AIRLINE TRANSPORT PILOTS LICENSE

(030 00 00 00 - FLIGHT PERFORMANCE AND PLANNING)

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
032 01 00 00	**PERFORMANCE OF SINGLE-ENGINE AEROPLANES NOT CERTIFIELD UNDER JAR/FAR 25 (LIGHT AEROPLANES) – PERFORMANCE CLASS B**	
032 01 01 00	**Definitions of terms and speeds used**	
	– Define the following terms	
	– Density altitude	
	– Climb gradient	
	– Unaccelerated flight	
	– Definition of speeds in general use	
	– Clear 50 ft speed (Take-off Safety Speed)	
	– Touch down speed (Reference Landing Speed)	
032 01 02 00	**Take-off and Landing Performance**	
032 01 02 01	**Effect of aeroplane mass, wind, density, altitude, runway slope, runway conditions**	
032 01 02 02	**Use of Aeroplane flight data**	
	– Determine the following distances:	
	– Take-off distance to 50 ft, landing distance from 50 ft , ground roll distance during landing	Appropriate chart and data are given
	– Climb height at given distance (of obstacle) from end of Take off Distance	
	– Determine wind component for landing performance	
	– Determine the take-off speeds	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Determine the maximum allowed take-off weight	
032 01 03 00	**Climb, cruise and descent performance**	
	– Explain the effect of temperature, wind, altitude on climb performance	
	– State rate of climb, angle of climb and minimum rate of descent and descent angle	
	– Resolve the forces during a steady climb-, and glide	
	– State the opposing forces during a horizontal steady flight	
	– Explain the effect of mass and wind on the descent performance	
032 01 03 01	**Use of Aeroplane flight data**	Appropriate chart and data Are given
	– Determine the cruise true airspeed (TAS)	
	– Determine the manifold air pressure (MAP)	
	– Determine distance covered, time and fuel consumption during climb	
	– Determine the range for certain conditions	
032 01 03 02	**Effect of density altitude and aeroplane mass**	
	– Explain the effect of altitude and temperature on cruise performance	
	– Explain the effect of mass on power required, drag and airspeed	
	– Explain the effect of altitude and temperature on the power required curve	
032 01 03 03	**Endurance and the effects of the different recommended power settings**	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Explain the effect of wind on the maximum endurance speed	
032 01 03 04	**Still air range with various power settings**	
	– Explain the effect of various power settings on the still air range	
032 02 00 00	**PERFORMANCE OF MULTI-ENGINE AEROPLANES NOT CERTIFIED UNDER JAR/FAR 25 (LIGHT TWIN) – PERFORMANCE CLASS B**	
032 02 01 00	**Definitions of terms and speeds**	
	– Define the following terms:	
	– Balanced/unbalanced field length	
	– Critical engine	
	– Speed stability, 2nd-regime or backside of power curve and normal regime	
	– Definition of speeds	
	– Define the following speeds:	
	– Vx speed for best angle of climb	
	– Vy speed for best rate of climb	
032 02 01 01	**Any new terms used for multi-engine aeroplane performance (032 01 01 00)**	
	– Explain the effect of the critical engine inoperative on the power required and the total drag	
	– Select from a list the correct order of take-off speeds	
	– Explain the parameter(s), which must be maintained at V_{MCA}, in case of engine failure	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Explain the effect of a clearway in take-off calculation	
	– Explain the effect of engine failure on controllability under given conditions	
	– State the effect for propeller- and light twin jet aeroplanes	
	– Name the limit(s) for $V_{max\ tire}$	
	– Define V_{2min}	
032 02 02 00	**Importance of performance calculations**	
032 02 02 01	**Determination of performance under normal conditions**	
	– Explain the effect of centre of gravity on fuel consumption	
	– Explain the effect of flap setting on the ground roll distance	
	– For both fixed and constant speed propellers, explain the effect of airspeed on thrust during the take-off run	
032 02 02 02	**Consideration of effects of pressure altitude, temperature, wind, aeroplane mass, runway slope and runway conditions**	
	– Explain the effect of temperature on the brake energy limited take-off mass	
	– Explain the effect of pressure altitude on the field length limited take-off mass	
	– Explain the effect of runway contamination on the take-off distance	
	– Explain the effect of mass on the speed for best angle, and best rate on the descent	
032 02 03 00	**Elements of performance**	

JAR-FCL REF NO	**LEARNING OBJECTIVES**	REMARKS
	– Discuss the aeroplane's C_L / C_D curve for specified configurations – Explain the certified engine thrust ratings – Explain the effect of temperature and altitude on the fuel flow for jet engine aeroplanes in given conditions – Explain the effect of bank angle at constant TAS on the load factor – Explain the effect of wind on the maximum range speed and speed for maximum climb angle – Explain the effect of mass on descent performance – Explain the effect of airspeed on the thrust of a jet engine aeroplane at constant RPM – Explain the effect of speed and angle of attack on the induced drag – Interpret the 'thrust required' and' thrust available' curves – Interpret the 'power required' and 'power available' curves – State and explain specific range (SR) and aeroplane's specific fuel consumption (SFC)	
032 02 03 01	**Take-off and landing distances** – Explain the effect of thrust reverser on take-off mass calculation – State the percentage of accountability for head, and tailwind during take-off calculations – Determine landing distance required (dry and wet) for destination and alternate airports valid for jet- and propeller aeroplanes	
032 02 03 02	**Rate of climb and descent**	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Explain the effect of selected power settings, speeds, mass and flaps on the rate of climb versus airspeed curve	
	– Explain the effect of mass, altitude and flaps on the idle descent	
032 02 03 03	**Cruise altitude and altitude ceiling**	
	– Define service, and absolute ceiling and optimum altitude	
	– Explain effect of altitude, mass, configuration on total drag under given conditions	
	– Interpret the Buffet onset Boundary Chart (BOB-chart)	
	– Describe manoeuvring capability, low, and high speed limits	
	– Indicate effects of mass and bank angle in the BOB-chart	
	– Identify buffet onset gust factor	
032 02 03 04	**Payload/range trade-offs**	
	– Interpret the payload-range diagram	
	– Describe cruise technique, and meteorological conditions	
032 02 03 05	**Speed/Economy trade-off**	
	– Explain the correlation between maximum endurance and fuel consumption	
032 02 04 00	**Use of performance graphs and tabulated data**	
	– Explain the effect of brake release before take off power is set on the accelerate, and stop distance	Appropriate chart is given
032 03 00 00	**PERFORMANCE OF AEROPLANCES CERTIFIED UNDER FAR/JAR 25 – PERFORMANCE CLASS A**	JAR 25 105

AIRLINE TRANSPORT PILOTS LICENSE

(030 00 00 00 - FLIGHT PERFORMANCE AND PLANNING)

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
032 03 01 00	**<u>Take – off</u>**	
	– Explain the essential forces affecting the aeroplane during take-off until lift off	
	– State the effects of angle of attack, thrust-to-weight ratio and flapsetting on acceleration distance	
032 03 01 01	**Definitions of terms and speed used**	
	– Define the following speeds:	IEM FCL 1.475(b)
	– V_{MC} : minimum control speed	JAR 25.149 (a thru d)
	– V_{MCG} : ground minimum control speed	JAR 25.149 (e)
	– V_{MCA} : air minimum control speed	JAR 25.149
	– V_{EF} : engine failure speed	JAR 25.107 (a) (1)
	– V_1 : critical engine failure speed (decision)	JAR 25.107 (a) (2)
	– V_R : rotating speed	JAR 25.107 (e)
	– V_2 : take-off safety speed for piston engine aircraft, or take-off climb speed or speed at 35 ft for jet Aircraft	JAR 25.107 (b) (c)
		JAR 25.107 (c)
	– V_{MU} : minimum unstick speed	JAR 25.107 (d) and (e)
	– V_{LOF} : lift off speed	JAR 25.107 (f)
	– V_{MBE} : max brake energy speed	
	– $V_{Max\ Tyre}$: max tyre speed	
	– V_S : stalling speed or minimum steady flight speed at which a/c is controllable	Distinguish V_{S0} & V_{S1}

JAR-FCL REF NO	**LEARNING OBJECTIVES**	REMARKS
	– Definitions of terms and distance used	
	– Define the following distances:	
	– TORA & TORR : 'Take off run available' & 'Take off run required' with all engines operating and one engine inoperative	JAR 25.113
	– TODA & TODR: 'Take off distance available' & 'Take off distance required' with all engines operating and one engine inoperative	JAR 25.113
	– ASDA & ASDR: 'Accelerate stop distance available' & 'Accelerate stop distance required'	JAR 25.109
	– Clearway and stopway	
	– Define balanced field length	
032 03 01 02	**Runway variables**	
	– Explain the effects of the following runway variables on take off performance	
	– dimensions, slope, surface condition (damp, wet or contaminated), PCN , field elevation, influence of contamination on friction coefficient	
032 03 01 03	**Aeroplane variables**	
	– Explain the effects of the following aeroplane variables on take off performance	
	– mass, configuration, variable power settings, reduced thrust, serviceability of high lift devices, application of reverse thrust, brakes and use of anti-skid devices	
032 03 01 04	**Meteorological variables**	
	– Explain the effects of the following meteorological variables on take off performance	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– wind components (along and across runway), precipitation, temperature and pressure altitude - wing icing - windshear	
032 03 01 05	**Take off speeds**	
	– Explain the significance and applicability of the take off and initial climb 'V' speeds for specified conditions and configuration for all engines operating and one engine inoperative	
	– State V_1 , V_R , V_2 , $V_{2 + increment}$, landing gear and flap/slat retraction speeds	
	– State upper and lower limits of the take off speeds V_1 , V_R and V_2	
	– State the reaction time between engine failure and recognition	
	– Elaborate on factors which affect V_2	
	– State mass, temperature, elevation and flap setting	
	– Explain the effect of pressure altitude on V_{MCA}	
	– Explain the effect of increasing altitude on the stall speed (IAS)	
032 03 01 06	**Take off distance**	
	– Explain the significance and applicability of the take off distances for specified conditions and configuration for all engines operating and one engine inoperative	
	– the influence of aeroplane-, runway- and meteorological variables	
	– the effect of early/late rotation of the aeroplane	
	– Explain the effect of using clearway on the take-off distance required	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Explain the effect of miscalculation of V_1 on the take-off distance required	
	– Explain the effect of using a higher or lower V_1 than the balanced V_1 on the take-off distance	
	– Explain effect of higher flap setting on the average drag during the acceleration distance	
032 03 02 00	**<u>Accelerate-stop distance</u>**	
	– Explain the significance and applicability of the accelerate-stop distance for specified conditions and configuration for all engines operating and one engine inoperative	
	– – Explain the influence of aeroplane, runway and meteorological variables	
	– Explain the effect of using a stopway on the accelerate-stop distance required	
	– Explain the effect of miscalculation of V_1 on the accelerate-stop distance required	
	– Explain the effect of using a higher or lower V_1 than the balanced V_1 on the accelerate-stop distance and action(s) to be taken in case of engine failure below V_1	
032 03 02 01	**Concept of balanced field length**	
	– Explain the significance and applicability of a balanced/unbalanced field length	
	– – Explain the effect of a stopway on the allowed take off mass and appropriate V_1	
	– – Explain the effect of a clearway on the allowed take off mass and appropriate V_1	
	– – State relation of take off distance, accelerate stop distance and V_1	
	– Elaborate on the runway length limited take-off mass (RLTOM)	
032 03 02 02	**Use of flight manual charts**	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Using the aeroplane performance data sheets, compute the accelerate stop distances, decision time and deceleration procedure assumptions	
	– Explain time-to-decide allowance, use of brakes, use of reverse thrust, brake energy absorption limits, delayed temperature rise and tyre limitations - fuse plug limit	Appropriate perform chart for take-off
	– Explain the typical form of the wind guide lines in the performance charts	
	– Explain the effect of anti-skid u/s during take-off	
	– Explain the effects of runway, aeroplane and meteorological variables on the tyre speed limited take off	
032 03 03 00	**<u>Initial climb</u>**	
	– Define gross,- and net take-off flight path with one engine inoperative	
	– State the effects of runway-, aeroplane,- and meteorological variables on determination of climb limited take-off mass (CLTOM) and obstacle limited take-off mass (OLTOM)	JAR 25.111-115-117-121-123
	– Explain the use of 35 ft vertical distance over obstacles and equivalent reduction in acceleration at the point at which the aeroplane is accelerated in level flight	
032 03 03 01	**Climb segments**	
	– Define the segments along the gross take-off flight path	
	– State distinct changes in the configuration, power or thrust, and speed	
	– State distinct differences in climb gradient requirements for various types of aeroplanes during	
	– State maximum bank angle when flying at V_2	Given appropriate

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Determine the climb limited take-off mass (CLTOM) given relevant data	performance chart
032 03 03 02	**All engines operating**	
	– Calculate by means of a rule of thumb the rate of climb of the aeroplane	
	– Calculate the climb gradient for a given Lift/Drag ratio, thrust, mass and gravitational acceleration (G)	
	– Describe the noise abatement procedures A and B during take-off according to PANS-OPS	
032 03 03 03	**Engine inoperative operation**	
	– Explain the effects of aeroplane and meteorological variables on the initial climb	
	– Consider influence of airspeed selection, acceleration and turns on the climb gradients, best rate of climb speed and best angle of climb speed	
	– Computation of maximum take-off mass at a given minimum gross gradient (2nd segment) sin of angle of climb, thrust per engine, G and drag	
032 03 03 04	**Obstacle clearance requirements**	
	– Distinguish difference between the Obstacle Limited Take off mass (OLTOM) and Climb Limited Take off mass (CLTOM)	
	– State the operational regulations for obstacle clearance of the net take-off flight path in the departure sector	
032 03 04 00	**<u>Climb</u>**	
	– Explain the effect of climbing with constant Mach Number on the lift coefficient	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Explain the effect of climbing with constant IAS on the drag	
	– Explain the effect of mass on the Rate of Climb (ROC) speed	
	– Computation of the maximum climb speed by using performance data	
	– Explain the effect of meteorological variables on the ground distance during climb	
032 03 04 01	**Use of flight manual performance charts**	
	– Distinguish the difference between the flat rated and non flat rated part in performance charts	
	– Elaborate on the cross over altitude, during a certain climb speed schedule (IAS-Mach Number)	
032 03 04 02	**Significant airspeeds for climb**	
	– Give, from a list, the correct sequence of speeds for jet transport aeroplanes	
	– State the effect of mass on V_X and V_Y	
	– State the effect on TAS when climbing in and above the troposphere at constant Mach Number	
	– State the effect of meteorological variables on the climb speeds	
	– State the effect on the operational speed limit when climbing at constant IAS	
	– State the effect of flaps on V_X and V_Y	
	– State the effect of acceleration on V_X and V_Y at a given constant power setting	
032 03 05 00	**<u>Cruise</u>**	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Explain the relationship between mass and minimum drag during a steady horizontal flight	
	– Explain and state the factors which affect the optimum long range cruise altitude	
	– Explain the relationship between airspeed and induced drag	
032 03 05 01	**Use of cruise charts**	
	– Explain in detail the Buffet Onset Boundary Chart (BOB-chart)	
	– State influence of bank angle, mass and 1.3 g buffet onset factor on the step climb	
	– Explain the purpose of step climbs used on long distance flights	
	– Explain and state factors which affect the choice of optimum altitude	
	– Explain the factors which might affect or limit the maximum operating altitude	
032 03 05 02	**Cruise control**	
	– Explain differences in flying $V_{long\ range}$ and $V_{max\ range}$ with regard to fuel flow and speed stability	
	– Discuss 'thrust/power available and required' curves in horizontal flight	
	– Explain reasons for flying above or below optimum altitude	
	– Computation of fuel consumption in relation to different aeroplane masses	Relevant data are given
	– Explain the difference between Specific Fuel Consumption (SFC) and Specific Range (SR)	
	– Computation of fuel mileage	Relevant data are given
	– Explain the factors which affect the thrust/power available and thrust/power required curves in horizontal flight	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS

032 03 05 03	**En-route One Engine Inoperative**
	– Explain in detail the drift-down procedure
	  – Identify factors which affect the en-route net flight path
	  – State minimum obstacle clearance height prescribed in JAR OPS 1.580
	  – Explain influence of deceleration on the drift-down profiles
	  – Explain the effect of one engine inoperative at high altitudes on the SFC and SR and drift-down speed
		JAR 25.123
		JAR OPS 1.580

032 03 05 04	**Obstacle clearance en-route** – Explain items mentioned in 032 03 05 04	JAR 25.123

032 03 05 05	**En-route – Airplanes with three or more Engines, two engines inoperative**
	– Analyse critical situation
	– State factors which affect the requirements and limitations:
	  – Limited systems operations
	  – Raised landing weather minima
	  – Cross wind limits
	  – Reduced range
	  – Highly reduced aeroplane performance	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
032 03 06 00	**Descent and landing** – Explain the effect of changing lift coefficient during glide at constant Mach Number – Describe effect of pitch changes on the glide distance – Explain the influence of mass, configuration, altitude on rate of descent, glide angle and lift/drag ratio – Resolve the forces during a steady idle-descent (glide) flight – Explain the effect of a descent at constant Mach Number on the margin to low speed,- and Mach buffet – State the requirements for establishing V_{REF} and V_T – State the requirements for the approach,- and landing climb limits – State the requirements for the maximum landing distance (dry and wet) applicable for turbo propeller and turbojet aeroplanes at both destination and alternate – Explain the relationship between mass, pitch angle, airspeed and lift/drag ratio during a glide	JAR 25.119, 121 and 125 V_{target} is not in JAR's
032 03 06 01	**Use of descent charts** – Explain the effects on Mach Number and airspeed (IAS) during a descent schedule – Explain the effect of mass on the vertical speed and forward speed at given conditions – Identify the difference between V_{MO} - V_{NE} - M_{MO}	
032 03 06 02	**Maximum permitted landing mass** – Explain factors as mentioned in the subject Mass & Balance	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– Demonstrate knowledge of brake energy limited landing weight - overweight landing - flap placard speed - limiting bank angle - landing distance required	
032 03 06 03	**Approach and landing data calculations**	Given:
	– Explain the effect of hydroplaning on landing distance required	a. JAR OPS
	– State three types of hydroplaning	b. JAR 25
	– Suitability of selected landing runway landing distance available	c. Appropriate aeroplane
	– Computation of maximum landing mass for the given runway conditions	Performance data sheets
	– State the requirements for determination of maximum landing mass	
	–	
	– Determine, using aeroplane performance data sheets, the maximum landing mass for specified runway and environmental conditions	
	– Computation of the minimum runway length for the given aeroplane mass condition	
	– State the requirements for determination of minimum runway length for landing	
	– Determine, using aeroplane performance data sheets, the minimum runway length for a specified landing mass, runway and environmental conditions	
	– Other factors: runway slope, surface conditions, wind, temperature, pressure altitude, PCN	
	– Explain the effect of runway slope, surface conditions and wind and how each factor modifies the maximum landing mass for given runway distance and landing distance required for given landing mass	

JAR-FCL REF NO	**LEARNING OBJECTIVES**	REMARKS

	– Explain the effect of temperature and pressure altitude and how they modify the maximum landing mass for given runway distance and landing distance required for given landing mass
	– Explain the effect of temperature and pressure altitude on approach and landing climb performance
	– Explain the limitations that may be imposed when ACN > PCN
	– Computation of expected landing mass
	  – Using the aeroplane performance and planning data sheets calculate the expected landing mass for specified basic weight, load and fuel requirements
	– Computation of approach and landing speeds
	  – Explain the factors affecting the determination of approach and landing speeds
	  – Using aeroplane performance data sheets determine approach and landing speeds for specified landing masses, configuration and conditions
	– Computations for alternate aerodromes
	  – Explain the requirements for alternate aerodromes
	  – Using aeroplane performance data sheets determine approach and landing speeds for specified landing masses, configuration and conditions
	– Definitions of terms and speeds used
	– V_T - threshold speed
	  – Explain the factors used in determination of V_T
		Changed to accord with JAR

JAR-FCL REF NO	**LEARNING OBJECTIVES**	REMARKS

	– Discontinued approach climb
	  – Explain the requirements and aeroplane configuration for the discontinued approach climb
	– Landing climb
	  – Explain the requirements and aeroplane configuration for the landing climb
	– Landing distance, dry, wet and contaminated runways
	  – Explain the factors to be considered in determining the landing distance required for dry, wet and contaminated runways
	– Landing distance required
	  – State the destination and alternate aerodrome landing distance requirements for turbojet and turbo-prop aeroplane
	  – In each case state the requirements for turbojet and turbo-prop aeroplanes
	  – State the limitations on dispatching an aeroplane if the landing requirements at the destination aerodrome are not met
	– Landing climb performance
	  – State the minimum performance requirement for landing climb
	– Landing configuration
	  – State the requirements for landing with all engine operating and one engine inoperative
	– Approach configuration	

JAR-FCL REF NO	LEARNING OBJECTIVES	REMARKS
	– State the requirements for the approach configuration with all engines operating and one engine inoperative	
032 03 07 00	**<u>Practical application of an airplane performance manual</u>**	
032 03 07 01	**Use of typical turbojet or turboprop aeroplane performance manual**	Given:
	– Take-off, en-route and landing mass calculation	a. JAR OPS
	– Determine from the aeroplane performance data sheets the maximum weights which satisfy all the regulations for take-off, en-route and landing given the appropriate conditions	b. JAR 25
	– Take-off data computations	c. Appropriate aeroplane Performance data sheets
	– Effects of runway variables, aeroplane variables and meteorological variables	
	– Explain the effect on aeroplane performance and operating weights of the following:	
	– Runway : dimensions, slope, surface condition, PCN	
	– Aeroplane : configuration, variable power settings, serviceability of high lift devices, reverse thrust, brakes and anti-skid devices	
	– Meteorological Conditions : wind components (along and across runway), precipitation, temperature and pressure	
	– Computation of the relevant 'V' speeds for take-off and initial climb	
	– Explain the significance and applicability of the take-off and initial climb 'V' speeds	
	– Using the aeroplane performance data sheets determine the relevant speeds for specified conditions and configuration for all engines operating and one engine inoperative	

JAR-FCL REF NO	**LEARNING OBJECTIVES**	REMARKS

	– Computation of runway distance factors
	  – Determine the effective length of the runway for specified configuration, runway and meteorological conditions for all engines operating and one engine inoperative, using the aeroplane performance data sheets
	– Determination of rate and gradient of initial climb
	  – Using the aeroplane performance data sheets determine the rate and gradient of climb with all engines operating and one engine inoperative for specified configuration and meteorological conditions
	– Determination of obstacle clearance
	  – Using the aeroplane performance data sheets determine the maximum mass at which obstacles can be cleared for specified conditions to comply with the regulations for all engines operating and one engine inoperative
	– Appropriate engine out calculations
	  – Using the aeroplane performance data sheets determine the aeroplane performance with all engines operating and one engine inoperative, for specified conditions
	
	– Climb computations
	– In each of the following, accurately extract the information from the aeroplane performance data sheets for the all engines operating and one engine inoperative cases
	  – Climb rates and gradients	

JAR-FCL REF NO	**LEARNING OBJECTIVES**	REMARKS
	– Time to climb – Fuel used	
032 03 07 02	**Cruise computations** – Power settings and speeds for maximum range, maximum endurance, high speed and normal cruise – Explain the effect on aeroplane range, endurance and fuel consumption of power setting/speed options – State the factors involved in the selection of cruise technique accounting for cost indexing, passenger requirements against company requirements – Extract the power settings and speeds from the aeroplane performance data sheets – Fuel consumption – Extract the fuel consumption figures from the aeroplane performance data sheets – Engine out operations, pressurisation failure, effect of lower altitude on range and endurance – Explain the effect on aeroplane operations of engine failure, pressurisation failure, effect of lower altitude on range and endurance – Extended Twin Operations (ETOPS) – State the additional factors to be considered for ETOPS – Additional consideration concerning fuel consumption – Effects of altitude and aeroplane mass	Given: a. JAR OPS b. JAR 25 c. Appreciate aeroplane

JAR-FCL REF NO	**LEARNING OBJECTIVES**	REMARKS
	– Explain the effect on fuel consumption of altitude and aeroplane mass – Fuel for holding, approach and cruise to alternate – Determine the fuel requirements for holding, approach and transit to an alternate from the aeroplane performance data sheets in normal conditions and the following abnormal conditions – After engine failure – After decompression	