For information only:

- Please note that this Appendix will be part of AC61-17, Revision 14, *Pilot Licenses and Ratings – Instrument Ratings.*
- CAA expects to publish the new revision of AC61-17 in June 2023.
- Until then, this Appendix is provided to enable flight training providers to amend their training material before the update occurs in June. Please continue to use the current version of AC61-17 for the syllabus for Instrument rating (IR) examinations.
- Please also note, there may be some minor changes and updates once AC61-17 Revision 14 is published in 2023, but we will endeavour to highlight any further changes at that time.

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Appendix I Instrument Rating Written Examination Syllabuses

Air Law Syllabus Matrix:

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Subject No 52 IR Air Law (Aeroplane and Helicopter)

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on knowledge deficiency reports and will provide valuable feed back to the examination candidate. These topic reference numbers may be common across the subject levels and therefore may not be consecutive within a specific syllabus.

Sub Topic	Syllabus Item
	General
52.2	**Aviation Legislation**
52.2.2	Describe the requirements to hold an aviation document, as laid down in S7. CA Act 1990
52.2.4	Describe the duties of the pilot-in-command, as laid down in S13. CA Act 1990
52.4	**Definitions**
	CAR Part 1 (unless otherwise noted)
	State the definition of:
	(a) Act;
	(b) ADS-B system;
	(c) aerodrome control service;
	(d) aerodrome operational area;
	(e) aerodrome traffic circuit;
	(f) aeronautical information circular;
	(g) aeronautical information publication (AIP);
	(h) AIP supplement;
	(i) air traffic control (ATC) service;
	(j) airworthiness certificate;
	(k) alternate aerodrome;
	(l) alternate means of navigation;
	(m) altitude;
	(n) approach control;
	(o) area control;
	(p) area navigation;
	(q) ATC clearance;

Sub Topic	Syllabus Item	
	(r)	ATC instruction;
	(s)	AWIB service;
	(t)	barometric vertical navigation (baro-VNAV); AIP GEN
	(u)	Category II precision approach procedure;
	(v)	ceiling;
	(w)	change over point (COP); AIP GEN
	(x)	clearance limit;
	(y)	command practice;
	(z)	continental (enroute); AC91-21
	(aa)	controlled airspace;
	(bb)	controlled flight;
	(cc)	co-pilot;
	(dd)	crew member;
	(ee)	day;
	(ff)	decision altitude (DA);
	(gg)	decision height (DH);
	(hh)	dual flight time;
	(ii)	final reserve fuel;
	(jj)	flight examiner;
	(kk)	flight level;
	(ll)	GPS database;
	(mm)	height;
	(nn)	IFR flight;
	(oo)	instrument approach procedure;
	(pp)	instrument flight;
	(qq)	instrument flight time;
	(rr)	instrument meteorological conditions;
	(ss)	instrument time;

Sub Topic	Syllabus Item	
	(tt)	Mach number;
	(uu)	minimum descent altitude (MDA);
	(vv)	minimum descent height (MDH);
	(ww)	minimum safe altitude (MSA); (AIP GEN)
	(xx)	minimum sector altitude (MSA 25M); (AIP GEN)
	(yy)	navigation specification;
	(zz)	night;
	(aaa)	NOTAM;
	(bbb)	pilot-in-command;
	(ccc)	performance-based navigation;
	(ddd)	precision approach procedure;
	(eee)	pressure altitude;
	(fff)	primary-means navigation system;
	(ggg)	procedure altitude; (AIP GEN)
	(hhh)	rated coverage; (AIP GEN)
	(iii)	RAIM warning; (CAR 19.203)
	(jjj)	rating;
	(kkk)	reporting point;
	(lll)	RNP;
	(mmm)	runway visual range;
	(nnn)	segment OCA; (AIP GEN)
	(ooo)	SEIFR passenger operation;
	(ppp)	Sole-means navigation system; (CAR 19.203)
	(qqq)	Supplemental means navigation system; (CAR 19.203)
	(rrr)	transition altitude; (AIP GEN)
	(sss)	transition layer; (AIP GEN)
	(ttt)	transition level; (AIP GEN)
	(uuu)	VFR flight;

Sub Topic	Syllabus Item
	(vvv) visibility;
	(www) visual meteorological conditions;
	(xxx) visual reference. (AIP GEN)
52.6	**Abbreviations**
	CAR Part 1 (unless otherwise noted)
	State the meaning of the following abbreviations:
	(a) ABAS; (AC91-21)
	(b) ACAS;
	(c) ADF;
	(d) ADS-B; (AC91-21)
	(e) ADS-C; (AC91-21)
	(f) AMoN; (AC91-21)
	(g) ANP; (AC91-21)
	(h) APCH; (AC91-21)
	(i) A-RNP; (AC91-21)
	(j) Baro-VNAV; (AC91-21)
	(k) DA; (AC91-21)
	(l) DF; (AC91-21)
	(m) DME;
	(n) FAF; (AIP GEN)
	(o) FAP; (AIP GEN)
	(p) FAS; (AC91-21)
	(q) FD; (AC91-21)
	(r) FDE; (AC91-21)
	(s) FRT; (AC91-21)
	(t) GBAS; (AC91-21)
	(u) GBNA; (AC91-21)
	(v) GLS; (AC91-21)

Sub Topic	Syllabus Item	
	(w)	GNSS; (CAR 19.203)
	(x)	GPS; (AC91-21)
	(y)	GPWS;
	(z)	IAC; (AIP GEN)
	(aa)	IAF; (AIP GEN)
	(bb)	ILS;
	(cc)	LNAV; (AC91-21)
	(dd)	LP; (AC91-21)
	(ee)	LPV; (AC91-21)
	(ff)	OPMA; (AC91-21)
	(gg)	PAR;
	(hh)	PBN;
	(ii)	PMoN; (AC91-21)
	(jj)	PRA;
	(kk)	P-RNAV; (AC91-21)
	(ll)	QFE;
	(mm)	QNH;
	(nn)	RAIM; (CAR 19.203)
	(oo)	RF; (AC91-21)
	(pp)	RNP APCH; (AC91-21)
	(qq)	RNP AR APCH; (AC91-21)
	(rr)	RVSM;
	(ss)	SBAS; (AC91-21)
	(tt)	STA; (AIP GEN)
	(uu)	TAWS;
	(vv)	TCAS;
	(ww)	TF; (AC91-21)
	(xx)	TSE; (AC91-21)

Sub Topic	Syllabus Item	
	(yy)	VNAV; (AC91-21)
	(zz)	VOR;
	(aaa)	VORSEC; (AIP GEN)
	(bbb)	VORTAC; (AIP GEN)
	(ccc)	VPA; (AIP GEN).
	Personnel Licensing	
52.10	**Requirements for Licences and Ratings**	
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52.10.6	State the requirements for entering flight details into a pilot's logbook. CAR 61	
52.10.8	State the requirements for holding an instrument rating. CAR 61	
52.10.10	State the licence and rating requirements for acting as a safety pilot during simulated instrument flight. CAR 91	
52.12	**Eligibility, Privileges and Limitations**	
52.12.2	Describe the allowance for a person who does not hold a current pilot's licence to fly dual with an instructor. CAR 61	
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Sub Topic	Syllabus Item
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52.22.6	State the inspection period for transponders. CAR 91
52.22.8	State the inspection period for the ELT. CAR 91
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52.24.4	State the communications and navigation equipment requirements for an IFR flight. CAR 91
52.24.6	State the equipment requirements of aircraft operating in airspace where RVSM is applied by ATC. CAR 91
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52.26.2	State the equipment requirements for an IFR flight. CAR 91
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Sub Topic	Syllabus Item
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Sub Topic	Syllabus Item
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Sub Topic	Syllabus Item
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Sub Topic	Syllabus Item
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52.68.2	State the equipment required by aircraft within the New Zealand flight information region, using GPS as a primary means navigation system. CAR 19
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56.68.22	State the Total System Error (TSE) permitted in the RNAV/RNP 2 PBN specification in the enroute phase in the NZFIR. AC91-21 Table 2
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Sub Topic	Syllabus Item
56.68.26	State the navigation infrastructure required to support RNAV/RNP 1 in the terminal and approach phases in the NZFIR. AC91-21 Table 3
56.68.28	State the CNS equipment requirements for operations in RNAV/RNP 1 in the terminal and approach phases in the NZFIR. AC91-21 Tables 3 and 5
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56.68.40	State the CNS equipment requirements for operations in RNP APCH in the approach and missed approach phases in the NZFIR. AC91-21 Tables 4 and 5
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	Airspace; Aerodromes; and Heliports
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52.70.6	Describe QNH zones and state when zone QNH should be used. AIP ENR
52.70.8	Describe the transition altitude, layer and level. AIP ENR
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52.72.2	State the altitude/flight level requirements when cruising IFR within the New Zealand FIR. CAR 91 & AIP ENR
52.72.4	Determine from charts and publications the minimum flight altitude (MFA) for a route sector.
52.72.6	Describe situations where ATC may assign cruising altitudes not in accordance with the IFR table of cruising altitudes. AIP ENR
52.72.8	State the position by which an aircraft must be at a higher MFA if changing to a track with a higher MFA. AIP GEN

Sub Topic	Syllabus Item
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52.74.4	Describe the procedures required of pilots operating transponders. AIP ENR
52.74.6	Describe the procedure whereby ATC can verify the accuracy of the Mode C function of a transponder. AIP ENR
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52.75.2	State the rules pertaining to operating IFR in the various classes of airspace. CAR 91 & AIP ENR
52.75.4	Describe the vertical limits and purpose of control zones (CTR). CAR 71
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52.75.22	State the restrictions and operating considerations relating to operating an aircraft in a volcanic hazard area (VHA). CAR 91 & AIP ENR
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Sub Topic	Syllabus Item
52.75.32	Explain the requirements for the operation of an aircraft in RNP airspace. AIP ENR
52.75.34	Interpret airspace information on aeronautical charts.
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52.76.2	Describe the limitations on the use of a place as an aerodrome or heliport. CAR 91
52.76.4	Describe the method of runway designation. AIP AD
52.76.6	Describe the movement area of an aerodrome. CAR 1
52.76.8	Interpret information on aerodrome/heliport charts. AIP GEN & AIP Volume 4
52.78	**Aerodrome Lighting**
52.78.2	Describe the lighting intensity classifications.
52.78.4	Describe the following lighting systems: (a) Runway edge lighting (REDL); (b) Runway landing threshold lighting (RTHL); (c) Runway end lighting (RENL); (d) Runway centreline lighting system (RCLL); (e) Runway end identifier lighting (REIL); (f) Approach lighting systems (ALS); (g) Circling guidance lighting (CGL); (h) Runway lead in lighting (RLLS); (i) Pilot activated lighting (PAL); (j) T-Visual approach slope indicators (T-VASIS); (k) Visual approach slope indicators (VASIS); and, (l) Precision approach path indicators (PAPI).
52.78.6	Describe aerodrome beacons.
	Emergencies; Incidents; and Accidents
52.82	**Communications and Equipment**
52.82.2	State the transponder code a pilot should set to indicate an emergency condition. AIP ENR
52.82.4	State the transponder code a pilot should set to indicate a loss of communications. AIP ENR

Sub Topic	Syllabus Item
52.82.6	State the transponder code a pilot should set to indicate that the aircraft is being subjected to unlawful interference. AIP ENR
52.82.8	Describe the means by which ATC will verify the transmission of an emergency SSR transponder code. AIP ENR
52.82.10	Describe the use of the speechless technique using un-modulated transmissions. AIP ENR
52.82.12	State the procedures for the emergency activation of an ELT. AIP GEN
52.82.14	State the pilot action required following the inadvertent transmission of an ELT. AIP GEN
52.82.16	State the requirements for the operational testing of an ELT. AIP GEN
52.82.18	State the procedures to be followed on receiving an ELT signal. AIP GEN
	Instrument Departures and Approaches
52.90	**Departure Procedures**
52.90.2	Interpret information on SID and Departure Procedure charts.
52.90.4	Determine the IFR take-off minima for a departure off a given runway. AIP ENR
52.90.6	State the IFR take-off minima if it is not prescribed in the AIPNZ VOL 2 & 3. AIP ENR
52.90.8	State the CAR Part 91 requirements and limitations of IFR reduced take-off minima. CAR 91 & AIP ENR
52.90.10	State the minimum height for a turn after take-off on departure. AIP ENR
52.90.12	State the minimum climb gradient on a SID unless otherwise specified. AIP ENR
52.90.14	Calculate the rate of climb required to meet the net climb gradient specified on instrument departures. AIP ENR
52.90.16	State when a departure procedure terminates. AIP ENR
52.90.18	State the limitation on the termination of radar vectoring for a departing IFR aircraft. AIP ENR
52.90.20	State the requirements for broadcasting intentions when departing from an unattended aerodrome. AIP ENR
52.90.22	State the requirements for and limitations on a visual departure. AIP ENR
52.90.24	Describe the operating restrictions where an IFR departure procedure is not promulgated. AIP ENR
52.92	**Holding Procedures**
52.92.2	State the maximum speed in en route holding patterns. AIP ENR

Sub Topic	Syllabus Item
52.92.4	State the maximum entry and holding pattern speeds. AIP ENR
52.92.6	Identify and describe appropriate holding pattern entry procedures. AIP ENR
52.92.8	State when an onwards clearance time will be passed to the pilots of an aircraft instructed to hold en route. AIP ENR
52.92.10	State when an expected approach time will be passed to the pilots of an aircraft instructed to hold at an initial approach fix. AIP ENR
52.92.12	State the angle of bank required during turns in a holding pattern. AIP ENR
52.94	**Approach Procedures**
52.94.2	Describe the descent limitations from cruise to approach commencement. AIP GEN
52.94.4	Interpret information on STAR charts.
52.94.6	State the limitation on a clearance to fly a STAR. AIP ENR
52.94.8	Define the minimum initial approach altitude. AIP ENR
52.94.10	Interpret information on instrument approach charts.
52.94.12	Determine the IFR meteorological minima for an instrument approach to a given runway.
52.94.14	State the meteorological minima which must exist prior to a landing off an instrument approach. CAR 91 & AIP ENR
52.94.16	Describe the procedures for joining overhead a navigation aid for an instrument approach. AIP ENR
52.94.18	State the minimum meteorological conditions which must exist before ATC may clear an aircraft for an instrument approach with a descent restriction. AIP ENR
52.94.20	State the meteorological and other conditions which will allow a pilot to request a visual approach in controlled airspace. AIP ENR
52.94.22	State the meteorological and other conditions which allow ATC to advise that conditions are suitable for a visual approach. AIP ENR
52.94.24	State the meteorological and other conditions which will allow a pilot to carry out a visual approach in uncontrolled airspace. AIP ENR
52.94.26	Describe the provision of separation and terrain clearance during a visual approach. AIP ENR
52.94.28	Given an aircraft's Vs, determine its category for approach speeds and minima. AIP ENR
52.94.30	State the category A and B speed limitations during an instrument approach under ICAO PANS OPS II procedures. AIP ENR

Sub Topic	Syllabus Item
52.94.32	State the requirements for making position reports during an instrument approach in controlled and uncontrolled airspace. AIP ENR
52.94.34	Describe the procedures for carrying out an instrument approach at an unattended aerodrome. AIP ENR
52.94.36	Determine the minimum descent altitude using a QNH from a remote location. AIP ENR
52.94.38	State when descent below decision altitude or minimum descent altitude may be made on an instrument approach. AIP ENR
52.94.40	Describe the missed approach procedures and limitations. AIP ENR
52.96	**Communications and Navigation Aid Failure**
52.96.2	Describe the procedures required following a communications failure en route. AIP ENR
52.96.4	Describe the procedures required following a communications failure during an instrument approach. AIP ENR
52.96.6	Describe the procedure to be carried out in the event of a radio navigation aid failure during an approach. AIP ENR

Subject No 53 IR Operational Knowledge (Aeroplane and Helicopter)

Note: *This syllabus is based on IFR flight as applicable to an IFR-equipped aircraft operating within the New Zealand FIR.*

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on knowledge deficiency reports and will provide valuable feed back to the examination candidate.

This syllabus presupposes a knowledge and understanding already attained at PPL level.

Sub Topic	Syllabus Item
	Meteorology
53.104	**Weather Maps**
53.104.2	Describe the weather sequence and general flying conditions associated with: (a) cold fronts; (b) warm fronts; (c) occluded fronts; and (d) stationary fronts.
53.104.4	Describe typical wind speeds and directions ahead of and behind these fronts in mid-latitudes.
53.104.6	Explain how subsidence and ascent of air influences the type of weather commonly associated with pressure systems.
53.104.8	Identify the general direction of movement of pressure systems in the mid-latitudes of the Southern Hemisphere.
53.104.10	Define the “westerly index” over New Zealand.
53.104.12	Identify ‘high’ and ‘low’ westerly indices on weather maps.
53.104.14	Explain the weather distribution across New Zealand in high and low westerly index situations.
53.104.16	Describe the significance of high and low westerly index situations across New Zealand to aviation.
53.106	**Fundamentals of the Atmosphere**
53.106.2	Define ‘pressure gradient’.
53.106.4	Identify strong and weak pressure gradients on a weather map.
53.106.6	Given examples of ambient temperature at a stated altitude, calculate: (a) the ISA temperature at that altitude; and (b) the ISA height at that temperature.

Sub Topic	Syllabus Item
53.106.8	Define:
	(a) QFE;
	(b) QNH;
	(c) QNE;
	(d) pressure altitude; and
	(e) flight levels (FL).
53.106.10	Describe how localised pressure changes occur in association with:
	(a) lee troughs;
	(b) thermal (or 'heat') lows; and
	(c) thunderstorms.
53.106.12	Describe 'diurnal' pressure variations.
53.106.14	State the latitudes where diurnal pressure variation is most significant.
53.106.16	Explain the effects of changes in the following elements on air density:
	(a) pressure;
	(b) temperature;
	(c) altitude; and
	(d) moisture content of the air.
53.106.18	Define 'density altitude' (DA).
53.106.20	Calculate 'density altitude'.
53.106.22	Describe the 'gradient wind' in the Southern Hemisphere with respect:
	(a) anticyclonically curved isobars; and
	(b) cyclonically curved isobars.
53.106.24	Describe the 'frictional wind balance'.
53.106.26	State typical wind direction deflections due to friction over:
	(a) the sea;
	(b) flat to undulating ground; and
	(c) mountainous regions.
53.106.28	Explain how the following affect the depth of the friction layer:

Sub Topic	Syllabus Item
	(a) atmospheric stability;
	(b) wind strength; and
	(c) surface roughness.
53.106.30	Describe the general characteristics of a mountain wave set-up with reference to:
	(a) wavelengths;
	(b) position and rotation of any possible rotor zones;
	(c) position and type of any possible cloud development;
	(d) the heights of the friction layer;
	(e) areas of probable severe turbulence; and
	(f) areas of possible severe airframe icing.
53.106.32	With reference to mountain waves:
	(a) explain the factors that affect the wave amplitude;
	(b) explain the factors that affect the wave-length; and
	(c) describe the flight conditions associated with mountain waves.
53.106.34	Explain the rotor streaming process.
53.106.36	Describe the flight conditions associated with rotor streaming.
53.106.38	Define the Föhn wind.
53.106.40	State the requirements for the development of a Föhn wind.
53.106.42	Describe the flight conditions when flying in Föhn conditions in the following positions:
	(a) to windward of the mountain range;
	(b) over the mountain range; and
	(c) on the lee side of the mountain range.
53.106.44	Describe the relationship between stability of air and cloud type.
53.106.46	Describe the 10 main cloud types as defined by the WMO.
53.106.48	Describe typical conditions for each of the 10 main cloud types with respect to:
	(a) turbulence;
	(b) icing; and
	(c) precipitation.

Sub Topic	Syllabus Item
53.106.50	Identify the following cloud sub-sets and outline the atmospheric conditions indicated by each:
	(a) Asperitas;
	(b) Mammatus;
	(c) Altocumulus Lenticularis;
	(d) Rotor Cloud;
	(e) Kelvin Helmholtz waves;
	(f) Altocumulus Castellanus; and
	(g) Banner cloud.
53.106.52	Define runway visual range (RVR).
53.106.54	State the difference between fog, mist and haze.
53.106.56	Describe anticyclones ('highs') with reference to:
	(a) their formation processes;
	(b) pressure patterns and wind flow;
	(c) subsidence and subsidence inversions; and
	(d) typical associated weather conditions.
53.106.58	Describe the development of 'cold' highs.
53.106.60	Discuss the hazards associated with anticyclones.
53.106.62	Outline the characteristics of:
	(a) mid to high-latitude depressions ('lows');
	(b) sub-tropical depressions; and
	(c) tropical cyclones.
53.108	**Hazardous Meteorological Conditions**
53.108.2	Define 'super-cooled water droplets'.
53.108.4	Describe the formation process of:
	(a) clear (glaze) ice;
	(b) rime (opaque) ice;
	(c) mixed ice;
	(d) hoar frost; and

Sub Topic	Syllabus Item
	(e) freezing rain.
53.108.6	With reference to clear, rime and mixed ice, describe the following:
	(a) associated cloud types;
	(b) temperature ranges;
	(c) droplet size;
	(d) height range relative to the freezing level; and
	(e) enhancing factors.
53.108.8	Explain the factors that influence the rate of ice accretion.
53.108.10	Describe the hazards of airframe icing to aircraft in flight.
53.108.12	List the intensity classifications of icing.
53.108.14	Describe the effect of different intensity classifications of icing on aircraft.
53.108.16	Explain methods of avoiding or mitigating airframe icing.
53.108.18	Describe the conditions required for the development of thunderstorms.
53.108.20	Describe the characteristics and development of:
	(a) convective localised (stationary) thunderstorms;
	(b) convective traveling thunderstorms;
	(c) orographic thunderstorms;
	(d) nocturnal tropical thunderstorms;
	(e) frontal and convergence-type thunderstorms;
	(f) surface trough and upper trough thunderstorms; and
	(g) warm front embedded thunderstorms.
53.108.22	With reference to flight in and around thunderstorms, describe the development, severity, and areas where the following are likely to be encountered:
	(a) turbulence;
	(b) icing;
	(c) microbursts;
	(d) first gust (or gust front);
	(e) electrical phenomena;
	(f) tornadoes (if any);

Sub Topic	Syllabus Item
	(g) hail; and
	(h) poor visibility.
53.108.24	Describe the characteristics of multi-cell thunderstorms
53.108.26	Describe the use of radar to identify thunderstorms.
53.108.28	Explain the precautions that can be taken by pilots to avoid or minimise the effects of flying in the vicinity of thunderstorms.
53.108.30	Describe the effects of the following enhancing factors on turbulence, from:
	(a) atmospheric stability;
	(b) surface roughness;
	(c) wind speed/direction; and
	(d) vertical windshear.
53.108.32	Describe the cause(s) and factors involved with the effects of low-level wind-shear due to:
	(a) surface friction;
	(b) thunderstorms;
	(c) temperature inversions;
	(d) frontal activity; and
	(e) wake turbulence from fixed and rotary winged aircraft.
53.108.34	Describe the techniques used to avoid or minimize the effects of low-level windshear.
53.108.36	Describe, in accordance with the ICAO definitions, the characteristics of:
	(a) light turbulence;
	(b) moderate turbulence; and
	(c) severe turbulence.
53.108.38	Explain the methods by which the aviation community is advised of volcanic eruptions within the New Zealand FIR.
53.108.40	Explain the hazards to aviation of volcanic ash encountered:
	(a) in flight; and
	(b) during the take-off and landing phases on an ash contaminated runway.
53.108.42	Explain the development of, and the hazards associated with, flight in the following conditions:

Sub Topic	Syllabus Item	
	(a)	dust storms;
	(b)	blowing surface snow (blizzards);
	(c)	whiteout (visual illusion type).
53.110	**Satellite and Radar Imagery**	
53.110.2	With respect to NZ IFR operations, using given examples of satellite imagery, identify the following:	
	(a)	areas of stable and unstable air;
	(b)	the processes causing each significant area or mass of cloud; and
	(c)	likely cloud types and weather associated with each significant area of cloud.
53.110.4	With respect to NZ IFR operations, interpret radar imagery in terms of:	
	(a)	precipitation types and intensity causing the radar echo;
	(b)	likely cloud types associated with the precipitation echo; and
	(c)	speed of movement and timing of radar echoes, and the expected impact at given locations.
	Human Factors	
53.201	**Physiology and the Effects of Flight**	
53.201.2	Explain how the partial pressure of oxygen changes as altitude increases.	
53.201.4	Describe the primary physiological and behavioural consequences of hypoxia for flight crew and passengers.	
53.201.6	List the main factors influencing variation in hypoxia onset (tolerance) between individuals.	
53.201.8	State the factors that affect the likelihood of suffering from hypoxia.	
53.201.10	Describe how hypoxia can be treated.	
53.201.12	Define the concept of ‘time of useful consciousness’.	
53.201.14	State the approximate time of useful consciousness at:	
	(a)	18,000ft;
	(b)	25,000ft; and
	(c)	35,000ft.
53.201.16	Explain oxygen paradox.	

Sub Topic	Syllabus Item
53.201.18	Describe how barotrauma can be prevented.
53.201.20	State the approximate required times between diving at various depths and flying.
53.201.22	Describe methods of cockpit/flight deck lighting and problems associated with each.
53.201.24	Describe the requirements for using corrective lenses.
53.201.26	Explain the visual illusions associated with sector whiteout.
53.201.28	Describe the methods of avoiding and/or coping with sector whiteout.
53.201.30	Specify the various levels of noise in decibels at which various grades of hearing protection are required.
53.201.32	Specify noise levels at which hearing damage may occur.
53.201.34	Describe what is meant by the action threshold for hearing protection.
53.201.36	Describe the factors which affect an individual's susceptibility to disorientation.
53.201.38	Describe the symptoms of gastrointestinal problems.
53.201.40	Identify the primary causes of food poisoning.
53.201.42	Describe the symptoms, effects and immediate treatments for the following hazards present in the aviation environment: (a) compressed gases; (b) liquid oxygen; and (c) de-icing fluids.
53.201.44	Identify and give examples of physical, environmental, task-related, organisational and psychological stressors.
53.201.46	Describe the effects of stress on attention, motivation and performance.
53.201.48	Describe the stages of sleep.
53.201.50	Describe the mechanism of sleep regulation.
53.201.52	Describe problems associated with sleep at abnormal times of the day.
53.201.54	Explain what is meant by sleep debt.
53.201.56	Describe methods of managing fatigue.
53.201.58	Describe methods by which age-related changes in memory and speed of information processing can be moderated by older pilots.
53.201.60	Describe what changes would indicate early dementia or age-related cognitive impairment in another pilot.

Sub Topic	Syllabus Item
53.203	**Aviation Psychology**
53.203.2	Explain the concept of mental workload.
53.203.4	Explain the concept of overload.
53.203.6	Describe methods of managing potential overload.
53.203.8	Describe and compare skill, rule and knowledge-based behaviours.
53.203.10	Describe the process of acquiring a skill.
53.203.12	Describe failures of skill, rule and knowledge-based behaviours.
53.203.14	Explain confirmation bias.
53.203.16	Describe the effect of the following on perception: (a) expectation; and (b) experience.
53.203.18	Describe the formation of mental models.
53.203.20	Describe the special perceptual problems associated with transitioning from IMC to VMC off an instrument approach.
53.203.22	Explain the relationship between crew resource management (CRM) and the building of situational awareness by pilots.
53.203.24	Identify risk assessment techniques.
53.203.26	Identify risk levels that compromise safety.
53.203.28	Identify situations where time pressure compromises safety or increases risk levels.
53.203.30	Define cognitive dissonance.
53.203.32	Describe the following personality traits and explain their effect on group decision making: (a) introversion; (b) extraversion; and (c) anxiety.
53.203.34	Describe a basic model of communications.
53.203.36	Describe the barriers to effective communication.
53.203.38	Identify techniques to reduce communication barriers.
53.203.40	Explain the following strategies used to reduce communication errors in aviation: (a) read backs;

Sub Topic	Syllabus Item	
	(b)	standard phraseology;
	(c)	standard calls;
	(d)	cross-checks;
	(e)	document verification checks;
	(f)	display and control setting checks; and
	(g)	sterile cockpit policies.
53.203.42	Describe and identify examples of overt/active and latent threats.	
53.203.44	Identify methods and means for detecting error in the aviation system.	
53.203.46	Describe error avoidance techniques.	
53.203.48	Explain the basic elements and features of the Reason Model.	
53.203.50	Describe and identify examples of an active failure/error.	
53.203.52	Describe and identify examples of a latent failure/error.	
53.203.54	Identify and describe slips, lapses, mistakes and violations.	
53.203.56	Identify the attributes of at-risk behaviour.	
53.203.58	Describe the concepts of risk creep and risk tolerance and their application within an aviation organisation.	
53.205	**Ergonomics**	
53.205.2	Describe the effects of advanced cockpit automation, including:	
	(a)	failure to monitor;
	(b)	boredom and complacency;
	(c)	loss of proficiency; and
	(d)	problems associated with equipment failure.
53.205.4	Explain the concept of mode awareness in setting up and operating automated systems.	
53.205.6	Describe elements of coping behaviour associated with automatic cockpits.	
53.205.8	Explain the importance of the following in control design:	
	(a)	size;
	(b)	shape/recognition by touch;
	(c)	location;

Sub Topic	Syllabus Item	
	(d)	layout and the uniformity of spatial arrangement;
	(e)	direction of movement; and
	(f)	visibility.
53.205.10	Describe common errors in display interpretation.	
53.205.12	Describe potential errors in the interpretation of the artificial horizon.	
53.205.14	Describe problems associated with the presentation and misinterpretation of alerts.	
53.205.16	Describe problems associated with the design and use of checklists and manuals.	
53.205.18	Describe problems associated with the design and use of maps and charts.	

Flight Navigation Syllabus Matrix						
-	-	Topic No.	PPL	CPL	IR	ATPL
-	-		6	18	54	38
Fundamentals of Air Navigation	Form of the Earth	2	√	√		√
	Direction on the Earth	4	√	√		√
	Distance on the Earth	6	√	√		√
	Speed/Velocity	8	√	√		√
	Position Referencing	10	√	√		√
	Altimetry	12	√	√	√	√
	Principles and Terminology	14	√			
	Time	16	√	√		√
	Twilight	18	√			
	Visibility	20				√
Aeronautical charts	Properties and Principles	22	√	√	√	√
	Scale	24				√
	Chart Reading	26	√	√	√	√
Circular Slide Rule	Computations	28	√	√		√
	Relative velocity	30				√
	Wind Components	32	√			
	Triangle of Velocities	34	√	√		√
	1:60 Rule	36	√	√		
Deduced (Dead) Reckoning	In Flight Revisions	38	√			
Flight Planning	Route Selection	40	√	√	√	
	Chart Preparation	42	√	√		
	Plan Preparation	44	√	√	√	
	Fuel Planning	46	√	√	√	
Navigation Procedures - VFR	VFR Flight Navigation	48	√	√		
	Special Procedures	50	√	√		
Navigation Procedures - IFR	Properties and Principles	52			√	
	Chart Plotting	54			√	√
	Enroute Diversion Calculation	58		√		√
Flight Management	Flight Management	60	√			√
	Fuel Management	62	√			
GNSS	Global Navigation Satellite System	70	√	√		√
Radar	Procedures	72	√			

Subject No 54 Flight Navigation - IFR

Note: *This syllabus is based on IFR navigation as applicable to navigating an IFR equipped aeroplane or IFR equipped turbine helicopter.*

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on knowledge deficiency reports and will provide valuable feed back to the examination candidate.

This syllabus presupposes a knowledge and understanding already attained at PPL level.

Sub Topic	Syllabus Item
	Fundamentals of Air Navigation
54.12	**Altimetry**
54.12.2	Define: (a) indicated altitude; (b) calibrated altitude; (c) true altitude; (d) pressure altitude (PA) (e) density altitude (DA); (f) flight level (FL); (g) transition altitude (h) transition layer; and (i) transition level.
54.12.4	Apply the table of IFR cruising levels below and above transition.
54.12.6	Explain how true and indicated altitudes are affected by changes in air pressure and air temperature.
54.12.8	Explain: (a) How changes in air pressure and air temperature affect the vertical profile during a non-ILS approach; and (b) The risks associated by low temperatures and QNH errors during a non-ILS approach.
54.12.10	Explain how true and indicated altitudes are related when using flight levels.
54.12.12	Explain what is meant by Reduced Vertical Separation Minima (RVSM).
54.12.14	Describe the extent of RVSM airspace.
54.12.16	Explain the requirements for operating in RVSM airspace.

Sub Topic	Syllabus Item
	Aeronautical Charts
54.22	**Properties and Principles**
54.22.2	List the aeronautical charts used in New Zealand for operations under IFR.
54.22.4	Identify the information published in the legends of aeronautical charts and in the CHART Symbols section of the AIPNZ Vol 2 & 3.
54.22.6	Explain the meaning of abbreviations and codes used in Operational Data for aerodromes in the AIPNZ.
54.22.10	Explain what is meant by: (a) ADEP; (b) ADES; (c) waypoint; (d) SID; and (e) STAR.
54.22.12	Define the following terms presented on enroute charts: (a) minimum enroute altitude (MEA); (b) minimum reception altitude (MRA); (c) minimum safe altitude (MSA); (d) route operating limitations (ROL); (e) minimum flight altitude (MFA); (f) compulsory reporting point; (g) non-compulsory reporting point; (h) VOR change-over point; and (i) Distance steps.
54.22.14	With regard to Standard Routes, describe in detail the: (a) function of the routes; (b) associated standard route clearance system; (c) manner in which standard routes are highlighted on enroute charts; (d) designator allocated to individual standard routes; and (e) documents where standard routes are published.

Sub Topic	Syllabus Item
54.22.16	With regard to uncharted routes, state the:
	(a) document, and section, where the routes are published;
	(b) designator allocated to the routes; and
	(c) meaning of chart symbols (e.g. asterisks).
54.26	**Reading IFR Charts**
54.26.2	Determine on appropriate enroute charts:
	(a) the magnetic tracks and distances of route segments;
	(b) the type or class of airspace in which an IFR flight is operating;
	(c) airspace boundaries;
	(d) airspace vertical limits; and
	(e) airspace controlling authority.
54.26.4	With regard to the World Geodetic System 1984 (WGS 84) datum, state where this datum is published.
54.26.6	Interpret information contained in the following charts, tables and diagrams published in the AIPNZ VOL 2 & 3:
	(a) VOR/DME MRA Sector (VORSEC) charts;
	(b) 25 DME Minimum Sector Altitude diagrams;
	(c) Standard Instrument Departure (SID) diagrams;
	(d) Standard Arrival Route (STAR) charts;
	(e) visual arrival charts;
	(f) instrument approach charts;
	(g) ground movement charts;
	(h) instrument T/O procedure chart - rate of climb table; and
	(i) IFR alternate aerodrome minima table.
54.26.8	Explain compliance procedures associated with:
	(a) VOR/DME MRA Sector (VORSEC) charts;
	(b) 25 DME Minimum Sector Altitude diagrams;
	(c) Standard Instrument Departure (SID) diagrams;
	(d) Standard Arrival Route (STAR) charts;

Sub Topic	Syllabus Item
	(e) visual arrival charts;
	(f) instrument approach charts; and
	(g) ground movement charts.
54.26.10	Interpret meteorological information for IFR takeoff minima.
54.26.12	Interpret meteorological information for IFR approach minima.
54.26.14	Explain the compliance procedures involved during precision and non-precision instrument approaches.
54.26.16	Describe the compliance procedures associated with published missed approaches.
	Flight Planning
54.40	**IFR Route Selection**
54.40.2	For the preparation of a flight plan, determine:
	(a) route details, including reporting points and turning points;
	(b) climb performance data including minimum climb gradients associated with published departure procedures;
	(c) descent performance data including rate of descent required to arrive at a position at a stipulated altitude, or to comply with published arrival procedures;
	(d) fuel consumption details during climb, cruise, descent, and during diversion (if different);
	(e) cruising level(s) considering topography, navigational and meteorological considerations;
	(f) ATC and Noise Abatement requirements;
	(g) speed limitations, if applicable; and
	(h) requirement for, and availability of, alternate(s).
54.44	**IFR Flight Plan Preparation**
54.44.2	Prepare an IFR flight plan which contains the following details:
	(a) point of departure including minimum departure altitude or departure instructions, if applicable;
	(b) rate of climb required to comply with published climb gradient;
	(c) location and altitude of top of climb and top of descent;
	(d) each sector of the flight identified as From/To;

Sub Topic	Syllabus Item	
	(e)	point of arrival including minimum procedure commencement altitude, if applicable;
	(f)	the altitude and time of each sector including mean climb and mean descent altitude;
	(g)	each sector distance;
	(h)	outside air temperatures for the calculation of TAS during climb, cruise and descent;
	(i)	the wind velocity used for climb, cruise and descent, including split climb and split descent;
	(j)	TAS for each sector;
	(k)	track (°M) of each sector;
	(l)	heading (°M), groundspeed and time for each sector; and
	(m)	climb, cruise and descent details of a diversion.
54.46	**IFR Fuel Planning**	
54.46.2	Calculate total fuel load required including provision for diversion, reserve and contingency fuel.	
54.52	**IFR Navigation Procedures**	
54.52.2	Define:	
	(a)	drift, drift angle, drift correction;
	(b)	track error, closing angle, total correction;
	(c)	magnetic and true bearing;
	(d)	position line; and
	(e)	fix.
54.52.4	Describe the principles involved in obtaining an accurate fix.	
54.52.6	Through the use of the navigation computer and mathematical means, solve problems involving:	
	(a)	the triangle of velocity;
	(b)	the 1 in 60 rule;
	(c)	time/speed/distance;
	(d)	time/fuel used/fuel consumption rate;
	(e)	height/time/distance/rate of climb/rate of descent; and

Sub Topic	Syllabus Item
	(f) calculate the track miles flown on a segment of a DME arc.
54.52.8	Based on information derived from currently used VOR and DME displays, and from GNSS instrumentation:
	(a) describe navigation aspects associated with published departure procedures;
	(b) calculate magnetic headings required to maintain or regain required magnetic tracks;
	(c) determine a position in relation to a navigation aid or aids;
	(d) calculate magnetic tracks to specified point(s);
	(e) calculate groundspeed;
	(f) calculate estimated times of arrival at destination or intermediate positions;
	(g) determine requirements with respect TOC/TOD and rate of climb/rate of descent;
	(h) position in terms of a radial and distance to or from a navigation aid;
	(i) calculate fuel consumption, and operational details or requirements resulting from fuel flow information;
	(j) describe navigation aspects associated with published arrival procedures;
	(k) calculate holding time over a navigation aid before diversion must be commenced;
	(l) describe Distance steps; and
	(m) describe a DME arc procedure.

Subject No 56 Instruments and Navigation Aids

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on knowledge deficiency reports and will provide valuable feed back to the examination candidate.

This syllabus presupposes a knowledge and understanding already attained at PPL level.

56.2 Pressure Instruments

56.2.2 Define:

(a) static pressure;

(b) dynamic pressure; and

(c) total (or pitot) pressure.

56.2.4 Distinguish between the following:

(a) static pressure;

(b) dynamic pressure; and

(c) total (or pitot) pressure.

56.2.6 With the aid of diagrams:

(a) identify the elements of a basic pitot-static system; and

(b) label the basic elements of a typical pitot-static probe.

56.2.8 Distinguish between separate pitot probe/static vents, and a combined pitot-static probe.

56.2.10 Describe the precautions and correct method of operation of the pitot heater.

56.2.12 With respect to the airspeed indicator (ASI) and, where appropriate, with the aid of diagrams or charts:

(a) explain the basic principle of operation;

(b) identify the markings on a typical light twin-engine aeroplane ASI;

(c) state the relationship between indicated, calibrated, equivalent and true airspeeds (IAS, CAS, EAS and TAS);

(d) explain the effect of blockages and leaks, and the remedies available to the pilot; and

(e) state the serviceability checks.

56.2.14 Explain the following errors affecting the airspeed indicator (ASI):

(a) instrument error;

(b) position error;

(c) compressibility error; and

(d) density error.

56.2.16 With respect to the altimeter and, where appropriate, with the aid of diagrams:

(a) explain the basic principle of operation;

(b) describe the use of the altimeter settings QNH, QFE and QNE;

(c) explain the effect of blockages and leaks, and the remedies available to the pilot; and

(d) state the serviceability checks.

56.2.18 Explain the following errors affecting the altimeter:

(a) instrument error;

(b) position error;

(c) lag; and

(d) temperature error; and

(e) an incorrectly set altimeter subscale setting.

56.2.20 With respect to the vertical speed indicator (VSI) and, where appropriate, with the aid of diagrams:

(a) explain the basic principle of operation;

(b) describe the errors affecting the instrument;

(c) explain the effect of blockages and leaks; and

(d) state the serviceability checks.

56.2.22 Explain the following errors affecting the vertical speed indicator (VSI):

(a) position error; and

(b) lag.

56.4 Gyroscopic Instruments

56.4.2 Describe the gyroscopic principles of rigidity and precession.

56.4.4 Describe a typical pneumatic system for powering gyro instruments.

56.4.6 List the advantages of an electrically powered gyro system.

56.4.8 Describe:

(a) real wander; and

(b) apparent wander.

56.4.10 Differentiate between real and apparent wander.

56.4.12 With respect to the turn indicator/turn coordinator and, where appropriate, with the aid of diagrams:

(a) describe the basic principle of operation; and

(b) state the serviceability checks.

56.4.14 Explain the following errors affecting the turn indicator/turn coordinator:

(a) suction error; and

(b) yaw with pitch error.

56.4.16 With respect to the heading/direction indicator (HI/DI) and, where appropriate, with the aid of diagrams:

(a) describe the basic principle of operation;

(b) state that the advantages of an electrically driven HI/DI; and

(c) state the serviceability checks.

56.4.18 Explain the following errors affecting the heading/direction indicator (HI/DI):

(a) gimbal error;

(b) real drift; and

(c) apparent drift/wander.

56.4.20 With respect to the attitude indicator (AI) and, where appropriate, with the aid of diagrams:

(a) describe the basic principle of operation (for both air-driven and electrically driven instruments); and

(b) state the typical limits in freedom.

56.4.22 Explain the following errors affecting the attitude indicator (AI):

(a) pendulosity error;

(b) erection error;

(c) acceleration error; and

(d) turning error.

56.6 Remote Indicating Compasses

56.6.2 With respect to remote-indicating compasses and, where appropriate, with the aid of diagrams explain the basic principle of operation:

(a) describe the compass card presentation on the radio magnetic indicator (RMI);

(b) describe interpretation of the annunciator, and the operation of the compass synchronising knob of the RMI; and

(c) explain the errors which can affect remote indicating compasses (including deviation), and how these can be avoided or reduced.

56.8 Basic Radio Principles

56.8.2 With respect to radio waves and, where appropriate, with the aid of diagrams define:

(a) cycle;

(b) frequency, and state the unit describing frequency; and

(c) wavelength and explain how it is related to frequency.

56.8.4 Describe the propagation of surface waves and the rule of thumb formula for calculation range of reception.

56.10 Primary Surveillance Radar (PSR)

56.10.2 Explain the principle of operation of PSR, including the principles of radar ranging and direction.

56.10.4 Explain the effect of the following factors on the operational range of PSR.

(a) pulse repetition frequency (PRF);

(b) pulse width (PW); and

(c) antenna rate of rotation.

56.10.6 State the maximum range of PSR in New Zealand.

56.12 Secondary Surveillance Radar (SSR)

56.12.2 Explain the principle of operation of SSR.

56.12.4 Explain the factors affecting the operational range of SSR.

56.12.6 State the maximum operational range of the SSR system in New Zealand.

56.12.8 State the advantages of SSR over PSR.

56.14 Transponders

56.14.2 Describe the following functions on a typical transponder control panel:

(a) standby (SBY);

(b) ON;

(c) ALT;

(d) test (TST);

(e) IDENT;

(f) code selection controls; and

(g) reply monitor light.

56.14.4 Describe the correct use of the IDENT button (or switch).

56.14.6 Explain the meanings of typical transponder terminology.

56.14.8 State the operational limits of Mode C readouts.

56.14.10 State the transponder emergency codes.

56.14.12 Describe the operation precautions required when changing codes.

56.16 Airborne Weather Radar

56.16.2 Explain the principle of operation of airborne weather radar.

56.16.4 Describe the function of:

(a) the tilt control;

(b) the range control;

(c) the ANT STAB switch; and

(d) the GAIN control.

56.16.6 Interpret the indications from a weather radar, in its various modes.

56.16.8 Describe the weather radar return strengths of various types of precipitation.

56.18 Visual Landing Aids

56.18.2 Describe the purpose of approach lighting systems and distinguish between the three types of system commonly used in New Zealand.

56.18.4 Describe the purpose of circling guidance lighting and runway lead-in lighting.

56.18.6 Given suitable diagrams, interpret the approach slope indications given by the following systems.

(a) T-VASIS;

(b) RAE red-white VASIS; and

(c) precision approach path indicator (PAPI) and abbreviated PAPI.

56.18.8 Explain the standard PAPI angle setting, and the setting of PAPI threshold crossing height (TCH).

56.18.10 State the possible atmospheric effects on approach slope indication.

56.18.12 Describe typical layout and presentation of the following lighting:

(a) normal runway;

(b) displaced threshold;

(c) runway touchdown zone;

(d) runway end indicator lighting;

(e) taxiway;

(f) wind direction ~~aerodrome beacons;~~ indicator lighting;

(g) aerodrome beacons;

(h) obstruction lighting; and

(i) aeronautical/marine beacons.

56.18.14 Describe pilot activated lighting (PAL) and the standard system of keying PAL.

56.18.16 Describe the standard system of keying PAL to:

(a) activate lighting;

(b) adjust the brilliance; and

(c) reactivate lighting.

56.18.18 Describe the means available for remote control of lighting other than PAL.

56.20 Reserved

56.22 VOR

56.22.2 Explain the basic operating principles of a VOR ground station, including the:

(a) reference phase signal;

(b) variable phase signal; and

(c) measurement of phase difference.

56.22.4 Describe what is meant by a VOR radial.

56.22.6 List the publications and charts that show VOR callsigns and frequencies.

56.22.8 Explain the importance of station identification before using the VOR.

56.22.10 Describe the presentation of the VOR CDI on a:

(a) fixed card;

(b) rotatable card; and

(c) HSI indicator.

56.22.12 Explain the operation of a typical VOR indicator, including:

(a) the omni-bearing selector (OBS);

(b) the course deviation indicator (CDI); and

(c) the TO/FROM indicator.

56.22.14 Describe how the VOR receiver can be used to:

(a) establish orientation of that aircraft to and from a VOR station;

(b) maintain a required track to a VOR station; and

(c) maintain a required track from a VOR station.

56.22.16 Describe the orientation of the CDI while maintaining the required radial when drift correction is being applied.

56.22.18 Describe the behaviour of the course deviation indicator (CDI) while the aircraft is off the selected radial, and the HDG °M and OBS selection are:

(a) within 90° of each other; and

(b) more than 90° apart.

56.22.20 Given suitable diagrams of VOR presentation (including RMI and HSI presentation), demonstrate its use for:

(a) orientation;

(b) crossing a radial and station passing; and

(c) intercepting radials inbound and outbound.

56.22.22 Discuss the factors affecting range and accuracy of VOR, including:

(a) maximum range;

(b) published route operating limitations; and

(c) errors, particularly terrain effect error with “scalloping” and “radial bending”.

56.24 Distance Measuring Equipment (DME)

56.24.2 State the primary functions of the DME.

56.24.4 Describe the basic principle of operation of DME.

56.24.6 Describe current DME presentations.

56.24.8 Explain the importance of station identification before using the DME.

56.24.10 Explain the operation of a typical DME controller, including:

(a) tuning with a paired VOR or ILS frequency;

(b) tuning directly to a DME frequency;

(c) DME ident;

(d) indication of signal loss; and

(e) saturation.

56.24.12 Explain the following:

(a) DME design maximum range; and

(b) DME distance (slant range) versus horizontal range.

56.24.14 Calculate the expected maximum range of the DME at different altitudes.

56.26 Instrument Landing System (ILS)

56.26.2 Explain the basic principle of operation of an instrument landing system **(**ILS), including:

(a) localiser principles;

(b) standard rated coverage;

(c) CDI indication;

(d) glideslope principles;

(e) glideslope angle; and

(f) glideslope indications.

56.26.4 State the localiser and glideslope displacement represented by full scale deviation of the CDI and glideslope indicators.

56.26.6 State the rule-of-thumb methods of calculating:

(a) the required height on a 3° glideslope at a given distance from the threshold; and

(b) the rate of descent required to maintain a 3° glideslope at any given groundspeed.

56.26.8 Given suitable diagrams of instrument presentation, interpret aircraft position with respect to ILS centreline and glideslope.

56.28 Global Navigation Satellite System (GNSS/GPS)

56.28.2 Describe in basic terms the principal GNSS systems – GPS, Galileo, GLONASS and BeiDou.

56.28.4 Describe the three main segments of the GNSS (GPS) system.

56.28.6 Outline the elements of the control segment.

56.28.8 Describe the user segment, including the basic principle of satellite ranging.

56.28.10 Explain the principles of fixing position using the GNSS system; including:

(a) the number of satellites required for 2D and 3D fixing;

(b) the operation of RAIM;

(c) the number of satellites required for fault detection (FD) and for fault detection and exclusion (FDE); and

(d) barometric aiding.

56.28.12 Explain how the receiver predicts the position of various satellites.

56.28.14 State the sources of GNSS error, and the maximum error which can be expected.

56.28.16 State the reasons for the display of a RAIM warning message, and the requirements under CAA Rules for continued navigation.

56.28.18 Explain the operation of:

(a) a RAIM prediction service; and

(b) onboard RAIM alerting.

56.28.20 Describe the application of the WGS 84 datum, and the likely effects on the GPS display of using coordinates from another datum.

56.28.22 Explain the methods of the augmentation of GPS accuracy.

56.28.24 State the factors influencing GNSS integrity, continuity and availability, including;

(a) data base validity;

(b) pilot data input; and

(c) GNSS/aircraft system integration.

56.30 Performance Based Navigation (PBN)

56.30.2 Describe Performance Based Navigation (PBN).

56.30.4 Describe the following elements of PBN:

(a) the Navigation Specification;

(b) the Navigation Aid Infrastructure; and

(c) the Navigation Application.

56.30.6 Explain what is meant by:

(a) 2D instrument approach operation;

(b) 3D instrument approach operation;

(c) ABAS;

(d) SBAS;

(e) GBAS;

(f) GBA;

(g) AMoN;

(h) APCH;

(i) RNAV;

(j) RNP;

(k) AR;

(l) ANP;

(m) EPU;

(n) Total System Error (TSE);

(o) LP;

(p) LPV;

(q) LNAV;

(r) VNAV;

(s) Baro-VNAV;

(t) Fly-by waypoints;

(u) Fly-over waypoints;

(v) Desired track (DTK);

(w) Track to fix (TF);

(x) Direct to fix (DF);

(y) Course to fix (CF); and

(z) Radius to fix (RF).

56.30.8 Differentiate between RNAV and RNP navigation specifications.

56.30.10 Explain where the various navigation specifications are applied.

56.30.12 Describe the construction of a PBN containment area.

56.32 Performance Based Surveillance

56.32.2 Explain what is meant by:

(a) Automatic Dependent Surveillance - Broadcast (ADS-B); and

(b) Multilateration.

56.32.4 Explain the function of:

(a) Automatic Dependent Surveillance - Broadcast (ADS-B); and

(b) Multilateration.

56.32.6 Explain the basic operating principle of:

(a) Automatic Dependent Surveillance - Broadcast (ADS-B); and

(b) Multilateration.

56.32.8 Explain the inputs and outputs of:

(a) Automatic Dependent Surveillance - Broadcast (ADS-B); and

(b) Multilateration.

56.32.10 Explain the limitations of:

(a) Automatic Dependent Surveillance - Broadcast (ADS-B); and

(b) Multilateration.

Subject No 20 Meteorology

For CPL holders a pass in subject No 20 CPL meteorology meets the requirement for the instrument rating meteorology written examination.

Subject No 34 Human factors

For CPL holders a pass in subject No 34 CPL human factors meets the requirement for the instrument rating human factors written examination.