

Appendix 2.0

COMBINED SYLLABUS OF THEORETICAL KNOWLEDGE FOR THE INSTRUMENT RATING, COMMERCIAL AND AIRLINE TRANSPORT PILOT LICENCE (AEROPLANE) AND (HELICOPTER)

Legend: I = Instrument Rating, C = Commercial Pilot, A = Airline Transport Pilot

Application	
	1. METEOROLOGY
	<u>1. THE ATMOSPHERE</u>
I C A	1. Composition of the Atmosphere
I C A	2. Water Vapour
I C A	3. Condensation Nuclei
A	4. Ozone
I C A	5. Structure of the Atmosphere
I C A	6. The Troposphere
A	7. The Stratosphere
A	8. The Mesosphere
I C A	9. International Standard Atmosphere
I C A	<u>2. PRESSURE</u>
	1. Definition of Atmospheric Pressure
	2. Imperial System
	3. Metric System
	4. Mercury Barometer
	5. Aneroid Barometer
	6. Barograph
	7. Digital Display Barometer
	8. Pressure Tendency
	9. Density Change
	10. Mean Sea Level Pressure Change
	11. Depressions
	12. Secondary Depressions
	13. Trough of Low Pressure

I C A

14. Anti-Cyclone or High Pressure
15. Ridge of High Pressure
16. Col Area
17. Pressure Gradient
18. Diurnal Pressure Variation
19. Altimetry
20. QFE
21. QNH
22. QNE
23. Application of Altimetry

3. TEMPERATURE

1. Temperature Scales
 2. Thermometers
 3. Radiation
 4. Conduction
 5. Convection
 6. Advection
 7. Land and Sea Heating/Cooling
 8. Diurnal Variations
 9. Lapse Rates
 10. Inversions
 11. Environmental Lapse Rate

I C A

4. DENSITY

1. Compressibility of Gasses
 2. Pressure
 3. Effect of Pressure
 4. Effect of Temperature
 5. Combined Effect of Pressure and Temperature

I C A	<ol style="list-style-type: none"> 6. Effect of Humidity 7. Density Altitude 5. <u>HUMIDITY</u> <ol style="list-style-type: none"> 1. Water Vapour 2. Saturation 3. Dew Point 4. Condensation 5. Sublimation 6. Evaporation 7. Relative Humidity 8. Vapour Pressure 9. Change of State 10. Psychrometer
I C A	<ol style="list-style-type: none"> 6. <u>ADIABATIC PROCESS, LAPSE RATE & STABILITY</u> <ol style="list-style-type: none"> 1. Adiabatic Process 2. Dry Adiabatic Lapse Rate 3. Saturated Adiabatic Lapse Rate 4. Environmental Lapse Rate 5. Relation SALR and DALR 6. Absolute Stability 7. Absolute Instability 8. Conditional Instability 9. Neutral Stability
I C A	<ol style="list-style-type: none"> 7. <u>WIND</u> <ol style="list-style-type: none"> 1. Buys Ballot's Law 2. Coriolis Force 3. Geostrophic Wind 4. Gradient Wind 5. Surface Friction

	6. Thermal Wind
	7. Local Winds
	8. The Föhn Wind
	9. The Berg Wind
	10. Anabatic Wind
	11. Katabatic Wind
	12. Sea Breeze
	13. Land Breeze
	14. Monsoons
C A	15. Trade Winds and the ITCZ (Inter-Tropical Convergence Zone)
C A	16. General Global Upper Wind Circulation
I C A	17. Westerly Wind Waves
I C A	18. Tropical Easterly Wind Wave
C A	19. Jet Streams
I C A	<u>8. AIR MASSES</u>
	1. Definition of an Air Mass
	2. Geographic Classification
	3. Moisture Content Classification
	4. Thermodynamical Classification
	5. Warm Air Masses
	6. Cold Air Masses
	7. Modification of an Air Mass
I C A	<u>9. CLOUDS</u>
	1. Causes of Cloud Formation
	2. Orographic Cloud
	3. Convergent Cloud
	4. Convection Cloud
	5. Turbulent Cloud

I C A

6. Frontal Cloud
7. Cloud Classification
8. Cloud Observations/Amount and Height

10. FOG AND MIST

1. Definition of Fog and Mist
2. Radiation Fog
3. Advection Fog
4. Upslope Fog
5. Valley Fog
6. Frontal Fog
7. Smog

I C A

11. VISIBILITY

1. Definition of Visibility
2. Glare
3. Runway Visual Range
4. Visibility from the Air
5. Visibility into Sun/Moon
6. Causes of Reduced Visibility

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12. PRECIPITATION

1. Condensation Nuclei
2. Ice Particle Theory
3. Coalescence Theory
4. Drizzle
5. Rain
6. Showers
7. Snow
8. Sleet
9. Hail
10. Freezing Rain

I C A

11. Precipitation and Aviation
13. FRONTS
 1. Frontal Slope
 2. Stationary Front - Stage 1
 3. Start of a Front - Stage 2
 4. Frontal Wave - Stage 3
 5. Moving Front - Stage 4
 6. Occluded Front - Stage 5
 7. Dissipating Stage - Stage 6
 8. The Cold Front
 9. The Warm Front
 10. Occluded Fronts
 11. Factors determining Weather Intensity of Fronts

I C A

14. THUNDERSTORMS
 1. Developing Conditions
 2. Convective Thunderstorms
 3. Frontal Thunderstorms
 4. Convergent Thunderstorms
 5. Orographic Thunderstorms
 6. Nocturnal Thunderstorms
 7. Cellular Structure of Thunder/s
 8. Cumulus Stage
 9. Mature Stage
 10. Dissipating Stage
 11. Surface Weather with T/S
 12. Flight Hazards with T/S
 13. Penetration Procedures
 14. After Entry

	15. Avoidance of Thundershowers
I C A	<u>15. TURBULENCE</u>
	1. Definition of Turbulence
	2. Criteria for Turbulence
	3. Mechanical Turbulence
	4. Low level Turbulence
	5. Wake Turbulence
	6. Mountain/Standing Waves
	7. Microburst
	8. Clear Air Turbulence – CAT
	9. Low Level Wind Shear Problems during Take-off/Landing-phase
	10. Approach Techniques for Wind Shear
	11. Terrain Features causing Wind Shear Problems
I C A	<u>16. ICE ACCRETION</u>
	1. Airframe Icing
	2. Hoar Frost
	3. Rime Ice
	4. Clear Ice
	5. Rain Ice
	6. Airframe Icing Protection Equipment
	7. Jet Engine Icing
	8. Throttle Icing
	9. Fuel Evaporation Icing
	10. Impact Icing
	11. Symptoms of Carburettor Icing
	12. Dangers of Icing
	13. Avoiding Icing Regions
I C A	<u>17. PRESSURE SYSTEMS</u>
	1. Trough of Low Pressure

I C A

2. Thermal Depressions
3. Orographic Depressions
4. Coastal Low
5. Tropical Cyclones
6. Anti-cyclones (Highs)
7. Cold Anti-cyclones
8. Warm Anti-cyclones

18. CLIMATOLOGY

1. General World Circulation
2. Basic Climatic Zones
3. Some World Weather Systems
 - (a) Doldrums;
 - (b) Trade Winds;
 - (c) Horse Latitude & Westerly's
4. South African Summer Patterns
5. South African Winter Patterns
6. The South Westerly Buster
7. The Cape Doctor
8. The Black South Easter

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19. AIRCRAFT MET OBSERVATIONS

1. Airep
 - Position Information
 - (i) Aircraft identification
 - (ii) Position
 - (iii) Time
 - (iv) Flight Level or Altitude
 - (v) Next Position and ETA
 - Operational Information
 - (i) Destination

		(ii) Endurance
		Meteorological Information
		(i) Outside Air Temperature
		(ii) Wind Direction and Wind Speed
		(iii) Turbulence
		(iv) Aircraft Icing
		(v) Cloud Base and Cloud Tops
		(vi) Supplementary Information
		2. ASDAR and AMDAR System
		<i>Weather satellites</i>
		3. Weather Satellites
		4. Orbits
		5. Imagery
		6. Data Collecting and Relay
		7. Current Operational Satellites
		8. Internet + WWW Satellite Data
C A	20.	<u>SYNOPS AND SYNOPTICS</u>
		1. Station Model
		2. Synoptic Charts
		3. Drawing of Isobars
		4. Synoptics
I C A	21.	<u>CODES/DOCUMENTATION</u>
		1. Metar
		2. Speci
		3. Taf
		4. Actual Upper Winds
		5. Prognostic Upper Winds
		6. Significant Weather Charts
I C A	22.	<u>METEOROLOGICAL ORGANISATIONS</u>
		1. World Meteorological Organisation

	2. International Civil Aviation Organisation
	3. South African Weather Bureau – SAWB
	4. Central Forecasting Office – CFO
	5. Main Forecasting Offices – MFO
	6. Weather Offices – WO
	7. Subsidiary Stations
	8. Automatic Weather Stations (AWS)
	9. Weather Services for Aviation
I C A	2. FLIGHT PLANNING AND PERFORMANCE
	2.1 Definitions and Terms
	ICAO, Annex 6
I C A	2.1.1 Airspeed Terminology and Symbols
	- RIAS, RCAS, RTAS, Mach number
	- VA, VFO, VFE, VF
	- VLO, VLE
	- VNO, VNE
	- VX, VY
	- VMO, MMO
	- VMCA, VMCG
	- VS, VSO
	- VSSE
	- VI, VR, V2, VREF, VLOF, VMBE
I C A	2.1.2 Meteorological Terminology (ISA, JSA)
	- OAT, IOAT, TAT, SAT, RAT
	- Temperature deviation from ISA
	- Pressure altitude
	- Density altitude
	- Aerodrome pressure
I C A	2.1.3 Aerodrome Terminology

		<ul style="list-style-type: none"> - Balanced and unbalanced field lengths - Clearway, stopway - TORA (take-off run available) - TODA (take-off distance available) - EMDA (emergency distance available) - WAT limits - LDA (landing distance available) - Displaced threshold - Runway slope - Runway strength - Single isolated wheel loading
I C A	2.1.4	Take-off flight path
	2.2	Aeroplane Manuals
		Use of graphs or tables to determine –
I C A	2.2.1	Take-off
		Take-off run (TORA)
		Take-off distance (TODA)
		Take-off speeds (V1, VR, V2)
		Maximum take-off mass
		Accelerate-go distance
		Accelerate-stop distance (ASDA)
		VMCA, VMCG limits
C A		Anti-skid inoperative
I C A		Reduced braking capability
C A		Tyre speed limits
I C A		Power settings
I C A	2.2.2	Climb
		Initial climb
		Obstacle clearance requirements
		Time, distance and fuel used
		Rate of climb
		Angle of climb
I C A	2.2.3	Cruise
		Constant power cruise
		Constant speed cruise
		Long range cruise
		Optimum altitude
		Range
		Endurance
		Fuel consumption, fuel used, fuel flow

			- ANM/fuel ratio
			- GNM/fuel ratio
			- wind components, wind range correction/trade-off
	CA		Mid-zone weights
	CA		Mid-zone weights
	IC A		One engine inoperative
	CA		In flight diversion
	CA		Integrated range tables
	A		Simplified flight planning graphs
	IC A		Step climb to optimum altitude
	CA		Power settings
	IC A		Fuel management
	CA		Alternate planning
	IC A		Re-dispatch planning
			Contingency allowance
	IC A	2.2.4	Descent
			Time, distance, fuel used
		2.2.5	Reserve fuel
			Holding fuel
			Contingency allowance
			Approach and landing fuel
			Minimum in tanks
	IC A	2.2.6	Landing
			Maximum landing mass
			Landing distance
	CA		Landing ground roll
	CA		Anti-skid inoperative
	IC A		Reverse thrust
	IC A	2.2.7	Flight plan
			Completion of fuel flight plan
		2.2.8	Miscellaneous graphs
			Airspeed calibration
			Altimeter calibration
			Indicated outside air temperature
			Total air temperature
			Stall speeds
			Pressurisation controller settings
	IC A	2.3	Mass and balance
		2.3.1	Terminology
			Arm, movement, reference datum, station, centre of gravity, CG arm, CG limits, mean aerodynamic chord (MAC) (LEMAC)
			Maximum ramp and taxi mass
			Maximum take-off mass
	CA		Maximum zero fuel mass
	CA		Empty operating mass
	CA		Cargo pallets

I C A		Maximum floor load
I C A	2.3.2	Loadsheet and Trimsheet
		Preparation of loadsheets and trimsheets
		Calculation of CG
		Movement of CG in flight maximum load at station
		Ballast
I C A	2.4	PET and PNR
	2.4.1	PET (Point of equal time)
		- all engines operating
		- one engine inoperative (critical point)
	2.4.2	PNR (Point of no return)
		- with or without reserve fuel
I C A	3.	RADIO AIDS
	3.1	Basic Radio Theory
	3.1.1	Electromagnetic waves
		- frequency, wave length, cycle, phase, amplitude
		- frequency bands
		- sidebands, double sideband, single sideband, band width
		- carrier wave, modulation, demodulation
		- amplitude modulation
		- frequency modulation
		- pulse modulation
		- multiplex
		- designation of emission
		- signal/noise ratio
I C A	3.1.2	Antennas
		- characteristics
		- polarisation
		- polar diagram
		- types of antennas
I C A	3.1.3	Wave propagation

		<ul style="list-style-type: none"> - ground waves - direct waves - sky waves - ionosphere, critical angle skip distance, dead space, refraction - frequency prognosis (MUF) - fading - factors affecting propagation (reflection, absorption, attenuation, coastline, mountain, static)
I C A	3.2.1	<p>Communication</p> <ul style="list-style-type: none"> - VHF communications - HF communications - Selcal
I C A	3.3.1	<p>Ground direction Finding (VDF)</p> <ul style="list-style-type: none"> - Principle - range - errors and accuracy - classification of bearings
I C A	3.3.2	<p>ADF (Automatic Direction Finding)</p> <p>NDB (Non-Directional beacon)</p> <ul style="list-style-type: none"> - A1A, A2A emissions, frequencies
I C A		<p>ADF loop theory</p> <ul style="list-style-type: none"> - rotating loop antenna - fixed loop antenna
I C A		<p>Range and coverage</p> <ul style="list-style-type: none"> - errors - accuracy - factors affecting range and accuracy - RBI (Relative Bearing Indicator) - RMI (Relative Magnetic Indicator) - calculations

I C A	3.3.3	VOR	Principles Presentation and interpretation Range and coverage Errors and accuracy Factors affecting range and accuracy Doppler VOR TVOR (Terminal VOR) CDI (Course Deviation Indicator) Calculations Frequencies
I C A	3.3.4	ILS (Instrument Landing System)	Principles Presentation and interpretation Back beam Range and coverage Errors and accuracy Factors affecting range and accuracy Categories Frequencies Calculations
A	3.3.5	MLS (Microwave Landing System)	Principles Presentation and interpretation Range and coverage Errors and accuracy Factors affecting range and accuracy
I C A	3.3.6	Radio Altimeter	Principle Frequency band Presentation and interpretation Errors and accuracy Calculations
C A	3.3.7	GPWS (Ground Proximity Warning System)	Principles Modes of operation
I C A	3.3.8	ELT (Emergency Locator Transmitter)	Principles Frequencies Testing
	3.4	Basic Radar Theory	
I C A	3.4.1	Pulse techniques	Associated terminology Primary radar Secondary radar Cathode Ray Tube (CRT)
I C A	3.4.2	Ground Radar	

		Principles Presentation and interpretation Range and coverage Errors and accuracy Factors affecting range and accuracy Calculations
I C A	3.4.3	DME (Distance Measurement Equipment)
		Principles Presentation and interpretation Range and coverage Errors and accuracy Frequencies DME/P (precision DME)
I C A	3.4.4	Airborne Weather Radar
		Principles Presentation and interpretation Range and coverage Errors and accuracy Factors affecting range and accuracy
I C A	3.4.5	SSR (Secondary Surveillance Radar)
		Principles Modes and codes
A	3.4.6	TCAS (Traffic Alert and Collision Avoidance System)
		Principles
A	3.4.7	Doppler Radar
		Principles Groundspeed and drift calculation Errors and accuracy
	3.5	AREA NAVIGATION SYSTEMS
	3.5.1	RNAV VOR/DME Area Navigation
		Principles Range and coverage Errors and accuracy Approach mode Calculations
I C A	3.6	GPS/GNSS
	3.6.1	GPS (Global Positioning System) components and principle of operation
		GPS system components, constellation, control and user Aircraft equipment requirements GPS satellite signal and pseudo random code Principle of position fixing Method of minimising receiving clock error Minimum satellites required for navigation functions Masking function Performance limitations of various equipment types GPS use of WGS84 co-ordinate system

I C A		<p>3.6.2 Navigation system performance requirements</p> <ul style="list-style-type: none"> Accuracy Integrity Means of providing GPS integrity; RAIM; procedural systems integration Availability Continuity of service <p>3.6.3 GPS errors and limitations</p> <ul style="list-style-type: none"> Ephemeris Clock Receiver Atmospheric/Ionospheric Multipath SA (selected availability) Typical total error associated with C/A code Effect of PDOP/GDOP on position accuracy Susceptibility to interference Comparison of vertical and horizontal errors Tracking accuracy and collision avoidance <p>3.6.4 Human Factors and GPS</p> <ul style="list-style-type: none"> Mode errors Data entry errors Data validation and checking including independent cross-checking procedures Automation induced complacency Non-standardisation of the GPS-pilot interface Human information processing and situational awareness
I C A		<p>3.6.5 GPS equipment – Specific navigation procedure</p> <ul style="list-style-type: none"> Select appropriate operational modes Recall categories of information contained in the navigation database Predict RAIM availability Enter and check user defined waypoints Enter/retrieve and check flight plan data Interpret typical GPS navigation displays LAT/LONG, distance and bearing to waypoint, CDI Intercept and maintain GPS defined tracks Determine TMG, GS, ETA, time and distance to WPT, WV in flight Indications of waypoint passage Use of direct to function Use of nearest aerodrome function Use of GPS in GPS and VOR/DME/GPS arrival procedures <p>3.6.6 GPS equipment checks</p> <ul style="list-style-type: none"> TSO status Satellites required RAIM status PDOP/GDOP status IFR database currency Receiver serviceability CDI sensitivity

		Position indication
	3.6.7	GPS warning and messages
		Loss of RAIM
		2D Navigation
		In Dead Reckoning mode
		Database out of date
		GPS fail
		Barometric input fail
		Power/battery fail
		Parallel offset on
		Satellite fail
	4.	NAVIGATION
	4.1	THE EARTH
I C A	4.1.1	Latitude, difference of latitude
		Longitude, difference of longitude
		Use of latitude and longitude co-ordinates to locate any specific position
C A	4.1.2	Great circle, small circle, rhumbline, convergency, conversion angle, great circle and rhumbline tracks and bearings calculations
I C A	4.1.3	Direction
		True north, magnetic north, compass north, isogonals, variation, compass deviation.
I C A	4.1.4	Distance
		Units of distance and height used in navigation
		Nautical mile, statute mile, kilometre, metre, yard, feet, inch
		Conversion from one unit to another
		Standard nautical mile (6080 feet)
		International nautical mile (1852 metres)
		Geographical nautical mile (6087 feet)
C A	4.1.5	Departure
		Relationship between nautical miles and minutes of longitude, calculations
I C A	4.1.6	Radio bearings
		QTE, QDR, QDM, QUJ
I C A	4.1.7	Navigational computer (slide rule), electronic navigation computers, units used
	4.2	CHARTS
C A	4.2.1	Chart projection theory
I C A		Orthomorphism Scale, chart length, earth distance, scale factor, representative fraction, scale problems
I C A	4.2.2	Mercator chart
C A		Construction and properties, representation of great circle, rhumbines, meridians, parallels of latitude
C A		Plotting radio bearings

I C A A		Scale variation and calculations Measurement or calculation of tracks and distance Meridional parts (ATPL only)
I C A	4.2.3	Lambert Conformal Conic Construction and properties Representation of great circles, rhumblines, meridians and parallels of latitude Plotting radio bearings
I C A I C A A	4.2.4	Polar Stereographic (ATPL only) Construction and properties Representation of great circles, rhumblines, meridians and parallels of latitude Plotting radio bearings Scale variation and calculations Measurement or calculation of tracks and distance
A	4.2.5	Grid Navigation (ATPL only) Construction and properties Representation of great circles, rhumblines, meridians and parallels of latitude Plotting radio bearings Scale variation and calculations Measurement or calculation of tracks and distance
I C A	4.3	RELATIVE VELOCITY Grid superimposed on Lambert and Polar Stereographic Charts Grid north, isogrivs, grivation Calculation of true, magnetic and grid headings or tracks
	4.4	SOLAR SYSTEM – TIME
C A	4.4.1	Measurement of time Speed of opening and closing Aircraft separation Controlled time of arrival by changing speed Line of constant bearing
I C A	4.4.2	UTC, GMT, LMT, Standard time The solar system Apparent solar day Mean solar day Sideral day Equinox, solstice, aphelion, perihelion Tropics of Cancer, Capricorn Arctic and Antarctic circles
C A C A C A	4.4.3	Determination of Sunrise, Sunset, Civil Time conversions International Date Line Twilight Variation of the time of Sunrise, Sunset with latitude and altitude Sunrise/Sunset along track (ATPL only) Moonrise, Moonset (ATPL only)
I C A	4.5	DEAD RECICONING (DR) NAVIGATION
	4.5.1	Basics of DR

		Track
		Heading (true, magnetic, compass)
		Wind velocity
		Airspeed (IAS, RAS, TAS, Machnumber)
		Groundspeed
		ETA
		Drift, wind correction angle
		DR Position, fix
I C A	4.5.2	Use of the navigational computer
		Speed, distance, time
		Fuel consumption
		Conversions
		Heading, track, groundspeed
		RAS, TAS, compressibility correction
		Wind velocity
I C A	4.5.3	Triangle of velocities, determination of
		Heading
		Track
		Groundspeed
		Wind velocity
		Drift
		Track error
I C A	4.6	NAVIGATION PLOTTING
	4.6.1	Navigation on the climb and descent
		Mean climb TAS
		Mean climb wind velocity
		Groundspeed
		Distance flown
I C A	4.6.2	En route navigation
C A		Air plot
I C A		Track plot
I C A		DR position
I C A		Use of single position lines, groundspeed check, back bearing, track made good
I C A		Running fix, transfer of position lines
I C A		Off-track corrections
I C A		Revised ETA
I C A		1 in 60 rule, alteration of heading
I C A		Double the angle on the bow
I C A		Relative bearing when abeam NDB
C A		Air plot wind velocity
I C A		Track and groundspeed wind velocity
C A		Doppler wind velocity
C A	4.6.3	Simple searches, square search
A	4.6.4	PNR and PET (ATPL only)
		PNR with alternate aerodrome
		PET with alternate aerodrome

5. OPERATIONAL PROCEDURES

5.1 DEFINITIONS AND ABBREVIATIONS APPLICABLE TO

	INSTRUMENT FLYING
I C A	1. ICAO DOCUMENT 8168 – VOLUME I FLIGHT PROCEDURES
	APPROACH PROCEDURES
	Chapter 1 – General Criteria
	1.2 The instrument approach procedure
	1.3 Categories of aircraft
	1.4 Obstacle clearance
	1.5 Obstacle clearance altitude/height (OCA/H)
	1.6 Factor affecting operational minima
I C A	Chapter 2 – Approach Procedure Design
	2.1 Instrument approach areas
I C A	Chapter 3 – Approach Segments
	3.1 General
	3.2 Standard instrument arrivals
	3.3 Initial approach segment
	3.4 Intermediate approach segment
	3.5 Final approach segment
	3.6 Missed approach
I C A	HOLDING PROCEDURES
	Chapter 1
	1.1 Shape and terminology associated with holding pattern
	1.2 Speeds, rate of turn, timing, distance and limiting radial
	1.3 Entry
	1.4 Holding
I C A	Chapter 2
	2.1 Holding area
	2.2 Buffer area
	2.3 Minimum holding level
I C A	ALTIMETER SETTING PROCEDURES
	Chapter 1 – Basic Requirements
	Chapter 2 – Procedures applicable to operators and pilots
	2.2 Pre-flight operational test
I C A	5.2 AERONAUTICAL INFORMATION PUBLICATION (AIP) SOUTH AFRICA

		ARRIVAL AND DEPARTURE PROCEDURES
		AIP ENR 1.9 Air Traffic flow management
		Slot time sectors
		Slot times
		AIP ENR 1.5 – Approach procedures
		1.5.1 – General
		1.5.2 – Arriving flights
		General procedures for arriving aircraft
		VMC approach
		Visual approach
		Communication failure procedures
		Interpretation of information provided on
		Standard Terminal Arrival Routes (STAR) and
		Standard Instrument Departures (SID) as published
		in the AIP
I C A		AERODROME CHARTS
		Interpretation of information provided on aerodrome charts as
		published in the AIP
I C A	5.3	NAVIGATION CHARTS
		World Aeronautical Charts
		Aerodrome Route facility chart
		Area charts
I C A	5.4	AERONAUTICAL INFORMATION CIRCULARS
		AIC 21.28 – Flying at unmanned aerodromes
		AIC 40.1 – Airspace Designation
		AIC 42.1 – Filing of flight plans and wake turbulence Categories
I C A	5.5	ICAO ANNEX 14 – AERODROMES
		(a) Definitions
		(b) Runway and Taxiway Markings
		Runway designation marking
		Runway centre line marking
		Threshold marking
		Displaced threshold markings
		Touchdown zone marking
		Runway side stripe marking
		Taxiway centre line marking
		Taxi-holding position markings
		(c) Angle of Approach and Runway lighting Systems
		PAPI and APAPI
		Runway threshold identification lights
		Runway edge lights
		Runway threshold and wing bar lights
		Runway end lights and stopway lights
		Runway centre line lights
		Runway touchdown lights
		Taxiway centre line lights
		(d) Declared Distances
		Runway length
		Landing distance available (LDA)
		Clearways and stopways

		Accelerate-stop distance available (ASDA) Take-off run available (TORA) Take-off distance available (TODA)
I C A	5.7	AERODROME OPERATING MINIMA
		(a) Civil Aviation Regulations (CAR)1997 Part 91
		91.06.31 – Minimum heights
		91.07.1 – Minimum flight altitudes
		91.07.5 – Aerodrome operating minima
		91.07.7 – Pre-flight selection of aerodromes
		91.07.8 – Planning minima for IFR flights
		91.07.9 – Meteorological conditions
		91.07.24 – Approach and landing conditions
		91.07.25 – Commencement and continuation of approach
C A		Low-visibility Operations
		91.08.1 – Aerodrome operating minima
		91.08.2 – General operating rules for low-visibility operations
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C A			
C A			
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denotes examination level knowledge

* denotes general knowledge level

7. AIR LAW

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Article 3 – Civil and State Aircraft

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*CHAPTER 2 – FLIGHT OVER TERRITORY OF CONTRACTING STATES

Article 5 – Right of non-scheduled flight

Article 6 – Scheduled air services

Article 7 – Sabotage

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Article 11 – Applicability of air regulations

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*CHAPTER 4 – MEASURES TO FACILITATE AIR NAVIGATION

Article 24 – Customs duty

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*CHAPTER 5 – CONDITIONS TO BE FULFILLED WITH RESPECT TO AIRCRAFT

Article 29 – Documents to be carried in aircraft

Article 31 – Certificates of airworthiness

Article 32 – Licences of personnel

Article 33 – Recognition of certificates and licences

Article 35 – Cargo restrictions

Article 36 – Photographic apparatus

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*CHAPTER 6 – INTERNATIONAL STANDARDS AND RECOMMENDED PRACTICES

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Article 38 – Departures from international standards and procedures

Article 40 – Validity of endorsed certificates and licences

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*CHAPTER 7 – THE ORGANISATION

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Article 44 – Objectives

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I C A		#SUBPART 2: ACCIDENT AND INCIDENT NOTIFICATION PROCEDURES 12.02.1 - Notification of accidents 12.02.2 - Notification of incidents 12.02.3 - Notification of accidents outside the Republic 12.02.4 - Particulars of notification 12.02.5 - Notification of hazards
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- 61.06.6 - Validity of Commercial Pilot Licence (helicopter)
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	121.08.28	- Take-off
	121.08.29	- Take-off flight path
	121.08.30	- En route
	121.08.31	- Landing at destination and alternate aerodromes
	121.08.32	- Landing on dry runways
	121.08.33	- Landing on wet and contaminated runways
A		SUBPART 9: MAINTENANCE
	121.09.1	- General
	121.08.2	- Aeroplane maintenance schedule
	121.08.3	- Maintenance contracted to approved maintenance organisation
C A		PART 127 – AIR TRANSPORT OPERATIONS – HELICOPTERS
C A		SUBPART 1: GENERAL
	127.01.1	- Applicability
	127.01.3	- Admission to flight deck
	127.01.3	- Drunkenness
C A		SUBPART 2: FLIGHT CREW
	127.02.1	- Composition of flight crew
	127.02.2	- Flight crew member emergency duties
	127.02.2	- Recency, route and heliport qualifications
	127.02.9	- Flight time and duty periods
C A		SUBPART 3: TRAINING AND CHECKING
C A		DIVISION ONE: GENERAL
	127.03.1	- Training of flight crew members
C A		DIVISION TWO: PILOT TRAINING
	127.03.3	- Conversion training
	127.03.4	- Differences training and familiarisation training
	127.03.5	- Upgrading to pilot-in-command
	127.03.6	- Pilot-in-command holding commercial pilot licence

		127.03.7	- Recurrent training and checking
		127.03.8	- Pilot qualification to operate in either pilots seat
		127.03.9	- Advanced qualification programme
C A			SUBPART 4: DOCUMENTATION AND RECORDS
		127.04.1	- Documents to be retained on the ground
		127.04.2	- Operations manual
		127.04.3	- Flight time and duty periods
		127.04.4	- Records of emergency and survival equipment
		127.04.5	- Flight crew member training records
		127.04.6	- Load and trim sheet
		127.04.7	- Helicopter checklist
C A			SUBPART 5: HELICOPTER INSTRUMENTS AND EQUIPMENT
		127.05.1	- Approval of instruments and equipment
		127.05.2	- Flight, navigation and associated equipment for helicopters operated under VFR
		127.05.3	- Flight, navigation and associated equipment for helicopters operated under IFR
		127.05.4	- Airborne weather radar equipment
		127.05.5	- Cockpit crew interphone system
		127.05.6	- Flight crew interphone system
		127.05.7	- Public address system
		127.05.9	- Survival suits
C A			SUBPART 6: OPERATING CERTIFICATE
		127.06.1	- Operating certificate
C A			SUBPART 7: FLIGHT OPERATIONS
		127.07.1	- Routes and areas of operation
		127.07.6	- Minimum flight altitudes
		127.07.7	- Heliport operating minima
		127.07.8	- Offshore operations

	127.07.9	- Smoking in helicopter
	127.07.10	- Fuel policy
	127.07.11	- Fuel and oil supply
	127.07.12	- Instrument approach and departure procedures
	127.07.13	- Noise abatement procedures
	127.07.14	- Carriage of infants and children
	127.07.15	- Carriage of passengers with disability
	127.07.16	- Limitations on carriage of infants, children and passengers with disability
	127.07.17	- Carriage of inadmissible passengers, deportees or persons in custody
	127.07.18	- Carry-on baggage
	127.07.19	- Securing of passenger cabin and galley
	127.07.20	- Passenger services
	127.07.21	- Incidents and defects
C A		SUBPART 8: HELICOPTER PERFORMANCE OPERATING LIMITATIONS
	127.08.1	- Classification
	127.08.2	- General provisions for all classes of helicopters
C A		DIVISION ONE: CLASS 1 HELICOPTER
	127.08.3	- General
	127.08.4	- Take-off
	127.08.5	- Take-off flight path
	127.08.6	- En route with one or more engines inoperative
	127.08.7	- Approach and landing
C A		DIVISION TWO: CLASS 2 HELICOPTER
	127.08.8	- General
	127.08.9	- Take-off
	127.08.10	- Take-off flight path
	127.08.11	- En route with one or more engines inoperative

		127.08.12 - Landing
C A		DIVISION THREE: CLASS 3 HELICOPTER
		127.08.13 - General
		127.08.14 - Take-off
		127.08.15 - En route
		127.08.16 - Landing
C A		SUBPART 9: MAINTENANCE
		127.09.1 - General
		127.09.2 - Helicopter maintenance schedule
		127.09.3 - Maintenance contracted to approved aircraft maintenance organisation
C		PART 135 – AIR TRANSPORT OPERATIONS – SMALL AEROPLANES
		SUBPART 1: GENERAL
		135.01.1 - Applicability
		135.01.3 - Admission to flight deck
		135.01.4 - Drunkenness
C		SUBPART 2 : FLIGHT CREW
		135.02.1 - Composition of flight crew
		135.02.2 - In-flight relief of flight crew members
		135.02.3 - Flight crew member emergency duties
		135.02.4 - Recency, route and aerodrome qualifications
C		SUBPART 3: TRAINING AND CHECKING
		DIVISION ONE : GENERAL
		135.03.1 - Training of flight crew members
C		DIVISION TWO: PILOT TRAINING
		135.03.3 - Conversion training
		135.03.4 - Differences training and familiarisation training
		135.03.5 - Upgrading to pilot-in-command
		135.03.6 - Pilot-in-command holding commercial pilot licence
		135.03.7 - Recurrent training and checking
		135.03.8 - Pilot qualification to operate in either pilots seat

C

SUBPART 3: DOCUMENTATION AND RECORDS

- 135.04.1 - Documents to be retained on the ground
- 135.04.2 - Operations manual
- 135.04.3 - Aeroplane operating manual
- 135.04.5 - Operational flight plan
- 135.04.6 - Flight time and duty period records
- *135.04.7 - Records of emergency and survival equipment
- *135.04.8 - Flight crew member training records
- #135.04.9 - Load and trim sheet
- #135.04.10 - Aeroplane checklist

C

SUBPART 5: AEROPLANE INSTRUMENTS AND EQUIPMENT

- *135.05.1 - Approval of instruments and equipment
- #135.05.2 - Flight, navigation and associated equipment for aeroplanes operated under VFR
- #135.05.3 - Flight, navigation and associated equipment for aeroplanes operated under IFR
- #135.05.4 - Altitude alerting system
- #135.05.5 - Airborne weather radar equipment
- #135.05.6 - Flight deck crew interphone system
- #135.05.7 - Means for emergency evacuation

SUBPART 6: OPERATING CERTIFICATE

- *135.06.1 - Operating certificate

SUBPART 7: FLIGHT OPERATIONS

- #135.07.1 - Routes and areas of operation
- #135.07.6 - Minimum flight altitudes
- #135.07.7 - Aerodrome operating minima
- #135.07.8 - Smoking in aeroplane
- *135.07.9 - Fuel policy
- #135.07.11 - Instrument approach and departure procedures

C		<p>#135.07.12 – Noise abatement procedures</p> <p>#135.07.13 – Carriage of infants and children</p> <p>*135.07.14 – Carriage of passengers with disability</p> <p>*135.07.15 – Limitations on carriage of infants, children and passengers with disability</p> <p>*135.07.16 – Carriage of inadmissible passengers, deportees or persons in custody</p> <p>*135.07.17 – Carry-on baggage</p> <p>#135.07.18 – Securing of passenger cabin and galley</p> <p>*135.07.19 – Passenger services</p> <p>*135.07.20 – Incidents and defects</p>
C		<p>SUBPART 8: AEROPLANE OPERATING LIMITATIONS</p> <p>135.08.1 – Classification</p> <p>135.08.2 – General provisions for all classes of aeroplanes</p>
C		<p>*DIVISION ONE: CLASS A AEROPLANE</p> <p>135.08.3 – General</p> <p>135.08.4 – Take-off</p> <p>135.08.5 – Net take-off flight path</p> <p>135.08.6 – En route with one engine inoperative</p> <p>135.08.7 – Landing at destination and alternate aerodromes</p> <p>135.08.8 – Landing on dry runways</p> <p>135.08.9 – Landing on wet and contaminated runways</p>
C		<p>*DIVISION TWO: CLASS B AEROPLANE</p> <p>135.08.10 – General</p> <p>135.08.11 – Take-off</p> <p>135.08.12 – Take-off flight path</p> <p>135.08.13 – En route</p> <p>135.08.14 – Landing at destination and alternate aerodromes</p> <p>135.08.15 – Landing on dry runways</p> <p>135.08.16 – Landing on wet and contaminated</p>

		runways
C		DIVISION THREE: CLASS D AEROPLANE
		135.08.17 - General
		135.08.18 - Take-off
		135.08.19 - Take-off flight path
		135.08.20 - En route
		135.08.21 - Landing at destination and alternate aerodromes
		135.08.22 - Landing on dry runways
		135.08.23 - Landing on wet and contaminated runways
C		SUBPART 9: *MAINTENANCE
		135.09.1 - General
		135.09.2 - Aeroplane maintenance schedule
		135.09.3 - Maintenance contracted to approved aircraft maintenance organisation
I C A		PART 139 – AERODROMES AND HELIPORTS – LICENSING AND OPERATION
		SUBPART 1: GENERAL
		#139.01.1 - Applicability
		#139.01.2 - Use of military aerodromes and heliports
		#139.01.3 - Restrictions
		*139.01.4 - Publication of restrictions and deviations
		#139.01.5 - Flights by night
		#139.01.10 - Safety measures against fire
		#139.01.12 - Use of runways or taxiways and landing at or taking off from aerodrome
I C A		PART 172 – AIR TRAFFIC SERVICES : AIRSPACE AND AIR TRAFFIC SERVICES
		#SUBPART 2: DESIGNATION AND CLASSIFICATION OF AIRSPACE
		172.02.1 - Designation of airspace
		172.02.2 - Classification of airspace
		172.02.3 - Designation of control areas
		172.02.4 - Designation of flight information regions

		172.02.5	- Designation of advisory areas
I C A	7.3	SOUTH AFRICAN CIVIL AVIATION TECHNICAL STANDARDS (CATS)	
		#PART 91 – GENERAL OPERATING AND FLIGHT RULES	
		91.06.10	- Lights to be displayed by aircraft
		91.06.21	- Visibility and distance from cloud
		91.06.29	- Identification and interception of aircraft
		91.06.33	- Semi-circular rule
		91.07.12	- Fuel and oil supply
I C A		PART 172 – AIR TRAFFIC SERVICES : AIRSPACE AND AIR TRAFFIC SERVICES	
		172.02.2	- Classification of airspace
I C A	7.4	AERONAUTICAL INFORMATION CIRCULARS	
		#20.2	- Altimeter setting procedures
		#42.1	- Filing of flight plans and wake turbulence separation data
I C A	8.	HUMAN PERFORMANCE	
	8.1.1	Basic concepts	
		Metabolism	
		Oxygen requirement of tissues	
		Composition of the atmosphere	
		The gas laws	
I C A	8.1.2	The respiratory system and circulation of the blood	
		Interrelationship of respiration and circulation	
		Composition and function of the blood	
		Blood pressure	
		-	control of blood pressure
		-	hypotension and hypertension
		-	hemodynamic effects of acceleration
		Functional anatomy of the respiratory system	
		-	ventilation of the alveolar space, respiratory control
I C A		Hypoxia	
		-	definition and cause of hypoxia
		-	symptoms of oxygen deficiency and treatment
		-	time of useful consciousness

I C A		Hyperventilation
		– definition and causes of hyperventilation
		– symptoms and treatment
I C A	8.1.3	The pressure cabin
		Rapid decompression, effects and counter measures
		Entrapped gases, barotrauma
	8.2	HUMAN INFORMATION PROCESSING
I C A	8.2.1	The General System
		Central and peripheral nervous system
		Sensory threshold, sensitivity, adaptation, habituation
		Reflexes and biological control systems
		Information processing by the central nervous system
		– mental set, attention (selective, divided, failure)
		– channel capacity, filtering
		– mechanisms of perception, constancies, selective perception
I C A	8.2.2	The Senses
		Vision
		– functional anatomy of the eyes
		– physiology of the visual system
		– visual acuity, refraction and refractive errors, presbyopia
		– the visual field, scanning of the environment
		– binocular vision
		– the intraocular pressure, glaucoma
		– hypoxia and vision
		– night vision (dark adaptation)
		– defective colour vision
		Hearing
		– functional anatomy of the ear
		– physiology of hearing
		– hearing loss (perceptive, conductive)
		– flight related hazards to hearing; noise related hearing loss barotrauma
		Equilibrium
		– functional anatomy and physiology

		<ul style="list-style-type: none"> - detection of rotary and linear acceleration - the subjective vertical - motion sickness
I C A	8.2.3	<p>Integration of sensory inputs; spatial disorientation and illusions</p> <p>Basic concepts and definitions Categories of disorientation Flight circumstances</p> <ul style="list-style-type: none"> - vertigo, Coriolis effect, pressure, vertigo, flicker vertigo - visual illusions (the leans, approach and landing problems) <p>effect of aircraft accelerations Prevention and handling of disorientation</p>
I C A	8.2.4	<p>Memory</p> <p>Functional description Information storage and recall</p> <ul style="list-style-type: none"> - short term memory - long term memory - working memory - effects of stress and time of day
I C A	8.3	<p>HUMAN BEHAVIOUR</p> <p>8.3.1 General concepts</p> <p>Personality</p> <ul style="list-style-type: none"> - characteristics - individual differences in personality - self concept - altitude development - cognitive dissonance <p>Behaviour and skills</p> <ul style="list-style-type: none"> - drives - learning - motivation and performance <p>Human error and reliability</p> <ul style="list-style-type: none"> - human error model

		<ul style="list-style-type: none"> - types of errors - prevention and counter measures - reliability of human behaviour - errors induced by external factors (ergonomics, organisations) - identification of hazardous altitudes - working in an automated cockpit - advantages/disadvantages - coping behaviour
I C A	8.3.2	<p>Cockpit management</p> <p>Crew co-ordination</p> <ul style="list-style-type: none"> - distribution of responsibilities - work with a crew concept <p>Crew co-operation</p> <ul style="list-style-type: none"> - small group dynamics (norms, atmosphere, pressure, communication, structure) - conflict management <p>Leadership, style of management</p> <ul style="list-style-type: none"> - concern for performance - concern for people - democratic vs autocratic style - encouraging inputs and feedback - optimising of crew performance in flight - correcting crew co-ordination deficiencies <p>Communication</p> <ul style="list-style-type: none"> - verbal and non-verbal communication - one- and two-way communication - effects of different communication styles - miscommunication (including cultural differences)
I C A	8.3.3	<p>Judgement and decision making</p> <p>Pilot judgement concepts</p> <ul style="list-style-type: none"> - types of judgement

		<ul style="list-style-type: none"> - motor skills and human factors
		Aeronautical decision making
		<ul style="list-style-type: none"> - decision making concepts
		<ul style="list-style-type: none"> - pilot responsibilities
		<ul style="list-style-type: none"> - behavioural aspects
		Identification of hazardous altitudes
		<ul style="list-style-type: none"> - physical factors
		<ul style="list-style-type: none"> - physiological factors
		<ul style="list-style-type: none"> - social influences and interface between people
		Pilot judgement awareness
		<ul style="list-style-type: none"> - risk assessment
		<ul style="list-style-type: none"> - cockpit stress management
		Applying decision making concepts
		<ul style="list-style-type: none"> - practical application
		<ul style="list-style-type: none"> - managing resources
		<ul style="list-style-type: none"> - safety awareness
I C A	8.4	FLYING AND HEALTH
	8.4.1	The high-altitude environment (ozone, radiation, humidity)
	8.4.2	Physiological and mental fitness
	8.4.3	Incapacitation
		<ul style="list-style-type: none"> - causes and symptoms
		<ul style="list-style-type: none"> - gastro-intestinal
		<ul style="list-style-type: none"> - cardio-vascular
		<ul style="list-style-type: none"> - side effects of drugs and medication
		<ul style="list-style-type: none"> - migraine
		<ul style="list-style-type: none"> - epilepsy
		<ul style="list-style-type: none"> - brain disorders
		Recognition: insidious and sudden incapacitation
		Procedures for dealing with incapacitation
I C A	8.4.4	Intoxication
		Tobacco
		Alcohol

		Drugs and self medication Various toxic materials
I C A	8.4.5	Body rhythm disturbances The biological clock Disturbances of circadian rhythms – causes (shift work, time-zone crossing) – symptoms – treatment
I C A		Sleep – functions – patterns – effects of disturbances and treatment
I C A	8.4.6	Fatigue Definition Causes Types and symptoms Prevention and treatment
I C A	8.4.7	Stress and anxiety Definition of stress Stress components Causes, stressors Coping behaviour – identifying and reducing stress – life stress management
I C A	8.4.8	Effects on performance Anxiety Defence mechanisms Effects of anxiety and defence mechanism General health aspects
I C A	8.4.9	Common minor ailments (colds, influenza, gastro-intestinal upsets) Tropical climates; risk, regulatory aspects Personal hygiene; oral, external, internal hygiene Diabetes Hyper/hypotension Obesity, lack of exercise Epidemic diseases
I C A	8.5	HYGIENE OF SURVIVAL
I C A	8.5.1	Survival in extreme climatological conditions – tropical

- arctic
- desert
- jungle
- high seas

9 AIRCRAFT TECHNICAL GENERAL

9.1 PRINCIPLES OF FLIGHT

C A	9.1.1	<p>Elements of Physics relating to aerodynamics</p> <p>Review of units of measurement Mass, weight, force, resolution and composition of forces, speed, acceleration inertia, momentum, motion on a curved track, work, power, energy, pressure, air density, moments and couples, velocity, temperature</p>
C A	9.1.2	<p>Derivation of Lift</p> <p>Equation of continuity Bernoulli's theorem Streamline flow Angle of attack Pressure distribution about a wing (transverse and longitudinal) Centre of pressure Wing shape (plan and section) and its effect on lift Lift formula Lift/drag ratio</p>
C A	9.1.3	<p>Drag</p> <p>Profile drag</p> <ul style="list-style-type: none"> - causes - variation with speed - methods of minimising <p>Induced drag</p> <ul style="list-style-type: none"> - causes - vortices - variation with speed - design factors affecting <p>Total effect of the combination of profile and induced drag</p>
C A	9.1.4	<p>Distribution of forces – balance of couples</p> <p>Lift/mass and thrust/drag couples Necessity of achieving balance Methods of achieving balance</p>
C A	9.1.5	<p>Stability</p>

			<ul style="list-style-type: none"> Axes and planes of rotation Static stability Dynamic stability Effects of design features on stability Interaction between stability in different planes Effect of altitude/speed on stability Roll and yaw dampers
C A	9.1.6	Stalling	<ul style="list-style-type: none"> Angle of attack Boundary layer and causes of stalling Variation of lift and drag in the stall Movement of the centre of pressure Tip stalling, its dangers and methods of minimising The spin (autorotation) Symptoms of the stall Stall warning devices Stall recovery Effect of turbulent flow over tail surfaces on stall recovery Stick pushers Enhanced stalling speed in manoeuvre
C A	9.1.7	Lift augmentation	<ul style="list-style-type: none"> Flaps <ul style="list-style-type: none"> - leading and trailing edge - effects of - advantages and disadvantages Slots and slats <ul style="list-style-type: none"> - effects of - advantages and disadvantages
C A	9.1.8	Effects of lift augmentation devices on lift/drag ratio Flying controls	<ul style="list-style-type: none"> Ailerons, elevators, rudders, spoilers <ul style="list-style-type: none"> - primary effects of - secondary effects Balancing of controls <ul style="list-style-type: none"> - aerodynamic balance - mass balance Powered controls <ul style="list-style-type: none"> - methods of transmitting demands to control surfaces - feedback of control surface displacement (feel)
C A	9.2	Trim (including variable incidence tail plane) PERFORMANCE (factors affecting)	

		9.2.1	Take-off and Climb
		9.2.2	Level flight
			Maximum range
			Maximum endurance
		9.2.3	Descending gliding, landing
			- landing techniques
			- considerations, factors affecting
		9.2.4	Turning, manoeuvres
		9.2.5	High speed flight
			Speed of sound, compressibility of air, airflow distribution and pressure wave formation, detached and attached shock waves, mach line, separation Aerofoils in compressible flows, boundary conditions, subsonic, transonic and supersonic flow patterns Wings and wing-fuselage combinations in compressible flow, influence of sweepback, change of aspect ratio. Variable incidence tail plane, large CG range, large speed range and large trim range, trim drag. Dutch roll, yaw and yaw dampers. Spiral stability, direction and lateral trim, high lift devices. Powered controls and artificial feel, stick pushers
			Free stream-mach number, local Mach number, critical Mach number, use of the Machmeter, shock stall – behaviour of aeroplane, effect of increasing Mach number, coefficients of lift and drag at transonic speeds
C A	9.3		AIRCRAFT ELEMENTS
		9.3.1	Valves
			Check valves
			Pressure release valves
			Selector valves
			Restrictors
			Thermal relief valves
C A	9.3.2		Bearings
			Plain bearings, split bearings and bushes
			Ball and roller bearings
C A	9.3.3		Pumps
			Gear type
			Diaphragm type
			Vane type
			Piston type
			Wobble type
			Centrifugal
			Pump drives
C A	9.4.3		Filters
			Strainers
			Sediment traps
	9.4		AIRFRAME AND SYSTEMS

C A	9.4.1	Fuselage
		Types of construction Structural components and materials
C A	9.4.2	Cockpit and cabin windows
		Construction (laminated glass) Structural limitations Window heating
C A	9.4.3	Aerofoils
		Types of construction Structural components and materials
C A	9.4.4	Control surfaces
		Vertical, horizontal and V tail surfaces
C A	9.4.5	Landing gear
		Types Construction Locking devices Emergency extension systems Accidental retraction prevention systems Position, movement lights and indicators Nose wheel steering Wheels and tyres (construction, limitations) Braking systems
		- construction
		- parking brake
		- operation of anti-skid system
		- operation of auto-brake system
		- operation, indications and warning systems
		- limitations and precautions
C A	9.4.6	Flight controls
		Primary controls
		- elevator, aileron, wing spoilers, rudder
		- trim
		- mode of actuation
		- operation, indicators
		- warning devices and controls
		Secondary controls lift augmentation and wing flaps
		- lift dumping and speed brakes
		- variable elevator

		<ul style="list-style-type: none"> - mode of operation (mechanical, hydraulic, fly by wire) - operation, indicators, warning devices
C A	9.4.7	<p>Hydraulics</p> <p>Basic principles of hydromechanics</p> <ul style="list-style-type: none"> - hydraulic fluids - schematic construction and functioning <p>Hydraulic systems</p> <ul style="list-style-type: none"> - main, stand-by, and emergency systems - accumulators - reservoirs - operation, indicators, warning systems - ancillary systems
C A	9.4.8	<p>Air driven systems – piston engine aircraft</p> <p>Pneumatic systems</p> <ul style="list-style-type: none"> - Power sources - schematic construction and functioning of pneumatic <p>De-ice systems</p> <p>Pneumatic leading edge de-icing of wings and control</p> <ul style="list-style-type: none"> - schematic construction - operational limitations - initiation/timing of de-icing system usage
C A	9.4.9	<p>Air driven systems – Turbopropeller and Jet aircraft</p> <p>Pneumatic system</p> <ul style="list-style-type: none"> - power sources - schematic construction - potential failures, safety devices - operation, indicators, warning systems - pneumatic operated systems <p>Anti-ice systems</p> <ul style="list-style-type: none"> - airfoil and control surfaces, power plant, air intakes <p>Windshield</p> <ul style="list-style-type: none"> - schematic construction, operating limitations and

		<ul style="list-style-type: none"> initiation - timing of de-icing system usage - ice warning systems
		<p>Non-pneumatic operated de-ice and anti-ice systems Schematic construction, functioning and operation of</p> <ul style="list-style-type: none"> - air intake - propeller - pitot static pressure sensor and stall warning devices - windshield - weeping anti-ice wing system - rain repellent system
C A	9.4.10	<p>Pressurisation</p> <ul style="list-style-type: none"> - cabin altitude, maximum cabin altitude - differential pressure - operation and indicators - safety devices and warning systems - rapid decompression, cabin altitude warning - emergency procedures
C A	9.4.11	<p>Air conditioning system</p> <ul style="list-style-type: none"> - construction, functioning, operation - indicators and warning devices - heating and cooling - temperature regulation - automatic and manual - ram air ventilation
C A	9.4.12	<p>Fuel system</p> <p>Fuel tanks</p> <ul style="list-style-type: none"> - structural components and types - location of tanks on single and multi-engine aircraft - sequence and type of refuelling

		<ul style="list-style-type: none"> - unusable fuel
		<p>Fuel feed</p> <ul style="list-style-type: none"> - gravity and pressure feed - crossfeed - schematic construction
C A		<p>Fuel dumping system</p> <ul style="list-style-type: none"> - fuel system monitoring - operation, indicators, warning systems - fuel management (sequencing of fuel tank switching) - dipstick
C A	9.4.13	<p>Electrics – direct current (DC)</p> <p>General</p> <ul style="list-style-type: none"> - electric circuits - voltage, current, resistance - Ohm’s law - resistive circuits - resistance as a function of temperature - electrical power, electrical work - fuses (function, type and operation) - the electrical field - the capacitor (function)
C A		<p>Batteries</p> <ul style="list-style-type: none"> - theory, types, characteristics - capacity - uses, servicing - hazards
C A		<p>Magnetism</p> <ul style="list-style-type: none"> - permanent magnetism - electromagnetism - relay, circuit breaker, solenoid valve (principle, function and application)

		<ul style="list-style-type: none"> - electromagnetic power - electromagnetic induction
C A		<p>Generators</p> <ul style="list-style-type: none"> - principle, function and application - monitoring devices - regulation, control and protection - modes of excitation - starter generator
C A		<p>Current distribution</p> <ul style="list-style-type: none"> - buses - monitoring of electrical flight instruments - ammeter, voltmeter - annunciators - electrical consumers - power distribution - operation and system monitoring
C A		<ul style="list-style-type: none"> - elementary switching circuits
C A	9.4.14	<p>The aircraft structure as an electrical conductor</p> <p>Electrics – alternating current (AC)</p> <p>General</p> <ul style="list-style-type: none"> - single and multi-phase AC
C A		<ul style="list-style-type: none"> - frequency - phase shift - AC components
C A		<p>Alternator</p> <ul style="list-style-type: none"> - 3 phase - brushless (construction and operation) - drive - constant speed drive - integrated drive
C A		<p>AC power distribution</p> <ul style="list-style-type: none"> - construction, operation and monitoring

			<ul style="list-style-type: none"> - protection circuits, paralleling of AC generators
C A		Transformers and inverters	<ul style="list-style-type: none"> - function - types and application
		Synchronous and asynchronous motors	<ul style="list-style-type: none"> - operation - application
C A		Transformer/rectifier units	
C A		Semiconductors	<ul style="list-style-type: none"> - principles of semiconductors - semiconductor resistors (properties and application) - rectifier (function and application) - transistor (function and application) - diode (function and application)
C A	9.4.15	Fire warning and extinguisher systems	<ul style="list-style-type: none"> Fire warning lights Test switches, live wire system Extinguisher systems Extinguishing agents Fire fighting methods Extinguishants Types of fires and preferred extinguishing agents
C A	9.4.16	Oxygen systems	
		High and low pressure systems	
C A	9.5	POWERPLANT – PISTON ENGINE	
C A	9.5.1	Engine nomenclature	<ul style="list-style-type: none"> Major parts and assemblies Cylinder arrangements Cylinder numbering Bore, stroke, engine displacement Swept volume Compression ratio
C A	9.5.2	Four stroke cycle	
		Compression ignition, spark ignition, valve lead, lag and overlap, ignition timing	
C A	9.5.3	Combustion process, factors necessary for efficient combustion, mixture ratios, temperatures	
C A	9.5.4	Cylinder pressure in normal operation engine indicators/instruments	
C A	9.5.5	Supercharging and turbo-supercharging	

C A	9.5.6	Detonation
		Factors contributing to detonation Effect and indications Stopping and prevention
C A	9.5.7	Pre-ignition
		Factors contributing to pre-ignition Effects and indication Stopping and prevention
C A	9.5.8	Relationship between detonation and pre-ignition
C A	9.5.9	Cylinder construction
		Barrel, cylinder head, head valves, valve operating mechanism, valve timing, valve clearances
C A	9.5.10	Pistons
		Piston rings, piston pin, connecting rods
C A	9.5.11	Crank shafts and camshaft gearing
		Dynamic dampers, bearings, camshafts
C A	9.5.12	Crankcase
		Construction, accessories, supercharger, breather systems
C A	9.5.13	Ignition system
		Battery (coil) ignition, HT magnetos, LT magnetos Ignition timing, single point and dual point ignition, flame pattern, staggered ignition, Impulse coupling, booster coil, induction vibrator High energy ignition burners, electric and battery power requirements Spark plugs, ignition harness, shielding
C A	9.5.14	Lubrication and Cooling
		Lubrication for reduction of friction and cooling, wet and dry sump system, lubrication method (splash, spray, pressure, mist), oil pressure pump, scavenge pump, oil pressure relief valve, lubrication system, lubrication of components, oil grades, oil cooling system, heat removal, temperature regulator, factors affecting viscosity of oil Air cooling, fins, importance of airflow ground handling, control of airflow
C A	9.5.15	Fuels: carburetion and fuel injection system
		Properties of fuel, fuel grades, air-fuel mixture ratio Basic carburettor – float chamber, main jet, air bleeds, idling system, accelerator pump, power enrichment system, mixture controls, altitude controls, idle cut-off Fuel injection system, swirl atomisation Fuel loss through evaporation and boiling Control of fuel flow, pressure control system Flow control systems, barometric pressure control Air-fuel ratio control

		<ul style="list-style-type: none"> - priming system - priming pump - solenoid - injection point
C A	9.5.16	<p>Icing</p> <p>Effect of ice on engine performance Physical principle of ice formation Prevention and removal of ice Carburettor heat</p>
C A	9.5.17	<p>Engine power</p> <p>Power measurement Indicated horse power Development of formula Brake horse power Torque measuring devices Calculation of power Determination of friction horse power Engine efficiency</p> <ul style="list-style-type: none"> - Thermal, mechanical, volumetric
C A	9.5.18	<p>Propellers</p> <p>General theory Conversion of engine torque to thrust Meaning of Pitch Reasons for blade twist Reasons for variable pitch/constant speed Propeller efficiency Windmilling drag Feathering Design features for power absorption Adverse effects of torque reaction Gyroscopic precession Asymmetric slipstream effect Asymmetric blade effect Fixed-pitch wood or metal propellers Variable speed and controllable pitch propellers Constant speed propeller, action of governor Propeller shaft, direct drive, reduction gear Unfeathering</p>
C A	9.5.19	<p>Piston engine handling</p> <p>Warm-up and ground checks Testing of engines and systems Engine limitations</p> <ul style="list-style-type: none"> - take-off power, climb power, control of temperature, cruise power, procedure for altering power settings - MAP/RPM relationship

		Exhaust gas temperature monitoring Use of supercharger/ turbo-supercharger Identification of engine faults – incorrect temperatures or pressures, rough running
		vibration, loss of power, probable causes, trouble shooting procedure, importance of cross checking information
C A	9.6	POWERPLANT: TURBO-PROPELLER AND TURBOJET
	9.6.1	Principles of operation
	9.6.2	Types of construction – centrifugal, axial flow
	9.6.3	Engine construction – air inlet – function
C A	9.6.4	Compressor Function Construction and mode of operation Effects of damage Compressor stall and surge Compressor characteristics
C A	9.6.5	Diffuser – function
C A	9.6.6	Combustion chamber Function, types and working principles Mixing ratio Fuel injectors Thermal load
C A	9.6.7	Turbine Function, construction and working principles Thermal and mechanical stress Effects of damage Monitoring of exhaust gas temperature
C A	9.6.8	Jet Pipe
C A	9.6.9	Function, different types, noise suppression Pressure, temperature and airflow in a turbine engine
C A	9.6.10	Reverse thrust
C A	9.6.11	Function, types and principles of operation Degree of efficiency Use and monitoring Performance and thrust augmentation
C A	9.6.12	Water injection, principles of operation Use and system monitoring Bleed air

		Effect of use of bleed air on thrust, exhaust temperature, RPM and pressure ratio
C A	9.6.13	Auxiliary gearbox – function
C A	9.6.14	Ignition
		Function, types, components, operation, safety aspects
C A	9.6.15	Starter
		Function, type, construction and mode of operation Control and monitoring Self sustaining and idle speeds
C A	9.6.16	Engine start malfunctions
		Cause and avoidance
C A	9.6.17	Fuel system
		Construction, components Operation and monitoring Malfunctions
C A	9.6.18	Lubrication
		Construction, components Operation and monitoring Malfunctions
C A	9.6.19	Fuel
		Effects of temperature Impurities Additives
C A	9.6.20	Thrust
		Thrust formula Flat rated engine Thrust as a function of airspeed, air density, pressure, temperature, RPM
C A	9.6.21	Engine operation and monitoring
C A	9.6.22	Auxiliary power Unit (APU)
		Function, types Location Operation and monitoring
C A	9.6.23	Ram air turbine – function
	9.7	SPECIAL OPERATIONAL PROCEDURES
C A	9.7.1	Minimum equipment list
C A	9.7.2	Ground de-icing
		Icing conditions Definition and recognition, on ground/in flight De-icing, anti-icing, types of de-icing fluids Performance deterioration, on ground/in flight
C A	9.7.3	Bird strike and avoidance

C A	9.7.4	Noise abatement
		Influence of the flight procedure (departure, cruise, approach)
		Influence by the Pilot (power setting, low drag, low power)
C A	9.7.5	Fire/smoke
		Carburettor fire
		Engine fire
		Fire in the cabin, cockpit, freight compartment (choice of appropriate fire extinguishing agents according to fire classification and use of the extinguishers)
		Actions in case of overheated brakes after aborted take-off and landing
		Smoke in the cockpit and the cabin (effects and actions taken)
C A	9.7.6	Decompression of pressurised cabin
		Slow decompression
		Rapid or explosive decompression
		Dangers and actions taken
C A	9.7.7	Windshear, microbursts
		Effects and recognition during departure and approach
		Actions to avoid and actions taken during encounter
C A	9.7.8	Wake turbulence
		Cause
		Influence of speed and mass, wind
		Actions taken when crossing traffic, during take-off and landing
C A	9.7.9	Security
		Unlawful events
C A	9.7.10	Emergency and precautionary landings
		Definition
		Cause
		Factors to be considered (wind, terrain, preparation, flight tactics, landing in various terrain and water)
		Passenger information
		Evacuation
		Actions after landing
C A	9.7.11	Fuel jettisoning
		Safety aspects
		Legal aspects
C A	9.7.12	Transport of dangerous goods
		Annex 18
		National legislation
		Practical aspects
C A	9.7.13	Contaminated runways
		Kinds of contamination
		Braking action, brake coefficient
		Performance corrections and calculations

10. CPL (H) ATG

10.1 Aircraft general knowledge

10.1.1 Airframe and systems, electrics, powerplant and emergency

Equipment

(1) Airframe and systems

(a) Fuselage

- (i) types of construction; and
- (ii) structural components and materials

(b) Cockpit and cabin windows

- (i) construction (laminated glass); and
- (ii) structural limitations

(c) Aerofoil

- (i) rotor blades;
- (ii) types of construction;
- (iii) properties of different aerofoil sections; and
- (iv) rotor balance, static and dynamic

(d) Control surfaces

- (i) vertical and horizontal stabilisers

(e) Landing gear

(i) Types

skid landing gear;
float landing gear;
emergency flood landing gear;

- (ii) construction;
- (iii) locking devices and emergency extension systems;
- (iv) accidental retraction prevention devices;
- (v) position, movement lights and indicators;

(vi) nose wheel steering;

(vii) wheels and tyres (construction and

- limitations);
- (viii) braking systems,
 - construction;
 - parking brake;
 - method of operation of anti-skid system;
 - method of operation of auto brake system; and
 - operation, indications and warning systems.
- (f) Flight controls (construction and operation)
 - (i) Flight controls
 - Collective pitch control;
 - throttle/fuel control;
 - cyclic pitch control;
 - mixing unit;
 - yaw pedals;
 - power assisted flight controls;
 - swash plate assembly;
 - rotating star;
 - non-rotating stop;
 - main rotor head system;
 - fully articulated system;
 - semi-rigid rotor system; and
 - rigid rotor systems
 - (ii) Dynamic transmission system
 - Main gear box;
 - intermediate gear box;
 - tail rotor gear box and drive shaft;
 - freewheel unit;
 - clutch unit;
 - engine to main gear box coupling; and
 - rotor brake system.
- (g) Hydraulics
 - (i) Basic principles of hydromechanics
 - Hydraulic fluids; and
 - schematic construction and functioning of hydraulic systems.
 - (ii) Hydraulic systems
 - Main, standby and emergency systems;
 - operation, indicators and warning systems; and ancillary systems.
- (h) Air driven systems (piston engines only)
 - (i) Pneumatic systems
 - Power sources; and
 - Schematic construction and functioning of



- Pneumatic systems
- (ii) De-ice systems
 - Pneumatic leading edge de-icing of wings and control surfaces; schematic construction; operational limitations; and initiation/timing of de-icing system usage.
- (i) Air Driven Systems – Turbo-propeller and Jet aircraft
 - (i) Pneumatic system
 - Power sources; schematic construction; potential failures, warning and devices; operation, indicators, warning systems; and pneumatic operated systems.
 - (ii) Air conditioning system
 - Construction, functioning, operation, indicators and warning devices; heating and cooling; temperature regulation; automatic and manual; and ram air ventilation.
- (j) Fuel system
 - (i) Fuel tanks
 - Structural components and types; location of tanks on single and multi-engine aircraft; sequence and types of refuelling; and unusable fuel
 - (ii) Fuel feed
 - Gravity and pressure feed; crossfeed; and schematic construction
 - (iii) Fuel dumping system
 - Fuel system monitoring
 - Operation, indicators, warning systems;
 - (iv) fuel management (sequencing of fuel tank switching); and
 - dip stick

Annexure A

Elements *EXCLUDED* for the CPL (VFR) examination:

As contained in the Composite Examination Syllabus for the various aircrew examinations Edition 1: 2002

METEOROLOGY

Paragraph 1:

4, 7, and 8

FLIGHT PLANNING & PERFORMANCE

Paragraph 2.1.1:

For the CPL (VFR)(H) V terms applicable to aeroplanes

Paragraph 2.1.3:

For the CPL (VFR)(H) the entire paragraph

Paragraph 2.2.1:

For the CPL (VFR)(H) the entire paragraph

Paragraph 2.2.3:

For the CPL (VFR)(H) –

Midzone weights

Step climb to optimum altitude

Redispatch planning

Paragraph 2.2.6

For the CPL (VFR)(H) the entire paragraph

Paragraph 2.3.1

Maximum ramp and taxi mass

RADIO AIDS

Paragraph 3.3.4

Paragraph 3.3.5

NAVIGATION

Paragraph 4.2.2 as indicated

Paragraph 4.2.4

Paragraph 4.2.5

Paragraph 4.6.4

INSTRUMENTS AND MAGNETISM

Paragraph 6.3.1

Paragraph 6.4.2 – as indicated

AIR LAW

In this subject the elements excluded are those pertaining to the specific category, i.e. class ratings for aeroplanes will be applicable to the CPL (A).

PART 91

91.06.27

91.06.34

SUBPART 8

SUBPART 9 as applicable to the category

PART 135

For both CPL (A) and CPL (H)

Paragraph 7.5 – as indicated

AIRCRAFT TECHNICAL

As indicated for the category

STUDY MATERIAL FOR THE INSTRUMENT RATING, COMMERCIAL AND AIRLINE TRANSPORT PILOT LICENCE SYLLABUS AEROPLANE AND HELICOPTER

The following is a list of publications that users may find helpful as reference material for the Instrument Rating, Commercial and Airline Transport Pilot Licence Syllabus. This list does not imply that ATO's must purchase the complete selection, nor does it claim to be comprehensive, or necessarily to give the best treatment of particular subjects, but has been drawn from commercial sources as suitable reference material. Alternative reference sources, including existing study material, may also be used provided that the contents of the syllabus is used as the ultimate guide in the preparation of such material

Air Pilots Manual – Volumes 2, 3 and 4 (UK) (previously known as Air Pilots Manual by Trevor Thom)

Airframe and Powerplant – General Handbook, Airframe Handbook, Powerplant Handbook (US)

The Private Pilot's Licence Course – Jeremy M Pratt (UK) Volumes 3, 4 and 5

The Private Pilot – C S Hames (Australia)

The Commercial Pilot – C S Hames – (Australia)

A Pilot's Guide to Aircraft and Their Systems – Dale Crane (USA)

South African Air Law for Private Pilots – Lilith A Seals (RSA)

Mechanics of Flight – A C Kermode (USA)

Southern Africa's Weather Patterns – J Van Heerden and L Hurry (RSA)

Aircraft Systems for Pilots – Dale De Remer (USA)

Flight Theory for Pilots – Charles E Dole (USA)

The Commercial Pilot's Study Manual Series – Mike Burton (UK)

South African AIP and AIC's (RSA)

Aviation Legislation in South Africa – Cor Beek (RSA)

ICAO Document 8168 Volume 1

ICAO Annex 14

Instrument Rating, Commercial and Airline Transport Pilot Licence study notes published by Aeronav Academy, Avex Air Training and Central Flying Academy or other similar institutions, provided that such notes have been compiled to comply with the relevant syllabus (RSA)

Ground Studies for Pilots, Volumes: Radio Aids, Meteorology, Navigation, Flight Instruments,

Flight Planning – (UK)

Aircraft Instruments and Integrated Systems – E H J Pallett

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)

Handling the Big Jets – D.P. Davies (UK)

Aircraft Performance Theory – P.J Swatton (UK)

The Aircraft Performance Requirements Manual – R.V Davies (UK)

Human Performance and Limitations in Aviation – R.D Campbell and M Bagshaw (UK)

Human Factors for Pilots – Roger Green and Associates (UK)

Human Factors and Pilot Performance – Air Pilot's Manual (UK)

Human Factors for General Aviation – Trollip/Jensen (USA)

Aviation Medicine and other Human Factors for Pilots – Dr Ross Ewing (NZ)

Aviation Medicine Manual (CAP 567) – UK Civil Aviation Authority (UK)

Principles of Avionics – Albert Helfrick (USA)

The Jet Engine – Rolls Royce (UK)

Avionics and Flight Management Systems for the Airline Transport Pilot – Threvor Thom (Australia)

Gas Turbine Engines – R.E.Birch (USA)

Avionics For The Pilot – Joe Johnston (UK)

Jet Engines – Klaus Hunecke (UK)

Aircraft Gas Turbine Technology – Irwin E Treager (USA)

Modern Airmanship – Van Sickle (USA)

AP3456 Vol 1-9, Ministry of Defence (UK)

ATPL Series (15 volumes) – Jeppesen (Europe)