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Introduction:

1 - To fully appreciate and understand subject 032 – Performance (Aeroplanes), the applicant will benefit from background knowledge in Subject 081 - Principles of Flight (Aeroplanes).

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
030 00 00 00	**FLIGHT PERFORMANCE AND PLANNING**						
032 00 00 00	**PERFORMANCE - AEROPLANES**						
032 01 00 00	**GENERAL**						
032 01 01 00	**Performance Legislation**						
032 01 01 01	Airworthiness Requirements according to CS 23 and CS 25						
LO	Interpret the European airworthiness requirements according to CS 23 relating to aeroplane performance	X	X				
LO	Interpret the European airworthiness requirements according to CS 25 relating to aeroplane performance	X					
LO	Name the general differences between aeroplanes as certified under CS 23 and CS 25	X					
032 01 01 02	Operational Regulations						
LO	Interpret the European operating regulations according to JAR-OPS 1	X	X				
LO	Name and define the performance classes for commercial air transportation according to JAR-OPS 1.470	X	X				
032 01 02 00	**General Performance Theory**						
032 01 02 01	Stages of flight						

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the following stages of flight: - Take off, - Climbing flight, - Level flight, - Descending flight, - Approach and landing.	X	X				
032 01 02 02	Definitions and Terms						
LO	Resolve the forces during steady climbing and descending flight	X	X				
LO	Determine the opposing forces during horizontal steady flight	X	X				
LO	Describe the meaning of excessive thrust and power using appropriate graphs	X	X				
LO	Describe the effect of excessive thrust and power on speed	X	X				
LO	Calculate the climb gradient given thrust, drag and aeroplane mass	X	X				
LO	Explain the terms rate of climb and rate of descent as the result of excessive power	X	X				
LO	Define the terms climb angle and climb gradient	X	X				
LO	Define the terms flight path angle and flight path gradient	X	X				
LO	Define the terms descent angle and descent gradient	X	X				
LO	Define the terms clearway (CWY) and stopway (STW) according to CS Definitions	X	X				
LO	Define the terms Take-off Run Available (TORA), Take-off Distance Available (TODA), Accelerate Stop Distance Available (ASDA) according to JAR-OPS 1.	X	X				
LO	Define the terms “Range” and “Endurance”	X	X				

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
032 01 02 03	Influencing Variables on Performance						
LO	Name and understand the factors that effect aeroplane performance, particularly: - Air density - Wind - Aeroplane mass - Aeroplane configuration - Aeroplane antiskid system status - Aeroplane centre of gravity - Aerodrome runway surface - Aerodrome runway slope	X	X				
032 02 00 00	**PERFORMANCE CLASS B - SINGLE-ENGINE AEROPLANES**						
032 02 01 00	**Definitions of speeds used**						
LO	Define the following speeds according to CS 23: - Rotation speed $V_{R,}$ - Speed at 50 ft above the take-off surface level, - Reference speed landing $V_{REF.}$	X	X				
032 02 02 00	**Effect of Variables on Single-Engine Aeroplane Performance**						
LO	Determine the wind component for take off and landing	X	X				
LO	Determine the regulatory factors for take-off and landing according to JAR-OPS 1	X	X				
LO	Explain the effect of temperature, wind and altitude on climb performance	X	X				
LO	Explain the effects of altitude and temperature on cruise performance	X	X				

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the effect of mass and wind on descent performance	X	X				
032 02 03 00	**Take-off and Landing**						
LO	Explain the take-off and landing requirements according to JAR-OPS 1	X	X				
LO	Determine the following distances: - Take-off distance - Landing distance - Ground roll distance - Maximum allowed take-off mass - Maximum allowed landing mass	X	X				
032 02 04 00	**Climb, Cruise and Descent**						
LO	Determine the climb height at a given distance (of obstacle) from end of take off distance	X	X				
LO	Determine the distance covered, time to climb and fuel consumption during climb	X	X				
LO	Explain the effects of different recommended power settings on range and endurance	X	X				
LO	Find the difference between still air distance (NAM) and ground distance (NM)	X	X				
LO	Explain the effect of wind and altitude on maximum endurance speed	X	X				
LO	Determine the cruise true airspeed (TAS)	X	X				
032 02 05 00	**Use of Aeroplane Performance data**						
032 02 05 01	Take-off						
LO	Find the minimum or maximum wind component	X	X				
LO	Find the take of distance and ground roll distance	X	X				
LO	Find the maximum allowed take-off mass	X	X				

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
032 02 05 02	Climb						
LO	Find the maximum rate of climb speed	X	X				
LO	Find the time, distance and fuel to climb	X	X				
LO	Find the rate of climb	X	X				
032 02 05 03	Cruise						
LO	Find power settings, cruise true airspeed (TAS) and fuel consumption	X	X				
LO	Find range and endurance	X	X				
032 02 05 04	Landing						
LO	Find the minimum or maximum wind component	X	X				
LO	Find the landing distance and ground roll distance	X	X				
032 03 00 00	**PERFORMANCE CLASS B - MULTI-ENGINE AEROPLANES**						
032 03 01 00	**Definitions of terms and speeds**						
LO	Define the following terms: - Critical engine, - Speed for best angle of climb (Vx) - Speed for best rate of climb (Vy)	X	X				
LO	Explain the effect of the critical engine inoperative on the power required and the total drag	X	X				
LO	Explain the effect of engine failure on controllability under given conditions	X	X				
032 03 02 00	**Effect of Variables on Multi-Engine Aeroplane Performance**						
032 03 02 01	Take-off and Landing						

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the effect of flap setting on the ground roll distance	X	X				
LO	For both fixed and constant speed propellers, explain the effect of airspeed on thrust during the take-off run	X	X				
LO	Explain the effect of pressure altitude on performance limited take-off mass	X	X				
LO	Explain the effect of runway conditions on the take-off distance	X	X				
LO	Determine the regulation factors for take-off according to JAR-OPS 1	X	X				
LO	Explain the percentage of accountability for head and tailwind components during take-off and landing calculations	X	X				
LO	Interpret obstacle clearance at take-off	X	X				
LO	Explain the effect of selected power settings, flap settings and aeroplane mass on the rate of climb	X	X				
LO	Describe the effect of engine failure on take-off climb performance	X	X				
LO	Explain the effect of brake release before take off power is set on the accelerate stop distance	X	X				
032 03 02 02	Climb, Cruise and Descent						
LO	Explain the effect of centre of gravity on fuel consumption	X	X				
LO	Explain the effect of mass on the speed for best angle- and best rate of climb	X	X				
LO	Explain the effect of mass on the speed for best angle and best rate of descent	X	X				
LO	Explain the effect of temperature and altitude on the fuel flow	X	X				
LO	Explain the effect of wind on the maximum range speed and speed for maximum climb angle	X	X				
LO	Explain the effect of mass, altitude and flaps on the glide descent	X	X				
LO	Describe various cruise techniques	X	X				
LO	Describe the effect of loss of engine power on climb an cruise	X	X				

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
032 03 02 03	Landing						
LO	Explain the effect of runway conditions on the landing distance	X	X				
LO	Determine the regulatory factors for landing according to JAR-OPS 1	X	X				
032 03 03 00	**Use of Aeroplane Performance data**						
032 03 03 01	Take-off						
LO	Find take off field length data	X	X				
LO	Calculate the field length limited take off mass	X	X				
LO	Find the accelerate go distance as well the accelerate-stop distance data	X	X				
LO	Find the ground roll and take off distance	X	X				
LO	Calculate maximum effort take off data	X	X				
LO	Calculate all engine and critical engine out take off climb data	X	X				
LO	Calculate obstacle clearance take off climb data	X	X				
032 03 03 02	Climb						
LO	Find rate of climb and climb gradient	X	X				
LO	Calculate single engine ceiling	X	X				
LO	Calculate obstacle clearance climb data	X	X				
032 03 03 03	Cruise and Descent						
LO	Find power settings, cruise true airspeed (TAS) and fuel consumption	X	X				

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Calculate range and endurance data	X	X				
032 03 03 04	Landing						
LO	Find landing field length data	X	X				
LO	Find landing climb data in the event of balked landing.	X	X				
LO	Find landing distance and ground roll distance	X	X				
LO	Find short field landing distance and ground roll distance	X	X				
032 04 00 00	**PERFORMANCE CLASS A - AEROPLANES CERTIFICATED UNDER CS 25 ONLY**						
032 04 01 00	**Take – off**						
LO	Explain the essential forces affecting the aeroplane during take-off	X					
LO	State the effects of angle of attack, thrust-to-weight ratio and flap setting on acceleration distance	X					
032 04 01 01	Definitions of terms used						
LO	Define the terms Aircraft Classification Number (ACN) and Pavement Classification Number (PCN)	X					

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Define and explain the following speeds in accordance with CS 25 and/or CS Definitions: - Minimum control speed with critical engine inoperative $V_{MC,}$ - Minimum control speed on or near ground V_{MCG} - Minimum control speed take-off climb- V_{MCA} - Engine failure speed - V_{EF} - Take-off decision speed - V_1 - Rotation speed - $V_{R,}$ - Minimum take-off safety speed - V_{2MIN} - Minimum unstick speed - V_{MU} - Lift off speed - V_{LOF} - Max brake energy speed - V_{MBE} - Max tyre speed - $V_{Max\ Tyre}$ - Stall speed or minimum steady flight speed at which a/c is controllable - V_S - Reference landing speed - V_{REF} - Minimum control speed, approach and landing - V_{MCL}	X					
LO	Define the following distances in accordance with CS 25: - Take off Run Available (TORA) and Take off Run Required (TORR) with all engines operating and one engine inoperativ. - Take off Distance Available (TODA) and Take off Distance Required (TODR) with all engines operating and one engine inoperativ. - Accelerate Stop Distance Available (ASDA) and - Accelerate Stop Distance Required (ASDR).	X					

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
032 04 01 02	Take off Distances						
LO	Explain the effects of the following Runway (RWY) variables on take off distances: - RWY length - RWY slope, - RWY surface conditions, - RWY elevation.	X					
LO	Explain the effects of the following aeroplane variables on take off distances: - Aeroplane mass, - Take off configuration, - Bleed Air configurations.	X					
LO	Explain the effects of the following meteorological variables on take off distances: - Wind, - Temperature - Pressure altitude.	X					
LO	Explain the take off distances for specified conditions and configuration for all engines operating and one engine inoperative.	X					
LO	Explain the effect of using clearway on the take-off distance required.	X					
LO	Explain the influence of V_1 and V_{2MIN} on take-off distance.	X					
LO	Explain the reaction time allowed for between engine failure and recognition when assessing the TOD.	X					
LO	Explain the effect of a miscalculation of V_1 on the take-off distance required	X					
032 04 01 03	Accelerate-stop distance						

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain the accelerate-stop distance for specified conditions and configuration for all engines operating and one engine inoperative.	X					
LO	Explain the effect of using a stop way on the accelerate-stop distance required	X					
LO	Explain the effect of miscalculation of V_1 on the accelerate-stop distance required	X					
LO	Explain the time-to-decide allowance (decision time) and deceleration procedure	X					
LO	Explain the use of brakes, use of reverse thrust, brake energy absorption limits, delayed temperature rise and tyre limitations.	X					
032 04 01 04	Balanced field length concept						
LO	Define the term balanced field length.	X					
LO	Understand the relationship between take off distance, accelerate stop distance and V_1 when using a balanced field	X					
LO	Describe the applicability of a balanced field length.	X					
032 04 01 05	Unbalanced field length concept						
LO	Define the term unbalanced field length.	X					
LO	Describe the applicability of an unbalanced field length.	X					
LO	Explain the effect of a stop way on the allowed take off mass and appropriate V_1 when using an unbalanced field	X					
LO	Explain the effect of a clear way on the allowed take off mass and appropriate V_1 when using an unbalanced field	X					
032 04 01 06	Runway length Limited Take-Off Mass (RLTOM)						
LO	Define the runway length limited take-off mass for balanced and unbalanced field length	X					
032 04 01 07	Take-off climb						

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Define the segments of the gross take-off flight path	X					
LO	Determine changes in the configuration, power, thrust and speed in the take-off flight path segments	X					
LO	Determine the differences in climb gradient requirements for 2, 3 and 4 engine aeroplanes.	X					
LO	State the maximum bank angle when flying at V_2	X					
LO	Explain the effects of aeroplane and meteorological variables on the take-off climb	X					
LO	Describe the influence of airspeed selection, acceleration and turns on the climb gradients, best rate of climb speed and best angle of climb speed.	X					
LO	Determine the climb limited take-off mass.	X					
032 04 01 08	Obstacle-limited take-off						
LO	Describe the operational regulations for obstacle clearance in the net take-off flight path.	X					
LO	Define gross and net take-off flight path with one engine inoperative in accordance with CS 25.	X					
LO	Explain the use of 35 ft vertical clearance over obstacles and equivalent reduction in acceleration at the point at which the aeroplane is accelerated in level flight	X					
LO	Determine the effects of aeroplane and meteorological variables on determination of obstacle limited take-off mass.	X					
LO	Determine the obstacle limited take-off mass.	X					
032 04 01 09	Performance limited take-off mass						
LO	Define Performance limited take-off mass.	X					
032 04 01 10	Use of Aeroplane Flight data						
LO	Determine the maximum masses that satisfy all the regulations for take-off from the aeroplane performance data sheets	X					

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Determine the relevant speeds for specified conditions and configuration from the aeroplane performance data sheets	X					
032 04 02 00	**Climb**						
032 04 02 01	Climb techniques						
LO	Explain the effect of climbing with constant IAS.	X					
LO	Explain the effect of climbing with constant Mach number.	X					
LO	Explain the correct sequence of climb-speeds for jet transport aeroplanes	X					
LO	Determine the effect on TAS when climbing in and above the troposphere at constant Mach number	X					
032 04 02 02	Influence of variables on climb performance						
LO	Explain the effect of aeroplane mass on the Rate of Climb (ROC).	X					
LO	Explain the effect of meteorological variables on the Rate of Climb (ROC).	X					
LO	Explain the effect of aeroplane acceleration during a climb with constant IAS or Mach number	X					
LO	Explain the effect on the operational speed limit when climbing at constant IAS.	X					
032 04 02 03	Use of Aeroplane Flight data						
LO	Explain the term “cross over altitude” which occurs during the climb speed schedule (IAS-Mach number).	X					
LO	Calculate the time to climb.	X					
032 04 03 00	**Cruise**						
032 04 03 01	Cruise techniques						
LO	Define cruise procedures “max endurance” and “max range”	X					
032 04 03 02	Max Endurance						

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Explain fuel flow in relation to TAS, thrust available and thrust required.	X					
LO	Find speed for max endurance.	X					
032 04 03 03	Max Range						
LO	Define the term specific range.	X					
032 04 03 04	Long Range Cruise						
LO	Define the term long range cruise	X					
032 04 03 05	Influence of variables on cruise performance						
LO	Explain the effect of centre of gravity (CG) position on range and endurance	X					
LO	Explain the effect of altitude on range and endurance	X					
LO	Explain the effect of meteorological variables on range and endurance	X					
032 04 03 06	Cruise altitudes						
LO	Define the term optimum altitude	X					
LO	Explain the factors which affect the choice of optimum altitude	X					
LO	Explain the factors which might affect or limit the maximum operating altitude	X					
LO	Explain the necessity for step climbs	X					
LO	Describe in detail the Buffet Onset Boundary (BOB)	X					
LO	Analyse influence of bank angle, mass and 1.3 g buffet onset factor on a step climb	X					
LO	Explain the term maximum altitude	X					
032 04 03 07	Cost index						
LO	Define the term cost index	X					

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Understand the reason for Economical Cruise Speed (ECON)	X					
032 04 03 08	Use of Aeroplane Flight data						
LO	Determine the all engines operating power settings and speeds from the aeroplane performance data sheets for: - Maximum range, - Maximum endurance, - High speed and normal cruise - High and low speed buffet	X					
LO	Determine the selection of cruise technique accounting for cost indexing, passenger requirements against company requirements.	X					
LO	Determine the fuel consumption from the aeroplane performance data sheets for various cruise configurations, holding, approach and transit to an alternate in normal conditions and after an engine failure	X					
032 04 04 00	**En-route One Engine Inoperative**						
032 04 04 01	Drift Down						
LO	Explain the drift-down procedure in accordance with CS 25.123	X					
LO	Determine the minimum obstacle clearance height prescribed in JAR-OPS 1.500	X					
LO	Define the speed during drift down	X					
LO	Explain influence of deceleration on the drift-down profiles	X					
032 04 04 02	Influence of variables on En-route One Engine Inoperative performance						
LO	Identify factors which affect the en-route net flight path	X					
032 04 04 03	Use of Aeroplane Flight data						

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Find one-engine out service ceiling, range and endurance given engine inoperative charts.	X					
LO	Find maximum continuous power/thrust settings given engine inoperative charts	X					
032 04 05 00	**Descent**						
032 04 05 01	Descent techniques						
LO	Explain the effect of descending with constant Mach number.	X					
LO	Explain the effect of descending with constant IAS.	X					
LO	Explain the correct sequence of descent speeds for jet transport aeroplanes	X					
LO	Determine the effect on TAS when descending in and above the troposphere at constant Mach number	X					
LO	Describe the following limiting speeds for descent: - Maximum operating speed V_{MO} - Maximum mach number M_{MO}	X					
LO	Explain the effect of a descent at constant Mach number on the margin to low speed buffet	X					
032 04 05 02	Influence of variables on descent performance						
LO	Explain the influence of mass, configuration and altitude on rate of descent and glide angle	X					
032 04 05 03	Use of Aeroplane Flight data						
LO	Determine the following information for all engines operating and one engine inoperative from the aeroplane performance data sheets: - Descent rates, - Time and distance for descent, - Fuel used during descent.	X					

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Find the time for descent and the Top of Descent (TOD) point	X					
032 04 06 00	**Approach and Landing**						
032 04 06 01	Approach requirements						
LO	Describe the requirements for the approach climb.	X					
LO	Describe the requirements for the landing climb.	X					
LO	Explain the effect of temperature and pressure altitude on approach and landing climb performance	X					
032 04 06 02	Landing field length requirement						
LO	Define the demonstrated landing distance (LD)	X					
LO	Define the landing distance available (LDA)	X					
032 04 06 03	Influence of variables on landing performance						
LO	Explain the effect of runway slope, surface conditions and wind on the maximum landing mass for a given runway length in accordance with JAR-OPS 1.	X					
LO	Explain the effect of temperature and pressure altitude on the maximum landing mass for a given runway length.	X					
LO	Explain the effect of hydroplaning on landing distance required	X					
LO	Define three types of hydroplaning in accordance with JAR-OPS 1	X					
032 04 06 04	Quick turnaround limit						
LO	Define the quick turnaround limits.	X					
032 04 06 05	Use of Aeroplane Flight data						
LO	Recall the JAR Landing field length requirements for dry, wet and contaminated runway.	X					

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		Aeroplane		*Helicopter*			*IR*
Syllabus Reference	**Syllabus and Learning Objectives**	ATPL	CPL	ATPL /IR	ATPL	CPL	
LO	Determine the JAR Field length required for landing with a given landing mass from the aeroplane performance data sheets	X					
LO	Determine the landing and approach climb limited landing mass from the aeroplane performance data sheets	X					
LO	Determine the landing field length limited landing mass from the aeroplane performance data sheets	X					
LO	Find the structural limited landing mass from the aeroplane performance data sheets	X					
LO	Calculate the maximum allowable landing mass as the lowest of: - Approach climb and landing climb limited landing mass, - Landing field length limited landing mass, - Structural limited landing mass.	X					
LO	Determine the maximum quick turnaround mass and time under given conditions from the aeroplane performance data sheets	X					
LO	Find the Limiting landing mass in respect of PCN	X					