static and dynamic longitudinal stability</b>			
<b>081 04 03 01</b>	<b>Methods for achieving balance</b>			
(01)	Explain the stabiliser as the means to achieve balance about the lateral axis.	B	X	
<b>081 04 03 02</b>	<b>Static longitudinal stability</b>			
(01)	Discuss the effect of the CG location on pitch manoeuvrability and longitudinal stability.	B	X	
<b>081 04 03 05</b>	<b>Location of centre of gravity (CG)</b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(02)	Explain the CG forward and aft limits with respect to: - longitudinal control forces; - elevator effectiveness; - stability.	B	X	
<b>081 04 04 00</b>	<b>Static directional stability</b>			
<b>081 04 04 01</b>	<b>Definition and effects of static directional stability</b>			
(01)	Define 'static directional stability'.	F	X	
(02)	Explain the effects of static directional stability being too weak or too strong.	B	X	
<b>081 04 04 05</b>	<b>Factors affecting static directional stability</b>			
(01)	Describe how the fin contributes to static directional stability.	B	X	
<b>081 04 05 00</b>	<b>Static lateral stability</b>			
<b>081 04 05 01</b>	<b>Definition and effects of static lateral stability</b>			
(01)	Define 'static lateral stability'.	F	X	
<b>081 04 05 04</b>	<b>Contribution of sideslip angle <math>\beta</math></b>			
(01)	Explain how without coordination, the bank angle ( $\emptyset$ ) creates sideslip angle ( $\beta$ ).	B	X	
<b>081 04 05 06</b>	<b>Factors affecting static lateral stability</b>			
(01)	Explain the contribution to the static lateral stability of: - dihedral, anhedral; - high wing, low wing.	B	X	
<b>081 04 06 00</b>	<b>Dynamic lateral/directional stability</b>			
<b>081 04 06 02</b>	<b>Tendency to spiral dive</b>			
(03)	Describe a spiral dive with respect to deviations in speed, bank angle, nose low-pitch attitude. and decreasing altitude.	B	X	
(p01)	Describe the differences between a spiral dive and a spin.	B	X	
(p02)	Describe the recovery procedure for a spiral dive.	B	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>081 05 00 00</b>	<b>Control</b>			
<b>081 05 01 00</b>	<b>General</b>			
<b>081 05 01 01</b>	<b>Basics - The three planes and three axes</b>			
(01)	Define: - lateral axis; - longitudinal axis; - normal axis.	F	X	
(03)	Describe the motion about the three axes (pitch, roll and yaw).	B	X	
(04)	Name and describe the devices that control these motions.	F	X	
<b>081 05 01 02</b>	<b>Camber change</b>			
(01)	State that camber is changed by movement of a control surface and explain the effect.	F	X	
<b>081 05 02 00</b>	<b>Pitch (longitudinal) control</b>			
<b>081 05 02 01</b>	<b>Elevator/all flying tails</b>			
(01)	Explain the working principle of the elevator/all flying tails and describe its function.	B	X	
(p01)	Describe the characteristics of a T-tail.	B	X	
<b>081 05 02 05</b>	<b>Moments due to engine thrust</b>			
(01)	Describe the effect of engine thrust on pitch.	B	X	
<b>081 05 03 00</b>	<b>Yaw (directional) control</b>			
<b>081 05 03 01</b>	<b>The rudder</b>			
(01)	Explain the working principle of the rudder and describe its function.	B	X	
<b>081 05 04 00</b>	<b>Roll (lateral) control</b>			
<b>081 05 04 01</b>	<b>Ailerons</b>			
(01)	Explain the functioning of ailerons.	B	X	
(05)	Describe the use of aileron deflection in normal flight, flight with sideslip, crosswind landings and turns.	B	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>081 05 04 04</b>	<b>Adverse yaw</b>			
(01)	Explain why the use of ailerons induces adverse yaw.	B	X	
<b>081 05 04 05</b>	<b>Means to avoid adverse yaw</b>			
(01)	Explain how the following reduce adverse yaw: - Frise ailerons; - differential ailerons deflection.	B	X	
<b>081 05 05 00</b>	<b>Roll/yaw interaction</b>			
<b>081 05 05 01</b>	<b>Explain roll/yaw interaction</b>			
(01)	Explain the secondary effect of roll.	B	X	
(02)	Explain the secondary effect of yaw.	B	X	
<b>081 05 06 00</b>	<b>Means to reduce control forces</b>			
<b>081 05 06 01</b>	<b>Aerodynamic balance</b>			
(01)	Describe the purpose of aerodynamic balance.	B	X	
(02)	Describe the working principle of the horn balance.	B	X	
(04)	Describe the working principle and application of: - balance tab; - anti-balance tab.	B	X	
<b>081 05 08 00</b>	<b>Trimming</b>			
<b>081 05 08 01</b>	<b>Reasons to trim</b>			
(01)	State the reasons for using trimming devices.	F	X	
(02)	Explain the difference between a trim tab and the various balance tabs.	B	X	
<b>081 05 08 02</b>	<b>Trim tabs</b>			
(01)	Describe the working principle of a trim tab including cockpit indications.	B	X	
<b>081 06 00 00</b>	<b>Limitations</b>			
<b>081 06 01 00</b>	<b>Operating limitations</b>			
<b>081 06 01 01</b>	<b>Flutter</b>			
(01)	Describe the phenomenon of flutter and how IAS and mass distribution affects the likelihood of flutter occurrence.	B	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(02)	Describe the use of control surface mass balance to alleviate the flutter problem by adjusting the mass distribution.	B	X	
(03)	State how to avoid flutter, and possible actions if flutter occurred.	F	X	
<b>081 06 01 03</b>	<b>Flap operating</b>			
(03)	Define $V_{FE}$ and describe flap limiting speeds.	F	X	
<b>081 06 01 04</b>	<b><math>V_{NO}</math> and <math>V_{NE}</math></b>			
(01)	Define $V_{NO}$ and $V_{NE}$ .	F	X	
(03)	Explain the hazards of flying at speeds close to $V_{NE}$ .	B	X	
<b>081 06 02 00</b>	<b>Manoeuvring envelope</b>			
<b>081 06 02 01</b>	<b>Manoeuvring load diagram</b>			
(01)	Describe the manoeuvring-load diagram.	B	X	
(02)	Define limit and ultimate load factor, and explain what can happen if these values are exceeded.	F	X	
(03)	Define $V_A$ .	F	X	
(04)	Identify and explain the varying features on the V-n diagram: - load factor 'n'; - speed scale; - $C_{LMAX}$ boundary; - $V_A$ .	R	X	
(06)	State the positive manoeuvring load factor limit applicable to CS-23 aeroplanes in the normal category.	F	X	
(08)	Explain the significance of $V_A$ and the adverse consequences of applying full, abrupt nose-up elevator deflection when exceeding $V_A$ .	B	X	
<b>081 06 02 02</b>	<b>Factors affecting the manoeuvring load diagram.</b>			
(01)	State the relationship of mass to: - load factor limits; - $V_A$ and state that if a single value for $V_A$ is given, it will be at the aeroplane's maximum structural take-off mass.	F	X	
<b>081 06 03 00</b>	<b>Gust envelop</b>			
<b>081 06 03 01</b>	<b>Gust-load diagram</b>			

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(p01)	State that $V_{NO}$ is the maximum operating airspeed in rough air for CS-23 aircraft.	F	X	
<b>081 07 00 00</b>	<b>Propellers</b>			
<b>081 07 01 00</b>	<b>Conversion of engine torque to thrust</b>			
<b>081 07 01 01</b>	<b><i>Explain conversion of aerodynamic force on a propeller blade</i></b>			
(01)	Explain resolution of aerodynamic force on a propeller blade element into lift and drag or thrust and torque. <i>Remark: In de examens wordt voor 'torque' de term 'weerstand' of 'draaiweerstand' gebruikt.</i>	B	X	
(02)	Describe how propeller thrust varies with IAS.	B	X	
<b>081 07 01 02</b>	<b><i>Relevant propeller parameters</i></b>			
(01)	Describe the geometry of a typical propeller blade element at the reference section: - pitch or blade angle.	B	X	
(02)	Describe how the terms 'fine pitch' and 'coarse pitch' can be used to express blade angle.	B	X	
<b>081 07 01 03</b>	<b><i>Blade twist</i></b>			
(01)	Define 'blade twist'.	F	X	
(02)	Explain why blade twist is necessary.	B	X	
<b>081 07 01 04</b>	<b><i>Fixed pitch and variable pitch/constant speed</i></b>			
(01)	List the different types of propellers: - fixed pitch; - variable pitch (governing)/constant speed.	F	X	
(02)	Discuss advantages and disadvantages of fixed pitch and constant speed propellers.	B	X	
(03)	Discuss climb and cruise propellers.	B	X	
(04)	Explain the relationship between blade angle, blade angle of attack and airspeed for fixed and variable pitch propellers.	B	X	
<b>081 07 01 06</b>	<b><i>Effects of ice on propeller</i></b>			
(01)	Describe the effects and hazards of ice on a propeller.	B	X	
<b>081 07 02 00</b>	<b>Engine failure</b>			



<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>081 07 02 01</b>	<b>Windmilling drag</b>			
(01)	Describe the effects of an inoperative engine on the performance of an aeroplane: - thrust loss/drag increase.	B	X	
<b>081 07 04 00</b>	<b>Secondary effect of propellers</b>			
<b>081 07 04 01</b>	<b>Torque reaction</b>			
(01)	Describe the effects of engine/propeller torque.	B	X	
<b>081 07 04 03</b>	<b>Slipstream effect</b>			
(01)	Describe the possible effects of the rotating propeller slipstream.	B	X	
<b>081 07 04 04</b>	<b>Asymmetric blade effect</b>			
(01)	Explain the asymmetric blade effect (also called P-factor).	B	X	
<b>081 07 04 05</b>	<b>Hazards and management of propeller effects</b>			
(01)	Describe, given direction of propeller rotation, the propeller effects during take-off run, rotation, initial climb and a go-around, and their consequence on controllability.	B	X	
<b>081 08 00 00</b>	<b>Flight mechanics</b>			
<b>081 08 01 00</b>	<b>Forces acting on an aeroplane</b> <i>Remark: For theoretical knowledge examination purposes the term 'climb angle' or 'glide angle' is assumed to be air-mass-related; 'flight-path angle' is assumed to be ground-related.</i>			
<b>081 08 01 01</b>	<b>Straight, horizontal, steady flight</b>			
(01)	Describe the forces that act on an aeroplane in straight, horizontal, and steady flight.	B	X	
(02)	List the four forces and state where they act on.	F	X	
(03)	Explain how the four forces are balanced including the function of the tailplane.	B	X	
<b>081 08 01 02</b>	<b>Straight, steady climb</b>			
(01)	Define 'flight path angle' (ground related).	F	X	
(02)	Describe the relationship between pitch attitude, climb angle and angle of attack for zero bank conditions.	B	X	
(03)	Describe the forces that act on an aeroplane in a straight, steady climb.	B	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
(04)	Name the forces parallel and perpendicular to the direction of flight.	F	X	
(05)	Explain why thrust is greater than drag.	B	X	
(06)	Explain why lift is less than weight.	B	X	
<b>081 08 01 03</b>	<b><i>Straight, steady descent</i></b>			
(01)	Describe the forces that act on an aeroplane in a straight steady descent.	B	X	
(03)	Explain why lift is less than weight.	B	X	
(04)	Explain why thrust is less than drag.	B	X	
<b>081 08 01 04</b>	<b><i>Straight, steady glide</i></b>			
(01)	Describe the forces acting on an aeroplane in a straight, steady glide.	B	X	
(03)	Describe the relationship between the glide angle and the lift-drag ratio.	B	X	
(04)	Explain the relationship between angle of attack, $V_{md}$ and the best lift-drag ratio.	B	X	
<b>081 08 01 05</b>	<b><i>Steady, coordinated turn</i></b>			
(01)	Describe the forces acting on an aeroplane in a steady, coordinated turn.	B	X	
(03)	Describe the difference between a coordinated and an uncoordinated turn and describe how to correct an uncoordinated turn using turn and slip indicator or turn coordinator.	B	X	
(04)	Explain that the turn radius only depends on TAS and bank angle.	B	X	
(07)	Explain the effects of bank angle ( $\varphi$ ) on: - load factor ( $LF = 1/\cos \varphi$ ); - drag.	B	X	
(09)	Define 'rate of turn' and 'rate-1 turn'.	F	X	

<b>Eind- en toetstermen</b>		<b>Tax</b>	<b>PPLA</b>	<b>PPLH</b>
<b>070 00 00 00</b>	<b>OPERATIONAL PROCEDURES</b>			
<b>071 02 00 00</b>	<b>Special operational procedures and hazards (general aspects)</b>			
<b>071 02 08 00</b>	<b>Wake turbulence</b>			
<b>071 02 08 01</b>	<b>Cause</b>			
(01)	Define the term "wake turbulence".	F	X	X
(02)	Describe tip vortices circulation.	B	X	X
(03)	Explain when vortex generation begins and ends.	B	X	X
(04)	Describe vortex circulation on the ground with and without crosswind.	B	X	X
<b>071 02 08 02</b>	<b>List of relevant parameters</b>			
(01)	List the three main factors which, when combined, give the strongest vortices (heavy, clean, slow).	F	X	X
(02)	Describe the wind conditions which are worst for wake turbulence near the ground.	B	X	X
<b>071 02 08 03</b>	<b>Actions taken when crossing traffic, during take-off and landing</b>			
(01)	Describe the actions to be taken to avoid wake turbulence, specifically separations.	B	X	X

Alleen de onderwerpen die als meest relevant voor privévliegers worden beschouwd zijn uitgewerkt in de leerdoelen. De onderwerpen die niet in de leerdoelen zijn uitgewerkt, maar wel terugkomen in de AMC-syllabus zijn in onderstaand tekstvak onder benoemd:

De volgende onderwerpen uit de AMC-syllabus zijn niet uitgewerkt in bovenstaande leerdoelen:

- **031: Mass calculations:** Use of standard masses for passengers, baggage and crew
- **032: Performance classes**

### **Wijzigingen toetsmatrijs LVPAFPP**

Wijzigingen leerdoelen versie 26-02-2019 (t.o.v. versie 30-11-2012):

#### **Algemene wijzigingen**

- De leerdoelen van de vakken die in één examen worden afgenomen, zijn in één document gevoegd.
- De leerdoelen zijn genummerd.
- De kolom met 'opmerkingen' is verwijderd. Alle informatie die (niet) geldt voor PPL staat (niet) in de LO's.

#### **FPP: Mass & Balance**

##### **Grote wijzigingen**

- 031 01 01 02: derde LO is verwijderd.
- 031 02 01 02: leerdoel (03) is toegevoegd.
- 031 02 02 01: leerdoel (01) is toegevoegd en derde LO is verwijderd.
- 031 02 02 03: beide leerdoelen zijn verwijderd. Leerdoel (p01) is voor PPLA toegevoegd.
- 031 02 03 01 (03): leerdoel is alleen voor PPLH (was alleen voor PPLA).
- 031 03 00 00: onderdeel is verwijderd.
- 031 04 01 01: leerdoel (03) is toegevoegd.
- 031 04 01 02: derde LO is verwijderd en leerdoel (04) is toegevoegd.
- 031 04 01 04: onderdeel is toegevoegd.
- 031 04 01 05: onderdeel is toegevoegd.
- 031 04 01 06: onderdeel is toegevoegd.
- 031 04 01 07: onderdeel is toegevoegd.
- 031 06 00 00: onderdeel is toegevoegd.

##### **Kleine wijzigingen**

- De kolom met 'opmerkingen' is verwijderd. Alle informatie die (niet) geldt voor PPL staat (niet) in de LO's.
- 031 04 01 01 (01): 'name' is aangepast naar 'state'.
- 031 04 01 02 (01) en (02): 'name' is aangepast naar 'state'.

#### **FPP: Performance – Aeroplanes**

##### **Grote wijzigingen**

- 032 01 02 02: eerste t/m achtste leerdoel zijn verwijderd.
- 032 01 03 00: onderdeel is toegevoegd.
- 032 01 04 00: onderdeel is toegevoegd.
- 032 01 05 00: onderdeel is toegevoegd.
- 032 02 01 01: leerdoel (02) is toegevoegd.
- 032 02 02 00: onderdeel is verwijderd.
- 032 02 03 00: Leerdoel (01), (03), (06), (07), (09), (10), (11) en (p01) zijn toegevoegd.
- 032 02 04 00: onderdeel is verwijderd.
- 032 02 05 00: onderdeel is verwijderd.
- 032 03 00 00: onderdeel is toegevoegd.

### **Kleine wijzigingen**

- 032 01 02 02 (07): 'Landing Distance Available (LDA)' en 'and determine from given data and/or appropriate aerodrome charts' toegevoegd.
- 032 02 03 01 (02): 'on the take-off distance' is toegevoegd.

## **Principles of Flight – Aeroplanes**

### **Grote wijzigingen**

- 081 01 01 01: 'Define dynamic pressure' is verwijderd.
- 081 01 01 03: 'List the factors that affect the aerodynamic moment', 'Describe the aerodynamic moment for a symmetrical aerofoil', 'Describe the aerodynamic moment for a positively cambered aerofoil' en 'Forces and equilibrium of forces Refer to 091 09 00 00' zijn verwijderd.
- 081 01 01 04: 'thickness to chord ratio or relative thickness', 'location of maximum thickness', 'angle of attack' en 'angle of incidence' zijn verwijderd.
- 081 01 01 05: 'taper ratio' is verwijderd en 'dihedral angle and anhedral' en 'angle of incidence' zijn toegevoegd.
- 081 01 02 04: 'Explain stable and unstable centre of pressure movement with angle of attack' is verwijderd.
- 081 01 02 08: onderdeel is verwijderd.
- 081 01 02 09: onderdeel is verwijderd.
- 081 01 03 01: 'State het approximate stall angle of attack' is verwijderd.
- 081 01 04 01: 'Explain upwash and downwash due to tip vortices', 'Describe the influence of flap deflection on the tip vortex' en 'List the parameters that influence the wake turbulence' zijn verwijderd.
- 081 01 04 02: 'State the factors that affect induced drag', 'Describe the influence of tip vortices on the angle of attack', 'Explain induced and effective local angle of attack', 'Explain the influence of the induced angle of attack on the direction of the lift vector', 'Explain the induced drag coefficient', 'Explain the relationship between the induced drag coefficient and the angle of attack or lift coefficient', 'Explain the influence of induced drag on:  $C_L - \alpha$  graph en  $C_L - C_d$ ' en 'Parabolic aeroplane polar in a graph and as a formula' zijn verwijderd.
- 081 01 05 02 (was 081 01 05 01): leerdoel (02) is toegevoegd.
- 081 01 05 03: onderdeel is verwijderd.
- 081 01 05 05: leerdoel (02) is toegevoegd.
- 081 01 05 06: onderdeel is verwijderd.
- 081 01 06 01: onderdeel is verwijderd.
- 081 01 06 02: onderdeel is verwijderd.
- 081 01 07 00: onderdeel is verwijderd.
- 081 01 08 00: onderdeel is verplaatst naar 081 03 00 00.

- 081 01 09 00: 'Describe trailing edge flaps and the reasons for their use during take-off and landing', 'Describe their effect on wing geometry', 'Describe how the effective chord line differs from the normal chord line' zijn verwijderd.
- 081 01 09 02: 'Describe leading edge high lift devices', 'state their effect on wing geometry', 'Compare their influence on the  $C_L - \alpha$  graph, compared with trailing edge flaps and a clean wing', 'Indicate the effect of leading edge devices on  $C_{LMAX}$ ', 'Explain how the  $C_L$  curve differs from that of a clean wing', 'Indicate the effect of leading edge devices on the stall or critical angle of attack', 'Compare their influence on the  $C_L - C_D$  graph' en 'Describe the effect on aeroplane controllability' zijn verwijderd.
- 081 01 12 00: alle leerdoelen zijn verwijderd. Leerdoel (02) is het enige overgebleven leerdoel over dit onderwerp.
- 081 03 00 00: onderdeel toegevoegd. Onderwerp 'the stall' is verplaatst van 081 01 08 00.
- 081 03 01 01 (was 081 01 08 01): 'Describe the turbulent layer', 'Define the transition point', 'List the differences between laminar and turbulent boundary layers', 'Explain why the laminar boundary layer separates easier than the turbulent one', 'List the factors that slow down the airflow over the aft part of an aerofoil, as angle of attack is increased' zijn verwijderd.
- 081 03 01 02 (was 081 01 08 02): 'Solve the 1g stall speed from the lift formula' en 'Describe the general idea why the load factor increases in turns', 'Calculate the change of stall speed as a function of the load factor', 'Calculate the increase of stall speed in a horizontal coordinated turn as a function of bank angle', en 'Calculate the change of stall of speed as a function of the gross mass' zijn verwijderd.
- 081 03 01 03 (was 081 01 08 03): 'geometric twist', 'Explain the influence of deflected ailerons' en 'Explain the influence of fences, vortex generators' zijn verwijderd.
- 081 03 01 05 (was 081 01 08 05): 'Explain the effect of ice, frost or snow on the stagnation point', 'Explain the absence of stall warning', 'Explain the abnormal behaviour of the stall', 'Describe when to expect in-flight icing', 'Explain the effect of a contaminated wing', 'Explain what 'on-ground' icing is', 'Describe the aerodynamic effects of de-anti-ice fluid after the holdover time has been reached', 'Explain how to avoid spins' en 'List the factors that cause a spin to develop' zijn verwijderd.
- 081 04 01 00: alle leerdoelen zijn verwijderd. Leerdoel (01), (03) en (4) zijn toegevoegd.
- 081 04 02 01: 'Explain the influence of the location of the wing centre of pressure relative to the centre of gravity on the magnitude and direction of the balancing force on stabiliser and canard', 'Explain the influence of the indicated airspeed on the magnitude and direction of the balancing force on stabiliser and canard' en 'Explain the influence of the balancing force on the magnitude of the wing/fuselage lift' zijn verwijderd.
- 081 04 02 02: onderdeel is verwijderd.
- 081 04 02 03: onderdeel is verwijderd.
- 081 04 03 05: huidige leerdoelen zijn vervangen door leerdoel (02).
- 081 04 04 01: onderdeel is verwijderd.
- 081 04 06 02: huidige leerdoelen zijn vervangen door leerdoel (03), (p01) en (p02).
- 081 05 01 01: 'Define pitch angle, roll and yaw angle' is verwijderd.
- 081 05 01 03: onderdeel is verwijderd.
- 081 05 02 01: 'Explain the working principle of the elevator and describe its function' en 'Describe the loads on the tailplane in normal flight, lower than normal flight speeds, and higher than normal speeds' zijn verwijderd.
- 081 05 02 02: onderdeel is verwijderd.
- 081 05 02 03: onderdeel is verwijderd.
- 081 05 02 04: onderdeel is verwijderd.
- 081 05 02 05: onderdeel is toegevoegd.
- 081 05 03 00: 'State the relationship between rudder deflection and the moment about the normal axis' en 'Describe the effect of sideslip on the moment about the normal axis' zijn verwijderd.
- 081 05 03 02: onderdeel is verwijderd.
- 081 05 06 01: Leerdoel (01) is toegevoegd, en 'Describe the working principle of internal balance' is verwijderd.

- 081 05 07 00: onderdeel is verwijderd.
- 081 06 01 03: 'V<sub>LO</sub>' en 'Explain why there is a difference between V<sub>LO</sub> and V<sub>LE</sub> in the case of some aeroplane types' zijn verwijderd.
- 081 06 02 01: 'Explain the relationship between VA and VS in a formula' is verwijderd.
- 081 06 02 02: Leerdoel (02) is vervallen en opgenomen in (01).
- 081 06 03 01: Huidige leerdoelen zijn verwijderd en vervangen door leerdoel (p01).
- 081 07 01 02 (01): 'blade chord line', 'propeller rotational velocity vector', 'true airspeed vector' en 'blade angle of attack' zijn verwijderd.
- 081 07 01 04 (was 081 07 01 03): 'adjustable pitch or variable pitch', 'Given a diagram, explain the forces acting on a rotating blade element in normal, feathered, windmilling and reverse operation' en 'Explain the effects of changing propeller pitch on the aeroplane at constant IAS' zijn verwijderd.
- 081 07 01 04: onderdeel is verwijderd.
- 081 07 02 02: onderdeel is verwijderd.
- 081 07 03 00: onderdeel is verwijderd.
- 081 07 04 02: onderdeel is verwijderd.
- 081 08 01 01: 'Describe the function of the tailplane' is verwijderd.
- 081 08 01 02: 'explain how IAS, angle of attack and flight path angle change in a climb performed with constant pitch attitude and normal thrust decay with altitude' is verwijderd.
- 081 08 01 03: 'Name the forces parallel and perpendicular to the direction of flight' is verwijderd.
- 081 08 01 04: 'Name the forces parallel and perpendicular to the direction of flight', 'Explain the effect of wind component on glide angle, duration and distance', 'Explain the effect of mass change on glide angle, duration and distance', 'Explain the effect of configuration change on glide angle, duration and distance' en 'Describe the relation between TAS and sink rate including minimum glide angle and minimum sink rate' zijn verwijderd.
- 081 08 01 05: 'Define angular velocity' en 'Explain the influence of TAS on rate of turn at a given bank angle' zijn verwijderd.

### **Kleine wijzigingen**

- Leerdoelen zijn opgeknipt in losse leerdoelen.
- 081 01 01 01 (09): 'define' is aangepast naar 'state'.
- 081 01 01 01 (16): aanpassing van 'Describe the Equation of Continuity' naar 'Explain the equation of continuity and its application to the flow through a stream tube'.
- 081 01 01 03 (01): aanpassing van 'Describe the force resulting from the pressure distribution around an aerofoil' naar 'Describe the originating point and direction of the resultant force caused by the pressure distribution around an aerofoil'.
- 081 01 01 03 (08): 'as the angle between the chord line and the undisturbed airflow' toegevoegd.
- 081 01 02 02 (02): aanpassing van 'Explain the effect on the stagnation point of angle of attack changes' naar 'Explain the movement of the stagnation point as the  $\alpha$  changes'.
- 081 01 03 01 is 081 01 03 02 geworden en 081 01 03 02 is 081 01 03 03 geworden.
- 081 01 03 02 (01) (was 081 01 03 01): aanpassing van 'Describe the lift formula and perform simple calculations' naar 'Explain the lift formula and the factors that affect lift'.
- 081 01 03 02 (02) (was 081 01 03 01): aanpassing van 'describe the  $C_L - \alpha$  graph (symmetrical and positively) naar 'Describe the effect of camber on the  $C_L - \alpha$  graph (symmetrical and positively cambered aerofoils)'.
- 081 01 03 03 (01) (was 081 01 03 02): aanpassing van 'Describe the drag formula and perform simple calculations' naar 'Describe the two-dimensional drag formula and the  $C_D - \alpha$  curve'.
- 081 01 03 03 (02) (was 081 01 03 02): 'cross-sectional area' en '9 surface roughness' zijn toegevoegd.
- 081 01 04 01 is 081 01 04 02 geworden en 081 01 04 02 is 081 01 04 03 geworden.
- 081 01 04 02 (03) (was 081 01 04 01): 'and the contribution to downwash behind the wing' is toegevoegd.

- 081 01 04 03 (03) (was 081 01 04 02): 'cruise' aangepast naar 'straight and level flight with variable speed'.
- 081 01 05 01 is 081 01 05 02 geworden en 081 01 05 02 is 081 01 05 03 geworden.
- 081 01 05 05 (01): 'describe' aangepast naar 'explain'.
- 081 01 05 07: titel aangepast van 'The total drag- speed graph' naar 'Variables affecting the total drag-speed graph'.
- 081 01 05 07 (05): 'and why this could occur' is toegevoegd.
- 081 01 06 00 is 081 01 06 01 geworden.
- 081 01 09 01 (01): 'describe' is toegevoegd.
- 081 01 09 01 (02): 'the CL and CD, and the reasons why this can be beneficial' is toegevoegd.
- 081 01 09 01 (04): 'indicate the variation in CL at any given  $\alpha$ ', 'indicate their effect on  $C_{LMAX}$ ', 'indicate their effect on critical  $\alpha$ ' zijn toegevoegd.
- 081 01 09 02 (04): 'state' is aangepast naar 'explain'.
- 081 01 12 00: titel aangepast van 'Special circumstances' naar 'Aerodynamic degradation'.
- 081 03 01 03 (01): 'explain' aangepast in 'describe'.
- 081 04 02 00 is onderdeel 081 04 03 01 van 081 04 03 00 geworden.
- 081 04 03 01 (01): aanpassing van 'Explain the stabiliser and the canard as the means to satisfy the condition of nullifying the total sum of the moments about the lateral axis' naar 'Explain the stabiliser as the means to achieve balance about the lateral axis'.
- 081 04 04 01 (02): 'too small or too large' aangepast in 'too weak or too strong'.
- 081 04 04 05 (was 081 04 04 04): alles verwijderd, behalve 'fin'.
- 081 04 05 01: onderdeel is verwijderd.
- 081 04 05 06 (was 081 04 05 05): 'define dihedral effect' is verwijderd.
- 081 05 01 02: aanpassing van 'Explain how camber is changed by movement of a control surface' naar 'State that camber is changed by movement of a control surface and explain the effect'.
- 081 05 02 01 (p01): aanpassing van 'Discuss advantages and disadvantages of T-tails' naar 'Describe the characteristics of a T-tail'.
- 081 05 06 01 (02): 'of the nose' is verwijderd.
- 081 06 01 01 (03): aanpassing van 'List the possible actions in the case of flutter in flight' naar 'State how to avoid flutter, and possible actions if flutter occurred'.
- 081 06 01 04 (03): 'dangers' is aangepast naar 'hazards'.
- 081 06 02 01 (06): aanpassing van 'State the load factor limits for JAR / CS 23 and 25 aeroplanes in a typical cruise condition and with flaps extended' naar 'State the positive manoeuvring load factor limit applicable to CS-23 aeroplanes in the normal category'.
- 081 06 02 01 (08): 'Explain the adverse consequences of exceeding VA and its limitations' naar 'Explain the significance of VA and the adverse consequences of applying full, abrupt nose-up elevator deflection when exceeding  $V_A$ '.
- 081 07 01 01 is 081 07 01 02 geworden, 081 07 01 02 is 081 07 01 03 geworden, 081 07 01 03 is 081 07 01 04 geworden en 081 08 01 05 is 081 07 01 06 geworden.
- 081 07 01 02 (02): aanpassing van 'Define fine and coarse pitch' naar 'Describe how the terms 'fine pitch' and 'coarse pitch' can be used to express blade angle'.
- 081 07 02 01 (01): 'list' is aangepast naar 'describe'.
- 081 07 04 00: titel aangepast van 'Moments and couples due to propeller operation' naar 'Secondary effect of propellers'.
- 081 08 01 05 (07): 'discuss' aangepast in 'explain'.

## **Operational Procedures**

### **Kleine wijzigingen**

- 071 02 08 01, 071 02 08 02, 071 02 08 03: verwijzingen zijn verwijderd.