PROPOSAL FOR THE INSERTION OF APPENDIX 2.0A TO SA-CATS 61 OF THE CIVIL AVIATION REGULATIONS, 2011

Legal: Consolidated amended Appendix 2.0 A with changes approved incorporated (Dated 2015-05-28)

APPENDIX 2.0 A TO SOUTH AFRICAN CIVIL AVIATION TECHNICAL STANDARDS (SA-CATS)

SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE COMMERCIAL PILOT LICENCE (AEROPLANE AND HELICOPTER).

IMPORTANT NOTES TO THIS SYLLABUS:

1. This appendix specifies the theoretical aspects required to be known for the CPL theoretical knowledge examinations.
2. Candidates may be examined on any of the elements included in this appendix that are applicable to the aircraft category licence sought and should be aware especially of the requirements of SA-CATS 61.01.10 (11)(d) and (e).
3. All compulsory aspects applicable to the respective aircraft category are marked with an "X."
   A mark in the category column "A" represents an aspect applicable to the aeroplane examination and a mark in the category column "H" represents an aspect applicable to the helicopter examination.
4. The column marked "REFERENCE" refers to the applicable section or part in the Regulations (CAR) or source document, when applicable. When a Technical Standard is referred to, this is indicated by the use of the acronym "CATS" or "TS." When a source document other than the Regulations is referred to in this column, this is indicated in plain words as a heading.
5. Candidates are expected to be familiar with all acronyms and abbreviations contained in Subpart 1.01.2 of the Regulations prior to attempting any of the subjects listed in this appendix, but will not be directly evaluated on this aspect in the examinations.
6. Candidates are to ensure that they use the most recent amendments to the Regulations, Technical Standards and other technical documentation when preparing for the examinations.
7. The suggested study material to use for preparation for this examination is communicated by Aeronautical Information Circular (AIC) and also posted on the Authority's website where deemed appropriate. This study material is assumed to be the default source material used by candidates and is therefore not referred to in this syllabus. Where reference material clarity is required or additional source material is to be used for specific syllabus aspects, this is stipulated in the relevant portion of the syllabus. Candidates are nevertheless free to use any material they wish in order to ensure their comprehension of the mandated subject matter and to comply with the prescribed theoretical knowledge requirements.
8. Candidates should note that some of the suggested study material might refer to foreign operational, certification and legislative requirements e.g. EU-OPS, JAA-OPS, CS 23 and CS 25. Except where specifically indicated, candidates will not be assessed on such aspects during this examination. The underlying theory, however (which in most cases is identical in South African and other international legislation), should be known and understood. In this regard, candidates are expected to differentiate between the underlying theoretical concepts which need to be known and the foreign requirements themselves, which need not be known. Such non-compulsory information might nevertheless still be interesting to a candidate for the purposes of personal enrichment and as an aid to general knowledge of aviation developments.
9. For examination study purposes, where any discrepancy exists between the information provided in the RSA AIP and the Regulations, the provisions of the latter shall be regarded as correct. Such a situation may occur naturally due to the delay present in the AIRAC cycle. Similarly, it may also occasionally occur that changes in the AIP are not reflected immediately in this Technical Standard due to the stringent time requirements involved in legislative changes. Such situations can be expected as the natural consequence of the SACAA's attempt to define the syllabus as closely as possible. In these circumstances (for example in the case of numbering changes), candidates are expected to resolve the temporary discrepancy by appropriate, logical cross-referencing between the syllabus and the AIP.
10. Refer to Appendix 2.0 C for the Syllabus of Theoretical Knowledge for the Instrument Rating.

SUBJECT:

AIRCRAFT TECHNICAL AND GENERAL (AEROPLANE)

ASPECT NUMBER	SYLLABUS ASPECT	CATEGORY APPLICABILITY
		Aeroplane

A.1.1	**AIRCRAFT ELEMENTS**	
	a. Valves	**X**
	− check valves, pressure release valves, selector valves, restrictors, thermal relief valves	**X**
	b. Bearings	**X**
	− plain bearings, split bearings, bushes, ball bearings, roller bearings	**X**
	c. Pumps	**X**
	− gear type, diaphragm type, vane type, piston type, centrifugal type	**X**
	- pump drives	**X**
	d. Filters	**X**
	− strainers, sediment traps	**X**
A.1.2	**AIRFRAME AND SYSTEMS**	
	a. Fuselage	**X**
	− types of construction	**X**
	− structural components and materials	**X**
	− stress	**X**
	b. Cockpit and cabin windows	**X**
	− construction (laminated glass)	**X**
	− structural limitations	**X**
	c. Wings and stabilising surfaces	**X**
	− types of construction and materials	**X**
	− structural components and materials	**X**
	− stress	**X**
	− vertical, horizontal and V-tail surfaces	**X**
	d. Landing gear	**X**
	− types	**X**
	− construction	**X**
	− locking devices and emergency extension systems	**X**
	− accidental retraction prevention devices	**X**
	− position, movement lights and indicators	**X**
	− nosewheel steering	**X**
	− wheels and tyres (construction, markings, limitations)	**X**
	− braking systems	**X**
	− construction	**X**

	− parking brake	**X**
	- Anti-skid system	**X**
	e. Hydraulics	**X**
	• **Basic principles of hydromechanics**	**X**
	− hydraulic fluids	**X**
	− components and operation of basic hydraulic system	**X**
	• **Hydraulic systems**	**X**
	− main, standby and emergency systems	**X**
	− operation, indicators and warning systems	**X**
	− ancillary systems	**X**
	f. Air driven systems	**X**
	• **Pneumatic systems**	**X**
	− power sources	**X**
	− components, construction and operation of basic system	**X**
	− potential failures, warning devices, indicators	**X**
	• **Air conditioning system**	**X**
	− heating and cooling	**X**
	− construction, functioning and controls	**X**
	− warning devices	**X**
	• **Pressurisation**	**X**
	− cabin altitude, maximum cabin altitude	**X**
	− differential pressure	**X**
	− pressurised zones in the aircraft	**X**
	− operation and indicators	**X**
	− safety devices and warning systems	**X**
	− rapid decompression, cabin altitude warning	**X**
	− emergency procedures	**X**
	• **De−ice systems**	**X**
	− pneumatic leading edge de-icing of wings/control surfaces	**X**
	− components, construction and operation	**X**
	− use and operational limitations	**X**
	• **Anti-ice systems**	**X**
	− aerofoil, control surfaces, powerplant, air intakes, windshield	**X**

	− components, construction and operation	**X**
	− use and operational limitations	**X**
	− ice warning system	**X**
	g. Non-pneumatic operated de-ice and anti-ice systems	**X**
	• **Components, construction and operation of:**	**X**
	− air intake	**X**
	− propeller	**X**
	− pitot, static pressure sensor and stall warning devices	**X**
	− windshield	**X**
	h. Fuel system	**X**
	• **Fuel tanks**	**X**
	− structural components and types	**X**
	− venting and drains: purpose	**X**
	− unusable fuel	**X**
	• **Fuel feed**	**X**
	− gravity feed	**X**
	− pressure feed, type of pumps	**X**
	− primer system, manual/electric	**X**
	− crossfeed	**X**
	• **Fuel system monitoring**	**X**
	− operation, indicators, warning systems	**X**
	− fuel management	**X**
	• **Fuel jettison**	**X**
A.1.3	**ELECTRICS**	
	a. Direct current	**X**
	• **General**	**X**
	− electric circuits and the electrical field	**X**
	− voltage, current, resistance	**X**
	− Ohm’s law	**X**
	− resistive circuits	**X**
	− resistance as a function of temperature	**X**
	− electrical power and electrical work	**X**
	− protection devices: fuses, circuit breakers, switches	**X**

	− function, type and operation	**X**
	− the capacitor: function	**X**
	• **Batteries**	**X**
	− theory, types and characteristics	**X**
	− capacity	**X**
	− hazards	**X**
	• **Magnetism**	**X**
	− permanent magnetism	**X**
	− electromagnetism	**X**
	− relay, circuit breaker, solenoid valve: principle, function and applications	**X**
	− electromagnetic power	**X**
	− electromagnetic induction	**X**
	• **Generators**	**X**
	− principle, function and applications	**X**
	− monitoring devices	**X**
	− starter generator	**X**
	• **Current distribution**	**X**
	− buses	**X**
	− ammeter and voltmeter	**X**
	− annunciators	**X**
	− inverter	**X**
	b. Alternating current	**X**
	− single and multi-phase AC	**X**
	− frequency	**X**
	− phase shift	**X**
	− AC components	**X**
	• **Alternators**	**X**
	- principle, function and applications	**X**
	- starter generator	**X**
	• **AC power distribution**	**X**
	− construction, operation and monitoring	**X**
	− protection circuits, paralleling of AC generators	**X**
	• **Transformers**	**X**

	− function	**X**
	− types and applications	**X**
A.1.4	**POWERPLANT − Piston engine**	
	− General	**X**
	− principle of the 4-stroke internal combustion engine	**X**
	− components, design types and cylinder numbering	**X**
	− definitions	**X**
	− bore, stroke, swept volume, compression ratio	**X**
	− cylinder construction:	**X**
	− barrel, cylinder head, valves, valve operating mechanism	**X**
	− valve timing, valve clearances, valve lead/lag/overlap	**X**
	− pistons, piston rings, connecting rods	**X**
	− crank shafts, dynamic dampers, bearings, camshafts	**X**
	− crankcase construction, accessories, breather systems	**X**
	− supercharging and turbo-charging	**X**
	− detonation and pre-ignition	**X**
	− contributing factors, effect and indications, recognition, stopping and prevention	**X**
	a. Engine power	**X**
	− indicated horsepower (IHP)	**X**
	− friction horsepower (FHP)	**X**
	− brake horsepower (BHP)	**X**
	b. Lubrication system	**X**
	− wet sump and dry sump principles and components	**X**
	− oil pressure and scavenge pumps, pressure relief valve	**X**
	− oil cooling system, temperature regulation	**X**
	− oil grades	**X**
	c. Air cooling	**X**
	− fins, baffles and cowl flaps	**X**
	− cylinder head temperature	**X**
	d. Ignition system	**X**
	• **Components, construction and operation**	**X**
	− HT magnetos, LT magnetos	**X**
	− impulse coupling, booster coil and induction vibrator	**X**

	− spark plugs, ignition harness and shielding	**X**
	− magneto serviceability checks	**X**
	e. Engine fuel supply	**X**
	− fuel, types, grades	**X**
	− detonation characteristics, octane rating	**X**
	− colour coding	**X**
	− carburettor components, construction and operation	**X**
	− fuel injection system components, construction, operation	**X**
	− priming system, manual and electric	**X**
	− icing, carburettor heat and alternate air	**X**
	− air/fuel ratio, mixture control	**X**
	− maximum power and fuel economy mixture settings	**X**
	f. Engine handling	**X**
	• **Limitations**	**X**
	− power and mixture settings, use of EGT	**X**
	− correct use of throttle (MAP), propeller control (RPM) and	**X**
	mixture	**X**
	• **Faults**	**X**
	− identification of engine problems	**X**
	− rough running	**X**
	− vibration	**X**
	− loss of power	**X**
A.1.5	**POWERPLANT − Turbine engine**	
	a. Principle of operation	**X**
	b. Types of construction	**X**
	− centrifugal	**X**
	− axial flow	**X**
	c. Engine construction	**X**
	• **Air inlet**	**X**
	− function	**X**
	• **Compressor**	**X**
	− function	**X**
	− construction and mode of operation	**X**

	− effects of damage	**X**
	− compressor stall and surge (cause, recognition, avoidance)	**X**
	− compressor characteristics	**X**
	• **Combustion chamber**	**X**
	− function	**X**
	− mixing ratios	**X**
	− fuel injectors	**X**
	• **Turbine**	**X**
	− function, construction and working principles	**X**
	− thermal and mechanical stress	**X**
	− effects of damage	**X**
	− monitoring of exhaust gas temperature	**X**
	• **Jet pipe**	**X**
	− function	**X**
	− different types	**X**
	− noise silencing devices	**X**
	d. Pressure, temperature and airflow in a turbine engine	**X**
	e. Reverse thrust	**X**
	− function, type and principles of operation	**X**
	− use and monitoring	**X**
	- failure	**X**
	f. Turbine engine systems	**X**
	• **Ignition**	**X**
	− function, types, components, operation, safety aspects	**X**
	• **Starter**	**X**
	− function, type, construction and mode of operation	**X**
	− control and monitoring	**X**
	− self-sustaining and idle speeds	**X**
	• **Engine start malfunctions**	**X**
	− types, cause and avoidance	**X**
	• **Fuel system**	**X**
	− construction and components	**X**
	− operation and monitoring	**X**

	− malfunctions	**X**
	• **Lubrication**	**X**
	− construction and components	**X**
	− operation and monitoring	**X**
	− malfunctions	**X**
	• **Fuel**	**X**
	− effects of temperature	**X**
	− impurities and additives	**X**
	• **Engine operating and monitoring**	**X**
A.1.6	**EMERGENCY EQUIPMENT**	
	a. Smoke detection	**X**
	− location, indicators, function test	**X**
	b. Fire detection and fire fighting	**X**
	− location, warning mode, function test	**X**
	c. Oxygen systems	**X**
	− types of systems, principles of operation	**X**
	− use and safety measures	**X**
A.1.7	**SPECIAL OPERATIONAL PROCEDURES AND HAZARDS**	
	a. Bird strike risk and avoidance	**X**
	b. Fire/Smoke	**X**
	− carburettor fire	**X**
	− engine fire	**X**
	− fire in the cabin, cockpit, freight compartment	**X**
	− selection of appropriate fire extinguishing agents with respect to fire classification	**X**
	− actions in case of over-heated brakes after aborted take-off and landing	**X**
	− smoke in the cockpit and cabin (effects and actions taken)	**X**
	c. Windshear, microburst	**X**
	− effects and recognition during approach/departure	**X**
	− actions to avoid and actions taken during encounter	**X**
	d. Wake turbulence	**X**
	− cause	**X**
	− influence of speed and mass, wind	**X**
	− actions taken during approach, landing, take-off, crossing behind	**X**

	e. **Contaminated runways:**	**X**
	• **SA CAR Part 1.01.1 Definitions:**	**X**
	- damp runway	**X**
	- dry runway	**X**
	- wet runway	**X**
	- contaminated runway	**X**
	• **Types of contamination**	**X**
	• **Hydroplaning / Aquaplaning**	**X**
	- types	**X**
	- critical speed formula	**X**
	- reducing the effects of hydroplaning	**X**
A.1.8	**SUBSONIC AERODYNAMICS**	
	a. Laws and definitions	**X**
	− units of measurement	**X**
	− Newton's Laws of Motion	**X**
	− mass and weight	**X**
	− inertia	**X**
	− velocity	**X**
	− temperature and density	**X**
	− static and dynamic pressure	**X**
	− momentum	**X**
	− acceleration	**X**
	− equilibrium	**X**
	− motion on a curved path	**X**
	− work, power and energy	**X**
	b. Airspeeds	**X**
	− Indicated Airspeed (IAS)	**X**
	− Calibrated Airspeed (CAS)	**X**
	− Equivalent Airspeed (EAS)	**X**
	− True Airspeed (TAS)	**X**
	− Mach number	**X**
	c. Lift	**X**
	− equation of continuity	**X**

	− Bernoulli's theorem and the venturi effect	X
	• **Aerofoil definitions**	X
	− relative airflow	X
	− camber and mean camber line	X
	− chord line	X
	− angle of attack	X
	− centre of pressure	X
	− pressure distribution around an aerofoil	X
	− lift formula and lift curve	X
	− lift/drag ratio	X
	• **Shape of an aerofoil**	X
	− symmetrical aerofoils	X
	− thickness to chord ratio	X
	− root chord, tip chord and mean aerodynamic chord	X
	− aspect ratio, angle of sweepback	X
	d. Drag	X
	• **Profile drag**	X
	− form drag	X
	− skin friction	X
	− causes, variation with speed, methods of minimising	X
	• **Induced drag**	X
	− causes, vortices, variation with speed/angle of attack	X
	− design methods used to minimise	X
	• **Drag formula**	X
	• **Drag curves, total drag curve and factors affecting**	X
	e. Thrust	X
	− thrust curve	X
	− thrust horse power (THP)	X
	f. Ground effect	X
	− definition	X
	− effect during take-off	X
	− effect during landing	X
	g. Flying controls	X

	• **Elevator, ailerons, rudder**	**X**
	− primary effects	**X**
	− secondary effects	**X**
	− stabilator	**X**
	− combined primary control surfaces	**X**
	• **Control balancing**	**X**
	− aerodynamic balance	**X**
	− tabs	**X**
	− mass balancing	**X**
	• **Trimming control systems**	**X**
	− fixed tabs, balance tab, anti-balance tab, servo tab	**X**
	− spring tab	**X**
	− variable incidence tailplane	**X**
	• **Adverse aileron yaw**	**X**
	− cause	**X**
	− principle of operation of differential and frise ailerons	**X**
	h. Lift augmentation	**X**
	• **Trailing edge flaps, types and method of operation**	**X**
	− effect on stalling angle	**X**
	− effect on stalling speed	**X**
	− use during take-off, approach and landing	**X**
	• **Leading edge flaps, types and method of operation**	**X**
	− effect on stalling angle	**X**
	• **Slats and slots**	**X**
	i. Stalling	**X**
	• **Boundary layer definitions**	**X**
	− laminar flow layer	**X**
	− turbulent flow layer	**X**
	− transition point	**X**
	− separation point	**X**
	• **Influence of angle of attack**	**X**
	− on pressure distribution	**X**
	− on centre of pressure	**X**

	• **Symptoms of the stall**	**X**
	− power off	**X**
	− power on	**X**
	− with and without flaps	**X**
	− stall warning indications	**X**
	− typical aural or visual indication	**X**
	• **Method of recovery**	**X**
	− use of controls and engine power or thrust	**X**
	• **The stall speed**	**X**
	Influence of:	**X**
	− the centre of gravity	**X**
	− power setting	**X**
	− wing loading	**X**
	• **Wing tip stalling**	**X**
	− design methods to minimise	**X**
	− washout	**X**
	− boundary layer fences	**X**
	− vortex generators	**X**
	− sawtooth leading edge	**X**
	j. Spinning	**X**
	• **The incipient spin (autorotation)**	**X**
	− development, recognition and recovery	**X**
	• **The full developed spin**	**X**
	− forces, development, recognition and recovery	**X**
	k. Forces acting on an aeroplane	**X**
	• **Straight and level flight**	**X**
	− balance of couples	**X**
	− relationship between power available and power required	**X**
	− range and endurance and factors affecting	**X**
	• **Climbing**	**X**
	− steady straight climb	**X**
	− balance of forces	**X**
	− maximum rate of climb	**X**

	− best angle of climb	**X**
	− factors affecting	**X**
	− use of power curves	**X**
	- cruise climb	**X**
	• **Descending**	**X**
	− without power	**X**
	− balance of forces	**X**
	− effect of weight, wind, configuration	**X**
	− gliding for range	**X**
	− gliding for endurance	**X**
	− effect of power	**X**
	• **Turning**	**X**
	− balance of forces	**X**
	− centrifugal and centripetal forces	**X**
	− load factor	**X**
	− turn rate and turn radius	**X**
	− effect of weight, power and speed	**X**
	− climbing and descending turns	**X**
	− steep turns	**X**
	l. Stability	**X**
	− axes and planes of rotation	**X**
	− static stability	**X**

SUBJECT: **AIRCRAFT TECHNICAL AND GENERAL (HELICOPTER)**		
ASPECT NUMBER	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY**
		H
A.2.1	**AIRCRAFT ELEMENTS**	
	a. Valves	**X**
	− check valves, pressure release valves, selector valves, restrictors, thermal relief valves	**X**

	b. Bearings	**X**
	− plain bearings, split bearings, bushes, ball bearings, roller bearings	**X**
	c. Pumps	**X**
	− gear type, diaphragm type, vane type, piston type, centrifugal type	**X**
	- pump drives	**X**
	d. Filters	**X**
	− strainers, sediment traps	**X**
A.2.2	**AIRFRAME AND SYSTEMS**	
	a. Fuselage	**X**
	− types of construction	**X**
	− structural components and materials	**X**
	− stress	**X**
	b. Cockpit and cabin windows	**X**
	− construction	**X**
	− structural limitations	**X**
	c. Landing gear (helicopter)	**X**
	− types: floats, skids, wheels	**X**
	− construction	**X**
	d. Helicopter configurations	**X**
	− single rotor	**X**
	e. Helicopter controls and rotors	**X**
	• **Control systems**	**X**
	− types, components, adjustments	**X**
	− primary controls (cyclic, collective, directional)	**X**
	f. Rotorheads	**X**
	− types, components, operation	**X**
	g. Tail rotors	**X**
	− types, components, operation	**X**
	- NOTARS	**X**
	h. Helicopter blades	**X**
	− types, construction, material, adjustment, balancing	**X**
	i. Helicopter control surfaces	**X**
	− vertical and horizontal stabilisers, construction, material	**X**

	j. Transmission systems	**X**
	• **Drive shafts**	**X**
	− types, components, materials	**X**
	• **Gearboxes**	**X**
	− types, construction, material, lubrication, indications	**X**
	- limitations	**X**
	- chip detector	**X**
	• **Clutches**	**X**
	− types, components	**X**
	• Freewheeling	**X**
	− types, components	**X**
	k. Rotor brake	**X**
	− components, construction	**X**
	l. Inspection	**X**
	− vibration, balancing, tracking	**X**
	m. Hydraulics	**X**
	• **Basic principles of hydromechanics**	**X**
	− hydraulic fluids	**X**
	− components and operation of basic hydraulic system	**X**
	• **Hydraulic systems**	**X**
	− main, standby and emergency systems	**X**
	− operation, indicators and warning systems	**X**
	n. Air driven systems	**X**
	• **Air conditioning system**	**X**
	− heating and cooling	**X**
	− construction, functioning and controls	**X**
	− warning devices	**X**
	- ram air ventilation	**X**
	o. De−ice and anti−ice systems (helicopter)	**X**
	− components, construction and operation of:	**X**
	− air intake, rotors (main and tail rotor)	**X**
	− pitot, static pressure sensor	**X**
	− windshield	**X**

	p. Fuel system	**X**
	• **Fuel tanks**	**X**
	− structural components and types	**X**
	− venting and drains: purpose	**X**
	• **Fuel feed**	**X**
	− gravity feed	**X**
	− pressure feed, type of pumps	**X**
	− primer system, manual/electric	**X**
	− crossfeed	**X**
	• **Fuel system monitoring**	**X**
	− operation, indicators, warning systems	**X**
	− fuel management	**X**
A.2.3	**ELECTRICS**	
	a. Direct current	**X**
	• **General**	**X**
	− electric circuits and the electrical field	**X**
	− voltage, current, resistance	**X**
	− Ohm's law	**X**
	− resistive circuits	**X**
	− resistance as a function of temperature	**X**
	− electrical power and electrical work	**X**
	− protection devices: fuses, circuit breakers, switches	**X**
	− function, type and operation	**X**
	− the capacitor: function	**X**
	• **Batteries**	**X**
	− theory, types and characteristics	**X**
	− capacity	**X**
	- uses	**X**
	− hazards	**X**
	• **Magnetism**	**X**
	− permanent magnetism	**X**
	− electromagnetism	**X**
	− relay, circuit breaker, solenoid valve: principle, function and applications	**X**

	− electromagnetic power	**X**
	− electromagnetic induction	**X**
	• **Generators**	**X**
	− principle, function and applications	**X**
	− monitoring devices	**X**
	− starter generator	**X**
	• **Current distribution**	**X**
	− buses	**X**
	− ammeter and voltmeter	**X**
	− annunciators	**X**
	− inverter	**X**
	• **Alternators**	**X**
	- principle, function and applications	**X**
	- starter generator	**X**
	b. Alternating current	**X**
	− single and multi-phase AC	**X**
	− frequency	**X**
	− phase shift	**X**
	− AC components	**X**
	• **AC power distribution**	**X**
	− construction, operation and monitoring	**X**
	− protection circuits, paralleling of AC generators	**X**
	• **Transformers**	**X**
	− function	**X**
	− types and applications	**X**
	• **Transformer/rectifier units**	**X**
A.2.4	**POWERPLANT − Piston engine**	
	a. General	**X**
	− principle of the 4-stroke internal combustion engine	**X**
	− components, design types and cylinder numbering	**X**
	b. Definitions:	**X**
	− bore, stroke, swept volume, compression ratio	**X**
	c. Engine and cylinder construction and operation:	**X**

	− barrel, cylinder head, valves, valve operating mechanism	**X**
	− valve timing, valve clearances, valve lead/lag/overlap	**X**
	− pistons, piston rings, connecting rods	**X**
	− crank shafts, dynamic dampers, bearings, camshafts	**X**
	− crankcase construction, accessories, breather systems	**X**
	− supercharging and turbo-charging	**X**
	d. Detonation and pre-ignition:	**X**
	− contributing factors, effect and indications, recognition, stopping and prevention	**X**
	e. Engine power	**X**
	− indicated horsepower (IHP)	**X**
	− friction horsepower (FHP)	**X**
	− brake horsepower (BHP)	**X**
	f. Lubrication system	**X**
	− wet sump and dry sump principles and components	**X**
	− oil pressure and scavenge pumps, pressure relief valve	**X**
	− oil cooling system, temperature regulation	**X**
	− oil grades	**X**
	G. Air cooling	**X**
	− fins, baffles	**X**
	− cylinder head temperature	**X**
	H. Ignition system	**X**
	• **Components, construction and operation**	**X**
	− HT magnetos, LT magnetos	**X**
	− impulse coupling, booster coil and induction vibrator	**X**
	− spark plugs, ignition harness and shielding	**X**
	− magneto serviceability checks	**X**
	i. Engine fuel supply	**X**
	− fuel, types, grades	**X**
	− detonation characteristics, octane rating	**X**
	− colour coding	**X**
	− carburettor components, construction and operation	**X**
	− fuel injection system components, construction, operation	**X**
	− priming system, manual and electric	**X**

	− icing, carburettor heat and alternate air	**X**
	− air/fuel ratio, mixture control	**X**
	− maximum power and fuel economy mixture settings	**X**
	j. Engine handling	**X**
	• **Limitations**	**X**
	− power and mixture settings, use of EGT	**X**
	− operational limitations	**X**
	• **Faults**	**X**
	− identification of engine problems	**X**
	− rough running	**X**
	− vibration	**X**
	− loss of power	**X**
A.2.5	**POWERPLANT − Turbine engine**	
	a. Principle of operation	**X**
	b. Types of construction	**X**
	− centrifugal	**X**
	− axial flow	**X**
	c. Engine construction	**X**
	• **Air inlet**	**X**
	− function	**X**
	• **Compressor**	**X**
	− function	**X**
	− construction and mode of operation	**X**
	− effects of damage	**X**
	− compressor stall and surge (cause, recognition, avoidance)	**X**
	− compressor characteristics	**X**
	• **Combustion chamber**	**X**
	− function	**X**
	− mixing ratios	**X**
	− fuel injectors	**X**
	• **Turbine**	**X**
	− function, construction and working principles	**X**
	− thermal and mechanical stress	**X**

	− effects of damage	**X**
	− monitoring of exhaust gas temperature	**X**
	d. Pressure, temperature and airflow in a turbine engine	**X**
	e. Turbine engine systems	**X**
	• **Ignition**	**X**
	− function, types, components, operation, safety aspects	**X**
	• **Starter**	**X**
	− function, type, construction and mode of operation	**X**
	− control and monitoring	**X**
	− self-sustaining and idle speeds	**X**
	• **Engine start malfunctions**	**X**
	− types, cause and avoidance	**X**
	• **Fuel system**	**X**
	− construction and components	**X**
	− operation and monitoring	**X**
	− malfunctions	**X**
	• **Lubrication**	**X**
	− construction and components	**X**
	− operation and monitoring	**X**
	− malfunctions	**X**
	• **Fuel**	**X**
	− effects of temperature	**X**
	− impurities and additives	**X**
	• **Engine operating and monitoring**	**X**
A.2.6	**EMERGENCY EQUIPMENT**	
	a. Fire detection and fire fighting	**X**
	− location, warning mode, function test	**X**
A.2.7	**SPECIAL OPERATIONAL PROCEDURES AND HAZARDS**	
	a. Ground de-icing	**X**
	− icing conditions	**X**
	− de-icing, anti-icing, types of fluids	**X**
	b. Bird strike risk and avoidance	**X**
	c. Noise abatement	**X**

	− influence of the flight procedure (departure, cruise or approach)	**X**
	− influence by the pilot (power setting, track of helicopter)	**X**
	d. Fire/Smoke	**X**
	− carburettor fire	**X**
	− engine fire	**X**
	− fire in the cabin or cockpit	**X**
	− selection of appropriate fire extinguishing agents with respect to fire classification	**X**
	− smoke in the cockpit and cabin (effects and actions taken)	**X**
	e. Windshear, microburst	**X**
	− effects and recognition during approach/departure	**X**
	− actions to avoid and actions taken during encounter	**X**
	f. Wake turbulence	**X**
	− cause	**X**
	− influence of speed, mass and wind	**X**
	− actions taken during approach, landing, take-off, crossing behind	**X**
	g. Rotor downwash	**X**
	h. Emergency procedures	**X**
	• Influence by technical problems:	**X**
	− engine failure	**X**
	− tail rotor/directional control failure	**X**
	− ground/resonance	**X**
	− blade/stall	**X**
	− settling with power	**X**
	− overpitch	**X**
	− overspeed	**X**
	− sudden stoppage	**X**
	− dynamic rollover/mast bumping	**X**
A.2.8	**SUBSONIC AERODYNAMICS**	
	a. Laws and definitions	**X**
	− units of measurement	**X**
	− Newton's Laws of Motion	**X**
	− mass and weight	**X**
	− inertia	**X**

	− velocity	**X**
	− temperature and density	**X**
	− static and dynamic pressure	**X**
	− momentum	**X**
	− acceleration	**X**
	− equilibrium	**X**
	− motion on a curved path	**X**
	− work, power and energy	**X**
	b. Airspeeds	**X**
	− Indicated Airspeed (IAS)	**X**
	− Calibrated Airspeed (CAS)	**X**
	− True Airspeed (TAS)	**X**
	c. Lift	**X**
	− equation of continuity	**X**
	− Bernoulli's theorem and the venturi effect	**X**
	• **Aerofoil definitions**	**X**
	− relative airflow	**X**
	− camber and mean camber line	**X**
	− chord line	**X**
	− angle of attack	**X**
	− centre of pressure	**X**
	− pressure distribution around an aerofoil	**X**
	− lift formula and lift curve	**X**
	− lift/drag ratio	**X**
	• **Shape of an aerofoil**	
	- types of aerofoils	**X**
	− aspect ratio	**X**
	d. Drag	**X**
	• **Profile drag**	**X**
	− form drag	**X**
	− skin friction	**X**
	− causes, variation with speed, methods of minimising	**X**
	• **Induced drag**	**X**

	− causes, vortices, variation with speed/angle of attack	**X**
	− design methods used to minimise	**X**
	• **Drag formulas**	**X**
	• **Drag curves, total drag curve and factors affecting drag**	**X**
	• **Rotor drag**	**X**
	e. Distribution of forces – balance of couples	**X**
	− lift/weight and thrust/drag couples	**X**
A.2.9	**HELICOPTER AERODYNAMICS**	
	a. Definitions:	**X**
	− axis of rotation	**X**
	− rotor shaft axis	**X**
	− tip path	**X**
	− tip path plane	**X**
	− rotor disc	**X**
	− disc loading	**X**
	− blade loading	**X**
	b. The forces diagram and associated terminology	**X**
	− pitch angle (blade angle)	**X**
	− rotational airflow	**X**
	− induced airflow	**X**
	− lift blade	**X**
	− drag blade	**X**
	− total reaction – blade	**X**
	− rotor thrust	**X**
	− rotor drag	**X**
	− torque	**X**
	c. Uniformity of rotor thrust along the blade	**X**
	− blade twist	**X**
	− taper	**X**
	− coning angle	**X**
	− centrifugal force	**X**
	− limits of rotor RPM	**X**
	− centrifugal turning moments	**X**

	d. Helicopter controls	**X**
	• **Collective lever**	**X**
	− collective pitch changes	**X**
	− relationship with rotor thrust and rotor drag	**X**
	• **Cyclic stick**	**X**
	− cyclic pitch changes	**X**
	− rotor disc attitude	**X**
	− rotor thrust tilt	**X**
	• **Yaw pedals**	**X**
	− fuselage torque	**X**
	− tail rotor drift	**X**
	− tail rotor roll	**X**
	− fenestron tail	**X**
	- Tail rotor failures	**X**
	- Other methods of anti-torque	**X**
	e. Rotor blade freedom of movement	**X**
	− the feathering axis	**X**
	− pitch angle	**X**
	f. Flapping	**X**
	− the flapping hinge	**X**
	− flapping to equality	**X**
	g. Dragging	**X**
	− the drag hinge	**X**
	− drag dampers	**X**
	− leading/lagging	**X**
	− periodic drag changes	**X**
	− blade CG (conservation of angular momentum)	**X**
	− hookes joint effect	**X**
	h. Phase lag and advance angle	**X**
	− the control orbit	**X**
	− pitch operating arm movement	**X**
	− rate of pitch change	**X**
	− rate of blade flapping	**X**

	− resulting disc attitude	**X**
	− phase lag definition	**X**
	− advantage angle – definition	**X**
	i. Vertical flight	**X**
	− take-off	**X**
	− vertical climb	**X**
	− vertical descent	**X**
	− hover outside ground effect	**X**
	− ground effect	**X**
	− factors affecting ground cushion	**X**
	- limitations on vertical flight	**X**
	− avoidance of dynamic roll-over	**X**
	j. Force in balance	**X**
	− at the hover	**X**
	− in forward flight	**X**
	− influence of CG	**X**
	− influence of rotor shaft tilt	**X**
	k. Translational lift	**X**
	− effect of horizontal airflow on induce flow	**X**
	− variation of total flow through the disc with forward flight	**X**
	− the relationship between pitch angle and angle of attack	**X**
	l. Power requirements	**X**
	− rotor profile power	**X**
	− power absorption – tail rotor and ancillary equipment	**X**
	− rotor profile power variation with forward speed	**X**
	− induced drag	**X**
	− parasite drag	**X**
	− total power required	**X**
	− power available	**X**
	m. Further aerodynamics of forward flight	**X**
	− transition to and from the hover	**X**
	− symmetry and asymmetry of rotor thrust	**X**
	− main rotor flapback	**X**

	− tail rotor flapback and methods of removal	**X**
	− factor affecting maximum forward speed	**X**
	− design limits of cyclic stick	**X**
	− airflow reversal	**X**
	− retreating blade stall	**X**
	− symptoms and recovery actions	**X**
	− compressibility	**X**
	− flow separation	**X**
	− inflow roll	**X**
	n. Factors affecting cyclic stick limits	**X**
	− density altitude	**X**
	− CG position	**X**
	o. The flare – power flight	**X**
	− thrust reversal	**X**
	− effect on helicopter attitude	**X**
	− increase in rotor thrust	**X**
	− decrease in rotor drag	**X**
	− increase in rotor RPM	**X**
	− effect of deceleration	**X**
	p. Settling with power (vortex ring)	**X**
	− tip vortices	**X**
	− comparison between induced flow and external flow	**X**
	− development	**X**
	− change in relative airflow along blade span	**X**
	− root stall and turbulence	**X**
	q. Blade sailing	**X**
	− rotor RPM and blade rigidity	**X**
	− effect of adverse wind	**X**
	− minimising the danger	**X**
	r. Autorotation − vertical	**X**
	− rate of descent airflow	**X**
	− effective airflow	**X**
	− relative airflow	**X**

	− inflow and outflow angle	**X**
	− autorotative force	**X**
	− rotor drag	**X**
	− effect of mass and altitude	**X**
	− control of rotor RPM	**X**
	− rotor RPM stability	**X**
	s. Autorotation – forward flight	**X**
	− factors affecting inflow angle	**X**
	− effect of forward speed on rate of descent	**X**
	− asymmetry of autorotative disc area in forward flight	**X**
	− turning	**X**
	− the flare	**X**
	− rotor RPM increase from movement of autorotative section	**X**
	− increase in rotor thrust	**X**
	− reduction in rate of descent	**X**
	− range and endurance	**X**
	− autorotative landing	**X**
	− height/velocity avoidance graph	**X**
	t. Stability	**X**
	− hover	**X**
	− forward flight	**X**
	− rearward flight	**X**
	− stability aids	**X**
	− stabilisers and effects of CG	**X**
	− gyro controlled stabiliser system	**X**
	− stabiliser bars	**X**
	− delta hinge effect	**X**
	− effect of lever application on attitude in translational flight	**X**
	u. Control power	**X**
	− the teetering head	**X**
	− fully articulated head	**X**
	− the rigid rotor	**X**
	− effect on stability	**X**

	− effect on dynamic/static rollover	**X**
	v. Power requirements − graphs	**X**
	− power required/power available graph	**X**
	− maximum rate of climb speed	**X**
	− operating with limited power	**X**
	− best angle of climb speed	**X**
	− maximum speed	**X**
	− range and endurance	**X**
	− overpitch	**X**
	− overtorque	**X**
	− turning	**X**
	w. Stability	**X**
	− helicopter axes and planes of rotation	**X**
	− static stability	**X**
	− dynamic stability	**X**
	− static and dynamic longitudinal stability	**X**
	− lateral directional stability	**X**
	− static and dynamic directional stability	**X**
	− effects of design features on stability	**X**
	- Helicopter stability augmentation systems	**X**
	x. Blade stall	**X**
	− stalling angle of attack	**X**
	− boundary layer flow	**X**
	− variation of lift and drag at the stall	**X**
	y. Transonic effects on blades	**X**
	− shock waves	**X**
	− formation and effect on helicopter handling	**X**

SUBJECT: **AIR LAW** **(AEROPLANE AND HELICOPTER)**			
ASPECT NUMBER	**REGULATION REFERENCE**	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY**

			A	H
A.3.1		**SOUTH AFRICAN CIVIL AVIATION REGULATIONS & TECHNICAL STANDARDS**		
	CAR Part 1.01.1	**Definitions and abbreviations**		
		- Accident	**X**	**X**
		- Active flight deck duty	**X**	
		- Acts of unlawful interference	**X**	**X**
		- Advisory airspace	**X**	**X**
		- Aerial work	**X**	**X**
		- Aerobatic flight	**X**	**X**
		- Aerodrome	**X**	**X**
		- Aerodrome operating minima	**X**	**X**
		- Aerodrome traffic zone	**X**	**X**
		- Aeronautical information circular (AIC)	**X**	**X**
		- Aeronautical information publication	**X**	**X**
		- Aeroplane	**X**	**X**
		- AIP Supplement	**X**	**X**
		- Airborne collision avoidance system	**X**	**X**
		- Aircraft	**X**	**X**
		- Aircraft category	**X**	**X**
		- Aircraft certificated for single-pilot operation	**X**	**X**
		- Aircraft flight manual	**X**	**X**
		- Aircraft operating manual	**X**	**X**
		- Aircraft type	**X**	**X**
		- Aircraft variant	**X**	**X**
		- Airmanship	**X**	**X**
		- Air operator certificate	**X**	**X**
		- Air side	**X**	**X**
		- Air-taxiing		**X**
		- Air traffic advisory service	**X**	**X**
		- Air traffic control service	**X**	**X**
		- Air traffic service	**X**	**X**
		- Air traffic service unit	**X**	**X**
		- Airworthy	**X**	**X**

		- Alerting service	X	X
		- Alternate aerodrome/ heliport	X	X
		- Altitude	X	X
		- Approach and landing phase helicopters		X
		- Approved training	X	X
		- Apron	X	X
		- ATS surveillance service	X	X
		- Authority to fly	X	X
		- Automatic dependent surveillance — broadcast	X	X
		- Ceiling / Cloud ceiling	X	X
		- Certificate of airworthiness	X	X
		- Child	X	X
		- Communication failure procedure	X	X
		- Competency	X	X
		- Configuration	X	X
		- Contaminated runway	X	X
		- Control area	X	X
		- Controlled flight	X	X
		- Control zone	X	X
		- Co-pilot	X	X
		- Corporate aviation operation	X	X
		- Crew member	X	X
		- Cargo	X	X
		- Carry-on baggage	X	X
		- Congested area		X
		- Congested hostile environment		X
		- Critical phase of flight	X	X
		- Cross country flight	X	X
		- Current flight plan	X	X
		- Danger area	X	X
		- Date of application	X	X
		- Day	X	X
		- Defined point		X

		- Designated flight examiner	X	X
		- Electronic flight bag	X	X
		- En-route alternate aerodrome		
		- En-route safe altitude	X	X
		- Estimated time of arrival (VFR)	X	X
		- Extended range operations	X	X
		- First aid	X	X
		- Flight	X	X
		- Flight crew member	X	X
		- Flight duty period	X	X
		- Flight information region	X	X
		- Flight information service	X	X
		- Flight level	X	X
		- Flight plan	X	X
		- Flight simulator training device	X	X
		- Flight time	X	X
		- General aviation operation	X	X
		- Full flight simulator	X	X
		- GNSS	X	X
		- Hazard	X	X
		- Helicopter	X	X
		- Helicopter load combination		X
		- Incident	X	X
		- Infant	X	X
		- Integrated aeronautical information package	X	X
		- Instrument meteorological conditions	X	X
		- International flight	X	X
		- Landing distance available	X	X
		- Large aircraft	X	X
		- Maneuvering area	X	X
		- Master minimum equipment list	X	X
		- Minimum equipment list	X	X
		- Maximum certificated mass	X	X

		- Meteorological service	X	X
		- Night	X	X
		- Operator	X	X
		- Passenger	X	X
		- Pilot	X	X
		- Pilot in command	X	X
		- Pilot in command under supervision	X	X
		- Psychoactive substances	X	X
		- Receiver Autonomous Integrity Monitoring	X	X
		- Rejected take-off distance required		X
		- Release to service	X	X
		- Restricted area	X	X
		- Runway-holding position	X	X
		- Safety pilot	X	X
		- Serious injury	X	X
		- Skills test	X	X
		- Special rules areas	X	X
		- Student pilot in command	X	X
		- Suitable aerodrome	X	X
		- Take-off and initial climb phase		X
		- Take-off distance available	X	X
		- Take-off run available	X	X
		- Taxi	X	X
		- Terminal control area	X	X
		- Threat	X	X
		- Threat management	X	X
		- Threshold	X	X
		- Transition altitude	X	X
		- Transition level	X	X
		- Tug	X	X
		- Tow	X	X
		- Visual approach	X	X
		- Visibility	X	X

		- Visual meteorological conditions	**X**	**X**
		- Wet runway	**X**	**X**
A.3.2	**CAR PART 12**	**AVIATION ACCIDENTS AND INCIDENTS**		
	Subpart 1:	**General**		
	12.01.1	Applicability	**X**	**X**
	12.01.9	Powers of the Investigator in Charge or an Investigator	**X**	**X**
	Subpart 2:	**Accident or incident notification procedures**		
	12.02.1	Notification of accidents	**X**	**X**
	12.02.2	Notification of incidents	**X**	**X**
	12.02.3	Notification of accidents or incidents outside the Republic	**X**	**X**
	12.02.4	Particulars of notification	**X**	**X**
	12.02.5	Notification of hazards	**X**	**X**
	Subpart 4:	**Scene of an accident**		
	12.04.1	Guarding of aircraft involved in accident	**X**	**X**
	12.04.2	Access to the scene of accident	**X**	**X**
	12.04.3	Control of evidence	**X**	**X**
	12.04.4	Interference with objects and marks at scene of accident	**X**	**X**
	12.04.5	Removal of damaged or disabled aircraft	**X**	**X**
A.3.3	**CAR PART 43**	**GENERAL MAINTENANCE RULES**		
	43.01.1	Applicability	**X**	**X**
	43.01.2	Falsification, reproduction or alteration of maintenance documents	**X**	**X**
	43.01.3	Logbooks	**X**	**X**
	43.01.5	Entries in logbooks	**X**	**X**
	43.02.2 (2)	Persons to carry out maintenance	**X**	**X**
	CATS 43.02.2	Persons to carry out maintenance	**X**	**X**
	43.02.7 (1)	Mass and balance	**X**	**X**
	43.02.18	Aircraft compass requirements	**X**	**X**
	CATS 43.02.18	Aircraft compass requirements	**X**	**X**
	43.04.1	Persons to certify release to service	**X**	**X**
A.3.4	**CAR PART 61**	**PILOT LICENSING**		
	61.01.1	Applicability	**X**	**X**
	61.01.2	Pilot licences	**X**	**X**
	61.01.3	Ratings for pilots	**X**	**X**

	61.01.5	Maintenance of competency and Skills Test	X	X
	61.01.6	Medical requirements and fitness	X	X
	61.01.7	Language	X	X
	61.01.8	Logging of flight time (excl (13) – (16))	X	X
	61.01.9	Crediting of flight time and theoretical knowledge (excl (9) – (27))	X	X
	61.01.11	Curtailment of privileges of licence holders aged 60 years or more	X	X
	61.01.12	Flight simulation training device	X	X
	61.01.14	Register of licences	X	X
	61.01.15	Training for acquiring licence, rating or validation	X	X
	61.01.16	Payment of currency fee	X	X
	61.01.18	Endorsements and record keeping	X	X
	61.05.1	Requirements for Commercial Pilot Licence (Aeroplane)	X	
	61.05.3	Theoretical knowledge examination for Commercial Pilot Licence (Aeroplane)	X	
	61.05.4	Skills test for Commercial Pilot Licence (Aeroplane)	X	
	61.05.5	Privileges and limitations of Commercial Pilot Licence (Aeroplane)	X	
	61.05.6	Period of validity of a Commercial Pilot Licence (Aeroplane)	X	
	61.05.7	Maintenance of Competency for a Commercial Pilot Licence (Aeroplane)	X	
	61.05.8	Ratings for special purposes for a Commercial Pilot Licence (Aeroplane)	X	
	61.06.1	Requirements for Commercial Pilot Licence (Helicopter)		X
	61.06.3	Theoretical knowledge examination for Commercial Pilot Licence (Helicopter)		X
	61.06.4	Skills test for Commercial Pilot Licence (Helicopter)		X
	61.06.5	Privileges and limitations of Commercial Pilot Licence (Helicopter)		X
	61.06.6	Period of validity of a Commercial Pilot Licence (Helicopter)		X
	61.06.7	Maintenance of Competency for Commercial Pilot Licence (Helicopter)		X
	61.06.8	Ratings for special purposes for Commercial Pilot Licence (Helicopter)		X
	61.09.1	Requirements for issue of class and type ratings (excl (11), (12))	X	X
	61.09.1	Requirements for issue of class and type ratings (excl (8) – (10))	X	X
	61.09.2	Training (excl (5))	X	X
	61.09.3	Skills test	X	X
	61.09.4	Circumstances in which type or class ratings are required	X	X
	61.09.7	Type and class ratings: Privileges and variants	X	X
	61.09.8	Type and class ratings	X	X

A.3.5	**CAR PART 67**	**MEDICAL CERTIFICATION**		
	67.00.2	Classes of medical certificates	**X**	**X**
	67.00.3 (2)	Functions of Director regarding medical examinations	**X**	**X**
	67.00.6	Period of validity of medical certificates (excl (4))	**X**	**X**
	67.00.8	Issuing of medical certificate	**X**	**X**
	67.00.9	Duties of holder of medical certificate	**X**	**X**
	67.00.13	Substance abuse	**X**	**X**
	67.00.14	Suspension or cancellation of medical certificate	**X**	**X**
A.3.6	**CAR PART 91**	**GENERAL AVIATION AND OPERATING FLIGHT RULES**		
	91.01.1	Applicability	**X**	**X**
	91.01.2	Authority of PIC and crew members	**X**	**X**
	91.01.3	Authorisation of personnel to taxi aeroplanes	**X**	
	91.01.6	Method of carriage of persons	**X**	**X**
	91.01.7	Admission to flight deck	**X**	**X**
	91.01.9	Portable electronic devices	**X**	**X**
	91.01.10	Endangering safety	**X**	**X**
	91.01.12	Use of time	**X**	**X**
	91.01.13	Additional flight crew member equipment	**X**	**X**
	91.01.14	Carriage of dangerous goods	**X**	**X**
	91.01.15	Passenger intoxication and unruly behaviour	**X**	**X**
	91.01.16	Psychoactive substances	**X**	**X**
	91.02.1	Crew composition and qualifications	**X**	**X**
	91.02.3	Crew member responsibilities	**X**	**X**
	91.02.4	Recency	**X**	**X**
	91.02.5	Crew members at duty stations	**X**	**X**
	91.02.6	Laws, regulations and procedures	**X**	**X**
	91.02.7	Duties of pilot-in-command regarding flight preparation	**X**	**X**
	91.02.8	Duties of pilot-in-command regarding flight operations	**X**	**X**
	91.03.1	Documents to be carried on board	**X**	**X**
	91.03.2	Aircraft flight manual	**X**	**X**
	91.03.3	Aircraft checklists	**X**	**X**
	91.03.4	Air traffic service flight plan and associated procedures	**X**	**X**
	91.03.5	Flight folio	**X**	**X**

	SACATS 91.03.5	Flight folio	X	X
	91.03.6	Fuel record	X	X
	91.03.7	Certificate of release to service	X	X
	91.03.9	Logbooks	X	X
	91.04.1	Use and installation of instruments and equipment	X	X
	91.04.2	Circuit protection devices	X	X
	91.04.3	Aircraft operating lights	X	X
	91.04.4	Flight, navigation and associated equipment for aircraft operated under VFR	X	X
	91.04.6	Additional equipment for single-pilot operation under IMC or at night	X	X
	91.04.8	Radio altimeter		X
	91.04.11	Seats, seat safety belts, harnesses and child restraint devices	X	X
	91.04.13	First aid and universal precaution kits	X	X
	91.04.16	Supplemental oxygen in case of non-pressurised aircraft	X	X
	91.04.18	Hand-held fire extinguishers	X	X
	91.04.23	Emergency locator transmitters	X	X
	91.04.24(1)(a)	Life jackets and other flotation devices	X	
	91.04.24(1)(c)	Life jackets and other flotation devices		X
	91.04.25	Life jackets and other flotation devices	X	X
	91.04.28	Airborne collision avoidance system	X	X
	91.04.30	Terrain awareness and warning systems (TAWS)	X	X
	91.05.1	Communication equipment	X	X
	91.05.2	Navigation equipment	X	X
	CATS 91.05.3	Use of global navigation satellite system	X	X
	91.06.1	Landing on roads	X	X
	91.06.2	Dropping objects, spraying or dusting	X	X
	91.06.3	Picking up objects	X	X
	91.06.6	Proximity and formation flights	X	X
	91.06.7	Right of way	X	X
	91.06.8	Following line features	X	X
	91.06.9	Aircraft speed	X	X
	91.06.10	Lights to be displayed by aircraft	X	X
	91.06.11	Taxi rules	X	X
	91.06.12	Operation on and in vicinity of aerodrome	X	X

	91.06.13	Signals	X	X
	SACATS 91.06.13	Signals	X	X
	91.06.15	Reporting position	X	X
	91.06.16	Mandatory radio communication in controlled airspace	X	X
	SA-CATS 91.06.16	Mandatory radio communications in controlled airspace	X	X
		- Radio communication failure (RCF) procedures – General	X	X
		- RCF procedures – VFR	X	X
		- Appendix 1 Standard Radio Communications Failure Procedure – VFR Arrivals	X	X
	91.06.17	Mandatory radio communication in advisory airspace	X	X
	91.06.18	Compliance with rules of air and air traffic control clearances and instructions	X	X
	91.06.19	Prohibited areas	X	X
	91.06.20	Restricted areas	X	X
	91.06.21(1)(a), (2)	Visibility and distance from cloud	X	
	91.06.21(1)(b), (2)	Visibility and distance from cloud		X
	91.06.22(1)	Special VFR weather minima	X	
	91.06.22(2)	Special VFR weather minima		X
	91.06.23	VFR flight determination and weather deterioration	X	X
	91.06.24	Compliance with IFR	X	X
	91.06.25	Aircraft equipment	X	X
	91.06.29	Identification and interception of aircraft	X	X
	SACATS 91.06.29	Identification and interception of aircraft	X	X
	91.06.30	Air traffic service procedures	X	X
	91.06.31	Priority	X	X
	91.06.32 (excl (2)	Minimum heights	X	
	91.06.32	Minimum heights		X
	91.06.33	Semi-circular rule	X	X
	SACATS 91.06.33	Semi-circular rule	X	X
	91.07.1	Routes and areas of operation	X	X
	91.07.2	Minimum flight altitudes	X	X
	SACATS 91.07.2	Minimum flight altitudes	X	X
	91.07.3	Use of aerodromes	X	X
	91.07.4	Helicopter landings and take-offs		X
	91.07.10	VFR operating minima	X	X

	91.07.12	Fuel supply	X	X
	SACATS 91.07.12(1)	Fuel supply	X	
	SACATS 91.07.12(2)	Fuel supply		X
	91.07.13	Refuelling or defuelling with passengers on board	X	X
	91.07.18	Seats, safety belts and harnesses	X	X
	91.07.19	Passenger seating	X	X
	91.07.20	Passenger movements and briefing	X	X
	91.07.21	Passenger health and safety	X	X
	91.07.24	Use of supplemental oxygen	X	X
	91.07.25	Approach and landing conditions	X	X
	91.07.28	Turning helicopter rotors		X
	91.07.29	Starting and running of engines	X	X
	91.07.30	Acrobatic flights	X	X
	91.07.31	Simulated instrument flight in aircraft	X	X
	91.07.32	Aeroplane operating procedures	X	
	91.07.34	Electronic flight bags	X	X
	91.07.35	Extended twin engine operations	X	
A.3.7	**CAR Part 92**	**Conveyance of dangerous goods**		
	92.00.1	Applicability	X	X
	92.00.8	Training	X	X
	92.00.18	Loading restrictions in cabin or on flight deck	X	X
	92.00.21	Loading in cargo aircraft	X	X
	92.00.27	Dangerous goods carried by passengers or flight crew members	X	X
A.3.8	**CAR Part 93**	**Corporate operations**		
A.3.9	93.01.1	Applicability	X	
	93.02.2	Extended twin engine operations	X	
	93.02.10	Fatigue management program	X	
A.3.10	**CAR Part 121**	**Air transport operations – carriage on aeroplanes of more than 19 passengers or cargo**		
	121.01.1	Applicability	X	
A.3.11	**CAR Part 127**	**Commercial air transport and general aviation operations: helicopters**		
	127.01.1	Applicability		X
	127.02.1(8)(9)(6)	Composition of flight crew		X
	127.07.8	Offshore operations		X

A.3.12	**CAR Part 135**	**Air transport operations – carriage of less than 20 passengers or cargo**		
	135.01.1	Applicability	**X**	
	135.01.2	Admission to flight deck	**X**	
	135.02.2	Minimum requirements for assignment as pilot-in-command	**X**	
	SACATS 135.02.2	Minimum requirements for assignment as pilot-in-command	**X**	
	135.07.5	Single-engine aeroplane IMC and night operations	**X**	
	SACATS 135.07.5	Single-engine aeroplane IMC and night operations	**X**	
	135.07.8	IFR or night flight without second-in-command	**X**	
	SACATS 135.07.8	IFR or night flight without second-in-command	**X**	
	135.08.7	Dispatch limitations: landing at destination and alternate aerodromes	**X**	
A.3.13	**CAR Part 139**	**Aerodromes and heliports**		
	139.01.1(2)	Applicability	**X**	**X**
	139.04.1	Approval and operation of non-licensed helicopter sites		**X**
A.3.14	**SA-CATS 172**	**Airspace and Air Traffic Services**		
	SA-CATS 172.02.2	Classification of airspace and level of service provision	**X**	**X**
A.3.15	**CAR Part 185**	**Enforcement**		
	185.00.1	Offences	**X**	**X**
A.3.16	**RSA Aeronautical Information Publication (AIP)**			
	ENROUTE			
	ENR 1.4.1	Classification of airspace	**X**	**X**
	ENR 1.5.1	General	**X**	**X**
	ENR 1.5.2	Arriving flights	**X**	**X**
	ENR 1.5.10	Departing flights General	**X**	**X**
	ENR 1.5.10.1	Noise abatement procedures	**X**	
	ENR 1.6.1	Primary radar	**X**	**X**
	ENR 1.6.2	Secondary surveillance radar (Excluding 1.6.2.3.4 & 1.6.2.3.5)	**X**	**X**
	ENR 1.7	Altimeter setting procedures (excluding 1.7.3b)	**X**	**X**
	AERODROMES			
	AD section	Interpretation of aerodrome information on AIP charts (Candidates should take note of the information in RSA AIP GEN section 2.2 for AIP abbreviations and section 2.3 for Chart symbols)	**X**	**X**
A.3.17	**JEPPESEN HIGH / LOW ALTITUDE ENROUTE CHARTS**			
	a. Recognition and knowledge of:		**X**	**X**

	- Air route structure	X	X
	- airspace structure and classification	X	X
	- communication frequencies	X	X
	- chart symbols	X	X
	- danger, restricted and prohibited airspace	X	X
	- aerodrome information	X	X
	- radio navigation facilities and frequencies	X	X
A.3.18	**ICAO ANNEX 14 – AERODROMES Vol 1**		
	a. Definitions		
	- Aerodrome beacon	X	X
	- Aerodrome elevation	X	X
	- Barrette	X	X
	- Clearway	X	
	- Declared distances (Take-off run available (TORA); Take-off distance available (TODA); Accelerate-stop distance available (ASDA); Landing distance available (LDA))	X	X
	- Displaced threshold	X	X
	- Holding bay	X	
	- Instrument runway (All types are to be known)	X	X
	- Landing area	X	X
	- Manoeuvring area	X	X
	- Marking	X	X
	- Movement area	X	X
	- Primary runway(s)	X	X
	- Runway	X	X
	- Runway-holding position	X	X
	- Runway strip	X	X
	- Runway turn pad	X	X
	- Shoulder	X	X
	- Sign	X	X
	- Stopway	X	X
	- Taxiway	X	X
	- Threshold	X	X
	- Touchdown zone	X	
	b. Chapter 2 Aerodrome data		

	- 2.2 Aerodrome reference point	X	X
	- 2.6 Strength of pavements	X	X
	- 2.8 Declared distances	X	X
	c. Chapter 3 Physical characteristics		
	- 3.6 Clearways	X	
	- 3.7 Stopways	X	
	- 3.14 Isolated aircraft parking position	X	X
	d. Chapter 5 Visual aids for navigation		
	• **5.2 Markings**		
	- 5.2.1 General	X	X
	- 5.2.2 Runway designation marking	X	X
	- 5.2.3 Runway centre line marking	X	X
	- 5.2.4 Threshold marking (including displaced threshold marking)	X	X
	- 5.2.5 Aiming point marking	X	
	- 5.2.6 Touchdown zone marking	X	
	- 5.2.7 Runway side stripe marking	X	X
	- 5.2.8 Taxiway centre line marking	X	X
	- 5.2.10 Runway-holding position marking	X	X
	- 5.2.11 Intermediate holding position marking	X	X
	- 5.2.16 Mandatory instruction marking	X	X
	- 5.2.17 Information marking	X	X
	5.3 Lights		
	- 5.3.5 Visual approach slope indicator systems	X	X
	- 5.3.8 Runway threshold identification lights	X	X
	- 5.3.9 Runway edge lights	X	X
	- 5.3.10 Runway threshold and wing bar lights	X	X
	- 5.3.11 Runway end lights	X	X
	- 5.3.12 Runway centre line lights	X	X
	- 5.3.15 Rapid exit taxiway indicator lights	X	X
	- 5.3.16 Stopway lights	X	X
	- 5.3.17 Taxiway centre line lights	X	X
	- 5.3.20 Stop bars	X	X
	- 5.3.21 Intermediate holding position lights	X	X

	- 5.3.23 Runway guard lights	X	X
	5.4 Signs		
	5.4.2 Mandatory instruction	X	X
	5.4.3 Information signs	X	X
	e. Declared Distances		
	- Runway length	X	X
	- Landing distance available (LDA)	X	X
	- Clearways and stopways	X	X
	- Accelerate-stop distance available (ASDA)	X	X
	- Take-off run available (TORA)	X	X
	- Take-off distance available (TODA)	X	X
A.3.19	**ICAO ANNEX 14 − AERODROMES Vol II Heliports**		
	a. Chapter 1 - 1.1 Definitions		X
	- Declared distances — heliports (Take-off distance available (TODAH); Rejected take-off distance available (RTODAH); Landing distance available (LDAH).		X
	- Dynamic load-bearing surface.		X
	- Elevated heliport.		X
	- Final approach and take-off area (FATO).		X
	- Helicopter air taxiway.		X
	- Helicopter clearway		X
	- Helicopter ground taxiway		X
	- Helicopter stand.		X
	- Helideck		X
	- Heliport		X
	- Protection area.		X
	- Rejected take-off area		X
	- Safety area		X
	- Shipboard heliport		X
	- Static load-bearing surface		X
	- Surface-level heliport		X
	- Taxi-route.		X
	- Touchdown and lift-off area (TLOF)		X
	- Winching area		X
	b. Chapter 2 Heliport data		X

	- 2.2 Heliport reference point		**X**
	- 2.3 Heliport elevation		**X**
	- 2.5 Declared distances		**X**
	c. Chapter 3 Physical characteristics		**X**
	• **3.1 Surface-level heliports**		**X**
	- Final approach and take-off areas		**X**
	- Helicopter Clearways		**X**
	- Touchdown and lift-off areas		**X**
	- Safety areas		**X**
	- Helicopter ground taxiways and ground taxi-routes		**X**
	- Helicopter air taxiways and air taxi-routes		**X**
	- Air transit route		**X**
	- Aprons		**X**
	- Location of a final approach and take-off area in relation to a runway or taxiway		**X**
	• **3.2 Elevated heliports**		**X**
	- Final approach and take-off areas and touchdown and lift-off areas		**X**
	- Helicopter clearways		**X**
	- Touchdown and lift-off areas		**X**
	- Safety areas		**X**
	- Helicopter ground taxiways and ground taxi-routes		**X**
	- Helicopter air taxiways and air taxi-routes		**X**
	- Aprons		**X**

SUBJECT: **FLIGHT PERFORMANCE AND PLANNING (AEROPLANE)**		
ASPECT NUMBER	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY** **A**
A.4.1	**AEROPLANE PERFORMANCE CLASSIFICATION**	
	South African Civil Aviation Regulations	
	a. Part 91.08 Performance Operating Limitations:	**X**
	- Part 91.08.1 General provisions	**X**

	- Part 91.08.4 Aeroplane performance classification	**X**
	- Part 91.08.5 Performance limitations Class A and Class C aeroplanes	**X**
	- SACATS 91.08.5 Performance limitations Class A and Class C aeroplanes	**X**
	b. Part 135.08 Aeroplane Performance Operating Limitations	**X**
	- Part 135.08.1 General requirements	**X**
	- Part 135.08.2 Take-off mass limitations	**X**
	- Part 135.08.3 Net take-off flight path	**X**
	- Part 135.08.7 Dispatch limitations: landing at destination and alternate aerodromes	**X**
	- Part 135.08.8 Dispatch limitations: wet runway – turbojet- or turbofan-powered aeroplanes	**X**
A.4.2	**CERTIFICATION**	
	a. South African Civil Aviation Regulations	
	• **Part 1.01.1 Definitions**	**X**
	- Type certificate	**X**
	- Type of aircraft	**X**
	• **Part 21: Certification procedures for products and parts**	**X**
	- Part 21.01.1 (a) to (f) Applicability	**X**
	- Part 21.01.2 (1)(c) - (d) & (2) Types of aircraft	**X**
	- Part 21.02.3 (1) (a) Airworthiness design standards	**X**
	b. South African Civil Aviation Technical Standards	**X**
	• **SA-CATS 21.02.3 Airworthiness design standards**	**X**
	- SA-CATS 21.02.3 (3) Aeroplanes: Normal, utility, acrobatic and commuter category	**X**
	- SA-CATS 21.02.3 (4) Aeroplanes: Transport category	**X**
A.4.3	**STAGES OF FLIGHT**	
	- **Take-off**	**X**
	- **Climb**	**X**
	- **Level Flight**	**X**
	- **Descending**	**X**
	- **Approach and landing**	**X**
A.4.4	**AIRSPEED TERMINOLOGY AND SYMBOLS**	
	a. IAS, RAS (CAS), TAS	**X**
	b. VA, VNO, VNE, VX, VY, VS, VSO, VFO, VFE, VLO, VLE, VMO, VS1g, VSR, VSR0, VSR1	**X**
	c. VMCG, VMCA, VMC, V1, VR, V2, VREF, VLOF, VMBE	**X**
A.4.5	**METEOROLOGICAL TERMINOLOGY**	

	a. International Standard Atmosphere (ISA)	**X**
	b. OAT, IOAT, TAT, SAT, RAT	**X**
	c. Temperature deviation from ISA	**X**
	d. Pressure altitude, Density altitude	**X**
	e. QNH, QFE, QNE	**X**
A.4.6	**AERODROME TERMINOLOGY**	
	- Runway length	**X**
	- Take-off run available (TORA)	**X**
	- Take-off run required (TORR)	**X**
	- Take-off distance available (TODA)	**X**
	- Take-off distance required (TODR)	**X**
	- Landing distance available (LDA)	**X**
	- Landing distance required (LDR)	**X**
	- Clearway, stopway	**X**
	- Displaced thresholds (permanent/temporary)	**X**
	- Accelerate-stop and accelerate-go	**X**
	- Runway slope	**X**
	- Runway strength (ACN/PCN)	**X**
	- Balanced and Unbalanced Field Lengths	**X**
	- WAT limits	**X**
A.4.7	**PERFORMANCE TERMINOLOGY**	
	a. Define "steady" flight	**X**
	b. The forces during steady climbing and descending flight	**X**
	c. The opposing forces during horizontal steady flight	**X**
	d. The "thrust/power required" and "thrust/power available" curves	**X**
	e. The effect of excess thrust and power on speed and/or climb performance	**X**
	f. Climb angle and climb gradient	**X**
	g. Flight path angle and flight path gradient	**X**
	h. Descent angle and descent gradient	**X**
	i. Service and absolute ceiling	**X**
	j. Range and Endurance	**X**
	k. Specific fuel consumption (SFC)	**X**
	l. Specific range (SR)	**X**

A.4.8	**FACTORS AFFECTING AEROPLANE PERFORMANCE**	
	- Temperature	**X**
	- Air density	**X**
	- Aeroplane mass	**X**
	- Aeroplane configuration	**X**
	- Aeroplane antiskid system status	**X**
	- Aeroplane centre of gravity	**X**
	- Aerodrome runway surface	**X**
	- Aerodrome runway slope	**X**
	- The effect of flap settings	**X**
	- The effects of different recommended power settings on range and endurance	**X**
	- The effect of wind and altitude on range and endurance	**X**
A.4.9	**USE OF AEROPLANE PERFORMANCE DATA CAP 697&698 - PERFORMANCE - SINGLE-ENGINE AEROPLANES**	
	a. Variables on single-engine aeroplane performance	**X**
	• **The effect of the wind component on take-off and landing performance**	**X**
	• **The effect of temperature, wind and altitude on climb performance**	**X**
	• **The effects of altitude and temperature on cruise performance**	**X**
	• **The effect of mass, wind and speed on descent performance**	**X**
	b. Use of aeroplane performance data SEP	**X**
	• **Take-off**	**X**
	- Find the minimum or maximum wind component	**X**
	- Find the take of distance and ground roll distance	**X**
	- Find the maximum allowed take-off mass	**X**
	- Find the take-off speed	**X**
	• **Climb**	**X**
	- Find the maximum rate of climb speed	**X**
	- Find the time, distance and fuel to climb	**X**
	- Find the rate of climb	**X**
	• **Cruise**	**X**
	- Find power settings, cruise true airspeed (TAS) and fuel consumption	**X**
	- Find range and endurance	**X**
	- Find the difference between still air distance (NAM) and ground distance (NM)	**X**
	• **Landing**	**X**

	- Find the minimum or maximum wind component	**X**
	- Find the landing distance and ground roll distance	**X**
A.4.10	**USE OF AEROPLANE PERFORMANCE DATA CAP 697&698 - PERFORMANCE - MULTI-ENGINE AEROPLANES**	
	a. Define and explain the following terms:	**X**
	• **Critical engine**	**X**
	• **The effect of the critical engine inoperative on the power required and the total drag**	**X**
	• **The effect of engine failure on controllability under given conditions**	**X**
	• **Effect of Variables on Multi-Engine Aeroplane Performance**	**X**
	b. Take-off and landing	**X**
	• **The effect of flap setting on the ground roll distance**	**X**
	• **For both fixed and constant speed propellers, explain the effect of airspeed on thrust during the take-off run**	**X**
	• **The effect of pressure altitude on performance limited take-off mass**	**X**
	• **The effect of runway conditions on the take-off distance**	**X**
	• **The percentage of accountability for head and tailwind components during take-off and landing calculations**	**X**
	• **Interpret obstacle clearance at take-off**	**X**
	• **The effect of selected power settings, flap settings and aeroplane mass on the rate of climb**	**X**
	• **The effect of engine failure on take-off climb performance**	**X**
	c. Climb, cruise and descent	**X**
	• **The effect of mass on the speed for best angle and best rate of climb**	**X**
	• **The effect of temperature and altitude on the fuel flow**	**X**
	• **The effect of wind on the maximum range speed and speed for maximum climb angle**	**X**
	• **The effect of mass, altitude, wind, speed and configuration on the glide descent**	**X**
	• **Describe various cruise techniques**	**X**
	• **The effect of loss of engine power on climb and cruise performance**	**X**
	d. Landing	**X**
	• **The effect of runway conditions on the landing distance**	**X**
A.4.11	**USE OF AEROPLANE PERFORMANCE DATA MEP**	
	a. Take-off	**X**
	- Find take off field length data	**X**
	- Calculate the field length limited take off mass	**X**
	- Find the accelerate go distance as well the accelerate-stop distance data	**X**
	- Find the ground roll and take off distance	**X**
	- Calculate maximum effort take off data	**X**

	- Calculate all engine and critical engine out take-off climb data	X
	- Calculate obstacle clearance take off climb data	X
	b. Climb	X
	- Find rate of climb and climb gradient	X
	- Calculate single engine service ceiling	X
	- Calculate obstacle clearance climb data	X
	- Find the time, distance and fuel to climb	X
	c. cruise and descent	X
	- Find power settings, cruise true airspeed (TAS) and fuel consumption, normal and one engine inoperative	X
	- Calculate range and endurance data	X
	- Find the time, distance and fuel to descent	X
	d. landing	X
	- Find landing field length data	X
	- Find landing climb data in the event of balked landing.	X
	- Find landing distance and ground roll distance	X
	- Find short field landing distance and ground roll distance	X
A.4.12	**MASS AND BALANCE**	
	a. Terminology	X
	- Define and explain the meaning of centre of gravity	X
	- CG limits − forward and aft	X
	- Define datum (reference point), arm and moment	X
	- Conditions of equilibrium (Balance of Forces and Balance of Moments)	X
	- Mean aerodynamic chord (MAC), (LEMAC)	X
	- Maximum Zero Fuel Mass	X
	- Maximum Ramp/Taxi Mass	X
	- Maximum Take-off Mass	X
	- Empty Operating Mass	X
	- Maximum Landing Mass	X
	- Use of cargo pallets	X
	- Maximum floor load	X
	- Define the following load terms: Payload, Taxi Fuel, Take off	X
	- Fuel, Trip Fuel/ Burn off, Reserve Fuel (Contingency,	X
	- Alternate, Final Reserve and Additional Fuel) and Extra Fuel.	X

	- Calculating payload without exceeding mass limitations	**X**
	b. Mass limitations	**X**
	- The relationship between aircraft mass and structural stress	**X**
	- The relationship between aircraft mass and performance	**X**
	- Centre of gravity (CG) limitations	**X**
	- The relationship between CG position and stability/controllability of aircraft	**X**
	- The effects if CG is in front of the forward limit and if CG is behind the aft limit	**X**
	- Describe the relationship between CG position and aircraft performance	**X**
	- Calculate maximum allowed payload and fuel load not to exceed given Allowed Mass for Take-off, Zero Fuel and Landing.	**X**
	c. Calculation of CG	**X**
	- The principle of calculating the aircraft"s CG position	**X**
	- Calculating CG for SEP CAP 696	**X**
	- Calculating CG MEP CAP 696	**X**
	- The principle of using % MAC for the description of the CG position	**X**
	- Calculate the CG position as % MAC	**X**
	- Loading of aircraft not exceeding CG limitation	**X**
	- Maximum load at station not exceeding CG limitation	**X**
	- Movement of CG in flight	**X**
	- Influence of weight shift on CG	**X**
	- Influence of weight loss on CG	**X**
A.4.13	**FLIGHT PLANNING GENERAL**	
	a. PET and PNR	**X**
	- PET (point of equal time)	**X**
	- CP (critical point)	**X**
	- PNR (point of no return)	**X**
	- PSR (point of safe return)	**X**
	b. Specific performance	**X**
	- Fuel weight and Performance	**X**
	- Specific weight	**X**
	- Specific gravity	**X**
	- Fuel consumption, fuel used, fuel flow, endurance	**X**
	- ANM/fuel ratio	**X**
	- GNM/fuel ratio	**X**

SUBJECT: FLIGHT PERFORMANCE AND PLANNING (HELICOPTER)		
ASPECT NUMBER	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY**
		H
A.5.1	**HELICOPTER PERFORMANCE CLASSIFICATION**	
	a. South African Civil Aviation Regulations	**X**
	• **Part 1.01.1 Definitions**	**X**
	— Operations in performance Class 1	**X**
	— Operations in performance Class 2	**X**
	— Operations in performance Class 3	**X**
	• **Part 91: General Aviation and Operating Flight Rules**	**X**
	— Part 91.08.1 General provisions	**X**
	— Part 91.08.2 Helicopter operating limitations	**X**
	— Part 91.08.3 Helicopter performance classification	**X**
	• **Part 127.08 Helicopter Performance Operating Limitations**	**X**
	- Part 127.08.1 Classification	**X**
	- Part 127.08.2 General provisions for all classes of helicopters	**X**
A.5.2	**CERTIFICATION**	
	a. South African Civil Aviation Regulations	**X**
	• **Part 1.01.1 Definitions**	**X**
	- Type certificate	**X**
	- Type of aircraft	**X**
	• **Part 21: Certification procedures for products and parts**	**X**
	- Part 21.01.1 (a) to (f) Applicability	**X**
	- Part 21.01.2 (1)(e) - (f) & (2) Types of aircraft	**X**
	- Part 21.02.3 (1) (a) Airworthiness design standards	**X**
	b. South African Civil Aviation Technical Standards	**X**
	• **SA-CATS 21.02.3 Airworthiness design standards**	**X**
	- SA-CATS 21.02.3 (5) Rotorcraft: Normal category (maximum certificated mass 2 700 kg or less)	**X**
	- SA-CATS 21.02.3 (6) Rotorcraft: Transport category	**X**
A.5.3	**AIRSPEED TERMINOLOGY AND SYMBOLS**	
	a. IAS, RAS (CAS), TAS	**X**

	b. VA, VNO, VNE, VX, VY,	**X**
A.5.4	**METEOROLOGICAL TERMINOLOGY**	
	- International Standard Atmosphere (ISA)	**X**
	- OAT, IOAT, TAT, SAT, RAT	**X**
	- Temperature deviation from ISA	**X**
	- Pressure altitude, Density altitude	**X**
	- QNH, QFE, QNE	**X**
A.5.5	**AERODROME TERMINOLOGY**	
	- Runway length	**X**
	- Helipads	**X**
A.5.6	**HELICOPTER PERFORMANCE OPERATING LIMITATIONS**	
	a. Take-off, take-off flight path	**X**
	b. En route with one or more engines inoperative	**X**
	c. Approach and landing	**X**
A.5.7	**USE OF BELL 206L HELICOPTER MANUAL:**	
	- Operating limitations	**X**
	- Basic Power Check Chart	**X**
	- Airspeed Correction Table	**X**
	- Height Velocity Diagram	**X**
	- Altitude Vs Gross Weight Limits	**X**
	- Hovering IGE − Take-off Power	**X**
	- Hovering IGE − Maximum Continuous Power	**X**
	- Hovering OGE − Take-off Power	**X**
	- Hovering OGE − Maximum Continuous Power	**X**
	- Maximum Rate of Climb − Take-off Power	**X**
	- Maximum Rate of Climb − Maximum Continuous Power	**X**
	- Density Altitude Chart	**X**
	- Fuel Loading Table 1 − ASTM TYPE JET B (JP-4)	**X**
	- Fuel Loading Table 2 − ASTM TYPE JET A & A-1 (JP-5)	**X**
	- Cabin and Baggage Compartment Table of Moments	**X**
A.5.8	**MASS AND BALANCE**	
	a. Terminology:	**X**
	- Arm, moment, reference datum, station, centre of gravity (CG)	**X**

	- CG limits − forward and aft	**X**
	- CG limits − lateral	**X**
	- Maximum ramp mass	**X**
	- Maximum zero fuel mass	**X**
	- Empty operating mass	**X**
	- Maximum floor load	**X**
	b. Calculation of CG	**X**
	c. Movement of CG in flight	**X**
	d. Maximum load at station	**X**
	e. Ballast	**X**
A.5.9	**PET AND PNR**	
	a. PET (point of equal time)	**X**
	b. PNR (point of no return)	**X**
	- with/without fuel reserve	**X**
	c. Fuel weight and Performance	**X**
	- specific weight	**X**
	- specific gravity	**X**
	- fuel consumption, fuel used, fuel flow, endurance	**X**
	- ANM/fuel ratio	**X**
	- GNM/fuel ratio	**X**

SUBJECT: **HUMAN PERFORMANCE AND LIMITATIONS (AEROPLANE AND HELICOPTER)**			
ASPECT NUMBER	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY**	
		A	**H**
A.6.1	**BASIC PHYSIOLOGY**		
	a. The atmosphere	**X**	**X**
	− composition and structure	**X**	**X**
	− the gas laws	**X**	**X**
	− oxygen requirement of tissues	**X**	**X**
	b. The Circulation System	**X**	**X**
	− composition and function of the blood	**X**	**X**

	− the heart and circulation system	X	X
	− blood pressure	X	X
	− pulse rate	X	X
	− blood donation	X	X
	− ailments, recognition and treatment	X	X
	c. The lungs	X	X
	− basic anatomy	X	X
	− breathing drive, gas transfer	X	X
	− ailments, recognition and treatment	X	X
	− partial pressure and effects of increasing altitude	X	X
	− hypoxia, types, symptoms and prevention	X	X
	− time of useful consciousness	X	X
	− effects of rapid decompression and decompression sickness	X	X
	− entrapped gases, barotrauma	X	X
	− hyperventilation, symptoms and treatment	X	X
	d. High altitude environment	X	X
	− ozone	X	X
	− radiation	X	X
	− humidity	X	X
	- effects of pressurisation	X	X
	- oxygen masks and regulators	X	X
	e. Vision	X	X
	− basic physiology of the eye	X	X
	− visual field, foveal and peripheral vision, the blind spot	X	X
	− monocular and binocular vision	X	X
	− visual defects and methods of correction	X	X
	− night vision	X	X
	− optical illusions	X	X
	− ailments and treatment	X	X
	f. Hearing	X	X
	− basic physiology	X	X
	− measurement of and effect sound, noise and hearing loss	X	X
	g. Equilibrium	X	X

	− vestibular system, function	X	X
	− detection of rotary, angular and linear acceleration	X	X
	− motion sickness, causes, symptoms and prevention	X	X
	− entrapped gases, barotrauma, valsalva	X	X
	h. Integration of sensory inputs	X	X
	− spatial disorientation	X	X
	− types of illusions	X	X
	− prevention	X	X
	- the senses	X	X
	i. Acceleration	X	X
	− effects of positive and negative acceleration on: cardio-vascular system, vision, limbs and lungs	X	X
A.6.2	**HEALTH AND HYGIENE**		
	a. Personal hygiene	X	X
	− colds	X	X
	− influenza	X	X
	− gastro-intestinal upset	X	X
	b. Problem areas for pilots	X	X
	− hearing loss	X	X
	− defective vision	X	X
	− hypotension, hypertension, coronary disease	X	X
	− obesity	X	X
	− nutrition	X	X
	− tropical climates, epidemic diseases	X	X
	− diabetes, hypoglycaemia	X	X
	c. Intoxication	X	X
	− tobacco	X	X
	− alcohol	X	X
	− drugs and self−medication	X	X
	− various toxic materials	X	X
	d. Incapacitation	X	X
	− symptoms and causes	X	X
	− gastro-intestinal	X	X
	− cardio-vascular	X	X

	− side effects of drugs and medication	X	X
	− epilepsy, faints	X	X
	− carbon monoxide poisoning	X	X
	e. Stress	X	X
	− categories: acute , chronic	X	X
	− stages	X	X
	− causes, stressors	X	X
	− anxiety	X	X
	− identification and management	X	X
	− defence mechanisms	X	X
	f. Fatigue	X	X
	− definition	X	X
	− types: acute, chronic	X	X
	− causes	X	X
	− symptoms	X	X
	− prevention and treatment	X	X
	- tiredness	X	X
	g. Body rhythm and sleep	X	X
	− circadian rhythms, disturbances	X	X
	− causes	X	X
	− symptoms	X	X
	− treatment	X	X
	h. Sleep	X	X
	− types and functions	X	X
	− patterns	X	X
	− disturbances and treatment	X	X
A.6.3	**BASIC AVIATION PSYCHOLOGY**		
	a. The central and peripheral nervous system	X	X
	- General adaptation syndrome	X	X
	− sensory threshold, sensitivity, adaptation	X	X
	− habituation	X	X
	− reflexes and biological control systems	X	X
	b. Human information processing	X	X

	• **Attention and vigilance**	X	X
	− selective attention	X	X
	− divided attention	X	X
	− perception	X	X
	− confirmation bias	X	X
	b. Memory	X	X
	• sensory memory	X	X
	• working (short term) memory	X	X
	- general	X	X
	- methods of increasing short term memory (chunking, association, mnemonics)	X	X
	• long-term memory	X	X
	- episodic memory	X	X
	- semantic memory	X	X
	- procedural memory	X	X
	− environment capture	X	X
	− factors affecting memorization and long term memory	X	X
	− amnesia	X	X
	− motor skills	X	X
	− action slips	X	X
	- learning and learning styles	X	X
	- motivation and perception	X	X
	- insight	X	X
	- arousal	X	X
	- cognition	X	X
	c. Human behaviour	X	X
	• **Personality**	X	X
	− characteristics	X	X
	− individual differences in personality	X	X
	− self concept	X	X
	− attitude development	X	X
	− identification of hazardous attitudes	X	X
	• **Behaviour and skills**	X	X
	− categories:, skill based, rule based, knowledge based	X	X

	− errors	X	X
	− situational awareness	X	X
	- human behaviour	X	X
	• **Human factors, errors and reliability**	X	X
	- SHELL model	X	X
	− human error model	X	X
	− types of errors	X	X
	- error chains	X	X
	− prevention and counter-measures	X	X
	• **Judgement and decision making**	X	X
	− decision making process	X	X
	− making and taking decisions	X	X
	− group versus individual decision making	X	X
	− influences on decision making	X	X
	− pilot judgement	X	X
	− perceptual judgement	X	X
	− cognitive judgement	X	X
	• **Cockpit management**	X	X
	− crew co-ordination	X	X
	− crew co-operation	X	X
	- Automation	X	X
	- complacency	X	X
	-ergonomics	X	X
	- cockpit lighting	X	X
	- checklists (use and design philosophy)	X	X
	• **Leadership**	X	X
	− leadership style	X	X
	− democratic versus autocratic style	X	X
	− cockpit gradient	X	X
	• **Communication**	X	X
	− verbal communication	X	X
	− non-verbal communication	X	X
	− one-way and two-way communication	X	X

	− conflict management and resolution	X	X
	- feedback	X	X
A.6.4	**First aid and survival**		
	a. First Aid	X	X
	- First aid	X	X
	- Fainting	X	X
	- Nose bleeds	X	X
	- Food poisoning	X	X
	- Dehydration	X	X
	- Head injuries	X	X
	- Bleeding	X	X
	- Fractures	X	X
	- Burns	X	X
	- Shock	X	X
	b. Survival	X	X
	- Body temperature	X	X
	- Survival equipment	X	X
	- Survival at sea or in water	X	X
	- Survival in very cold climates	X	X
	- Survival in very hot, arid climates	X	X
	- Survival in a jungle	X	X

SUBJECT: **INSTRUMENTS** **(AEROPLANE AND HELICOPTER)**			
ASPECT NUMBER	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY**	
		A	**H**
A.7.1	**AIR DATA INSTRUMENTS**		
	a. Pitot and static system	X	X
	− pitot tube, construction and principles of operation	X	X
	− static source	X	X
	− malfunction	X	X

	− heating	X	X
	− alternate static source	X	X
	b. Altimeter	X	X
	− construction and principles of operation	X	X
	− simple, sensitive and servo assisted altimeters	X	X
	− errors and tolerances	X	X
	− settings, QNH, QFE, QNE	X	X
	− pressure, true and absolute altitude	X	X
	− altitude alert	X	X
	c. Airspeed indicator (ASI)	X	X
	− construction and principles of operation	X	X
	− meaning of coloured sectors	X	X
	− maximum speed indicator	X	X
	− errors, blockages and leaks	X	X
	d. Vertical speed indicator (VSI)	X	X
	− construction and principles of operation	X	X
	− aneroid and instantaneous VSI (IVSI)	X	X
	− errors	X	X
A.7.2	**GYROSCOPIC INSTRUMENTS**		
	a. Gyroscopic fundamentals	X	X
	– theory of gyroscopic forces (stability, precession)	X	X
	– types, construction and principles of operation:	X	X
	– vertical gyro	X	X
	– rate gyro	X	X
	− tied gyro	X	X
	– apparent wander/drift	X	X
	− real wander/drift	X	X
	− mountings, gimbals	X	X
	– drive types: electrical, vacuum system	X	X
	b. Directional gyro (DG)	X	X
	− construction	X	X
	− principle of operation	X	X
	− limitations	X	X

	− calculation of drift	X	X
	c. Remote indicating compass	X	X
	− construction and principle of operation	X	X
	− components	X	X
	− modes of operation	X	X
	− mountings, gimbals	X	X
	– drive types: electrical, vacuum system	X	X
	− application, uses of output data	X	X
	d. Artificial horizon (AH)	X	X
	− construction and principle of operation	X	X
	− turn and acceleration errors	X	X
	− application, uses of output data	X	X
	e. Turn and slip indicator	X	X
	− construction and principle of operation	X	X
	− errors	X	X
	− Turn Co-ordinator	X	X
	− rate of turn and angle of bank	X	X
	f. Horizontal Situation Indicator (HSI)	X	X
	- construction and principle of operation	X	X
	- information displayed	X	X
A.7.3	**ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)**		
	- design and operation	X	X
	- Flight Management Systems (FMS)	X	X
	- Primary Flight Display (PFD) and information displayed	X	X
	- Navigation Display (ND) / Multi-function Display (MFD) and information displayed	X	X
	- Mode Control Panel (MCP)	X	X
	− information display types and colours	X	X
	− data input	X	X
	− typical aircraft installation	X	X
	- propulsion system displays	X	X
	- crew alerting display	X	X
A.7.4	**FLIGHT DIRECTOR SYSTEM**		
	− principle of operation	X	

	− input sources	X	
	− operation of attitude director indicator (ADI)	X	
	− operation of horizontal situation indicator (HSI)	X	
A.7.5	**AIR TEMPERATURE INDICATORS**		
	− sensors	X	X
	− ram rise, recovery factor	X	
	− SAT, RAT AND TAT	X	
A.7.6	**AUTOPILOT**		
	− general principles of operation	X	X
	− types: single axis, two axis, three axis	X	X
	− lateral modes (pitch)	X	X
	− longitudinal modes (roll)	X	X
	− combined modes (roll and pitch)	X	X
A.7.7	**MAGNETISM**		
	a. Terrestrial magnetism	X	X
	− resolution of the earth's magnetic field into vertical and	X	X
	horizontal components	X	X
	− the effects of change of latitude on these components	X	X
	− directive force, isodynes	X	X
	− magnetic dip, isoclinals	X	X
	− variation, isogonals, agonic line	X	X
	− changes of the earth's magnetic field, secular, periodic	X	X
	b. Aircraft magnetism	X	X
	− horizontal hard iron, components P and Q	X	X
	− compass swing, calculation of coefficients A, B and C	X	X
	− correction of coefficients A, B and C	X	X
	− deviation on any heading	X	X
	− change of deviation with change of latitude and aircraft	X	X
	heading	X	X
	− turning and acceleration errors	X	X
	c. Magnetic compass	X	X
	− components and principle of operation	X	X
	− serviceability tests	X	X

	− adjustment and compensation of direct reading compass	X	X
A.7.8	**STALL WARNING**		
	a. types of basic stall warning devices	X	
	- basic (pneumatic)	X	
	- electric	X	
	b. Advanced stall warning systems and stall protection	X	
	- components and principle of operation	X	
	- protection provided	X	
A.7.9	**POWERPLANT AND SYSTEM MONITORING INSTRUMENTS**		
	a. Principles, presentation and operational use of:	X	X
	− pressure and temperature sensors	X	X
	− pressure and temperature indicators	X	X
	− RPM indicator, piston and turbine engines	X	X
	− fuel gauge and fuel flow indicators	X	X
	− Torque meter	X	X
	− Vibration monitors	X	X
	− Chip detection	X	X

SUBJECT 8: **METEOROLOGY** **(AEROPLANE AND HELICOPTER)**			
ASPECT NUMBER	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY**	
		A	**H**
A.8.1	**CLIMATOLOGY AND METEOROLOGY**		
	- Difference and definitions.	X	X
A.8.2	**THE ATMOSPHERE**		
	- Properties, composition and structure.	X	X
	− ICAO International standard atmosphere (ISA).	X	X
	− ISA deviation.	X	X
A.8.3	**ATMOSPHERIC PRESSURE**		
	a. General	X	X
	- Definition.	X	X
	- Measurement and units in use: Pa, hPa/ Mb /inches mercury/ millimetres mercury	X	X

	- Conversion between units.	X	X
	− Mercury barometer.	X	X
	− Aneroid barometer.	X	X
	- Pressure altitude.	X	X
	− QNH, QFE, QFF and QNE/1013.25 hPa.	X	X
	− Pressure variation with height and diurnal variation.	X	X
	− Isobars.	X	X
	- Pressure gradient.	X	X
	b. Low-pressure systems:	X	X
	- Characteristics and related terminology.	X	X
	- Thermal lows.	X	X
	− Troughs.	X	X
	- Cut-off lows.	X	X
	- Typical cyclonic weather.	X	X
	c. High-pressure systems.	X	X
	- Characteristics and related terminology.	X	X
	- Thermal highs.	X	X
	− Ridges.	X	X
	− Typical anti-cyclonic weather.	X	X
	Cols and associated weather.	X	X
	Synoptic charts.	X	X
A.8.4	**TEMPERATURE**		
	a. General:	X	X
	− Measurement and units in use: Celsius scale, Fahrenheit, Kelvin	X	X
	- Conversion between units.	X	X
	b. Heating of the atmosphere and heat transfer processes:	X	X
	- Insolation.	X	X
	- Radiation, conduction, convection.	X	X
	- Advection.	X	X
	c. Diurnal variation of temperature.	X	X
	d. Specific heat. Land and sea heating and cooling.	X	X
	e. Atmospheric greenhouse effect.	X	X
A.8.5	**HUMIDITY**		

	a. Atmospheric water and changes of state:	**X**	**X**
	- Latent heat.	**X**	**X**
	− Evaporation, condensation, freezing, melting.	**X**	**X**
	- Sublimation and deposition.	**X**	**X**
	b. Saturation, vapour pressure and dew point temperature.	**X**	**X**
	c. Wet bulb and dry bulb temperatures. The psychrometer.	**X**	**X**
	d. Atmospheric humidity and measurement of humidity:	**X**	**X**
	− Absolute humidity.	**X**	**X**
	− Relative humidity.	**X**	**X**
A.8.6	**DENSITY**		
	a. The gas laws and the compressibility of air.	**X**	**X**
	− Boyle's law.	**X**	**X**
	− Charles's law.	**X**	**X**
	− The ideal gas equation (Boyle's and Charles's laws).	**X**	**X**
	b. Factors affecting density:	**X**	**X**
	− Temperature.	**X**	**X**
	− Pressure.	**X**	**X**
	− Altitude and latitude.	**X**	**X**
	− Humidity.	**X**	**X**
	c. Density altitude:	**X**	**X**
	- Definition.	**X**	**X**
	- Calculating density altitude.	**X**	**X**
	- Effect of density altitude on aircraft performance.	**X**	**X**
	d. The dangers of flight operations in hot, high and humid conditions.	**X**	**X**
A.8.7	**ALTIMETRY**		
	a. Variation of atmospheric pressure levels with changing pressure and temperature.	**X**	**X**
	b. Calculations involving pressure and temperature corrections.	**X**	**X**
	c. Calculating true altitude.	**X**	**X**
A.8.8	**WIND**		
	a. Definitions and terminology:	**X**	**X**
	− Veering and backing.	**X**	**X**
	− Gust, squall, lull, gale, hurricane, gust factor.	**X**	**X**
	b. Measurement of wind:	**X**	**X**

	- Wind direction and speed.	X	X
	- Wind vane and anemometer.	X	X
	c. Formation of wind:	X	X
	− Pressure gradient force.	X	X
	− Coriolis effect.	X	X
	− Geostrophic wind and Buys Ballot's law.	X	X
	− Gradient wind.	X	X
	− Surface wind.	X	X
	− Diurnal variation of wind.	X	X
	d. Global circulation patterns:	X	X
	- General global pressure distribution.	X	X
	- General surface winds and circulation patterns (Trade winds, prevailing westerlies, polar easterlies).	X	X
	e. Local winds:	X	X
	− Land and Sea breezes.	X	X
	− Katabatic and anabatic winds.	X	X
	− The Föhn wind.	X	X
	− The Berg wind.	X	X
	- The Sirocco.	X	X
	- The Khamsin.	X	X
	- The Simoon.	X	X
	- The Shamal.	X	X
	- The Haboob.	X	X
	- The Harmattan.	X	X
A.8.9	**LAPSE RATES, ADIABATIC PROCESSES, AND STABILITY**		
	a. The theory of adiabatic processes.	X	X
	b. Lapse rates:	X	X
	− Environmental lapse rate (ELR).	X	X
	− Dry adiabatic lapse rate (DALR).	X	X
	− Saturated adiabatic lapse rate (SALR).	X	X
	c. Atmospheric stability:	X	X
	− Absolute stability.	X	X
	− Absolute instability.	X	X
	− Conditional instability.	X	X

	− Neutral stability.	X	X
	Inversions.	X	X
	Isothermal layers.	X	X
A.8.10	**CLOUDS**		
	a. Cloud observations and measurement:	X	X
	- Cloud amount.	X	X
	- Definitions of cloud ceiling and cloud base.	X	X
	- Methods of measuring cloud base and ceiling.	X	X
	b. Cloud formation:	X	X
	− Convective.	X	X
	− Orographic.	X	X
	− Frontal.	X	X
	− Convergent.	X	X
	− Turbulent.	X	X
	c. Cloud classification.	X	X
	d. Cloud types.	X	X
A.8.11	**PRECIPITATION**		
	a. Condensation nuclei.	X	X
	b. Precipitation processes:	X	X
	− Bergeron theory (ice particle theory).	X	X
	− Collision and coalescence theory.	X	X
	c. Types of precipitation.	X	X
	d. Intensity of precipitation.	X	X
	e. Continuity of precipitation.	X	X
A.8.12	**THUNDERSTORMS**		
	a. Formation:	X	X
	− Conditions for development.	X	X
	b. Thunderstorm classification:	X	X
	− Convective.	X	X
	− Orographic.	X	X
	− Convergent.	X	X
	− Frontal.	X	X
	− Nocturnal.	X	X

	c. Additional classifications:	**X**	**X**
	- Ordinary and severe.	**X**	**X**
	- Line storms (squall lines).	**X**	**X**
	d.The three stages of thunderstorm development.	**X**	**X**
	e. The gust front and related phenomena.	**X**	**X**
	f. Hazards:	**X**	**X**
	− Windshear and turbulence.	**X**	**X**
	− Microbursts.	**X**	**X**
	− Hail.	**X**	**X**
	- Icing.	**X**	**X**
	- Lightning	**X**	**X**
	- Tornadoes.	**X**	**X**
	g. Avoidance and penetration.	**X**	**X**
A.8.13	**ICE ACCRETION**		
	a. Dangers.	**X**	**X**
	b. Airframe icing:	**X**	**X**
	− Conditions for formation.	**X**	**X**
	- Kinetic heating formula.	**X**	**X**
	c. Types:	**X**	**X**
	− Clear (glaze) ice.	**X**	**X**
	− Rime ice.	**X**	**X**
	− Mixed ice.	**X**	**X**
	− Freezing precipitation and rain ice.	**X**	**X**
	− Hoar frost.	**X**	**X**
	d. Engine icing:	**X**	**X**
	e. Piston engine icing.	**X**	**X**
	− Impact icing.	**X**	**X**
	− Fuel icing.	**X**	**X**
	− Carburettor icing: cause, recognition, prevention.	**X**	**X**
	f. Gas turbine engine icing.	**X**	**X**
	g. Factors affecting the severity of icing.	**X**	**X**
	h. ICAO definitions for levels of icing:	**X**	**X**
	- Light, moderate, severe.	**X**	**X**

	i. Ice protection:	X	X
	- Anti-icing and de-icing.	X	X
A.8.14	**WINDSHEAR AND TURBULENCE**		
	a. Windshear:	X	X
	− Definition of windshear.	X	X
	- Causes.	X	X
	− Low-level windshear.	X	X
	− Effect on aircraft in flight.	X	X
	- Approach techniques.	X	X
	b. Turbulence:	X	X
	− Definition of turbulence.	X	X
	− Types and causes.	X	X
	c. Mountain waves and associated turbulence:	X	X
	- Conditions for formation and dangers.	X	X
	− Visual detection of mountain waves.	X	X
	d. Wake turbulence:	X	X
	- Cause.	X	X
	- Dangers.	X	X
	- Conditions affecting its severity.	X	X
	- Wake turbulence weight categories.	X	X
	- Avoidance during crossing traffic, take-off and landing.	X	X
A.8.15	**VISIBILITY**		
	a. Visibility:	X	X
	- Definition and measurement.	X	X
	- Types of visibility restrictions and their definitions: mist, fog, haze, glare, smog, dust and sand.	X	X
	- Slant visibility.	X	X
	b. Runway visual range (RVR):	X	X
	- Definition and measurement.	X	X
	c. Fog:	X	X
	− Radiation fog.	X	X
	− Advection fog.	X	X
	− Frontal fog.	X	X
	− Orographic (upslope).	X	X

	− Steam fog.	X	X
A.8.16	**AIR MASSES**		
	- Definition of an air mass.	X	X
	- Classification.	X	X
	− Modification.	X	X
	− Air masses affecting South Africa.	X	X
A.8.17	**FRONTS**		
	a. Mid-latitude (temperate) cyclones.	X	X
	b. Cold fronts:	X	X
	− Formation, characteristics and weather.	X	X
	− Changes with the passage of the front.	X	X
	− Flying conditions and penetration procedures.	X	X
	c. Warm fronts:	X	X
	− Formation, characteristics and weather.	X	X
	− Changes with the passage of the front.	X	X
	− Flying conditions and penetration procedures.	X	X
A.8.18	**HURRICANES (TROPICAL CYCLONES)**		
	- Development and characteristics.	X	X
	- Associated weather.	X	X
	- Commonly occurring regions.	X	X
A.8.19	**CLIMATOLOGY AND WORLD WEATHER**		
	a. General world climatic zones.	X	X
	b. ITCZ: characteristics, weather and seasonal movement.	X	X
	c. Regional climatology:	X	X
	- General African climate and significant weather.	X	X
	- Mediterranean climate, weather. Significant weather.	X	X
A.8.20	**SOUTH AFRICAN WEATHER**		
	a. South African climate and climatic regions.	X	X
	b. South African summer patterns.	X	X
	c. South African winter patterns.	X	X
	d. South African weather phenomena:	X	X
	- Mid-latitude (temperate) cyclones (frontal systems).	X	X
	- Hurricanes (Tropical cyclones).	X	X

	- Coastal lows.	X	X
	− the South Westerly Buster	X	X
	- Easterly weather (the Guti).	X	X
	− The Cape Doctor	X	X
	− Cut-off lows and the Black South Easter	X	X
A.8.21	**METEOROLOGICAL INFORMATION**		
	a. SAWS aviation website – www.aviation.weathersa.co.za:	X	X
	- Basic layout.	X	X
	- Information obtainable.	X	X
	b. Weather analysis and forecasting:	X	X
	− Synoptic weather charts and symbols. Station decode.	X	X
	− Significant (prognostic) weather charts.	X	X
	− Upper winds and temperatures charts.	X	X
	c. Weather information for flight planning:	X	X
	d. Interpretation of:	X	X
	- METAR.	X	X
	- TAF.	X	X
	- SPECI.	X	X
	- SIGMET/ AIRMET/ SPECIAL AIR REPORT.	X	X
	e. Meteorological broadcasts for aviation:	X	X
	- ATIS.	X	X

SUBJECT: **NAVIGATION** **(AEROPLANE AND HELICOPTER)**			
ASPECT NUMBER	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY**	
		A	**H**
A.9.1	**THE EARTH**		
	a. Form of the earth	X	X
	- polar axis, direction and rate of rotation	X	X
	- great circles, small circles and rhumb lines	X	X
	- meridians of longitude, limits east/west, prime meridian	X	X

	- difference of longitude	**X**	**X**
	- convergency and conversion angle	**X**	**X**
	- latitude, limits north/south, equator	**X**	**X**
	- difference of latitude	**X**	**X**
	- use of co-ordinates to fix position	**X**	**X**
A.9.2	**DIRECTION**		
	- true north	**X**	**X**
	- magnetic north	**X**	**X**
	- isogonals and variation east and west	**X**	**X**
	- compass north	**X**	**X**
	- application of compass deviation	**X**	**X**
	- radio bearings: QTE, QDR, QDM, QUJ	**X**	**X**
A.9.3	**DISTANCE**		
	- units of distance: nautical and statute miles, kilometres, metres, feet	**X**	**X**
	- conversion from one unit to another	**X**	**X**
	- relationship between nautical miles and minutes of latitude	**X**	**X**
A.9.4	**THE SOLAR SYSTEM AND TIME**		
	- seasonal and apparent movements of the sun	**X**	**X**
	- apparent solar day	**X**	**X**
	- mean solar day	**X**	**X**
	- sidereal day	**X**	**X**
	- Equinox, solstice, aphelion, perihelion	**X**	**X**
	- Tropics of Cancer and Capricorn	**X**	**X**
	- Local mean time (LMT), zone time and standard time	**X**	**X**
	- conversions of arc to time	**X**	**X**
	- co−ordinated universal time (UTC)	**X**	**X**
	- time conversions	**X**	**X**
	- international date line	**X**	**X**
	- determination of sunrise, sunset, civil twilight	**X**	**X**
	- variation of time with sunrise, sunset, latitude and altitude	**X**	**X**
A.9.5	**CHARTS**		
	a. Chart projection theory	**X**	**X**
	- types of projection: Azimuthal/Plane, cylindrical, conical	**X**	**X**

	- orthomorphic/conformal charts	X	X
	- scale, representative fraction, scale factor and calculations	X	X
	b. Mercator chart	X	X
	- method of construction and properties	X	X
	- representation of great circle, rhumb lines, meridians and	X	X
	- parallels of latitude	X	X
	- plotting radio bearings	X	X
	- scale variation and calculations	X	X
	- measurement or calculation or tracks and distance	X	X
	c. Lamberts Conformal Conic	X	X
	- method of construction and properties	X	X
	- representation of great circle, rhumb lines, meridians and parallels of latitude	X	X
	- plotting radio bearings	X	X
	- scale variation and calculations	X	X
	- measurement or calculation or tracks and distance	X	X
A.9.6	**RELATIVE VELOCITY**	X	X
	- speed of opening and closing	X	X
	- aircraft separation	X	X
	- controlled time of arrival by changing speed	X	X
A.9.7	**DEAD RECKONING (DR) NAVIGATION**	X	X
	a. Use of the navigation computer/calculator	X	X
	- speed, distance, time, EET and ETA	X	X
	- fuel consumption and endurance	X	X
	- RAS, TAS compressibility correction	X	X
	- conversions	X	X
	b. Triangle of velocities, determination of:	X	X
	- heading, track	X	X
	- TAS, groundspeed	X	X
	- wind velocity	X	X
	- drift	X	X
A.9.8	**NAVIGATION PLOTTING**		
	a. Use of South African Plotting chart (1: 5 000 000)	X	X
	b. Navigation during climb and descent	X	X

	- constant RAS	X	X
	- constant rate of climb	X	X
	- mean climb wind velocity	X	X
	- groundspeed/distance covered during climb and descent	X	X
	c. Navigation in cruising flight	X	X
	- heading and TAS vector since last confirmed position	X	X
	d. Use of various fixes to revise navigation data	X	X
	- plotting of co-ordinates	X	X
	- use of single position lines (QTE) to confirm GS	X	X
	- radial and DME distance	X	X
	- combination of NDB/VOR bearings	X	X
	- determination of track, distance and EET/ETA for destination	X	X
	e. Track corrections	X	X
	- use of 1 in 60 rule	X	X

SUBJECT: **RADIO AIDS & COMMUNICATION (AEROPLANE AND HELICOPTER)**			
ASPECT NUMBER	**SYLLABUS ASPECT**	**CATEGORY APPLICABILITY**	
		A	**H**
A.10.1	**BASIC RADIO THEORY**		
	a. Electromagnetic waves	X	X
	− frequency, wave length, cycle, phase, amplitude	X	X
	− frequency bands	X	X
	− sidebands, double sideband, single sideband,	X	X
	− band width	X	X
	− carrier wave, modulation, demodulation	X	X
	− amplitude modulation	X	X
	− frequency modulation	X	X
	− pulse modulation	X	X
	− designation of emission	X	X
	− signal/noise ratio	X	X

	b. Antennas	**X**	**X**
	− characteristics	**X**	**X**
	− polarisation	**X**	**X**
	− polar diagram	**X**	**X**
	− types of antennas	**X**	**X**
	c. Wave propagation	**X**	**X**
	− ground waves	**X**	**X**
	− direct waves	**X**	**X**
	− sky waves	**X**	**X**
	− ionosphere, critical angle, skip distance	**X**	**X**
	− dead space, refraction	**X**	**X**
	− fading	**X**	**X**
	− factors affecting propagation (reflection,	**X**	**X**
	− absorption, attenuation, coastline, mountain, static)	**X**	**X**
A.10.2	**AUTOMATIC DIRECTION FINDER (ADF)**		
	a. ADF loop theory, rotating and fixed loop antennas	**X**	**X**
	− principles	**X**	**X**
	− presentation and interpretation	**X**	**X**
	− coverage	**X**	**X**
	− range	**X**	**X**
	− errors and accuracy	**X**	**X**
	− factors affecting range and accuracy	**X**	**X**
	− RBI and RMI	**X**	**X**
A.10.3	**VHF OMNI-DIRECTIONAL RANGE (VOR)**		
	− principles	**X**	**X**
	− presentation and interpretation	**X**	**X**
	− coverage	**X**	**X**
	− range	**X**	**X**
	− errors and accuracy	**X**	**X**
	− factors affecting range and accuracy	**X**	**X**
	− CDI and RMI	**X**	**X**
	− Doppler VOR	**X**	**X**
A.10.4	**DISTANCE MEASURING EQUIPMENT (DME)**		

	− principles	X	X
	− presentation and interpretation	X	X
	− coverage	X	X
	− range	X	X
	− errors and accuracy	X	X
	− factors affecting range and accuracy	X	X
A.10.5	**BASIC RADAR PRINCIPLES**		
	− pulse techniques and associated terms	X	X
A.10.6	**GROUND RADAR**		
	− principles	X	X
	− presentation and interpretation	X	X
	− coverage	X	X
	− range	X	X
	− errors and accuracy	X	X
	− factors affecting range and accuracy	X	X
	− errors and accuracy	X	X
	− factors affecting range and accuracy	X	X
	− application for navigation	X	X
C.10.7	**SECONDARY SURVEILLANCE RADAR (SSR)**		
	− principles	X	X
	− presentation and interpretation	X	X
	− modes and codes, including mode S	X	X
A.10.8	**AIRBORNE WEATHER RADAR**		
	− principles	X	X
	− presentation and interpretation	X	X
	− coverage	X	X
	− range	X	X
A.10.9	**RADIO ALTIMETER**		
	− principles	X	X
	− frequency band	X	X
	− presentation and interpretation	X	X
	− errors and accuracy	X	X
A.10.10	**EMERGENCY LOCATOR TRANSMITTER (ELT)**		

	− principles	**X**	**X**
	− frequencies	**X**	**X**
	− testing	**X**	**X**
A.10.11	**AREA NAVIGATION (RNAV)**		
	VOR/DME area navigation	**X**	**X**
	− principle of operation	**X**	**X**
	− advantages and disadvantages	**X**	**X**
	− accuracy, reliability and coverage	**X**	**X**
	− flight deck equipment	**X**	**X**
A.10.12	**SATELLITE ASSISTED NAVIGATION: GNSS / NAVSTAR GPS**		
	− system Components and principle of operation	**X**	**X**
	− advantages and disadvantages	**X**	**X**
	- navigation system performance requirements	**X**	**X**
	− reliability/integrity	**X**	**X**
	- authorisation and documentation	**X**	**X**
	- errors and limitations	**X**	**X**
	- human Factors and GNSS	**X**	**X**