Appendix 13.0

COMBINED SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE GRADE III FLIGHT INSTRUCTOR RATING (AEROPLANE) (A) AND (HELICOPTER) (H)

A list of publications which applicants for pilot licence examinations may find helpful is provided at the end of this document.

Ref. No.	Description	(A)	(H)
1.0	**AIR LAW**		
1.0	**AIR LAW**		
1.1	**SOUTH AFRICAN CIVIL AVIATION REGULATIONS OF 1997 (CAR)**		
1.1.1	**PART 1: DEFINITIONS AND ABBREVIATIONS**		
	As applicable to a Grade III flight instructor	X	X
1.1.2	**PART 12: AVIATION ACCIDENTS AND INCIDENTS**		
	12.02.1 – Notification of accidents 12.02.2 – Notification of incidents 12.02.3 – Notification of accidents and incidents outside the Republic 12.02.4 – Particulars of notification 12.04.1 – Guarding of aircraft involved in accident 12.04.4 – Interference with objects and marks at scene of accident	X	X
1.1.3	**PART 61: FLIGHT CREW LICENSING**		
	Subpart 1: General 61.01.2 – Pilot licences 61.01.3 – Ratings for pilots 61.01.5 – Maintenance of competency and skills tests 61.01.6 – Medical requirements and fitness 61.01.7 – Language 61.01.8 – Logging of flight time (1 – 11, 17) 61.01.9 – Crediting of flight time & theoretical knowledge examinations (1 – 5, 7, 9, 12, 13, 14, 19, 21, 24, 25, 26, 27) 61.01.11 – Suspension and withdrawal of privileges and appeal 61.01.17 – Payment of currency fee 61.01.19 – Endorsements and record keeping	X	X
	Subpart 2: Student Pilot Licence 61.02.1 – Requirements for a Student Pilot Licence 61.02.2 – Application for Student Pilot Licence 61.02.3 – Issuing of a Student Pilot Licence 61.02.4 – Validity of a Student Pilot Licence 61.02.5 – Privileges and limitations of a Student Pilot Licence 61.02.6 – Ratings for special purposes for Student Pilot Licence	X	X
	Subpart 3 – Private Pilot Licence (A) 61.03.1 – Requirements for a Private Pilot Licence (A) 61.03.2 – Application for and issue of a Private Pilot Licence (A) 61.03.3 – Theoretical knowledge for a Private Pilot Licence (A) 61.03.4 – Skills test for a Private Pilot Licence (A) 61.03.5 – Privileges and limitations of a Private Pilot Licence (A) 61.03.6 – Period of validity of Private Pilot Licence (A) 61.03.7 – Maintenance of competency for a Private Pilot Licence (A)	X	

	61.03.8 – Ratings for special purposes for a Private Pilot Licence (A) 61.03.9 – Recency requirements for a Private Pilot licence (A)		
	Subpart 4 – Private Pilot Licence (H) 61.04.1 – Requirements for a Private Pilot Licence (H) 61.04.2 – Application for and issue of a Private Pilot Licence (H) 61.04.3 – Theoretical knowledge for a Private Pilot Licence (H) 61.04.4 – Skills test for a Private Pilot Licence (H) 61.04.5 – Privileges and limitations of a Private Pilot Licence (H) 61.04.6 – Period of validity of Private Pilot Licence (H) 61.04.7 – Maintenance of competency for a Private Pilot Licence (H) 61.04.8 – Ratings for special purposes for a Private Pilot Licence (H) 61.04.9 – Recency requirements for a Private Pilot licence (H)		X
	Subpart 13: Class and Type Ratings 61.13.1 – Requirements for the issue of class and type ratings (1 – 7, 9) 61.13.2 – Training for class and type ratings 61.13.3 – Skills test for class and type ratings 61.13.7 – Type and class ratings – Privileges and variants 61.13.8 – Type and class ratings	X	X
	Subpart 16: Grade III Aeroplane Flight Instructor Rating 61.16.1 – Requirements for a Grade III Aeroplane Flight Instructor Rating 61.16.2 – Application for a Grade III Aeroplane Flight Instructor Rating 61.16.3 – Theoretical knowledge examination for a Grade III Aeroplane Flight Instructor Rating 61.16.4 – Skills test for a Grade III Aeroplane Flight Instructor Rating 61.16.5 – Privileges and limitations of a Grade III Aeroplane Flight Instructor Rating 61.16.6 – Period of validity and reissue of a Grade III Aeroplane Flight Instructor Rating 61.16.7 – Revalidation of a Grade III Aeroplane Flight Instructor Rating	X	
	Subpart 19: Grade III Helicopter Flight Instructor Rating 61.19.1 – Requirements for a Grade III Helicopter Flight Instructor Rating 61.19.2 – Application for a Grade III Helicopter Flight Instructor Rating 61.19.3 – Theoretical knowledge examination for a Grade III Helicopter Flight Instructor Rating 61.19.4 – Skills test for a Grade III Helicopter Flight Instructor Rating 61.19.5 – Privileges and limitations of a Grade III Helicopter Flight Instructor Rating 61.19.6 – Period of validity and reissue of a Grade III Helicopter Flight Instructor Rating 61.19.7 – Revalidation of a Grade III Helicopter Flight Instructor Rating		X
1.1.4	**PART 67: MEDICAL CERTIFICATION**		
	67.00.2 – Classes of medical certificates 67.00.6 – Period of validity of medical certificates 67.00.9 – Duties of holder of medical certificate 67.00.10 – Foreign medical assessments	X	X
1.1.5	**PART 91 – RULES OF THE AIR AND GENERAL OPERATING RULES**		
	Subpart 1: General Provisions		

	91.01.1 – Applicability 91.01.2 – Authority of pilot-in-command 91.01.3 – Authorisation of personnel to taxi aeroplanes 91.01.4 – Search and rescue information 91.01.5 – Information on emergency and survival equipment carried 91.01.9 – Portable electronic devices 91.01.10 – Endangering safety 91.01.11 – Preservation of documents	X	X
	Subpart 2: Flight Crew 91.02.1 – Composition of flight crew 91.02.2 – Flight crew member emergency duties 91.02.3 – Flight crew member responsibilities 91.02.4 – Recency 91.02.5 – Flight crew members at duty stations 91.02.6 – Laws, regulations and procedures 91.02.7 – Duties of pilot-in-command regarding flight preparation 91.02.8 – Duties of pilot-in-command regarding flight operations	X	X
	Subpart 3: Documentation and Records 91.03.1 – Documents to be carried on board 91.03.2 – Aircraft flight manual 91.03.3 – Aircraft checklists 91.03.4 – Air traffic service flight plan 91.03.5 – Flight folio 91.03.6 – Fuel and oil record 91.03.7 – Certificate of release to service	X	X
	Subpart 4: Instruments and Equipment 91.04.1 – Use of instruments and equipment by pilot 91.04.2 – Circuit protection devices 91.04.3 – Aircraft operating lights 91.04.4 – Flight, navigation and associated equipment for aircraft operated under VFR 91.04.14 – Seats, seat safety belts, harnesses and child restraint devices 91.04.15 – Stowage of articles, baggage and cargo 91.04.16 – Standard first aid kit 91.04.19 – Supplemental oxygen in the case of non-pressurised aircraft 91.04.21 – Hand-held fire extinguishers	X X	X X
	Subpart 6: Rules of the Air – Flight Rules 91.06.1 – Landing on roads 91.06.2 – Dropping objects spraying or dusting 91.06.3 – Picking up objects 91.06.4 – Towing 91.06.6 – Proximity and formation flights 91.06.7 – Right of way 91.06.8 – Following line features 91.06.9 – Aircraft speed 91.06.10 – Lights to be displayed by aircraft	X	X

	91.06.11 – Taxi rules 91.06.12 – Operation on and in the vicinity of aerodrome 91.06.13 – Signals 91.06.15 – Reporting position 91.06.16 – Mandatory radio in controlled airspace 91.06.17 – Mandatory radio in advisory airspace 91.06.18 – Compliance with air traffic control clearance and instructions 91.06.19 – Prohibited areas 91.06.20 – Restricted areas 91.06.21 – Visibility and distance from cloud 91.06.22 – Special VFR weather minima 91.06.23 – Responsibility to ascertain whether VFR flight is permitted 91.06.29 – Identification and interception of aircraft 91.06.30 – Air traffic service procedures 91.06.31 – Priority 91.06.32 – Minimum heights 91.06.33 – Semi-circular rule	X	X
	SUBPART 7: FLIGHT OPERATIONS 91.07.1 – Routes and areas of operation 91.07.2 – Minimum flight altitudes 91.07.3 – Use of aerodromes	X	X
	91.07.4 – Helicopter landings and take-offs		X
	91.07.9 – Meteorological conditions 91.07.10 – VFR operating minima 91.07.11 – Mass and balance 91.07.12 – Fuel and oil supply (and CATS 91.07.12, excluding all special procedures) 91.07.13 – Refuelling or de-fuelling with passengers on board 91.07.14 – Smoking in aircraft 91.07.17 – Submission of air traffic service flight plan 91.07.18 – Seats, safety belts and harnesses 91.07.19 – Passenger seating 91.07.20 – Passenger briefing 91.07.23 – Use of supplemental oxygen 91.07.26 – In-flight simulation of emergency situations	X	X
	91.07.27 – Turning helicopter rotors		X
	91.07.28 – Starting of engines 91.07.29 – Acrobatic flights 91.07.32 – Simulated instrument flight in aircraft	X	X
1.1.6	**PART 139: AERODROMES AND HELIPORTS**		
	139.01.1 – Applicability 139.01.2 – Use of military aerodromes and heliports 139.01.5 – Flights by night 139.01.10 – Safety measures against fire	X	X

1.1.7	**AIP, AIC, NOTAM**		
	Basic knowledge of the AIRAC system, sections of the AIP, etc. as applicable to a Grade III instructor	X	X
1.2	**INTERNATIONAL CIVIL AVIATION ORGANISATION (ICAO)**		
	Basic knowledge of the purpose and role of ICAO, Standards and Recommended Practices (SARPs), Registration of Differences, Annexes, Documents, Signatories, etc. (See end of this appendix).	X	X
2.0	**APPLIED METEOROLOGY**		
2.1	**The atmosphere**		
	(a) Composition of the atmosphere	X	X
	(b) Structure of the atmosphere	X	X
	(c) International Standard Atmosphere	X	X
2.2	**Pressure**		
	(a) Definition of atmospheric pressure	X	X
	(b) Units of pressure (Imperial and metric system)	X	X
	(c) Pressure tendency and pressure surfaces	X	X
	(d) Isobars	X	X
	(e) Mean sea level pressure change	X	X
	(f) Low pressure/cyclonic flow	X	X
	(g) Through of low pressure	X	X
	(h) High pressure/anti-cyclonic flow	X	X
	(i) Ridge of high pressure	X	X
	(j) Col area	X	X
	(k) Pressure gradient	X	X
	(l) Diurnal pressure variation	X	X
	(m) Altimetry	X	X
	(n) QFE, QNH, standard setting (QNE)	X	X
	(o) Simple applications of altimetry to aviation	X	X
2.3	**Temperature and heat**		
	(a) Difference between heat and temperature	X	X
	(b) Methods of heat transfer	X	X
	(c) Temperature scales	X	X
	(d) Thermometers	X	X
	(e) Land and sea heating/cooling	X	X

	(f) Diurnal variations	X	X
	(g) Relationship between temperature, pressure, and volume of a gas	X	X
	(h) Adiabatic process	X	X
2.4	**Humidity**		
	(a) Water vapour	X	X
	(b) Evaporation	X	X
	(c) Condensation	X	X
	(d) Sublimation	X	X
	(e) Saturation	X	X
	(f) Dew point	X	X
	(g) Relative humidity	X	X
	(h) Vapour pressure	X	X
2.5	**Density**		
	Definition of density	X	X
	Effects of temperature and pressure on the density of air	X	X
	Effects of humidity on the density of air	X	X
	Definition of density altitude	X	X
	Calculation of density altitude and applications to aviation	X	X
2.6	**Stability and instability**		
	Absolute, conditional and neutral stability	X	X
	Lapse rates (ELR, DALR, SALR)	X	X
	Inversions	X	X
2.7	**Wind**		
	(a) Buy's Ballot's Law	X	X
	(b) Coriolis force	X	X
	(c) Geostrophic wind	X	X
	(d) Gradient wind	X	X
	(e) Surface friction	X	X
	(f) Thermal wind	X	X
	(g) Anabatic wind	X	X
	(h) Katabatic Wind	X	X
	(i) Sea breeze	X	X
	(j) Land breeze	X	X

	(k) Measurement and expression of wind velocity	X	X
2.8	**Air masses**		
	(a) Definition of an air mass	X	X
	(b) Geographic classification	X	X
	(c) Moisture content classification	X	X
	(d) Thermodynamic classification	X	X
	(e) Warm air masses	X	X
	(f) Cold air masses	X	X
	(g) Modification of an air mass	X	X
2.9	**Clouds**		
	(a) Cloud formation	X	X
	(b) Advection and convection	X	X
	(c) Orographic cloud	X	X
	(d) Convergent cloud	X	X
	(e) Convection cloud	X	X
	(f) Turbulent cloud	X	X
	(g) Frontal cloud	X	X
	(h) Cloud classification	X	X
	(i) Cloud observations/amount and height	X	X
2.10	**Fog and mist**		
	(a) Definition of fog and mist	X	X
	(b) Radiation fog	X	X
	(c) Advection fog	X	X
	(d) Upslope fog	X	X
	(e) Valley fog	X	X
	(f) Frontal fog	X	X
	(g) Smog	X	X
2.11	**Visibility**		
	(a) Definition and measurement of visibility	X	X
	(b) Glare	X	X

	(c) Visibility from the air	X	X
	(d) Visibility into sun/moon	X	X
	(e) Causes of reduced visibility	X	X
2.12	**Precipitation**		
	(a) Condensation nuclei	X	X
	(b) Ice Particle Theory	X	X
	(c) Coalescence Theory	X	X
	(d) Drizzle	X	X
	(e) Rain	X	X
	(f) Showers	X	X
	(g) Snow	X	X
	(h) Sleet	X	X
	(i) Hail	X	X
	(j) Freezing rain	X	X
2.13	**Fronts**		
	(a) Formation of fronts	X	X
	(b) The cold front	X	X
	(c) The warm front	X	X
	(d) Occluded fronts	X	X
	(e) Factors determining weather intensity of fronts	X	X
	(f) Flight conditions and hazards associated with fronts	X	X
2.14	**Thunderstorms**		
	(a) Developing conditions	X	X
	(b) Convective thunderstorms	X	X
	(c) Frontal thunderstorms	X	X
	(d) Convergent thunderstorms	X	X
	(e) Orographic thunderstorms	X	X
	(f) Nocturnal thunderstorms	X	X
	(g) Cellular structure of thunderstorms	X	X

	(h)	Cumulus stage	X	X
	(i)	Mature stage	X	X
	(j)	Dissipating stage	X	X
	(k)	Surface weather associated with thunderstorms	X	X
	(l)	Flight hazards associated with thunderstorms	X	X
	(m)	Avoidance of thunderstorms	X	X
2.15	**Turbulence**			
	(a)	Definition of turbulence	X	X
	(b)	Criteria for turbulence	X	X
	(c)	Mechanical turbulence	X	X
	(d)	Low level turbulence	X	X
	(e)	Wake turbulence	X	X
	(f)	Mountain/Standing waves	X	X
	(g)	Microbursts	X	X
	(h)	Clear Air Turbulence (CAT)	X	X
	(i)	Terrain features causing windshear	X	X
	(j)	Flight hazards associated with turbulence and windshear	X	X
2.16	**Ice accretion**			
	(a)	Airframe icing	X	X
	(b)	Hoar frost	X	X
	(c)	Rime ice	X	X
	(d)	Clear ice	X	X
	(e)	Rain ice	X	X
	(f)	Airframe icing protection equipment (small aircraft)	X	X
	(g)	Throttle icing	X	X
	(h)	Fuel evaporation icing	X	X
	(i)	Impact icing	X	X
	(j)	Symptoms of carburettor icing	X	X

	(k) Dangers of icing	X	X
	(l) Avoiding icing regions	X	X
2.17	**Climatology**		
	(a) General world circulation	X	X
	(b) South African summer patterns	X	X
	(c) South African winter patterns	X	X
	(d) Berg winds	X	X
	(e) The south westerly buster	X	X
	(f) The Cape doctor	X	X
	(g) The black south easter	X	X
2.18	**Weather observations and reporting**		
	(a) South African Weather Bureau (SAWB)	X	X
	(b) Weather satellites	X	X
	(c) Weather stations	X	X
	(d) Automatic Weather Stations (AWS)	X	X
	(e) ATIS, internet, cell phone	X	X
2.19	**Codes/documentation**		
	(a) METAR	X	X
	(b) TAF	X	X
	(c) Speci	X	X
	(d) Winds and Temperatures	X	X
	(e) Significant Weather Charts	X	X
3.0	**APPLIED NAVIGATION**		
3.1	**The Earth**		
	(a) Shape of the Earth, Axis of Rotation, Poles, Direction and Rate of Rotation	X	X
	(b) Great circle, small circle, meridians, Equator, parallels of latitude, bearing measurement, great circle and rhumbline tracks	X	X
	(c) Latitude and Longitude	X	X
	(d) Tropics of Cancer and Capricorn	X	X
	(e) Use of latitude and longitude co-ordinates to locate any specific position, conversion to decimal notation and vice versa	X	X
	(f) Cardinal directions, True North	X	X

	(g)	Earth's Magnetism	X	X
	(h)	The Magnetic Compass, Variation, Magnetic North, Isogonals, Agonic Lines, Compass Deviation, Compass North	X	X
	(i)	Units of distance used in navigation, relationship to the Earth and conversions: Nautical Mile, Statute Mile, Kilometre, Metre, Foot	X	X
	(j)	Measurement of time: UTC, GMT, LMT, Standard Time	X	X
	(k)	International Date Line	X	X
	(l)	Time Conversions	X	X
	(m)	Sunrise and Sunset, effect of latitude	X	X
3.2	**Charts**			
	(a)	Mercator and Lambert's (basic properties)	X	X
	(b)	World Aeronautical Charts (WAC)	X	X
	(c)	Definition of Scale and simple calculations	X	X
	(d)	Track lines and measurement of distance and track bearing (mid-latitude)	X	X
3.3	**Dead-reckoning (DR) navigation**			
	(a)	True, Magnetic Track	X	X
	(b)	True, Magnetic and Compass Heading	X	X
	(c)	True Air Speed (TAS), Ground Speed (GS)	X	X
	(d)	Wind velocity and drift correction	X	X
	(e)	Triangle of velocities and solution of simple problems	X	X
	(f)	Navigation computer (circular slide rule) use	X	X
	(g)	1 in 60 rule and applications to drift correction	X	X
	(h)	Distance, time, speed calculations	X	X
	(i)	Fuel consumption calculations	X	X
3.4	**Radio and satellite navigation (as applicable to PPL training)**			
	(a)	VOR use and limitations, homing, radial reporting, intercepting and maintaining a radial	X	X
	(b)	ADF/NDB use and limitations, QDM & QDR reporting, intercepting and maintaining a QDM or QDR	X	X
	(c)	DME distance, slant distance	X	X
	(d)	VDF	X	X

	(e) GPS use and limitations, GPS distance vs. DME distance	X	X
3.5	**Practical navigation**		
	(a) ICAO flight plans	X	X
	(b) Classes of airspace	X	X
	(c) Methods of setting course and time management en-route	X	X
	(d) Uncertain of position tactics	X	X
	(e) Minimum altitudes	X	X
	(f) Altimeter setting procedures	X	X
	(g) Use of transponder	X	X
	(h) Mass and balance terminology and calculations	X	X
	(i) Use of tables and graphs from POH/AFM	X	X
	(j) Flying for range	X	X
	(k) Flying for endurance	X	X
4.0	**PRINCIPLES OF FLIGHT & FLIGHT INSTRUCTION**		
4.1	**Theory of instruction**		
	(a) Techniques of applied instruction		
	(b) The learning process		
	(c) Elements of effective teaching		
	(d) Student evaluation and testing, training philosophies		
	(e) Training programme development		
	(f) Lesson planning		
	(g) Classroom instructional techniques		
	(h) Use of training aids		
	(i) Analysis and correction of student errors		
	(j) Human performance relevant to flight instruction including principles of threat and error management		

*[**Editorial note:** These topics have been inserted by means of AIC 30.2 dated 12 March 2009].*

4.2	**Introductory physics**		
	(a) Composition and structure of the atmosphere	X	X
	(b) Physical Properties: pressure, static pressure, dynamic pressure, temperature, compressibility, humidity, density and their mutual relationship	X	X

	(c)	International Standard Atmosphere (ISA)	X	X
	(d)	Equation of continuity	X	X
	(e)	Bernoulli's Principle – Venturi Effect	X	X
	(f)	Measurement of airspeed	X	X
	(g)	Definition of and relationship between TAS, EAS, IAS, CAS and GS	X	X
	(h)	Basic understanding of the concepts speed, velocity, acceleration, mass, inertia, force, weight, work, power, energy, potential energy, kinetic energy, pressure energy, momentum, turning moment, couple, centre of gravity (CG)	X	X
	(i)	Newton's Laws of Motion	X	X
	(j)	The four main forces acting on an aeroplane in flight (lift, weight, thrust, drag)	X	X
4.3	**Lift and aerofoils**			
	(a)	Terminology: Leading Edge, Trailing Edge, Gross Wing Area (S), Net Wing Area, Wing Span, Average Chord, Aspect Ratio, Taper Ratio, Wash Out, Chord Line, Chord, Mean Camber Line, Camber, Maximum Camber, Maximum Thickness, Angle of Attack, Angle of Incidence, Coefficient of Lift	X	X
	(b)	Streamline, turbulent and free stream airflow	X	X
	(c)	Pressure distribution around an aerofoil	X	X
	(d)	Upwash, downwash, stagnation point, centre of pressure (cp), aerodynamic centre	X	X
	(e)	Lift Force	X	X
	(f)	Lift Formula: $L = C_L(\frac{1}{2}\rho V^2)S$	X	X
	(g)	CL vs. Angle of Attack Curve (Lift Curve)	X	X
	(h)	Factors affecting Lift	X	X
4.4	**Drag**			
	(a)	Form Drag, Boundary Layer and Skin Friction Drag, Interference Drag, Profile Drag, Parasite Drag	X	X
	(b)	Spanwise Flow, Wing Tip Vortices, Induced Drag	X	X
	(c)	Total reaction	X	X
	(d)	Total drag and the drag curves	X	X
	(e)	Drag formula: $D = C_D(\frac{1}{2}\rho V^2)S$	X	X
	(f)	Factors affecting drag and methods of reducing drag	X	X

	(g)	Lift to drag ratio and relationship to angle of attack	X	X
	(h)	Minimum Drag Speed (VMD)	X	X
4.5	**Stability**			
	(a)	Roll, pitch and yaw, the associated three planes and axes	X	X
	(b)	Horizontal and vertical stabilisers	X	X
	(c)	Equilibrium and pitching moments	X	X
	(d)	Definitions of dynamic and static stability	X	X
	(e)	Stable, neutral and unstable situations	X	X
	(f)	Longitudinal, lateral and directional stability and factors affecting them	X	X
4.6	**Flying controls**			
	(a)	The Primary Control Surfaces: Ailerons, Rudder, Elevators, Stabilator, Ruddervators	X	
	(b)	Primary effects of each control surface	X	
	(c)	Secondary/further effects of each control surface	X	
	(d)	Adverse aileron yaw and methods to overcome it	X	
	(e)	Effects of speed, slipstream and location of CG	X	
	(f)	Description and principle of balance tabs, anti-balance tabs, trim tabs	X	
	(g)	Trailing Edge Flaps: simple, split, slotted, fowler and combinations	X	
	(h)	Purpose, function and effects of trailing edge flaps	X	
	(i)	Effects of cyclic, collective and rudder pedal inputs		X
	(j)	Effect of rotor configuration on control power		X
4.7	**Straight and level flight**			
	(a)	Forces and equilibrium	X	X
	(b)	Pitching moments and couples, effect of the horizontal stabiliser	X	X
	(c)	Relationship between change in speed, attitude, altitude, weight or configuration	X	X
	(d)	Thrust vs. TAS and Power vs. TAS curves	X	X
	(e)	Flying for endurance or range (reciprocating engines)	X	X
4.8	**Climbing**			
	(a)	Climb angle, forces and equilibrium, pitching moments	X	X
	(b)	Rate of climb, VX, VY, cruise climb	X	X

	(c)	Climb performance and power curves, service ceiling and absolute ceiling	X	X
	(d)	Effects of altitude, speed, temperature, wind, weight, and configuration	X	X
4.9	**Descending**			
	(e)	Forces and equilibrium	X	X
	(e)	(A) Power-off descent (glide) and effects of altitude, speed, temperature, wind, weight, configuration, and lift to drag ratio	X	
	(e)	Best glide speed	X	X
	(e)	Power-on descents	X	X
4.10	**Turning**			
	(a)	Centripetal force, bank angle, forces in a steady, co-ordinated turn	X	X
	(b)	Effect of bank angle on load factor and stalling speeds	X	X
	(c)	Relationship between bank angle, turn radius, turn rate and speed	X	X
	(d)	Effects of altitude, speed, temperature, wind, weight, and configuration	X	X
	(f)	Effect of torque	X	X
	(g)	Balanced turns, slipping and skidding and the sideslip	X	X
	(h)	Climbing and descending turns	X	
	(i)	Spiral dive initiation, recognition and recovery	X	
4.11	**Take-off and landing**			
	(a)	Definition of terms (SE only) – take-off distance required/available; ground roll; landing distance required/available; critical speeds and their relationship	X	
	(b)	Factors affecting take-off and landing performance – mass, density altitude; wind; runway surface and slope	X	
4.12	**Stalling**			
	(a)	Boundary layer, laminar and turbulent flow, transition point, separation point, adverse pressure gradient	X	
	(b)	Movement of centre of pressure, decrease in lift, increase in drag, pitching moment	X	
	(c)	Stalling angle of attack	X	
	(d)	Definition of stalling speed, VS, VS0, relationship to lift and accelerated or G stall	X	
	(e)	Effects on stalling speed of weight, CG, manoeuvres and load factor, power, configuration, wing planform, wing contamination, altitude	X	
	(f)	Symptoms of the developing stall	X	
	(g)	Inherent and artificial stall warnings	X	

	(h)	Aircraft characteristics at the stall	X	
	(i)	Recovery from the stall	X	
	(j)	Wingtip stalling and devices to prevent it	X	
4.13	**Spin awareness/avoidance**			
	(a)	Description of a spin and comparison with spiral dive	X	
	(b)	Requirements for the development of a spin	X	
	(c)	Autorotation, CL and CD vs. angle of attack curves	X	
	(d)	Recovery from an incipient spin	X	
	(e)	Effects of CG on the spin and spin recovery	X	
4.14	**Aircraft technical**			
	(a)	Fuselage, wings, tail assembly, flying controls	X	
	(b)	Airframe limitations: weights, speeds, velocity/load factor (V–n) diagram	X	
	(c)	Fuselage, controls (collective, cyclic, yaw pedals)		X
	(d)	Landing gear, tyres and brakes	X	
	(e)	Landing gear (skids, wheels and tyres, braking systems and shock absorbers)		X
	(f)	Piston engines: basic principles, four-stroke cycle, valves and valve timing, ignition system, exhaust system, cooling	X	X
	(g)	Carburettor, mixture control, detonation, pre-ignition, icing, fuel injection, turbo-charging	X	X
	(h)	Propeller terminology, forces on a blade section, thrust curve, propeller efficiency, variable pitch propeller and constant speed unit (CSU), effects of increasing or decreasing propeller rpm, wind-milling effect	X	
	(i)	Drive systems, gear boxes, clutch systems, rotors, blade construction, rotor heads		X
	(j)	Basic fuel and oil systems, engine handling	X	X
	(k)	Basic electrical system, batteries, alternators and generators, fuses and circuit breakers	X	X
	(l)	Vacuum system	X	X
	(m)	Pressure instruments: airspeed indicator (ASI), altimeter, vertical speed indicator (VSI), problems and errors	X	X
	(n)	Gyroscopic instruments: precession and rigidity, turn co-ordinator, turn indicator, attitude indicator/artificial horizon (AI/AH), direction indicator (DI), sources of power, problems and errors	X	X

	(o)	Magnetic compass, variation, deviation, dip, acceleration and turning errors	X	X
	(p)	Navigation instruments: basic principles of VOR, ADF/NDB, RMI, GPS	X	X
	(q)	Transponder: basic principles, modes and use	X	X
4.15	**Helicopter terms**			
	(a)	Plane of rotation		X
	(b)	Axes of rotation		X
	(c)	Rotor shaft axis		X
	(d)	Tip path plane		X
	(e)	Rotor disc		X
	(f)	Disc loading		X
	(g)	Blade loading		X
4.16	**The forces diagram and associated terminology**			
	(a)	Pitch angle		X
	(b)	Induced airflow		X
	(c)	Relative airflow to the blade		X
	(d)	Angle of attack		X
	(e)	Drag-blade		X
	(f)	Total reaction-blade		X
	(g)	Rotor thrust		X
	(h)	Rotor drag		X
	(i)	Torque		X
	(j)	Mass		X
	(k)	Uniformity of rotor thrust along blade span		X
	(l)	Blade twist		X
	(m)	Blade taper		X
	(n)	Coning angle		X
	(o)	Centrifugal force		X
	(p)	Limits of rotor RPM		X
	(q)	Centrifugal turning moments		X

4.17	**Helicopter controls**		
	(a) Collective lever (i) collective pitch changes (ii) relationship with rotor thrust and rotor drag		X
	(b) Cyclic stick (i) cyclic pitch changes (ii) rotor disc attitude (iii) rotor thrust tilt		X
	(c) Yaw pedals (i) fuselage torque (ii) tail-rotor drift (iii) tail-rotor roll		X
4.18	**Rotor blade freedom of movement**		
	(a) Feathering (i) the feathering hinge (ii) pitch angle		X
	(b) Flapping (i) the flapping hinge (ii) alleviation of bending stresses (iii) flapping to equality		X
	(c) Dragging (i) the drag hinge (ii) drag dampers (iii) leading/lagging (iv) periodic drag changes (v) blade C of G (conservation of angular momentum)		X
	(d) Vertical flight (i) take off (ii) vertical climb (iii) vertical descent		X
4.19	**Hovering**		
	(a) Outside – Inside ground effect (i) factors affecting ground cushion (ii) re-circulation		X
	(b) Forces in balance (i) in the hover (ii) in forward flight (iii) influence of centre of gravity (iv) influence of rotor shaft tilt		X
	(c) Translational lift (i) effect of horizontal airflow on induced flow		X

	(ii) variation of total flow through the disc with forward flight		
4.20	**The relationship between pitch angle and angle of attack**		
	(a) Power requirements (i) rotor profile power (ii) power absorption – tail rotor and ancillary equipment (iii) rotor profile power variation with forward speed (iv) induced drag (v) parasite drag (vi) rotor profile drag (vii) total power required (viii) power available		X
4.21	**Transition from and to the hover**		
	(a) Symmetry and asymmetry of rotor thrust		X
	(b) Main rotor flapback		X
	(c) Tail rotor flapback and methods of removal		X
4.22	**Factors affecting maximum forward speed**		
	(a) Design limits of cyclic stick		X
	(b) Airflow reversal		X
	(c) Retreating blade stall		X
	(d) Symptoms and recovery actions		X
	(e) Flow separation		X
4.23	**Factors affecting cyclic stick limits**		
	(a) All up mass (AUM)		X
	(b) Density altitude		X
	(c) Centre of gravity position		X
	(d) The flare – power flight		X
4.24	**Helicopter-specific hazardous conditions**		
	(a) Vortex Ring State (Settling with Power) (i) tip vortices (ii) comparison between induced flow and rate of descent flow (iii) development (iv) change in relative airflow along blade span – root stall and turbulence		X
	(b) Blade sailing (i) rotor RPM and blade rigidity (ii) effect of adverse wind (iii) minimising the danger		X

	(c) Autorotation – vertical (i) rate of descent airflow (ii) effective airflow (iii) relative airflow (iv) inflow and inflow angle (v) autorotative force		X
	(d) Blade regions (i) stalled region (ii) driven region (iii) driving region (iv) rotor drag (v) effect of mass and altitude (vi) control of rotor RPM		X
	(e) Autorotation – forward flight (i) factors affecting inflow angle (ii) effect of forward speed on rate of descent (iii) effect of forward speed on the three regions (iv) turning (v) the flare (vi) rotor RPM increase from movement of autorotative section (vii) increase in rotor thrust (viii) reduction in rate of descent (ix) autorotation for range and endurance (x) height/velocity avoidance graph		X
	(f) Rollover (i) dynamic roll-over and avoidance of (ii) static rollover (iii) effect of centre of gravity		X
	(g) Operating with limited power		X
	(h) Overpitch		X
	(i) Ground resonance		X
	(j) Mast bumping		X

ICAO – WHAT IS IT?

ICAO, the International Civil Aviation Organisation, is one of the specialised agencies of the United Nations. The 1944 *Convention on International Civil Aviation* was signed in Chicago by 52 countries (member States), but didn't officially come into being until 1947, when the 26th State ratified the Convention. There are currently 185 member States of which South Africa is one.

Why is it important?

ICAO:

- Is a global body charged with the safety of and development of standards for international civil aviation;

- Sets international standards for safety and security;
- Provides a global forum for international aviation issues.

What are the aims and objectives of ICAO?

Article 44 of the Convention states that the aims and objectives of ICAO are to develop the principles and techniques of international air navigation and to foster the planning and development of international air transport.

How is ICAO organised?

ICAO is composed of:

- An Assembly, composed of representatives from all contracting States. The Assembly normally meets every 3 years, votes a triennial budget, and sets the work program for the next triennium;
- A Council, the governing body composed of 33 States, elected by the Assembly for three-year terms. (The U.S. has always been elected to the Council.) The Council establishes Standards and Recommended Practices (SARPs) and incorporates them into Annexes to the Convention. The Council is headed by an elected President, who also serves for three years;
- The Secretariat, headed by a Secretary General and divided into five bureaus – Air Navigation, Air Transport, Technical Co-Operation, Legal, and Administration and Services;
- The headquarters of ICAO is located in Montreal, Canada. In addition, there are seven ICAO regional offices – in Bangkok, Cairo, Dakar, Lima, Mexico City, Nairobi, and Paris.

What is the "Chicago Convention"?

The Chicago Convention is the legal instrument that established ICAO.

What are Annexes?

Over the years, the ICAO Council has developed and adopted 18 technical Annexes to the Convention. Article 37 of the Convention charges ICAO with establishing International Standards and Recommended Practices (SARPs). These SARPs are incorporated as Annexes to the Convention. A Standard is a specification the uniform application of which is necessary for the safety or regularity of international civil air navigation. A Recommended Practice is a practice that is agreed to be desirable but not essential.

What are the subjects of these Annexes?

Annex 1 – Personnel Licensing

Licensing of flight crews, air traffic controllers and aircraft maintenance personnel.

Annex 2 – Rules of the Air

Rules relating to the conduct of visual and instrument flights.

Annex 3 – Meteorological Service for International Air Navigation

Provision of meteorological services for international air navigation and reporting of meteorological observations from aircraft.

Annex 4 – Aeronautical Charts

Specifications for aeronautical charts for use in international aviation.

Annex 5 -- Units of Measurement to be used in Air and Ground Operations.

Annex 6 – Operation of Aircraft

Specifications which will ensure in similar operations throughout the world a level of safety above a prescribed minimum.

Note: ICAO is considering merging this Annex with Annex 8.

Annex 7 – Aircraft Nationality and Registration Marks

Requirements for registration and identification of aircraft.

Annex 8 – Airworthiness of Aircraft

Certification and inspection of aircraft according to uniform procedures.

Note: ICAO is considering merging this Annex with Annex 6.

Annex 9 – Facilitation

Specifications for expediting the entry and departure of aircraft, people, cargo, and other articles at international airports.

Annex 10 – Aeronautical Telecommunications

Standardisation of communications equipment, systems, and procedures.

Annex 11 – Air Traffic Services

Establishment and operation of air traffic control, flight information, and alerting services.

Annex 12 – Search and Rescue

Organisation and operation of facilities.

Annex 13 – Aircraft Accident Investigation

Uniformity in the notification, investigation of, and reporting on aircraft accidents.

Annex 14 – Aerodromes

Specifications for the design and operations of aerodromes.

Annex 15 – Aeronautical Information Services

Methods for the collection and dissemination of aeronautical information required for flight operations.

Annex 16 – Environmental Protection

Specifications for aircraft noise certification, noise monitoring, and noise exposure units for land-use planning and aircraft engine emissions.

Annex 17 – Security – Safeguarding International Civil Aviation against Acts of Unlawful Interference

Specifications for safeguarding international civil aviation against acts of unlawful interference.

Annex 18 – The Safe Transport of Dangerous Goods by Air

Specifications for the labelling, packing, and shipping of dangerous cargo.

How are Annexes changed?

Adoption of amendments to Annexes requires a 2/3 vote by the Council, then submission to each of the contracting States. Typically, the amendments become effective within three months of Council approval, unless disapproved by a majority of the contracting States during that time.

What happens if a contracting State disagrees with a change?

Contracting States are expected to implement SARPs unless a particular State gives notice to ICAO that it is unable to comply because a SARP conflicts with State regulations. ICAO publishes these "differences" in Supplements to Annexes. When other signatory States do not accept differences submitted by a State, that condition may limit that State's acceptance of type and operation of aircraft.

SUGGESTED STUDY MATERIAL FOR THE INITIAL INSTRUCTOR THEORETICAL KNOWLEDGE EXAMINATION – AEROPLANE AND HELICOPTER:

- South African AIP, NOTAM and current AICs applicable to a Grade III instructor (RSA)
- Aviation Law – C Beek (RSA) and SA CAA website (www.caa.co.za)
- Southern Africa's Weather Patterns – J Van Heerden and L Hurry (RSA)
- The Private Pilot's Handbook – G D P Worthington (RSA)
- Air Pilots Manual – Volumes 2, 3 and 4 – P. Godwin (Previously Thom) (UK)
- The Private Pilot's Licence Course – Jeremy M Pratt (U(K) Volumes 3 and 4
- Principles of Helicopter Flight – W J Wagtendonk
- The Helicopter Pilot's Manual – N Bailey, Volume 1 – Principles of Flight (UK)
- The Helicopter Pilot's Manual – N Bailey, Volume 2 – Powerplants, Instruments and Hydraulics (UK)
- Rotorcraft Flying Handbook – Federal Aviation Administration (USA)
- Rotary Wing Flight – Nicholas Ean (USA) available from ASA
- The Helicopter Pilot's Handbook – G D P Worthington/K Piggott (RSA)
- Study notes compiled and published by South African Flight Schools (note that the SA CAA cannot accept responsibility for the content of these notes.)

Additional Resources:

- Meteorology for Pilots – M Wickson (UK)
- Flying Training for The Private Pilot Licence – Instructor Manual – R D Campbell (UK)
- Mechanics of Flight – A C Kermode (USA)
- Flight without Formulae – A C Kermode (USA)