CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

Advisory Circular
AC61-17

Revision 14

Pilot Licences and Ratings—Instrument Rating

-TBC

General

Civil Aviation Authority advisory circulars (ACs) contain guidance and information about standards, practices, and procedures that the Director has found to be an **acceptable means of compliance** with the associated rules and legislation.

Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate AC.

Purpose

This AC describes an acceptable means of compliance with requirements for flight time experience and on the examination syllabus content that is acceptable to the Director for meeting the Civil Aviation Rule requirements for the issue of an Instrument Rating.

Related Rules

This AC relates specifically to Civil Aviation Rule Part 61 Subpart Q–Instrument Ratings.

Change Notice

Revision 14 updates the IR theory and practical syllabi to include Performance Based Navigation as the foundational knowledge and training requirement. ~~Revision 13 deletes an item in the syllabus, which is no longer relevant under section 54.22.24 *With regard to uncharted routes* (found on page 28), and adds a Version History, below.~~

Version History

The record of revisions to this AC are outlined below:

AC Revision No.	Effective Date	Summary of Changes
AC61-1.17	6 October 1998	Initial issue of this AC
AC61-1.17 Rev 1	10 February 2002	Included new paragraph (b) under AMC 61.801 reducing flight-time experience requirements for an instrument rating (IR) for pilots undertaking an integrated CPL(A) and IR training course conducted by a Part 141 certificated training organisation.

Published by
Civil Aviation Authority
PO Box 3555
Wellington 6140

Authorised by
DCE Aviation Safety

AC61-1.17 Rev 2	12 January 2004	Updated to account for the introduction of the Visual Navigation Charts and Visual Planning Charts along with the replacement of the Planning Manual, Instrument Flight Guide and Visual Flight Guide with the new AIP NZ Volumes. In the flight test syllabus changes are made to include GPS arc arrival procedures.
AC61-1.17 Rev 3	23 June 2004	Introduced format changes to the knowledge syllabus for Air Law with the content of each subject given a subject number and each topic within that subject a topic number, to be used on 'knowledge deficiency reports' (KDRs) to provide feedback to the examination candidate. Other changes were editorial or minor word amendments.
AC61-1.17 Rev 4	11 May 2006	Included amendments to instrument rating issue and renewal as a result of the continued withdrawal of non-directional radio beacons (NDBs), the increased availability of GPS approaches and the increasing number of modern aircraft being imported into New Zealand which are not fitted with automatic direction finder (ADF). The requirement to demonstrate ADF is no longer compulsory for IR issue or renewal. Therefore, the requirement to identify the aircraft's position by cross reference to a VOR radial and NDB cross track was removed. Guidance was given for the issue and renewal of IR in aircraft equipped with a 'glass cockpit' defined as Technically Enhanced Aircraft. The requirement to demonstrate an approach fully utilising the auto-pilot was removed as a compulsory requirement for IR issue. In Appendix II the IR flight test syllabus was updated in accordance with the published CAA Instrument Rating Flight Test Standards Guide. The specific performance parameters were removed from this AC as they are detailed in the CAA Instrument Rating Flight Test Standards Guide.
AC61-1.17 Rev 5	9 May 2007	Renumbered this AC from AC 61-1.17 to AC 61-17 as part of a project to standardise numbering of ACs.
AC61-1.17 Rev 6	29 June 2009	Inserted a revised Subject 54-Flight Navigation IFR and Subject 56-Instrument and Navigation Aids and included a Flight Navigation Subject Matrix.

AC61-1.17 Rev 7	14 June 2010	Inserted a revised syllabus for Subject 52-IR Law (Aeroplane and Helicopter) and included an Air Law Syllabus Matrix.
AC61-1.17 Rev 8	12 September 2012	Inserted a ground training syllabus for the endorsement of the GNSS approach aid (Appendix III) and amended the definition of a Technically Enhanced Aircraft (TEA) and the currency requirements for TEA and non-TEA aircraft.
AC61-1.17 Rev 9	18 September 2012	Minor editorial change to item 14 in the classroom training and examination requirements of Appendix III GNSS Theory Course Syllabus.
AC61-1.17 Rev 10	29 October 2012	Minor editorial change to the course concept of Appendix III GNSS Theory Course Syllabus.
AC61-1.17 Rev 11	4 April 2013	Minor editorial change to GNSS requirements (page 44 and 48).
AC61-1.17 Rev 12	5 October 2016	Introduced the requirement for Performance Based Navigation (PBN), and RNP1, into the instrument rating and details transition arrangements.
AC61-1.17 Rev 13	24 August 2021	Deleted an obsolete item in the syllabus, under section 54.22.24 *With regard to uncharted routes* (on page 28) and adds this Version History.
AC61-1.17 Rev 14	TBC 2022	Inserts a revised Subject 52-IR Air Law, Subject 54-Flight Navigation IFR and Subject 56-Instruments and Navigation Aids syllabi. Inserts a new syllabus Subject 53-IR Operational Knowledge specifically for PPL holders only. Removes references to technically enhanced (TEA) and replaces with electronic flight instrument systems (EFIS), and defines competency requirements. Defines the requirements for single-pilot and multi-pilot privileges. Introduces training requirements for navigation specifications including a new training syllabus in Appendix III. Introduces 2D and 3D approach terminology and clarifies the approach procedures required for initial issue and competency demonstrations. Outlines the conditions in which FMS ratings can be recognised as GNSS endorsements for licence issue

		Updates the requirements for GNSS receiver competency demonstration. Clarifies what is determined as similar navigation systems. Updates Appendix II Instrument Rating Flight Test Syllabus – Incorporates 'accuracy for all aircraft' section into the 'Inflight' section. Removes Appendix III GNSS Theory Course Syllabus and replaces with PBN Pilot Knowledge and Training Syllabus. Adds Appendix IV ADF/NDB Theory Course Syllabus. ***Note**: Because of the scale of this revision, the numbering and order of many of the Sub-sections has changed.*

Table of Contents

Rule 61.801 Eligibility Requirements

Flight time experience

Rule 61.801(a)(2) requires an applicant for an instrument rating to have flight time experience acceptable to the Director.

The following is acceptable to the Director:

EITHER

(i) 50 hours of VFR cross-country navigation flight time as pilot-in-command, of which not less than 10 hours are in the appropriate category of aircraft; and

(ii) 10 hours dual instrument cross-country flight time under an IFR flight plan; and

(iii) 40 hours instrument time; and

(iv) 20 hours instrument flight time in that category of aircraft, of which at least 10 hours are dual instruction as required by rule 61.801(a)(4).

OR

Where an applicant for an instrument rating is undertaking the instrument rating training course in conjunction with a 200-hour CPL (A) training course conducted in accordance with AC61-5 by a training organisation certificated under Part 141, where the certificate authorises the holder to conduct that training.

(i) 50 hours cross-country flight time in aeroplanes, which is to include the 20 hours training in accordance with the CPL (A) cross-country day navigation syllabus set out in Appendix II of AC61-5 and 10 hours dual instrument cross-country flight time under an IFR flight plan; and

(ii) 40 hours instrument time; and

(iii) 20 hours instrument flight time in that category of aircraft, of which at least 10 hours are dual instruction as required by rule 61.801(a)(4).

Ground training course

A ground course based on the ~~syllabuses~~ syllabi detailed in Appendix I meets the requirements of the ground course in air law; flight navigation - IFR; meteorology; instruments and navigation aids; and human factors in rule 61.801(a)(3).

Flight training course

Appendix II of this AC meets the requirements of the 10 hours of dual flight training in IFR procedures in rule 61.801(a)(4).

Written examination credit

The written examination credit required by rule 61.801(a)(5) comes into effect when all the written examinations have been passed in the qualifying period of three years and the written examination credit is valid for three years as detailed in rule 61.17(c) and (d).

The instrument rating written examinations are based on the ~~syllabuses~~ syllabi detailed in Appendix I of this AC. For CPL holders, the meteorology and human factors training, and

examinations required by rules 61.801(a)(3) (iii) and (v) and 61.801(a)(5) are the same as those for the CPL; therefore, credits in these subjects are acceptable towards the issue of an instrument rating. For PPL holders, a credit in Subject 53 IR Operational Knowledge meets these requirements.

Flight test

The Instrument Rating Flight Test (IRT) referred to in this document covers both the initial issue instrument rating and subsequent competency demonstrations. The requirements of the IRT ~~flight test~~ in rule 61.801(a)(6) and 61.807(a)(1) are set out in the Instrument Rating Flight Test Standards Guide published by the Director. These are detailed in Appendix II of this AC and the flight tests are conducted by appropriately authorised flight examiners on behalf of the Director.

An applicant for an IRT must hold a current licence and type rating on the aeroplane being used for the test. If the IRT is conducted in a Multi Engine aircraft, then no further test is required for Single Engine IR privileges. If the IRT is taken in a Single Engine or Centre Line Thrust aircraft, then a further flight test is required for IR privileges in a Multi Engine aircraft.

Although a current medical is not required by the applicant for the completion of an annual competency demonstration, the privileges of an IR cannot be exercised without an appropriate current medical (see rules 61.801(a)(1) and 61.805 (b)(4)). A current Class 1 or 2 Medical is required for the initial IRT.

The IRT can be conducted on either an Electronic Flight Instrument System (EFIS) or a conventional analogue flight display. Pilots who have successfully demonstrated IR competence on one of these displays or systems, who wish to then exercise these privileges on an alternative flight display or system, must complete a demonstration of competence. Subsequent competency demonstrations are only required on either the EFIS or analogue flight display but are valid for both. However, before exercising the privilege of an IR, it is the responsibility of the pilot in command to ensure they are sufficiently current and competent on the applicable flight display or system.

For the purposes of this AC, a flight display is considered an EFIS when all the flight instruments, including the pitot static instruments, are integrated into one display. Systems where an electronic attitude indicator and/or an electronic horizontal situation indicator are installed, but a conventional system of pitot static instruments are displayed separately, are not considered EFIS.

Note: *If initially qualified on an EFIS, the analogue flight display competency demonstration must include limited panel techniques.*

If the aircraft is fitted with an autopilot the pilot must demonstrate competence in its use.

IRTs are to be conducted either single-pilot or multi-pilot. An IRT may not be conducted multi-pilot unless the aircraft's type certificate, flight manual, operating rule or the operators approved operating procedure/s requires that the aircraft be operated by a multi-pilot crew. Those pilots who hold multi-pilot privileges are required to complete a separate single-pilot IRT before single pilot privileges may be used, or vice versa.

~~The successful demonstration of competence in a technically enhanced aircraft (TEA) is only valid for use in a TEA.~~

An examination knowledge deficiency report (KDR) is a report issued on completion of a written examination that details areas where questions were answered incorrectly. The applicant for an instrument rating flight test must provide the flight examiner with written examination KDRs in

accordance with rule 61.21(a)(5). These KDRs, with content acknowledged against the relevant rule reference(s), must be certified prior to the flight test by a Category A or B flight instructor that the applicant has been examined in these areas and their knowledge has improved. The flight examiner conducting the flight test will test the applicant's knowledge of the written examination subject areas including but not limited to items included in the KDRs.

The initial IRT is valid for 12 months. Subsequent IRTs can be completed within 60 days of the annual due date; see rules 61.807(a)(1)(i), and 61.807(c).

General guidance

Where a pilot is undertaking their instrument rating training as part of an integrated 200 hour CPL (aeroplane) training course conducted by a training organisation certificated under Part 141, where the certificate authorises the holder to conduct that training, the Director considers it acceptable for the pilot to spend more of the total flight time experience required for the CPL flying on IFR cross-country navigation rather than accumulating VFR cross-country navigation flight time, to meet the 50 hours that is acceptable to the Director under rule 61.801(a)(2).

Instrument time accumulated in an approved synthetic training device towards the instrument time experience under rule 61.801(a) and (b) should be certified in the pilot's logbook in accordance with rule 61.33.

Rule 91.261 Requirements for navigation specification

PBN training and competency endorsement

Rule 91.261(2)(i) requires the person to be suitably trained and qualified for the navigation specification applicable to the planned route and airspace.

PBN training, and subsequent navigation specification endorsement, requires the candidate to demonstrate knowledge and competency in the practices and procedures identified in Appendix III for each applicable navigation specification. An initial issue Instrument Rating with PBN endorsement will include both RNAV 1 and RNAV 2 navigation specifications, as well as RNP APCH (RNAV (GNSS)). Those candidates who elect to, and successfully complete, an RNP 1 privilege, either on an initial issue flight test or a demonstration of competency, will automatically receive RNP 2 privileges.

For those seeking other navigation specification privileges, these are required to be examined separately; either as an additional test, or as part of a demonstration of competency.

For pilots within a Part 119 organisation, pilot competency is achieved through operator compliance with their training programme and adherence to the standard operating procedures specified in their exposition.

The training syllabus applicable to each navigation specification is detailed in Appendix III.

Rule 61.803 Issue

Licence endorsement

Instrument approach classification

An instrument approach is an approach and landing using instruments for navigation guidance based on a published instrument approach procedure. There are two methods for executing instrument approaches:

a) a two-dimensional (2D) instrument approach procedure, using lateral navigation guidance only (non-precision approaches) and

b) a three-dimensional (3D) instrument approach procedure, using both lateral and vertical navigation guidance (precision approaches or PBN APV).

Navigation aid or system

The ~~additional~~ approach aid or systems, which may be endorsed on the licence under rule 61.803(b) and (c), are: ADF, GNSS, ILS and VOR.

Pilots qualified on a Flight Management System (FMS) as part of an approved aircraft type rating course using a GNSS approach are considered to have met the requirements for the issue of GNSS, provided that the FMS approach system is certified in the pilots logbook in accordance with Rule 61.805(b)(3).

Privileges, such as, single pilot or multi-pilot, single engine or multi-engine, EFIS or analogue flight display, GNSS receiver ~~technically enhanced aircraft (TEA), the type and model of GPS unit~~ and PBN qualifications ~~(RNAV 2, RNAV 1, RNP 2 and RNP 1)~~ only need to be entered in the pilot's logbook and recorded on the flight test report.

The following logbook format may be used:

I hereby certify that _____has satisfactorily demonstrated competency in the use of ADF, GNSS, ILS, VOR (delete as applicable) and PBN navigation specification/s _____ in an analogue/EFIS equipped aircraft, centreline-thrust/multi-engine/single-engine aeroplane/helicopter to single-pilot/multi-pilot standard (delete as applicable).

Instrument Approach Procedures demonstrated 2D / 3D (delete as applicable)

GNSS Receiver Make_____
Examiner_____
Client ID _____ Date_____

Rule 61.805 Privileges and Limitations

Competency demonstration on approach aid or system

The approach aids or systems that may be certified in the holder's logbook under rule 61.805(b)(3) are: ADF, VOR, GNSS and ILS ~~and PBN~~.

~~In the case of GPS the type and model of each GPS unit demonstrated also needs to be recorded in accordance with rule 19.205(a).~~

~~PBN qualifications should be specified as RNAV 2, RNAV 1, RNP 2 and/or RNP 1~~.

Competency demonstration on navigation specification

On issue of this AC, ~~amendment a pilot with~~ pilots holding a current GNSS endorsement that was issued under rule 19.205(b) are deemed competent in RNAV 2, RNAV 1 and RNAV (GNSS)[1] approaches as detailed in ~~AC~~ AC91-21 and the applicable navigation specification notice. For pilots who have also demonstrated competency in RNP 1 procedures are also deemed competent in the use of RNP 2 procedures.

~~On issue of this AC amendment, a pilot with a current GNSS endorsement may, until their next competency demonstration, also exercise RNP 1 privileges. After 1 Jan 2017, any pilot seeking initial GNSS endorsement or having their annual competency checked and who requires RNP 1 privileges must demonstrate competency on an appropriate RNP 1 procedure as part of the flight test. The flight test at Appendix II of this AC contains the RNP 1 standards acceptable to the Director. Pilots who demonstrate RNP 1 competency meet the requirements of, and may be issued with, RNP 2 and RNAV 1 privileges.~~

In accordance with Part 61.809, a pilot in command who had previously been certified competent in the use of a GNSS receiver under rule 19.205 is deemed to have met the requirements of rule 61.805(b)(3) and may carry out an instrument approach procedure under IFR using that GNSS receiver.

Prior to exercising the privileges of the IR on an alternative make of GNSS receiver, a pilot is required to demonstrate competence in an aircraft or an approved simulator.

Note: *It is possible to be qualified for a range of GNSS receivers. Before exercising the privilege of an IR, it is the responsibility of the pilot in command to ensure they are sufficiently current on the applicable unit.*

Flight examiners may continue to flight test in accordance with the instrument examiner privileges they hold and in accordance with the above.

The following logbook format may be used:

I hereby certify that _____has demonstrated competence in the use of _____(make) GNSS Receiver for use under IFR.

[1] **RNP APCH** approaches [currently identified as "RNAV (GNSS)"]

*Examiner*_____
Client ID _____ *Date*_____

Rule 61.807 Currency Requirements

~~A demonstration of competency required by rule 61.807(a)(1) generally consists of items detailed in Appendix II of this AC. However, as set out above, a successful demonstration of competence in a technically enhanced aircraft is only valid for use in a technically enhanced aircraft.~~

~~EXCEPT:~~

~~(i) Pilots who meet the IFR operational requirements of Part 119 in a non-TEA and hold a current IR in a TEA may exercise IR privileges in either configuration.~~

~~(ii) Similarly, pilots who meet the IFR operational requirements of Part 119 in a TEA **and** hold a current IR in a non-TEA may exercise IR privileges in either configuration.~~

~~(iii) In addition, a current flight examiner who holds the examiner privilege of IR renewal may, at their discretion, also exercise the privileges in either configuration provided both the examiner rating and IR are current.~~

~~A successful demonstration of competence in a single engine or centre line thrust aircraft is only valid for use in a single engine or centre line thrust aircraft.~~

~~A successful demonstration of competence in a multi-engine or centre line thrust aircraft would meet the requirements of a single engine demonstration provided that both the multi-engine and single engine (or centre line thrust) aircraft are conventional or both aircraft conform with the definition of a TEA.~~

~~**Definition – technically enhanced aircraft (TEA)**~~

~~A technically enhanced aircraft (TEA) is defined as an aircraft approved for IFR flight in which the primary flight instruments and navigation information are displayed electronically, by an integrated system that has been certified at TSO level, and is capable of displaying critical information about an aircraft's flight path, situation, position, and progress.~~

The annual IRT is completed by a demonstration of competency required by rule 61.807(a)(1) utilising the Instrument Rating Flight Test Standards Guide and syllabus located in Appendix II of this AC. If the candidate is conducting IFR operations under the authority of an air operator certificate issued under Part 119, then competency is assessed in accordance with the appropriate Rule Part 121, 125 or 135.

Instrument-rated pilots are also required to maintain ongoing IR currency by completing at least three hours' instrument time (which must include at least one hour of instrument flight time) and three published instrument approach procedures within the preceding 90 days.

General guidance

The three instrument approach procedures ~~approaches~~ required by rule 61.807(a)(2)(i) and (ii) may be completed in actual or simulated conditions, ~~be the same approach type~~ and be the same instrument approach procedure (2D or 3D). One approach may be carried out in a synthetic flight trainer approved for that purpose.

For the purpose of meeting this currency requirement, an 'approach' is one that conforms with the published approach procedure and includes flight under actual or simulated conditions to include at least the final leg of the approach procedure to the missed approach point or minimum descent altitude (MDA).

The number and type of approach procedure carried out on each flight should be recorded in the pilot's logbook. Column 16 or 17 may be used for this purpose, for example: 1 x 2D IAP. ~~1xVOR.~~

Where a safety pilot is used for the purpose of simulated instrument flight, the safety pilot must meet the requirements of Part 91.125. To gain instrument flight experience towards the required instrument flight time for issue of recent experience requirements of an instrument rating, the safety pilot must also meet the requirements of Part 61.25(c). The name of the safety pilot~~'s name~~ should be entered in the pilot's logbook in the co-pilot column.

Similar navigation system

Rule 61.807(a)(4) allows for approach currency to be maintained by using a similar type of navigation system. While the rule does not define what type of navigation systems are similar, ~~VOR, NDB, LLZ, and GNSS are generally regarded as similar types of navigation systems~~ a 2D or 3D instrument approach conducted in accordance with a published approach procedure are regarded as similar types of navigation systems, as follows:

- A 2D instrument approach procedure (IAP) utilises instrument displays that provide only lateral (directional) navigation information; for example, VOR**,** NDB, LLZ RNP APCH-LNAV (RNAV/GNSS) and *RNP APCH-LP (WAAS required)*.
- A 3D IAP utilises instrument displays that provide both lateral and vertical navigation information; for example, ILS, *MLS, GLS*, RNP APCH-LNAV/VNAV (Baro) and *RNP APCH-LPV*.

***Note:** The **italicised approaches** indicate the PBN operational approvals that may be issued to support international operations but are not yet implemented in the NZ FIR.*

Co-pilots

Rule 61.807(a)(1) and (2) for co-pilots. Instrument rating holders acting as co-pilot in a multi-pilot ~~two-pilot~~ crew may not credit instrument time toward the currency requirement of rule 61.807(a)(2) unless the aircraft's type certificate, flight manual, ~~or~~ operating rule or the operators' approved operating procedure/s, requires that the aircraft be operated by a multi-pilot ~~two-pilot~~ crew and; in accordance with rule 61.31(c), the co-pilot is manipulating the controls during actual or simulated instrument conditions.

Pilots operating under Part 119

For a pilot conducting IFR operations in accordance with Part 121, ~~or~~ 125 or 135 under the authority of a Part 119 air operator certificate the following would meet the requirements of rule 61.807(a)(5):

(i) A satisfactory demonstration of competency required in accordance with rule 61.801(a)(6), each element of which may be spread over the immediately preceding 12 months.

(ii) The certificate holder is authorised in accordance with rules 119.13(b)(3), 121.603,125.603 or ~~rule125.603~~ 135.603 (as appropriate).

(iii) The pilot is the 'handling pilot' and is flying as if they were pilot-in-command during the demonstration of each element required by rule 61.801(a)(6).

(iv) The demonstration of competence is conducted by a flight examiner meeting the requirements of rule 121.607 or rule 125.607 or 135.607 ~~121.583 or rule 125.605~~ (as appropriate).

Note: *Rule 61.807(a)(5) is an option instead of 61.807(a)(4) for currency that is only available for a pilot operating under Part 121, 125, or 135 for a Part 119 AOC holder.*

The aircraft type meets the requirements of rule 119.153(a)(1) or (a)(2) as appropriate or in the case of a flight simulator is approved for the purpose under rule 121.11.

Logbook endorsement

The following format may be used to certify the successful demonstration of competency required by rule 61.807(a)(1)(ii):

I hereby certify that _____ has successfully demonstrated competency in accordance with the instrument rating flight test syllabus in an analogue/EFIS equipped aircraft, centreline-thrust/multi-engine/single-engine aeroplane/helicopter to single-pilot/multi-pilot standard (delete as applicable).

Instrument Approach Procedures demonstrated 2D / 3D (delete as applicable)

Annual currency demonstration due_____ (day/month/year).
Examiner_____
Client ID _____ Date _____

~~*I hereby certify that _____ has successfully demonstrated competency in accordance with the instrument rating flight test syllabus in a conventional/technically-enhanced (TEA) aircraft, centreline-thrust/multi-engine/single-engine aeroplane/helicopter to single-pilot/two-pilot standard.*~~

~~*Annual currency demonstration due (day/month/year).*~~
~~*Examiner_____*~~
~~*Client ID _____ Date _____*~~

Appendix I Instrument Rating Written Examination Syllabuses

Air Law Syllabus Matrix:

Sub-Heading	**PPL**	**CPL**	**IR**	**ATPL(A)**	**ATPL(H)**
	Subject # 4	**Subject # 16**	**Subject # 52**	**Subject # 36**	**Subject # 37**
General					
Aviation Legislation	4.2	16.2	52.2	36.2	37.2
Definitions	4.4	16.4	52.4	36.4	37.4
Abbreviations	4.6	16.6	52.6	36.6	37.6
Personnel Licensing					
Requirements for Licences and Ratings	4.10	16.10	52.10	36.10	37.10
Eligibility, Privileges and Limitations	4.12	16.12	52.12	36.12	37.12
Competency, Currency and Recency	4.14	16.14	52.14	36.14	37.14
Medical Requirements	4.16	16.16	52.16	36.16	37.16
Airworthiness of Aircraft and Aircraft Equipment					
Documentation	4.20	16.20	52.20	36.20	37.20
Aircraft Maintenance	4.22	16.22	52.22	36.22	37.22
Instruments and Avionics	4.24	16.24	52.24	36.24	37.24
Equipment	4.26	16.26	52.26	36.26	37.26
General Operating and Flight Rules					
General Operating Requirements	4.30	16.30	52.30	36.30	37.30
General Operating Restrictions	4.32	16.32	52.32	36.32	37.32
General Meteorological Requirements and Restrictions	4.34	16.34			37.34

Carriage of Dangerous Goods	4.36	16.36		36.36	37.36
Helicopter External Load Operations		16.38			37.38
Air Operations					
Air Operations Crew Requirements		16.40		36.40	37.40
Air Operations Requirements and Restrictions		16.42		36.42	37.42
Air Operations Meteorological Requirements and Restrictions		16.44		36.44	37.44
Air Operations Performance Requirements		16.46		36.46	37.46
Air Operations Weight and Balance Requirements					37.48
Flight Planning and Preparation					
Flight Preparation	4.50	16.50	52.50	36.50	37.50
Alternate Requirements			52.52	36.52	37.52
Fuel Requirements	4.54	16.54	52.54	36.54	37.54
Flight Plans	4.56	16.56	52.56	36.56	37.56
En route Limitations		16.58		36.58	
Air Traffic Services					
Communications	4.60	16.60	52.60	36.60	37.60
Clearances	4.62	16.62	52.62	36.62	37.62
Separation	4.63	16.63	52.63	36.63	37.63
Terrain Clearance			52.64	36.64	37.64
Weather Avoidance			52.65	36.65	37.65
Radar Services	4.66	16.66	52.66	36.66	37.66
Oceanic Procedures				36.67	

~~Global Navigation Satellite System~~		~~16.68~~	~~52.68~~	~~36.68~~	~~37.68~~
Performance Based Navigation			52.68	36.68	37.68
Airspace; Aerodromes; and Heliports					
Altimetry	4.70	16.70	52.70	36.70	37.70
Cruising Levels	4.72	16.72	52.72	36.72	37.72
Transponders	4.74	16.74	52.74	36.74	37.74
Airspace	4.75	16.75	52.75	36.75	37.75
Aerodromes and Heliports	4.76	16.76	52.76	36.76	37.76
Aerodrome Lighting	4.78	16.78	52.78	36.78	37.78
Emergencies; Incidents; and Accidents					
Responsibilities of Operators and Pilots	4.80	16.80		36.80	37.80
Communications and Equipment	4.82	16.82	52.82	36.82	37.82
Instrument Departures and Approaches					
Departure Procedures			52.90	36.90	37.90
Holding Procedures			52.92	36.92	37.92
Approach Procedures			52.94	36.94	37.94
Communications and Navigation Aid Failure			52.96	36.96	37.96

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;
	(r) ATC instruction;
	(s) AWIB service;
	(t) barometric vertical navigation (baro-VNAV); AIP GEN
	(u) Category II precision approach procedure;
	(v) ceiling;

Sub Topic	Syllabus Item	
	(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;
	(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;

Sub Topic	Syllabus Item	
	(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;
	(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;

Sub Topic	Syllabus Item	
	(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)
	(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;

Sub Topic	Syllabus Item
	(ww) TF; (AC91-21)
	(xx) TSE; (AC91-21)
	(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**
52.10.2	State the requirements for holding a pilot's licence. CAR 61
52.10.4	State the requirements for a pilot-in-command to hold a type rating on the type of aircraft being flown. CAR 61
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
52.12.4	State the eligibility requirements for the issue of an instrument rating. CAR 61
52.12.6	State the privileges of holding an instrument rating. CAR 61
52.12.8	State the limitations on the holder of an instrument rating. CAR 61
52.12.10	State the qualification requirements for carrying out various types of instrument approach. CAR 61
52.14	**Competency, Currency and Recency**
52.14.2	State the currency requirements of a pilot who is the holder of an instrument rating CAR 61.
52.14.4	State the currency requirements for carrying out an instrument approach. CAR 61
52.16	**Medical Requirements**
52.16.2	State the hearing standard required for the holder of an instrument rating. CAR 61
	Airworthiness of Aircraft and Aircraft Equipment
52.20	**Documentation**
52.20.2	State the documents which must be carried in aircraft operated in New Zealand. CAR 91
52.22	**Aircraft Maintenance**
52.22.2	State the inspection period for radios. CAR 91

Sub Topic	Syllabus Item
52.22.4	State the inspection period for altimeters. CAR 91
52.22.6	State the inspection period for transponders. CAR 91
52.22.8	State the inspection period for the ELT. CAR 91
52.24	**Instruments and Avionics**
52.24.2	State the minimum instrument requirements for an IFR flight. CAR 91
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
52.26	**Equipment**
52.26.2	State the equipment requirements for an IFR flight. CAR 91
52.26.4	State the requirements for indicating the time in flight. CAR 91
52.26.6	State the requirements for night flight. CAR 91
52.26.8	Explain the requirement for altitude alerting/assigned altitude indicating. CAR 91
52.26.10	State the requirements for an ELT. CAR 91
	General Operating and Flight Rules
52.30	**General Operating Requirements**
52.30.2	State the requirements for operating an aircraft in simulated instrument flight. CAR 91
52.30.4	State the requirements for carrying appropriate aeronautical publications and charts in flight. CAR 91
52.30.6	State the requirements for the maintenance of an en route track. CAR 91
52.30.8	State the requirements for IFR cruising altitude or flight level. CAR 91
52.32	**General Operating Restrictions**
52.32.2	State the restrictions on the use of portable electronic devices in flight. CAR 91
52.32.4	State the speed limitations on aircraft operating under IFR. CAR 91
52.32.6	State the restrictions when operating IFR in icing conditions. CAR 91
52.32.8	State the minimum altitudes for IFR flight. CAR 91
	Flight Planning and Preparation
52.50	**Flight Preparation**
52.50.2	Explain the requirements for obtaining and considering relevant information prior to flight. CAR 91
52.50.4	Describe the publications and their content that provide operational route and aerodrome information.
52.50.6	Derive operational information from charts and publications that provide route, approach and aerodrome information.
52.52	**Alternate Requirements**

Sub Topic	Syllabus Item
52.52.2	State the meteorological minima at destination which would require an alternate to be nominated. CAR 91
52.52.4	Determine the meteorological minima required at an aerodrome for it to be nominated as an IFR alternate. CAR 91
52.52.6	State the power supply requirements for the selection of an aerodrome as an alternate on an IFR air operation. CAR 91
52.52.8	State the reference datum for take-off meteorological minima for IFR operations. CAR 91
52.52.10	State the reference datum for landing meteorological minima for IFR operations. CAR 91
52.52.12	State the reference datum for alternate meteorological minima for IFR operations. AIP ENR
52.54	**Fuel Requirements**
52.54.2	State the fuel reserve required for an IFR flight in a non-turbine-powered aeroplane. CAR 91
52.54.4	State the fuel reserve required for an IFR flight in a turbine-powered aeroplane or a helicopter. CAR 91
52.56	**Flight Plans**
52.56.2	State the requirements for the filing of a flight plan for flight under IFR. CAR 91
52.56.4	State the notification lead time for filing an IFR flight plan. CAR 91 & AIP ENR
52.56.6	State the requirements for adhering to an IFR flight plan. CAR 91
52.56.8	State the requirements for the notification of changes to a filed IFR flight plan. CAR 91
52.56.10	State the requirements for an inadvertent departure from an IFR flight plan. CAR 91
52.56.12	State the requirements for the terminating an IFR flight plan at an aerodrome without ATS. CAR 91
	Air Traffic Services
52.60	**Communications**
52.60.2	Derive from operational publications, the required radio frequency for communicating with specified ATC units.
52.60.4	State the requirements for making position reports to an ATS unit. CAR 91 & AIP ENR
52.60.6	State the contents of various IFR position reports. AIP ENR
52.60.8	State the purpose of Universal Communications Services (UNICOM). AIP GEN
52.60.10	State the purpose of an Aerodrome Frequency Response Unit (AFRU). AIP GEN
52.60.12	State the purpose of Aerodrome and Weather Information Broadcasts (AWIB). AIP GEN
52.60.14	State the meaning of the various light signals from a control tower. CAR 91 & AIP AD
52.60.16	State the communications requirements when TIBA procedures are in force. AIP ENR
52.62	**Clearances**

Sub Topic	Syllabus Item
52.62.2	State the requirements for complying with ATC clearances and instructions. CAR 91 & AIP ENR
52.62.4	State the requirements for coordinating with an aerodrome flight information service. CAR 91
52.62.6	State the requirements for receiving an ATC clearance prior to entering various types of airspace, and ground manoeuvring area. CAR 91 & AIP ENR
52.62.8	State the requirements for receiving an ATC clearance prior to re-entering controlled airspace. CAR 91 & AIP ENR
52.63	**Separation**
52.63.2	Describe the situations where Air Traffic Control is responsible for the provision of separation between VFR, SVFR and IFR traffic. AIP ENR
52.63.4	Describe the situations where the pilot-in-command of an IFR flight is responsible for maintaining separation from other traffic. AIP ENR
52.63.6	Describe the normal separation standards applied by ATC. AIP ENR
52.63.8	Describe the situations where the normal separation may be reduced. AIP ENR
52.63.10	State the meaning of the term “Essential Traffic”. AIP ENR
52.63.12	State the conditions under which longitudinal separation between reciprocal track aircraft may be reduced. AIP ENR
52.63.14	State the minimum lateral and longitudinal separation between RNP10 aircraft, as permitted by ICAO Regional Supplementary procedures (Doc 7030). AIP ENR
52.63.16	State the deviation from an assigned indicated airspeed or Mach number and ETA outside of which pilots are required to notify ATC. CAR 91
52.63.18	State the wake turbulence separation requirements for light and medium aircraft. AIP AD
52.63.20	State the maximum airspeed below 10,000 feet. CAR 91
52.63.22	State the minimum descent height in IMC at an unattended aerodrome where traffic conflict may exist. AIP ENR
52.64	**Terrain Clearance**
52.64.2	Describe the determination of the minimum safe altitude for IFR flight. AIP GEN
52.64.4	Explain the coverage and use of VORSEC charts. AIP GEN
52.64.6	Explain the coverage and use of 25nm Minimum Sector Altitude diagrams. AIP GEN
52.64.8	State when the radar control service is responsible for the provision of terrain clearance. AIP ENR
52.64.10	Explain how radar control provides terrain clearance. AIP ENR
52.64.12	Describe the use of DME descent steps for maintaining terrain clearance during departure climb or descent for an approach. AIP GEN & ENR
52.65	**Weather Avoidance**
52.65.2	State the requirements for deviation off track for weather avoidance. AIP ENR
52.66	**Radar Services**

Sub Topic	Syllabus Item
52.66.2	Describe the radar services available to IFR flights. AIP ENR
52.66.4	Describe the responsibility of the radar controller to keep an aircraft within controlled airspace. AIP ENR
52.66.6	State the accuracy limits required when under radar speed control. AIP ENR
52.66.8	State the distance from touchdown that radar speed control can be maintained on an instrument and a visual approach. AIP ENR
52.66.10	State the meteorological and other conditions which allow a radar controller to vector an aircraft for a visual approach. AIP ENR
52.66.12	State the criteria for a radar controller to consider an unknown aircraft to be on a conflicting path with another aircraft. AIP ENR
52.68	**~~Global Navigation Satellite System~~ Performance Based Navigation**
~~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~~
52.68.2	Describe the requirements which a Part 91 operator must meet to conduct a PBN operation. AC91-21
~~52.68.4~~	~~State the meaning of a GPS "sole means navigation system". CAR 19~~
52.68.4	Describe the PBN Operational Approval Process. AC91-21
~~52.68.6~~	~~State the restriction on using GPS as a sole means navigation system under IFR in the New Zealand flight information region. CAR 19~~
52.68.6	Identify who is responsible for ensuring that electronic navigation data and equipment software is valid and updated for the equipment installation the PBN approval is based on. AC91-21
~~52.68.8~~	~~State the actions required of pilots, under IFR using GPS equipment as a primary means navigation system, if system degradation occurs. CAR 19~~
52.68.8	Identify who is responsible for ensuring that electronic navigation data and equipment software is valid and updated for the equipment installation the PBN approval is based on. AC91-21
52.68.10	Describe the minimum flight altitude for an aircraft operating under IFR using GPS equipment as a primary means navigation system. CAR 19.215
52.68.~~10~~12	State the requirements which must be met before a pilot of an aircraft operating within the New Zealand flight information region, under IFR, using GPS equipment as a primary means navigation system, is permitted random flight routing. CAR 19.217
~~52.68.12~~	~~State the requirements for carrying out an instrument approach using GPS equipment as a primary means navigation system. CAR 19~~
~~52.68.14~~	~~State the requirements for the nomination of an alternate if GPS is used as a primary means navigation system. CAR 19~~
52.68.14	Describe the contingency procedures required by aircraft within the New Zealand flight information region, in the event of loss of Primary Means of Navigation. CAR 91 and AC91-21 Appendix I
52.68.16	State the ICAO PBN specifications implemented in the NZ FIR, in each of the following phases of flight:

Sub Topic	Syllabus Item
	(a) Enroute Continental/Domestic;
	(b) Terminal;
	(c) Initial, Intermediate and Missed Approach; and,
	(d) Final Approach. AC91-21 Table 1
52.68.18	State the surveillance and communications requirements expected to apply in RNAV 2 in the enroute phase in the NZFIR. AC91-21 Table 2
52.68.20	State the navigation infrastructure required to support RNAV/RNP 2 in the enroute phase in the NZFIR. AC91-21 Table 2
56.68.22	State the CNS equipment requirements for operations in RNAV 2 enroute continental/domestic airspace in the NZFIR. AC91-21 Table 5
56.68.24	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
56.68.26	State the surveillance and communications requirements expected to apply in RNAV/RNP 1 in the terminal and approach phases in the NZFIR. AC91-21 Table 3
56.68.28	State the navigation infrastructure required to support RNAV/RNP 1 in the terminal and approach phases in the NZFIR. AC91-21 Table 3
56.68.30	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
56.68.32	State the Total System Error (TSE) permitted in the RNAV/RNP 1 PBN specification in the terminal and approach phases in the NZFIR. AC91-21 Table 3
56.68.34	State the limitation, during approach operations, on aircraft with advisory vertical navigation systems only. AC91-21
56.68.36	Describe the authorisation requirements applicable to RNP AR APCH procedures. AC91-21
56.68.38	State the surveillance and communications requirements expected to apply in RNP APCH in the approach phase in the NZFIR. AC91-21 Tables 4 and 5
56.68.40	State the navigation infrastructure required to support RNP APCH in the approach and missed approach phases in the NZFIR. AC91-21 Tables 4 and 5
56.68.42	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
56.68.44	State the Total System Error (TSE) permitted in the RNP APCH PBN specification in the approach and missed approach phases in the NZFIR. AC91-21 Table 4
	Airspace; Aerodromes; and Heliports
52.70	**Altimetry**
52.70.2	Explain the altimeter setting requirements for flight under IFR. CAR 91 & AIP ENR
52.70.4	State the procedure to use to obtain an altimeter setting when QNH is not available prior to take-off and the requirement to obtain a QNH once in flight. AIP ENR
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

Sub Topic	Syllabus Item
52.72	**Cruising Levels**
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
52.74	**Transponders**
52.74.2	State the requirements for the operation of transponders within the New Zealand FIR. CAR 91 & AIP ENR
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
52.74.8	State the requirements and limitations on an aircraft operating in transponder mandatory airspace without an operating transponder. CAR 91 & AIP ENR
52.75	**Airspace**
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
52.75.6	Describe the vertical limits and purpose of control areas (CTA). CAR 71
52.75.8	State the status and conditions relating to flight in VFR transit lanes. AIP ENR
52.75.10	Describe the status and purpose of a general aviation area (GAA), and state the process for IFR flights to transit through GAA airspace. CAR 91 & AIP ENR
52.75.12	Describe visual reporting points.
52.75.14	Describe the status of controlled airspace when ATC go off duty. AIP GEN
52.75.16	State the restrictions on operating an aircraft in a restricted area. CAR 91 & AIP ENR
52.75.18	State the restrictions on operating an aircraft in a military operational area (MOA). CAR 91 & AIP ENR
52.75.20	State the restrictions and operating considerations relating to operating an aircraft in a mandatory broadcast zone (MBZ). CAR 91 & AIP ENR
52.75.22	State the restrictions and operating considerations relating to operating an aircraft in a volcanic hazard area (VHA). CAR 91 & AIP ENR
52.75.24	State the restrictions and operating considerations relating to operating an aircraft in a danger area. CAR 91 & AIP ENR
52.75.26	State the restrictions and operating considerations relating to operating an aircraft in a parachute drop zone (PDZ). AIP ENR

Sub Topic	Syllabus Item
52.75.28	State the operating considerations relating to operating an aircraft in a common frequency zone (CFZ). AIP ENR
52.75.30	State the operating considerations relating to operating an aircraft over or close to temporary hazards/airspace. AIP ENR
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.
52.76	**Aerodromes and Heliports**
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
52.82.6	State the transponder code a pilot should set to indicate that the aircraft is being subjected to unlawful interference. AIP ENR

Sub Topic	Syllabus Item
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
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**

Sub Topic	Syllabus Item
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
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

Sub Topic	Syllabus Item
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 aeroplane or IFR equipped helicopter operating within the New Zealand Domestic 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.
53.106.8	Define:
	(a) QFE;
	(b) QNH;

Sub Topic	Syllabus Item
	(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:
	(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;

Sub Topic	Syllabus Item
	(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.
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;

Sub Topic	Syllabus Item
	(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,
	(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.

Sub Topic	Syllabus Item
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); (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.

Sub Topic	Syllabus Item
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: (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.

Sub Topic	Syllabus Item
	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.
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.

Sub Topic	Syllabus Item
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.
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.

Sub Topic	Syllabus Item
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;
	(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;

Sub Topic	Syllabus Item
	(b) shape/recognition by touch;
	(c) location;
	(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 ~~a multi engine turbine air transport type 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. ~~(j) QNH;~~ ~~(k) QFE.~~
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 Minimum (RVSM).
54.12.14	Describe the extent of RVSM airspace.
54.12.16	Explain the requirements for operating in RVSM airspace.
	Aeronautical Charts
54.22	**Properties and Principles**
54.22.2	List the aeronautical charts used in New Zealand for operations under IFR.

Sub Topic	Syllabus Item
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.
~~54.22.8~~	~~Interpret information published on aerodrome Instrument Approach charts.~~
~~54.22.10~~	~~Demonstrate proficiency in determining distances on IFR enroute charts using the linear scales printed separately on the charts, and using the latitude scale along meridians.~~
~~54.22.12~~	
~~54.22.14~~	~~Describe how magnetic tracks and distance are presented on enroute charts.~~
~~54.22.16~~	~~Define and plot a great circle and rhumb line on an appropriate chart.~~
	~~Explain the function of the International date line~~
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.
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,

Sub Topic	Syllabus Item
	(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;
	(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.
~~54.26~~	~~**Chart Reading**~~

Sub Topic	Syllabus Item
~~54.26.2~~	~~Using a protractor, describe how non-published magnetic tracks can be drawn on enroute charts.~~
~~54.26.4~~	~~Describe how to identify, on appropriate enroute charts;~~
	~~(a) different airspace classes and types;~~
	~~(b) airspace boundaries;~~
	~~(c) airspace vertical limits;~~
~~54.26.6~~	~~(d) airspace controlling authority.~~
	~~With regard to the World Geodetic System 1984 (WGS 84) datum, state:~~
	~~(a) where this datum is published;~~
~~54.26.8~~	~~(b) the abbreviation used to denote the datum;~~
	~~Describe the information contained in the following charts, tables and diagrams published in the AIPNZ VOL 2 & 3, and explain compliance procedures associated with:~~
	~~(a) VOR/DME MRA Sector charts;~~
	~~(b) 25 DME Minimum Sector Altitude diagrams;~~
	~~(c) Standard Instrument Departure (SID) diagrams;~~
	~~(d) visual arrival charts;~~
	~~(e) Standard Arrival Route (STAR) charts;~~
	~~(f) ground movement charts;~~
	~~(g) instrument T/O procedure chart – rate of climb table;~~
	~~(h) IFR alternate aerodrome minima table.~~
	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).

Sub Topic	Syllabus Item
~~54.40.4~~	~~Define:~~
	~~(a) point of no return (PNR);~~
	~~(b) equi-time point (ETP).~~
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;
	(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.
	~~(n) time and distance to the point of no return (PNR);~~
	~~(o) time and distance to the qui-time point (ETP);~~
	~~(p) SARTIME.~~
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.

Sub Topic	Syllabus Item
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, (f) calculate the track miles flown on a segment of a DME arc. ~~Interpret meteorological information for IFR take-off minima.~~
54.52.8	Based on information derived from currently used VOR and DME displays, and from GNSS instrumentation: ~~describe , determine or calculate~~ (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.
~~**54.54**~~	~~**Chart Plotting**~~
~~54.54.2~~	~~Describe the principles involved in obtaining an accurate fix.~~
~~54.54.4~~	~~Describe the information that should be displayed by ADF/VOR/DME instrumentation to confirm position in relation to:~~ ~~(a) a navigation aid or aids; or~~

Sub Topic	Syllabus Item
	~~(b) a magnetic track.~~
~~54.54.6~~	~~Locate a position on a chart:~~
	~~(a) from an NDB given magnetic direction to and from;~~
	~~(b) from a VOR given radial and DME distance;~~
	~~(c) from a pair of NDB tracks or VOR radials.~~
~~54.54.8~~	~~Calculate the distance from a VOR/NDB, given track, groundspeed and two VOR/NDB radial/bearing fixes.~~
~~54.54.10~~	~~Calculate the lateral distance off track, given track error and distance from navaid:~~
~~54.54.12~~	~~Using the transfer of position lines procedure (˚M), determine a new position, given:~~
	~~(a) an initial position;~~
	~~(b) a track required from that position;~~
	~~(c) a magnetic heading, or information to determine a magnetic heading;~~
	~~(d) a TAS, or information to determine TAS;~~
	~~(e) distance(s), or information to determine distance(s);~~
	~~(f) ADF,VOR and/or DME information at specific times to calculate and plot position lines.~~
	~~***Note:** The new position may be required to be expressed in terms of lat/long, or as a bearing and distance from or to a navigation aid.~~
~~54.54.14~~	~~Having established a new position using the transfer or position line procedure, calculate or determine any or all of the following:~~
	~~(a) drift;~~
	~~(b) track error;~~
	~~(c) wind velocity;~~
	~~(d) correction to heading to make good a point or track;~~
	~~(e) estimated time of arrival at point of track.~~
~~**54.56**~~	~~**Chart Reading**~~
~~54.56.2~~	~~Determine:~~
	~~(a) the type or class of airspace in which an IFR flight is operating;~~
~~54.56.4~~	~~(b) ATC aspects when operating IFR in controlled and uncontrolled airspace.~~
	~~Interpret meteorological information for IFR approach minima.~~
~~54.56.6~~	~~Interpret, describe and explain the procedures involved during precision and non-precision instrument approaches.~~
~~54.56.8~~	~~Describe the procedures associated with published missed approaches.~~
~~**54.58**~~	~~**En route Diversion Calculations**~~
~~54.58.2~~	~~Calculate en route:~~
	~~(a) time and distance to the point of no return (PNR) ;~~

Sub Topic	Syllabus Item
	~~(b) time and distance to the equi-time point (ETP).~~
	~~**Radio Aids**~~
~~**54.64**~~	~~**Automatic Direction Finder (ADF)**~~
~~54.64.2~~	~~Describe the presentation and function of the ADF needle on a fixed card, rotatable card and RMI indicator.~~
~~54.64.4~~	
~~54.64.6~~	~~Describe the purpose of each control on the ADF control panel.~~
~~54.64.8~~	~~List the publications and charts that show NDB callsigns and frequencies.~~
~~54.64.10~~	~~Explain why it is important to check the NDB ident before using an NDB.~~
~~54.64.12~~	~~Explain what is meant by relative bearing.~~
	~~Given an aircraft magnetic heading and a relative bearing, or an RMI presentation calculate:~~
	~~(a) magnetic bearing to an NDB;~~
	~~(b) magnetic bearing from an NDB.~~
~~54.64.14~~	~~Describe the track followed by an aircraft experiencing a crosswind when the ADF needle is kept on the 360°R position.~~
~~54.64.16~~	
	~~Explain how the ADF can be used to maintain track with drift correction applied:~~
	~~(a) when tracking to an NDB;~~
~~54.64.18~~	~~(b) when tracking away from an NDB.~~
~~54.64.20~~	~~Identify aircraft position relative to NDB or multiple NDB's.~~
	~~Describe the limitations associated with NDB navigation.~~
~~**54.66**~~	~~**VOR**~~
~~54.66.2~~	~~Describe the presentation and function of the VOR CDI on a fixed card, rotatable card and a HSI indicator.~~
~~54.66.4~~	
~~54.66.6~~	~~Explain the importance of station identification before using the VOR.~~
~~54.66.8~~	~~List the publications and charts that show VOR callsigns and frequencies.~~
~~54.66.10~~	~~Describe what is meant by a (VOR) radial.~~
	~~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;~~
	~~(c) maintain a required track from a VOR station.~~
~~54.66.12~~	~~State 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;~~
	~~(b) more than 90° apart.~~
~~54.66.14~~	~~State the orientation of the CDI while maintaining the required radial when drift correction is being applied.~~
~~54.66.16~~	

Sub Topic	Syllabus Item
~~54.66.18~~	~~Identify aircraft position relative to a VOR station or stations.~~
~~**54.68**~~	~~Describe the limitations associated with VOR navigation.~~
~~54.68.2~~	~~**Distance Measuring Equipment (DME)**~~
~~54.68.4~~	~~State the primary functions of the DME.~~
~~54.68.6~~	~~Describe current DME presentations.~~
~~54.68.8~~	~~Explain the importance of station identification before using the DME.~~
~~54.68.10~~	~~Explain how to engage the DME:~~ ~~(a) when the aid is coupled to a VOR;~~ ~~(b) when the aid is not coupled to a VOR.~~ ~~Describe the limitations associated with DME navigation.~~
~~**54.70**~~	~~**GNSS**~~
~~54.70.2~~	~~**GNSS Global Navigation Satellite System (GNSS)**~~
~~54.70.4~~	~~List the common GNSS reference systems used and the significance of using the correct system.~~
~~54.70.6~~	~~Explain the significance of RAIM predictions~~ ~~State the factors influencing GNSS dependability including;~~ ~~(a) data base validity;~~ ~~(b) pilot data input;~~ ~~(c) GNSS/aircraft system integration.~~

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 ~~instrument rating~~ level.

56.2	**Pressure Instruments**
56.2.2	Define: ~~and distinguish between the following:~~ (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.

~~(b) distinguish between separate pitot probe/static vents, and a combined pitot-static probe;~~

~~(d) state the precautions to be taken with pitot heat and pitot covers.~~

~~52.2.6~~ ~~Describe position error~~

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

~~56.2.8~~ ~~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) state the errors affecting the ASI;~~

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

~~(f) state the serviceability checks.~~

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

56.2.12 With respect to the ~~altimeter~~ 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;
~~describe the use of the altimeter settings QNH, QFE and QNE;~~

(c) state the relationship between indicated, calibrated, equivalent and true airspeeds (IAS, CAS, EAS and TAS);
~~describe the errors affecting the instrument;~~

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

(e) state the serviceability checks.

~~56.2.12~~ ~~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.~~

56.2.14 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.

~~56.4.4~~ ~~Define the four classes of gyroscope (space, tied, earth, and rate).~~

~~56.4.6~~ ~~Describe, and make a comparison between pneumatic and electrical gyroscopic instrument power sources.~~

~~56.4.8~~ ~~Describe, and differentiate between real and apparent wander.~~

~~56.4.10~~ ~~With respect to the turn indicator/turn coordinator and, where appropriate, with the aid of diagrams:~~

~~(a) differentiate between the instrument presentations;~~

~~(b) explain the basic principle of operation;~~

~~(c) describe the errors affecting the instrument;~~

~~(d) explain the principle and use of the coordination ball; and,~~

~~(e) state the serviceability checks.~~

~~56.4.12~~ ~~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) describe the errors affecting the instrument (including apparent drift); and,~~

~~(c) state the serviceability checks.~~

~~56.4.14~~ ~~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);~~

~~(b) describe the operation and function of the pendulous unit;~~

~~(c) describe the operation and function of the torque motor/levelling switch erection systems;~~

~~(d) describe the errors affecting the instrument; and,~~

~~(e) state the typical limits in freedom.~~

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.

~~56.6.2~~ ~~Describe the earth's magnetic field and describe:~~

~~(a) magnetic dip, and components H and Z; and,~~

~~(b) variation.~~

~~56.6.4~~ ~~With respect to direct-reading magnetic compasses and, where appropriate, with the aid of diagrams:~~

~~(a) explain how dip is compensated for;~~

~~(b) explain acceleration and turning error;~~

~~(c) define deviation; state how it is compensated for, and how correction can be made for residual deviation; and~~

~~(d) state the serviceability checks.~~

~~56.6.6~~ ~~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.

~~56.8.2~~ ~~Describe the basic features of electromagnetic radiation.~~

~~56.8.4~~ ~~Describe where radio waves exist within the electromagnetic spectrum.~~

~~56.8.6~~ ~~With respect to radio waves and, where appropriate, with the aid of diagrams define:~~

~~(a) cycle;~~

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

~~(c) wavelength, and explain how it is related to frequency;~~

~~(d) amplitude;~~

~~(e) attenuation;~~

~~(f) phase; and,~~

~~(g) phase difference.~~

~~Calculate frequency, given wavelength.~~

~~56.8.8~~

~~Calculate wavelength, given frequency.~~

~~56.8.10~~

~~Describe polarisation of a radio signal and its relationship to the orientation of~~

~~56.8.12~~ ~~transmission and receiving aerials.~~

~~Explain modulation of a carrier wave, and with the aid of diagrams, distinguish~~

~~56.8.14~~ ~~between amplitude modulation (AM) and frequency modulation (FM).~~

~~State the relative advantages and disadvantages of AM and FM.~~

~~56.8.16~~

~~Describe single sideband (SSB) and state the advantages and disadvantages in its~~

~~56.8.18~~ ~~use.~~

~~Describe the following types of radio wave propagation:~~

~~56.8.20~~

~~(a) surface waves, and the effect of diffraction (scattering) and wave tilting;~~

~~(b) sky waves, including the effect of frequency, critical angle, skip distance and dead spaces; and,~~

~~(c) direct waves, and the rule-of-thumb formula for calculating maximum range of reception.~~

~~Briefly describe the effects of static and atmospheric attenuation.~~

~~56.8.22~~

~~Explain the relationship between frequency and refraction in the ionosphere.~~

~~56.8.24~~

~~Describe the changes to the height of the ionosphere at night and the effect of~~

~~56.8.26~~ ~~this change on the optimum useable HF frequencies.~~

~~Explain the optimum useable frequency of an HF signal.~~

~~56.8.28~~

56.10 Primary Surveillance Radar (PSR)

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

~~a) the frequency bands/wavelengths typically used; and,~~

~~(b) 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.

~~56.10.8 Explain the factors which effect the minimum and maximum range of a primary radar system.~~

~~56.10.10 Describe the limitations in the operational use of PSR.~~

56.12 Secondary Surveillance Radar (SSR)

56.12.2 Explain the principle of operation of SSR.

~~56.12.4 Distinguish between primary surveillance radar (PSR) and secondary surveillance radar (SSR)~~.

~~56.12.6 Describe the advantages and disadvantages of SSR over PSR~~.

56.12.~~8~~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.

~~56.12.10 State the maximum operational range of the SSR system in New Zealand.~~

56.14 Transponders

56.14.2 ~~Distinguish between Mode A and Mode C transmissions from a transponder, and~~ 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~~ ~~State the frequency band used in an airborne weather radar, and explain why this band is used~~

56.16.~~6~~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.~~8~~6 Interpret the indications from a weather radar, in its various modes.

56.16.~~10~~8 Describe the weather radar return strengths of various types of precipitation.

~~56.16.12~~ ~~Describe the advantages of a narrow beam in a primary pulsed radar system.~~

~~56.16.14~~ ~~Explain the advantages of Doppler Weather Radar.~~

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.~~16~~18 Describe the means available for remote control of lighting other than PAL.

56.20 ~~NDB and ADF~~ Reserved

~~56.20.2 Describe the basic features of a non directional beacon (NDB), including:~~

~~(a) the range of frequencies usually employed;~~

~~(b) the factors affecting operational range; and,~~

~~(c) typical name, frequency, identification and location details.~~

~~56.20.4 Describe the basic components of an aircraft automatic direction finder (ADF).~~

~~56.20.6 Explain the basic principles of loop direction finding, including the:~~

~~(a) generation of maximum and null signals in different loop positions;~~

~~(b) use of polar diagrams;~~

~~(c) application of a sense aerial to resolve ambiguity; and,~~

~~(d) automatic seeking of the null position (hence ADF).~~

~~56.20.8 Describe the basic principle of operation of a fixed loop, and state the advantages a fixed versus rotating loop.~~

~~56.20.10 State the importance, when tuning an NDB, of making a positive identification of the station tuned, and of checking proper functioning of the ADF.~~

~~56.20.12 Describe the function of the controls on a typical ADF control panel, including:~~

~~(a) ANT (or REC or VOICE) mode;~~

~~(b) ADF (or COMP) mode;~~

~~(c) TEST mode;~~

~~(d) BFO (or CW); and,~~

~~(e) the LOOP position, where fitted.~~

~~56.20.14 Given suitable diagrams of instrument presentation, describe the use of a relative bearing indicator (RBI), a rotatable card ADF, and a radio magnetic indicator to determine:~~

~~(a) magnetic bearing to an NDB (orientation);~~

~~(b) position in relation to required track to/from an NDB;~~

~~(c) interception of a required track to/from an NDB; and,~~

~~(d) station passage.~~

~~Explain the following factors which affect the accuracy of ADF indications:~~

~~(a) night effect;~~

~~56.20.16~~ ~~(b) coastal refraction;~~

~~(c) mountain effect; and,~~

~~(d) precipitation static and thunderstorms.~~

VOR

56.22

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~~ ~~Given suitable diagrams, explain the operation of a typical VOR indicator, including:~~

~~(a) radials, and the use of the omni-bearing selector (OBS);~~

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

~~(c) the TO/FROM indicator.~~

~~56.22.6~~ ~~Given suitable diagrams of VOR presentation (including RMI and HSI presentation), demonstrate its use for:~~

~~(a) orientation;~~

~~(b) crossing a radial and station passing;~~

~~(c) maintaining track on a radial; and,~~

~~(d) intercepting radials inbound and outbound.~~

~~56.22.8~~ ~~Discuss the factors affecting range and accuracy of VOR, including:~~

~~(a) maximum range, published route operating limitations; and,~~

~~(b) errors, particularly terrain effect error with "scalloping" and "radial bending".~~

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.~~2~~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.~~4~~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.

~~(f) tuning a VORTAC frequency.~~

56.24.~~6~~12 Explain ~~and calculate~~ the following:

(a) DME design maximum range; and,

~~(b) expected maximum range at different altitudes; and,~~

~~(c)~~(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.

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

~~(a) localiser principles; standard rated coverage, and CDI indication;~~

~~(b) glideslope principles; angle, and indication; and,~~

~~(c) marker beacons, indication of passage.~~

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 ~~above threshold for~~ 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 ~~State~~ Describe the three main segments of the GNSS (GPS) system.

~~56.28.4 Describe the GNSS satellite constellation including:~~

~~(a) frequency used for transmissions;~~

~~(b) types of pseudo-random code;~~

~~(c) GNSS time reference;~~

~~(d) ephemeris;~~

~~(e) almanac.~~

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) elimination of clock error;~~

(b) the operation of RAIM;

~~(d) PDOP/GDOP;~~

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

(d) barometric aiding.

~~(e) receiver masking function~~

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. ~~with and without selective availability applied.~~

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) ~~the~~ 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.

~~Explain the principle of operation of Differential GPS (DGPS).~~

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.

Appendix II Instrument Rating Flight Test Syllabus

Flight test conduct

This flight test is conducted in accordance with the Flight Test Standards Guide Instrument Rating (A) or (H).

The use of checklists is mandatory for the purpose of instrument rating issue or currency demonstrations.

Demonstrations of GNSS, NDB and VOR tracking, holding and approach procedures should be carried out individually (without the benefit of any other aid).

For single pilot privileges, the flight examiner will examine the ability of the candidate to competently perform all normal and emergency phases of flight without autopilot use or any form of assistance from the examiner.

The extent to which autopilot use is permitted throughout the remainder of the flight test is at the examiner's discretion. If the aircraft is fitted with a suitable autopilot the flight examiner may require the candidate to fully utilise the autopilot during at least one approach.

If the flight examiner deems it necessary, in the interests of safety, to intervene with any physical action, then the test will result in mandatory failure.

Unless otherwise stated all manoeuvres and procedures are to be performed having recourse to all available instruments. ~~The applicant may demonstrate competence either using a co-pilot or as a single-pilot.~~

~~It is expected that crewing of the aircraft will be in accordance with its flight manual. However, if an applicant elects to operate with two crew in a single-pilot certificated aircraft, or the test is conducted in a multi-crew certificated aircraft, the candidate will be expected to demonstrate proper management of the co-pilot. In this case the flight examiner or a suitably rated co-pilot will act as a co-pilot.~~

An IRFT conducted ~~instrument rating issue flight test taken~~ as single pilot, will be one in which the candidate is to carry out all the pilot duties relating to that flight. If any assistance in the form of oral advice is necessary from the flight examiner during the issue flight test, then the test will result in mandatory failure.

~~If any assistance in the form of oral advice is necessary from the flight examiner during a currency demonstration, then at the discretion of the flight examiner and with the candidate's consent, the currency demonstration *may* be continued as a two pilot flight test with the examiner acting as co-pilot.~~

Where the examiner carries out the duties of the co-pilot, for the purpose of a multi-pilot ~~two-pilot~~ flight test, the examiner will perform those duties by neither being obstructive nor above average, primarily relying on prompts from the candidate.

For a multi-pilot IR, the aircraft's type certificate, flight manual, operating rule or the operators approved operating procedure/s requires that the aircraft be operated by a multi-pilot crew, or an approved simulator of the same type, both the examiner and candidate must be type rated. The flight examiner *may* elect to conduct the flight test from an observer's position or act as the co-pilot.

~~The competency demonstrations required by two pilot and single pilot demonstrations are the same. However, for two pilot demonstrations the candidate is required to divide in-flight responsibilities so as to utilise the co-pilot in a meaningful way.~~

~~Where the examiner, with the candidate's consent, elects to continue a single pilot currency demonstration as a two pilot demonstration, the candidate's pre-flight briefing of the co-pilot's duties may be examined post flight.~~

~~Where the instrument rating flight test is carried out in an approved simulator, the flight examiner *may* elect to conduct the flight test from an observer's position.~~

The degree of accuracy required is published for ~~flight examiner guidance~~ in the Instrument Rating Flight Test Guide, and while the applicant is intended to maintain flight within these tolerances, temporary minor excursions outside the established limits are acceptable providing positive remedial action is taken.

It is neither recommended nor required that unusual attitudes or simulated asymmetric (where applicable) be carried out in IMC.

Flight test form, CAA 24061/07, may be used as an aid to examiners for recording and reporting instrument rating issue, competency demonstrations or the addition of a navigation aid.

Aircraft and equipment

The aircraft must be certified for IFR flight and to the PBN standard required for the flight test. The radio communication and navigation equipment are to be of an approved standard, and an intercommunication system acceptable to the flight examiner is to be fitted. Should a flight examiner determine, during the course of the test, that the aircraft instrumentation or equipment fails to meet an acceptable standard, the flight examiner may cancel the test and the aircraft is not to be used for such purposes again until such time as the defects have been remedied.

An acceptable means of simulating instrument flight conditions, such as a hood, foggles or screens that prevent peripheral external visual reference to the pilot being tested must be used.

The aircraft is to be fitted with:

- Fully functioning dual flight controls.
- Those instruments essential to the manoeuvres planned to be demonstrated during the flight visible to both pilots without excessive parallax error.
- At least three-point lap-and-sash harness.
- Intercommunication equipment acceptable to the flight examiner.

General requirements

The candidate is to provide adequate and private facilities for briefing prior to and after the flight test.

The test is to include an oral knowledge test followed by a pilot competency test. Failure to demonstrate competence in any item of the test may result in the applicant and the instructor being advised of the failure aspects and the further training believed necessary before a further flight test may be undertaken.

An applicant is to demonstrate an ability to perform solely by reference to instruments the flight manoeuvres and procedures applicable to the type of approach aid or system for which a rating is desired.

~~For the purpose of issue or currency, a demonstration of the DME or GPS arc procedure is compulsory, and both the VOR and one other approach (ADF or GNSS) are compulsory with at least one approach commencing from overhead the aid or the final approach fix.~~

~~As a result of the introduction of PBN within New Zealand all applicants for a GNSS endorsement on an instrument rating must complete a theory ground course in accordance with Appendix III of this AC. Appendix III meets the requirements of rule 61.801(a)(3)(ii).~~

Approaches

The Instrument Rating **initial issue** flight test must include the following approaches:

- one VOR approach, and
- at least one other (non-VOR) approach, either 2D or 3D.

An **Instrument Rating Competency Demonstration** must include:

- two instrument approach procedures which use different types of navigation aids or systems, and
- at least one of the instrument approach procedures demonstrated must be a 3D type, if the pilot holds a 3D privilege and wishes to continue to exercise that 3D privilege.

Additional aids may be added to the IR at any time, either during the initial issue test, a competency demonstration or as a stand-alone test.

Holds

For the initial issue, competency demonstration or the addition of another aid, one entry and one complete hold must be conducted. If the entry procedure is Sector 3 (direct), this counts as the entry and a further hold must be flown.

Personal preparation

The candidate is to demonstrate a professional attitude to aviation by arriving punctually for the flight test, suitably attired and fit for flying.

The candidate is to present, for the examiner's inspection, evidence of identity, their summarised and certified pilot's logbook, pilot's licence (that meets the night flight requirements of that licence), written exam credits, knowledge deficiency reports (KDRs), appropriate and current Navigation Charts and plates; and previous competency demonstration record (if applicable).

The candidate will demonstrate a sound knowledge of IR privileges, currency, and medical requirements.

Operational flight plan preparation

The candidate is to demonstrate proficiency in the following.

(a) Preparation of an operational flight plan along charted or promulgated routes between two aerodromes at least 35nm apart, one of which must be a controlled aerodrome. The

applicant is to use appropriate meteorological information and is to have a good knowledge of the requirements governing such flights including fuel requirements, applicable weather minima, choice of altitudes and air traffic services procedures, choice of alternate (as and when required).

(b) Making a sound go/no-go decision based on all available information (including, if applicable, GNSS RAIM prediction).

(c) Assessing the aircraft's performance capabilities in respect to departure, enroute and approach procedure requirements.

Knowledge of flight rules

The candidate is to demonstrate knowledge of:

(a) Fuel requirements under IFR, including contingency requirements.

(b) The conditions that would require an alternate to be nominated and the criteria for the selection of a suitable alternate including in the event of a loss of Primary Means of Navigation (PMoN).

(c) Take-off, enroute, approach and circling minima.

(d) IFR cruising levels.

(e) Icing conditions.

Flight preparation

The candidate will exhibit knowledge of the:

(a) Aircraft ~~Radio Station~~ equipment approval, including PBN RNP level limitations appropriate for route and qualification sought, suitable alternate means of navigational equipment (AMoN) and ADS-b. ~~CAA Form 2129 – Aircraft radio Station Approval~~

(b) Aircraft technical log.

(c) Fuel requirements including reserves for IFR flight in accordance with Parts 91, 135 and 125 or Part 121 as appropriate, including contingency planning requirements in the event of a loss of PMoN.

(d) Fuel quantity on board the aircraft prior to flight, the aircraft's fuel consumption and endurance and the correct tank selection in accordance with the aircraft's flight manual.

(e) Pre-flight inspection with emphasis on items applicable to IFR operations, including anti-icing equipment where applicable.

(f) Aircraft's instruments serviceability checks, including RAIM availability.

RTF procedures and navigation aid tuning

The candidate will:

(a) Obtain, record, read back, ~~and~~ clarify comply or reject clearances as appropriate.

(b) Make appropriate transmissions at compulsory reporting points.

(c) Use correct aeronautical phraseology with appropriate assertiveness and seek clarification where applicable.

(d) Tune, identify and test the aircraft's navigation equipment in accordance with recommended procedures and the manufacturer's instructions, including GNSS navigation databases.

(e) Tune, test and operate the aircraft's transponder as required.

(f) Load, check and operate any required PBN routes, procedures and approaches and ensure GNSS is in correct mode for phase of operation, i.e. ENR, TERM, LNAV etc.

Loss of communication or navigation aid failure procedures

The candidate will demonstrate knowledge of the loss of communications procedure or navigation aid failure for various phases of flight, including GPS loss of integrity or failure for PBN operations. For EFIS ~~TEA~~ -aircraft this will include failure of the multi-function display (MFD) if applicable.

Multi-pilot IR assessment

When the flight test is to demonstrate multi-pilot IFR competency, the applicant is expected to act in the role of Pilot-in-Command and Pilot Flying. Crew resource management will, therefore, form part of the assessment.

Two pilot crew responsibility briefing (if applicable)

~~When the flight test is to demonstrate multi-crew IFR competency the applicant is to brief the co-pilot/examiner on their duties and responsibilities. The candidate will:~~

~~(a) Brief the co-pilot (examiner) on their responsibilities and duties applicable to the flight.~~

~~(b) Prior to departure the applicant is to demonstrate proficiency in radiotelephone procedures, understanding clearances and the ground checking of radio navigation/communication equipment and flight instruments. The examiner will carry out in flight duties, when requested.~~

~~(c) Monitor the co-pilot's actions during flight.~~

In flight

~~In a single-engine, technically enhanced or multi-engine aircraft as the case may be, the applicant is to demonstrate competence to the given limitations over the planned route.~~
Simulated instrument flight is to be introduced at the take-off minima for the aerodrome of departure and discontinued at the landing minima for the aerodrome of destination. The flight will be planned at least in part within controlled airspace.

Attention will be given to the applicant's ability to:

- Fly the aircraft smoothly and accurately ~~on~~ by sole reference to instruments.
- Conform to the appropriate departure procedure.
- Intercept and track using ~~both~~ the ~~VOR and ADF or GNSS~~ navigation aids or systems individually as enroute and approach aids.
- Update estimated times of arrival where appropriate.

- Transition to the instrument approach procedure.

Instrument transition

The candidate will transition smoothly from visual flight to instrument flight at the published IFR minimum for take-off.

The holder of a PPL (A or H) or CPL(H) will demonstrate for IR issue, as specific exercises:

Straight and level flight:

Achieve and maintain accurate level flight at the nominated altitude. Accurately maintain the nominated heading and trim for level flight.

Level turns:

Coordinated level medium turns through 180º left and right, using and maintaining an accurate bank angle of 30º.

Climbing and descending:

Entering and maintaining climbing and descending flight, maintaining a constant airspeed and heading.

Climbing turns to altitude:

Climbing turns at Rate 1 whilst maintaining the nominated airspeed to enter level flight at a predetermined altitude.

Descending turns to altitude:

Descending turns at Rate 1 whilst maintaining the nominated airspeed to enter level flight at a predetermined altitude.

Limited panel:

By sole reference to basic flight instruments, and in the case of helicopters (where the flight manual permits), without benefit of stabilisation systems, or in the case of an EFIS equipped ~~technically enhanced~~ aircraft by sole reference to standby instruments as a result of a primary flight display (PFD) failure, demonstrate achieving and maintaining level flight, maintain the nominated compass heading and accurately trim for level flight.

Demonstrate level Rate 1 turns onto a nominated compass heading maintaining the nominated altitude.

Recognise and demonstrate recovery from power on (reduced power setting at examiner discretion) nose high, nose low and spiral dive attitudes (appropriate to the aircraft size and type). During the recovery, correctly identify the aircraft's attitude, apply the correct recovery technique to initially return to straight and level flight and then return to the nominated altitude and compass heading.

Note: *If the weather precludes, this item may be completed on a separate flight within 30 days of the initial part of the test.*

All candidates will demonstrate:

Departure procedures:
By carrying out a departure procedure in accordance with a standard instrument departure (SID) using ground-based aids (GBA), PBN procedures or ATC instructions. Tolerances are to be maintained within the procedure design.

Engine failure after take-off: (for multi-engine aeroplanes or helicopters)

- By maintaining control after a simulated engine failure under simulated instrument flight conditions, with continued climb in accordance with the departure procedure (or an appropriate emergency procedure).
- Using the emergency checklist or QRH to follow up memory items.
- Making appropriate simulated radio calls and nominating an appropriate plan of action.

Note: *Feathering the propeller (aeroplane) is neither required nor encouraged for instrument rating demonstrations. In approved simulators, engine failure after take-off at or above V1 may be simulated.*

Enroute procedures:

- Adapt to ATC requirements, applying good airmanship as applicable, i.e. speed limitations, enroute delays or holding, re-routing requirements.
- Enroute tolerances are subject to consideration of bends or fluctuations of track guidance and within the rated coverage of the navigation aid or where applicable meet PBN standards and minima.

~~By complying with IFR procedures en-route (PBN where required) and for helicopters, demonstrate level acceleration and deceleration between the minimum speed for IFR flight and normal cruise.~~

Use of checklists:
By using normal and emergency checklists as applicable to the operation.

General use of autopilot:

- By carrying out the appropriate serviceability checks prior to flight.
- Utilising the autopilot in flight; able to programme, monitor and identify "capture" of armed modes (as appropriate and applicable).
- Demonstrating knowledge of the autopilot's capabilities and limitations and recognising autopilot mode failures (as applicable).

~~**Interception and tracking VOR:**~~
~~By intercepting and maintaining a track by sole reference to VOR.~~
~~**Interception and tracking GNSS** (if applicable)**:**~~
~~By intercepting and maintaining a track by sole reference to GNSS data.~~
~~**Interception and tracking NDB** (if applicable)**:**~~
~~By intercepting and maintaining a track by sole reference to an NDB.~~

~~**ATS compliance:**~~

~~By maintaining a listening watch.~~
~~Communicating clearly and concisely using aviation phraseology.~~
~~Recording and complying with clearances and instructions as appropriate.~~

Holding procedures

By identifying and applying the correct hold entry and holding technique applicable to the published hold procedure.

The tracking tolerance is that applicable to the enroute standards for the applicable aid. The holding procedure design is based on turns at 25º angle of bank or Rate 1 (whichever is the lesser). The pilot is to make adjustments for wind to ensure the interception and maintenance of the inbound track.

Unusual attitudes, full panel:

Timely ~~immediate~~ recognition and correct recovery to straight and level flight from steep climbing turns and spiral dives, as appropriate to the aircraft type. Note: If the weather precludes, this item may be completed on a separate flight within 30 days of the initial part of the test.

Arrivals

Carry out an arrival. Either a standard arrival (STAR), direct to join an arc or initial approach fix (IAF), or radar vectors as appropriate and in accordance with the published procedure and ATC instructions.

Descend as required to maintain profile in accordance with ATC clearances and published minimum altitudes. Arc arrival procedures are examined at the examiner's discretion and are required to be flown to remain within +/- 1nm of the arc radius.

Approaches

During the briefing the examiner will nominate which approaches are to be flown. Before beginning an approach, confirm weather conditions are suitable. Altimeters must be correctly set with the appropriate QNH. Each approach is to be flown with the aeroplane correctly configured and in trim such that a stable approach path is maintained to DA/H or MDA/H.

GNSS approach:

A RAIM check must be completed prior to any RNP GNSS approach (before or during flight). Verify correct GPS scaling for the approach. Within half scale of the inbound track, descent may be commenced.

VOR approach:

The VOR approach is mandatory for instrument rating issue flight test and must be flown with no GNSS derived data including GPS distance, moving map and wind vectors. The navigation aid must be identified prior to commencing the approach. Within 5º of the inbound track, descent may be commenced.

NDB approach:

The navigation aids must be identified prior to commencing the approach. Within 5º of the inbound track, descent may be commenced.

ILS approach:

The navigation aids must be identified prior to commencing the approach. Interception and maintenance of LLZ and glideslope within procedure tolerances.

Circling approach: (aeroplanes only, at examiner's discretion)

Demonstration of the transition from an instrument approach procedure to a ~~visual circuit~~ circling approach and landing on a runway preferably at an angle of at least 80º to the final instrument approach track within the lowest circling minima authorised for the aircraft at the aerodrome concerned. A higher altitude may be nominated by the flight examiner.

The aircraft must not descend below the circling MDA until in a position where the final descent may begin, using normal manoeuvres, speeds and descent rates.

Angle of bank and rate of turn:

For all procedures except circling approach, the approach procedures are designed to provide terrain clearance using a maximum of 25º angle of bank or Rate 1 (whichever is the lesser). Lesser angles of bank apply to procedure design for high performance aircraft on departure.

Circling approach procedure designs are based on, 20º angle of bank or Rate 1 (whichever is the lesser). The angle of bank and rate of turn used by the pilot should be appropriate to the procedure and the conditions. Therefore, the pilot may increase or decrease the angle of bank to make good the desired track; however, the procedure design minimum angles of bank must be achieved in terrain critical areas, whilst excessive angles of bank must also be avoided.

Speeds:

Instrument procedures flown are to comply with the requirements of the aircraft flight manual and with the relevant approach procedure design speeds. If nominated, the higher minima are to be applied when a higher speed is utilised for the approach. During the briefing the candidate will nominate to the examiner the speeds they intend to target through the various phases of flight.

One engine inoperative performance: (multi-engine aircraft only)

Failure of an engine will be simulated prior to, or during, an instrument approach procedure and an engine-out missed approach initiated from minimum altitude in accordance with the missed approach procedure for that aid.

Missed approach procedure:

~~The applicant is to demonstrate a missed approach from minimum altitude in accordance with the missed approach procedure for the aid~~

Prompt initiation of the published missed approach procedure is required.

All 2D missed approaches must be conducted without descent below the published MDA in accordance with the published procedure. For 3D approaches, a slight descent below DA/DH is acceptable if the go around has already been initiated. Tolerances are to be maintained within the procedure design.

ATS compliance:

By maintaining a listening watch.

Communicating clearly and concisely using aviation phraseology.

Recording, ~~and~~ clarifying, complying or rejecting ~~with~~ clearances and instructions as appropriate.

~~**Accuracy for all aircraft**~~

~~*(**Note:** flight test demonstration parameters are stated for the guidance of examiners in the relevant flight test standards guide)*~~

~~**Recovery from unusual attitudes:**~~

~~Immediate recognition and correct recovery to straight and level flight followed by a return to the heading and height nominated by the examiner.~~

~~**Speeds:**~~

~~Instrument procedures flown are to comply with the requirements of the aircraft flight manual and with the relevant approach procedure design speeds. If nominated, the higher minima are to be applied when a higher speed is utilised for the approach.~~

Enroute tracking:

Enroute tolerances are subject to consideration of bends or fluctuations of track guidance and within the rated coverage of the navigation aid or where applicable meet PBN standards and minima.

Holding procedure:

The tracking tolerance is that applicable to the enroute standards for the applicable aid. The holding procedure design is based on turns at 25º angle of bank or Rate 1 (whichever is the lesser). The pilot may increase or decrease the angle of bank to make good the inbound track. The pilot is to make adjustments for wind to ensure the interception and maintenance of the inbound track.

Departure and missed approach:

Accuracy tolerances arethe same as the tolerances applied to instrument approach procedures. Tolerances maintained within the procedure design.

DME or GPS Arc arrival procedures (at examiners' discretion):

Descent as required to maintain profile on crossing designated radials in accordance with ATC clearances and published minimum altitudes.
Tracking standards are those for the appropriate navigation aid.

Flown to remain within +/- 1nm of the arc radius

Initiation of missed approach procedures:

Up to three seconds for recognition and up to 3 seconds to initiate climb or turn, or both, as appropriate.

Prompt initiation of the published missed approach procedure.

Angle of bank and rate of turn:

For all procedures except circling approach, the approach procedures are designed to provide terrain clearance using a maximum of 25º angle of bank or Rate 1 (whichever is the lesser). Lesser angles of bank apply to procedure design for high performance aircraft on departure.

Circling approach procedure designs are based on, 20º angle of bank or Rate 1 (whichever is the lesser). The angle of bank and rate of turn used by the pilot should be appropriate to the procedure and the conditions. Therefore, the pilot may increase or decrease the angle of bank to make good the desired track; however, the procedure design minimum angles of bank must be achieved in terrain critical areas, whilst excessive angles of bank must also be avoided.

GNSS approach: (Where possible the GNSS approach should be preceded by a PBN STAR (with holding if required).

Verify correct GPS scaling for the approach. Within half scale of the inbound track, descent may be commenced. Go around initiated (if applicable) not below MDA/MDH.

VOR and NDB approach: (Compulsory for instrument rating issue and annual competency demonstrations.)

Within 5º of the inbound track, descent may be commenced

Go around initiated (if applicable) not below MDA/MDH.

NDB approach: (Not compulsory for instrument rating issue or annual competency demonstrations unless currency is required for ADF approach.)

Within 5º of the inbound track, descent may be commenced.

~~**ILS approach:**~~

~~(Not compulsory for instrument rating issue or annual competency demonstrations unless currency is required for ILS approaches.)~~

~~Go-around commenced initiated not below DA/DH.A slight descent below DA/DH is acceptable as long as the go around has been initiated.~~
~~Knowledge of LLZ procedure. Satisfactory compliance with radar directions, smooth acquisition and maintenance of track and approach profile.~~

IR annual competency demonstration:

This will be to the same standard and contain the same elements (except where provided) as the initial issue flight test.

Operators certificated to conduct annual competency demonstrations within their training organisations may be certificated to conduct annual instrument rating competency demonstrations using an approved synthetic flight training device, in accordance with the approved conditions of use.

IR approach aid endorsement:

An applicant for an additional approach-aid endorsement to the instrument rating is to demonstrate competence to a flight examiner on that approach aid in accordance with the Instrument Rating Flight Test Standards Guide. Such a demonstration may be completed independently or as part of the annual competency demonstration.

In addition to the practical competency demonstration, NDB approach aid endorsements require the successful completion of the ADF/NDB Theory Course as outlined in Appendix IV and be certified in their logbook.

Appendix III PBN Pilot Knowledge and Training Syllabus

The PBN navigation specifications outlined in this syllabus cover a wide range of operations, and training needs to be appropriate to the specific circumstances. Although this syllabus, derived from the ICAO Doc 9613, includes guidance for flight crew training for the published navigation specifications, the guidance is not consistent in detail and scope across the range of specifications. The amount and type of training required will vary significantly upon several factors including:

1. previous training and experience
2. complexity of operations, and
3. aircraft equipment.

The following knowledge requirements apply to all PBN operations, although the content and complexity will vary depending upon the specific operation (see AC91-21 Section 10 Pilot Knowledge and Training for further detail):

1. Area navigation principles
2. Navigation system principles
3. Equipment operation and functionality
4. Flight planning
5. Operating procedures
6. Contingency procedures
7. Performance monitoring and alerting
8. Operating limitations

When developing PBN training programmes, the following theoretical and practical items should be addressed to the extent that the pilots are familiar with and have knowledge of the items that are applicable to each individual navigation specification:

RNAV 1 and 2; RNP 1 and 2; RNP APCH (LNAV and LNAV/VNAV)

(a) the information contained in AC91-21 and applicable notice;

(b) the meaning and proper use of aircraft equipment/navigation suffixes;

(c) procedure characteristics (including route and airspace) as determined from chart depiction and textual description;

(d) depiction of waypoint types (fly-over and fly-by), required path terminators (IF, TF, DF) and any other types used by the operator (if applicable), as well as associated aircraft flight paths;

(e) required navigation equipment for operation on RNAV routes/SIDs/STARs and RNP APCH/SIDs/STARs, e.g. DME/DME, DME/DME/IRU, and GNSS;

(f) RNAV/RNP system-specific information:

i) levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradation;

ii) functional integration with other aircraft systems;

iii) the meaning and appropriateness of route discontinuities as well as related flight crew procedures;

iv) pilot procedures consistent with the operation;

v) types of navigation sensors (e.g. DME, IRU, GNSS) utilised by the RNAV/RNP system and associated system prioritisation/weighting/logic;

vi) turn anticipation with consideration to speed and altitude effects;

vii) interpretation of electronic displays and symbols; and

viii) understanding of the aircraft configuration and operational conditions required to support RNAV/RNP operations, i.e. appropriate selection of CDI scaling (lateral deviation display scaling);

(g) RNAV/RNP equipment operating procedures, as applicable, including how to perform the following actions:

i) verify currency and integrity of the aircraft navigation data;

ii) verify the successful completion of RNAV/RNP system self-tests;

iii) initialise navigation system position;

iv) retrieve and fly an RNAV/RNP route, SID, STAR and RNP APCH with appropriate transition;

v) adhere to speed and/or altitude constraints associated with a route, SID, STAR and RNP APCH procedure;

vi) select the appropriate STAR or SID for the active runway in use and be familiar with procedures to deal with a runway change;

vii) perform a manual or automatic update (with take-off point shift, if applicable);

viii) verify waypoints and flight plan programming;

ix) Fly an interception of an initial or intermediate segment of an approach following ATC notification;

x) fly direct to a waypoint;

xi) fly a course/track to a waypoint;

xii) intercept a course/track;

xiii) following vectors and re-joining an RNAV/RNP route from “heading” mode;

xiv) determine cross-track error/deviation. More specifically, the maximum deviations allowed to support RNAV/RNP must be understood and respected;

xv) resolve route discontinuities;

xvi) remove and reselect navigation sensor input;

xvii) when required, confirm exclusion of a specific NAVAID or NAVAID type;

xviii) when required by the authority, perform gross navigation error checks using conventional NAVAIDs;

xix) change arrival airport and alternate airport;

xx) perform parallel offset functions if capability exists. Pilots should know how offsets are applied, the functionality of their particular RNAV/RNP system and the need to advise ATC if this functionality is not available;

xxi) perform RNAV/RNP holding functions;

(h) operator-recommended levels of automation for phase of flight and workload, including methods to minimise cross-track error to maintain route centre line;

(i) R/T phraseology for RNAV/RNP applications; and

(j) contingency procedures for RNAV/RNP system failures.

RNAV 5

In addition to the above items, the following knowledge of RNAV 5 is required:

(a) the capabilities and limitations of the RNAV system installed;

(b) the operations and airspace for which the RNAV system is approved to operate; and

(c) the NAVAID limitations with respect to the RNAV system to be used for the RNAV 5 operation.

RNP 4 and 10

There are no specific additional training requirements for RNP 4 and 10, other than the general requirements prescribed in AC91-21, *Operational Approvals – Performance-Based Navigation*, Section 10 Pilot Knowledge and Training; and the applicable notices.

RNP APCH (LP & LPV)

In addition to the above items for RNP APCH, the following knowledge of LP & LPV minima is required:

(a) RNP approach concept containing LP or LPV minima:

i) theory of approach operations;

ii) approach charting;

iii) use of the approach system including:

1) selection of the LP or LPV approach procedure; and

2) ILS look alike principle;

iv) use of lateral navigation mode(s) and associated lateral control techniques;

v) use of VNAV mode(s) and associated vertical control techniques;

vi) R/T phraseology for LP or LPV approach operations; and

vii) the implication for LP or LPV approach operations of systems malfunctions which are not related to the approach system (e.g. hydraulic failure);

(b) RNP approach operation containing LP or LPV minima:

i) definition of LP or LPV approach operations and its direct relationship with RNAV(GNSS) procedures;

ii) regulatory requirements for LP or LPV approach operations;

iii) required navigation equipment for LP or LPV approach operations:

1) GPS concepts and characteristics;

2) augmented GNSS characteristics; and

3) MEL;

iv) procedure characteristics:

1) chart depiction;

2) aircraft display depiction; and

3) minima;

v) retrieving an LP or LPV approach procedure from the database (e.g. using its name or the SBAS channel number);

vi) change arrival airport and alternate airport;

vii) flying the procedure:

1) use of autopilot, autothrottle and flight director;

2) flight guidance mode behaviour;

3) lateral and vertical path management;

4) adherence to speed and/or altitude constraints;

5) fly interception of an initial or intermediate segment of an approach following ATC notification;

6) fly interception of the extended FAS (e.g. using the VTF function);

7) consideration of the GNSS approach mode indication (LP, LPV, LNAV/VNAV, lateral navigation); and

8) the use of other aircraft equipment to support track monitoring, weather and obstacle avoidance;

viii) ATC procedures;

ix) abnormal procedures; and

x) contingency procedures.

RNP-AR APCH

In addition to the above items in relation to RNP APCH (LNAV and LNAV/VNAV) and (LP & LPV), the following knowledge specific to RNP AR APCH is required:

(a) definition of RNP AR APCH;

(b) the differences between RNAV and RNP;

(c) the types of RNP AR APCH procedures and familiarity with the charting of these procedures;

(d) the programming and displaying of RNP and aircraft specific displays (e.g. actual navigation performance (ANP display));

(e) how to enable and disable the navigation updating modes related to RNP;

(f) the navigation accuracy appropriate for different phases of flight and RNP AR APCH procedures and how to select the navigation accuracy, if required;

(g) the use of GPS RAIM (or equivalent) forecasts and the effects of RAIM availability on RNP AR APCH procedures (pilot and dispatchers);

(h) when and how to terminate RNP navigation and transfer to traditional navigation due to loss of RNP and/or required equipment;

(i) how to determine database currency and whether it contains the navigational data required for use of GNSS waypoints;

(j) explanation of the different components that contribute to the TSE and their characteristics (e.g. effect of temperature on baro-VNAV and drift characteristics when using IRU with no radio updating); and

(k) temperature compensation — pilots operating avionics systems with compensation for altimetry errors introduced by deviations from ISA may disregard the temperature limits on RNP AR APCH procedures, if pilot training on the use of the temperature compensation function is provided by the operator and the compensation function is utilized by the crew. However, the training must also recognize the temperature compensation by the system is applicable to the VNAV guidance and is not a substitute for the pilot compensating for the cold temperature effects on minimum altitudes or the DA

(l) Procedures for verifying that each pilot's altimeter has the current setting before beginning the final approach of an RNP AR APCH procedure, including any operational limitations associated with the source(s) for the altimeter setting and the latency of checking and setting the altimeters approaching the FAF;

(m) The use of aircraft radar, TAWS, GPWS, or other avionics systems to support the pilot's track monitoring and weather and obstacle avoidance;

(n) The effect of wind on aircraft performance during RNP AR APCH procedures and the need to remain within RNP containment area, including any operational wind limitation and aircraft configuration essential to safely complete an RNP AR procedure;

(o) The effect of ground speed on compliance with RNP AR APCH procedures and bank angle restrictions impacting the ability to remain on the course centre line. For RNP AR APCH procedures, aircraft are expected to maintain the standard speeds associated with the applicable category;

(p) The relationship between RNP and the appropriate approach minima line on an approved published RNP AR APCH procedure and any operational limitations noted on the chart, e.g. temperature limits, RF leg requirements or loss of GNSS updating on approach;

(q) Concise and complete pilot briefings for all RNP AR APCH procedures and the important role CRM plays in successfully completing an RNP AR APCH procedure;

(r) Alerts from the loading and use of improper navigation accuracy data for a desired segment of an RNP AR procedure;

(s) The performance requirement to couple the autopilot/flight director to the navigation system's lateral and vertical guidance on RNP AR APCH procedures requiring an RNP of less than RNP 0.3;

(t) The importance of aircraft configuration to ensure the aircraft maintains any required speeds during RNP AR procedures;

(u) The events triggering a missed approach when using the aircraft's RNP capability;

(v) Any bank angle restrictions or limitations on RNP AR APCH procedures;

(w) The potentially detrimental effect on the ability to comply with an RNP AR APCH procedure when reducing the flap setting, reducing the bank angle or increasing airspeed;

(x) Pilot knowledge and skills necessary to properly conduct RNP AR APCH operations;

(y) Programming and operating the FMC, autopilot, auto throttles, radar, GPS, INS, EFIS (including the moving map), and TAWS in support of RNP AR APCH procedures;

(z) The effect of activating TOGA while in a turn;

(aa) FTE monitoring and impact on go-around decision and operation;

(bb) Loss of GNSS during a procedure;

(cc) Performance issues associated with reversion to radio updating and limitations on the use of DME and VOR updating; and

(dd) Flight crew contingency procedures for a loss of RNP capability during a missed approach. Due to the lack of navigation guidance, the training should emphasis the flight crew contingency actions that achieve separation from terrain and obstacles. The operator should tailor these contingency procedures to their specific RNP AR APCH procedures.

A-RNP

A-RNP is an aircraft specific qualification that covers the following navigation specifications: RNAV 5, RNAV 1, RNAV 2, RNP 2, RNP 1 and RNP APCH. The pilot training syllabi for these individual specifications is located above.

Appendix IV ~~III GNSS Theory Course Syllabus~~ ADF/NDB Theory Course Syllabus

Introduction

This syllabus is guidance for developing a course for ~~RNP and RNAV~~ ADF Instrument Rating privileges.

Pilot training must include classroom training and examination, and practical training on the equipment to be used (in simulator, training device, or aircraft), covering the following matters with appropriate logbook endorsement.

Course concept

This course is a prerequisite for the issue of ~~GNSS~~ ADF as a navigation aid endorsement to an instrument rating.

Before ~~Prior to undertaking~~ taking the endorsement demonstration, the applicant must provide evidence to the holder of a current flight examiner rating with the examiner privilege of additional navigation aid ~~GNSS~~ ADF that they have successfully completed a course in accordance with this syllabus.

The flight examiner must be satisfied with the content of the course as delivered to the candidate by questioning the candidate appropriately on the content of the course syllabus.

Classroom training and examination

Automatic Direction Finder (ADF) and Non-Directional Beacon (NDB) Principles

1) Describe the basic features of a non-directional beacon (NDB), including:
   (a) the range of frequencies usually employed;
   (b) the factors affecting operational range; and,
   (c) typical name, frequency, identification and location details.
2) Describe the basic components of an aircraft automatic direction finder (ADF).
3) Explain the basic principles of loop direction finding, including the:
   (a) generation of maximum and null signals in different loop positions;
   (b) use of polar diagrams;
   (c) application of a sense aerial to resolve ambiguity; and,
   (d) automatic seeking of the null position (hence ADF).
4) Describe the basic principle of operation of a fixed loop and state the advantages a fixed versus rotating loop.
5) State the importance, when tuning an NDB, of making a positive identification of the station tuned, and of checking proper functioning of the ADF.
6) Describe the function of the controls on a typical ADF control panel, including:

(a) ANT (or REC or VOICE) mode;

(b) ADF (or COMP) mode;

(c) TEST mode;

(d) BFO (or CW); and,

(e) the LOOP position, where fitted.

7) Given suitable diagrams of instrument presentation, describe the use of a relative bearing indicator (RBI), a rotatable card ADF, and a radio magnetic indicator to determine:

(a) magnetic bearing to an NDB (orientation);

(b) position in relation to required track to/from an NDB;

(c) interception of a required track to/from an NDB; and,

(d) station passage.

8) Explain the following factors which affect the accuracy of ADF indications:

(a) night effect;

(b) coastal refraction;

(c) mountain effect; and,

(d) precipitation static and thunderstorms.

9) Describe the presentation and function of the ADF needle on a fixed card, rotatable card and RMI indicator.

10) Describe the purpose of each control on the ADF control panel.

11) Be familiar with the publications and charts that show NDB callsigns, frequencies and route depiction.

12) Explain why it is important to check the NDB ident before using an NDB.

13) Explain what is meant by relative bearing.

14) Given an aircraft magnetic heading and a relative bearing, or an RMI presentation calculate:

(a) magnetic bearing to an NDB;

(b) magnetic bearing from an NDB.

15) Describe the track followed by an aircraft experiencing a crosswind when the ADF needle is kept on the 360°R position.

16) Explain how the ADF can be used to maintain track with drift correction applied:

(a) when tracking to an NDB;

(b) when tracking away from an NDB.

17) Identify aircraft position relative to NDB or multiple NDB's.

In aircraft, simulator, or training device

1) Correctly tune, ident and verify an NDB.
2) Brief and fly a published SID with transition to an NDB route.
3) Adhere to speed and/or altitude constraints associated with a SID.
4) Determine allowable deviation limits and maintain flight within those limits.
5) Carry out contingency procedures for NDB/ADF failures.
6) Perform NDB holding functions.
7) Retrieve and fly, an NDB arc and approach.
8) Adhere to speed and/or altitude constraints associated with an NDB Approach.
9) Initiate a missed approach procedure from the Missed Approach Point.

~~Performance Based Navigation (PBN) Principles~~

~~1. State the principles of RNAV 1 and 2, RNP 1 and 2 and RNP APCH~~

~~2. Describe in basic terms the principal GNSS systems – GPS, Galileo, GLONASS and BeiDou.~~

~~3. Explain navigation database menus and sub menus.~~

~~4. Explain how to confirm data validity and a verifiable source for current applicable software versio~~

~~5. Understand system software configuration management.~~

~~6. Using the basic block diagram of an RNAV system explain the function and operation of each component.~~

~~7. Describe the effects of RAIM outages, Fault Detection (FD), and Fault Detection and Exclusion (FDI on PBN.~~

~~8. Explain the difference between an almanac and ephemeris data on GNSS operations.~~

~~9. Explain the effect of barometric altitude input.~~

~~10. Explain the operating principle of RAIM.~~

~~11. Explain the difference between Fly-by and Fly-over waypoints.~~

~~12. List the required navigation and communication equipment for RNAV, RNP, and RNP APCH operations.~~

~~13. Describe the basic differences between TSO C129 and C145/146 receivers, including scaling differences.~~

~~14. State and apply the operational conditions required to support RNP 1 and 2 (no surveillance) operations and RNAV 1 and 2 operations (under surveillance).~~

~~15. State the actions to be taken in the event of loss of integrity, system failure and system messages.~~

~~16. List the effects on turn anticipation with consideration to speed and altitude.~~

~~17. Explain the contingency procedures for RNAV/RNP failures.~~

~~18. State the aviation documents required for PBN operations.~~

Charting

1. Demonstrate a working knowledge of definitions and abbreviations associated with RNP, RNAV ar RNP APCH operations.
2. Be familiar with the interpretation of chart legends including route depiction, flyover and fly-by waypoints.
3. Explain the significance of the WGS-84 earth model.

Aircraft and equipment knowledge

1. Describe the use of navigation database menus and submenus.
2. Describe system software configuration management.
3. Describe annunciator message importance of warnings; both cautions and advisory, and their applicability.

Pilot operations

1. Discuss human factors in PBN.
2. Demonstrate filing of ICAO flight plans in compliance with current flight planning requirements.
3. Identify operator procedures, including methods to minimise cross track error.
4. Explain monitoring procedures for each stage of flight.
5. Explain turn anticipation with consideration of speed and altitude effects.
6. Demonstrate appropriate RTF phraseology.

Equipment specific training

On ground

1. Describe the capabilities and limitations of the installed system from the Aircraft Flight Manual or AFM Supplement.
2. Explain levels of automation, mode annunciations, changes, alerts etc.
3. Explain system software configuration management.
4. Demonstrate removal and re-selection of navigation sensor input.
5. Demonstrate confirmation of exclusion of sensor input.
6. Describe functional integration with other aircraft systems.
7. Interpret electronic displays and symbols.
8. Identify where HDG, GS, TK, XTK,G/S etc. are displayed.
9. Demonstrate RAIM prediction.
10. Verify currency and integrity of the aircraft navigation data.
11. Initialise navigation system self-tests.
12. Verify the successful completion of the navigation system self-tests.
13. Verify waypoints and flight plan programming.
14. Edit or amend current flight plan with routing changes.
15. Perform an FDE prediction for flights to a destination and alternate.

~~In aircraft, simulator, or training device~~

~~1. Initialise system position.~~

~~2. Perform a manual or automatic update with take-off point shift if applicable.~~

~~3. Verify waypoints and navigation system flight plan programming.~~

~~4. Retrieve and fly a planned SID and reprogram with a subsequent runway change.~~

~~5. Adhere to speed and/or altitude constraints associated with a SID.~~

~~6. Vector off and re-join a route or procedure.~~

~~7. Determine allowable deviation limits and maintain flight within those limits.~~

~~8. Carry out contingency procedures for RNAV/RNP failures.~~

~~9. Demonstrate how to change CDI scaling.~~

~~10.Perform parallel track offset functions if capability exists.~~

~~11.Perform gross navigation error checks with legacy aids.~~

~~12.Perform RNAV/RNP holding functions.~~

~~13.Change the planned destination and alternate airport.~~

~~14.Select and fly the appropriate STAR and demonstrate and handle a runway change.~~

~~15.Adhere to speed and/or altitude constraints associated with a STAR.~~

~~16.Retrieve and fly, an RNAV (GNSS) approach.~~

17.~~Adhere to speed and/or altitude constraints associated with an RNP APCH.~~