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

# Advisory Circular AC61-3

**Revision 31**

**5 April 2025**

## Pilot Licences and Ratings— Private Pilot Licence

### General

Civil Aviation Authority (CAA) Advisory Circulars (ACs) contain information about standards, practices, and procedures that the Director has found to be an **acceptable means of compliance** with the associated rule.

Consideration will be given to other methods of compliance that are 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 flight time experience and examination syllabus content requirements, for the issue of private pilot licences, to assist applicant(s), to meet the requirements of Civil Aviation Rule Part 61 *Pilot Licences and Ratings.*

### Related Rules

This AC relates to Civil Aviation Rule Part 61 Pilot Licences and Ratings – specifically Subpart D.

### Change Notice

Revision 31 makes changes to Subject No. 4, PPL Air Law (Aeroplane and Helicopter) and associated matrix and to align with redrafted rules under the Civil Aviation Act 2023 (CA Act 2023). New act references have been updated. It also:

- updates the note on page 4 relating to online applications
- updates a website link to the flight test standards guide for the PPL cross-country demonstration of competency, and
- corrects some minor stylistic errors.

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**Version History**

The record of revisions to this AC is outlined below:

| AC Revision No. | Effective Date | Summary of Changes |
|---|---|---|
| AC61-1.3 | 6 October 1998 | This AC formed part of a series, which together replaced AC61-1, AC61-2 and AC61-1A. |
| AC61-1.3 Rev.1 | 15 April 2002 | Provided for up to five hours of flight-training experience in a Cicare SVH-3 tethered helicopter trainer to be credited towards the total flight experience required for the issue of a private pilot licence (Helicopter). |
| AC61-1.3 Rev.2 | 12 January 2004 | Updated this AC 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. |
| AC61-1.3 Rev.3 | 23 June 2004 | Introduced format changes to the syllabus for Air Law. Each subject was given a subject number and each topic within that subject a topic number. These reference numbers will be used on 'knowledge deficiency reports' (KDRs) and will provide valuable feedback to the examination candidate. Improved feedback through the use of KDRs will be progressively implemented. The syllabi content are consistent with the previous syllabi so no changes to the examinations will result. The remaining subjects are still under review.<br><br>The section on the Cicare SVH-3 tethered helicopter was deleted and replaced with helicopter simulator to cover all such craft. The PPL helicopter cross country night training and testing section is clarified. |
| AC61-1.3 Rev.4 | 15 February 2005 | Addressed an error in Appendix I covering helicopter flight experience for night flying where Revision 3 incorrectly stated students must have 2 hours of instrument flight time in aeroplanes before undertaking night flight training, this was amended to helicopters. Amendment was made to helicopter night flight to include the required instrument flight manoeuvres and detailed the minimum helicopter instrumentation required.<br><br>Appendix IV covering the private pilot licence aeroplane flight test syllabus was updated to include medium turns. |

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| | | As a result of the reissue of Part 71 the following syllabus items were amended:<br><br>4.50.20 wording changed from military operational area to military operating area.<br><br>4.50.26 wording changed from volcanic hazard area to volcanic hazard zone.<br><br>4.50.32 wording changed from low flying area to low flying zone.<br><br>4.50.22 on conditional areas and 4.50.30 on parachute drop zones, were deleted with the Sub Topic number reserved for future use. |
| AC61-1.3 Rev.5 | 5 September 2005 | Corrected Sub Topic 4.14.6 and 4.26.2 from references to the Civil Aviation Rule Part to references to the relevant sections of the Civil Aviation Act 1990. |
| AC61-1.3 Rev.6 | 22 December 2005 | Some syllabus items under Subject 6 Air Navigation and Flight Planning were given minor amendments to better frame the question. New syllabus items 6.14.6, 6.16.6, 6.34.10 and 6.34.12 were inserted.<br><br>Sub Topic 2.10.10 was corrected to refer to the AIPNZ and AC172-1. |
| AC61-1.3 Rev.7 | 11 May 2006 | Amended Private Pilot Licence eligibility requirements in regard to written examinations and flight tests in accordance with the PPL Flight Test Standards Guide and the reissue of Part 61. |
| AC61-3 Rev.8 | 9 May 2007 | Sub Topic 8.36.2(a) General Area Weather Forecast was amended to Area Forecast. |
| AC61-3 Rev.9 | 1 August 2008 | Sub Topic 10.18.2 was inserted as it was not inserted along with the other Human Factor syllabus items in Revision 6. |
| AC61-3 Rev.10 | 1 January 2009 | Sub Topic 10.36.2 numbering was corrected. |
| AC61-3 Rev.11 | 31 March 2009 | Amendments were related to the reissue of Part 61 and to clarify requirements. |
| AC61-3 Rev.12 | 29 June 2009 | Amended Private Pilot Licence eligibility requirements in regard to written examinations and flight tests in accordance with the PPL Flight Test Standards Guide and the reissue of Part 61. |
| AC61-3 Rev.13 | 14 June 2010 | Sub Topic 8.36.2(a) General Area Weather Forecast was amended to Area Forecast. |

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| AC61-3 Rev.14 | 14 October 2010 | Sub Topic 10.18.2 was inserted as it was not inserted along with the other Human Factor syllabus items in Revision 6. |
| AC61-3 Rev.15 | 14 February 2011 | Sub Topic 10.36.2 numbering was corrected. |
| AC61-3 Rev.16 | 21 June 2011 | Other amendments related to the reissue of Part 61 and to clarify requirements were made. |
| AC61-3 Rev.17 | 13 July 2011 | Amended the Total Flight Experience section to reflect a recent Part 91 amendment to permit instruction for the issue of a pilot licence or rating in an amateur-built helicopter. |
| AC61-3 Rev.18 | 13 July 2012 | Clarified the air law credit requirements for PPL (A) and (H). |
| AC61-3 Rev.19 | 17 May 2013 | • Introduced a syllabus of instrument flight training for PPL Aeroplane<br>• Updated the cross-country training syllabus for aeroplanes to include a demonstration of competency in cross country navigation techniques by day and/or by night rather than just meeting an experience requirement<br>• Updated the PPL (H) issue flight test syllabus in relation to 'quick stops'<br>• Clarified the mountain flying requirements for pilots with prior experience who must meet the eligibility requirements for the issue of a New Zealand licence<br>These changes resulted in a renumbering and reordering of the various Appendices. |
| AC61-3 Rev.20 | 4 February 2014 | Amended the reference to annual review of airworthiness to the current term review of airworthiness. |
| AC61-3 Rev.21 | 24 March 2014 | Amended the syllabuses and associated matrix for subjects 12 and 14 which have been reviewed and reformatted and aligned the topics that have commonality between aeroplanes and helicopters. |
| AC61-3 Rev.22 | 24 December 2014 | Introduced a new paragraph in 'Appendix I –Private Pilot Experience – Aeroplane – Total flight experience' (under 'terrain and weather awareness' minimum flight time requirements). This provided elaboration for terrain and weather awareness requirements for applicants who may already have acceptable experience. |

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| AC61-3 Rev.23 | 9 June 2015 | Reviewed 'Subject No.10 Human Factors' in 'Appendix II – Private Pilot Licence Written Examination Syllabus' of this AC. |
| AC61-3 Rev.24 | 20 April 2016 | Introduced that student pilots may complete the PPL training syllabus while holding an NZTA DL9 medical certificate but require a class 2 medical certificate for issue of the private pilot licence (PPL); and reflected changes to the qualifying period in which ground examinations were to be completed. |
| AC61-3 Rev.25 | 24 November 2017 | Introduced a revised and updated knowledge syllabus for the subject of Meteorology. |
| AC61-3 Rev.26 | 26 June 2018 | Reviewed this AC, and:<br>• Amended Appendix I, helicopter experience requirements, by removing the requirement of 1 hour's solo flight time for basic mountain flying flight time. This amendment provided the supervising instructor with the flexibility to tailor the minimum hour requirement to the student's needs.<br>• Updated knowledge syllabus for the subject of meteorology. |
| AC61-3 Rev.27 | 5 April 2021 | • Deleted references to a recreational pilot licence (RPL) as the RPL category is to be revoked under amendment 17 to Part 61;<br>• Outlined the process for the issue or renewal of a New Zealand Transport Agency (NZTA) medical certificate in respect of a PPL; and<br>• Outlined the privileges which a holder of a PPL with a Land Transport (DL9) medical certificate may, or may not, exercise.<br>***Note:*** *On 17 January 2022, CAA made changes to the PPL Air Law Syllabus Item 4.6 (j) on page 24. This was incorrectly referred to as "RULE" in the latest revision and has been changed to CAR; (AIP GEN). CAA would like to thank the participant who brought this error to our attention.* |

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| AC61-3 Rev.28 | 1 December 2022 | • Amended reference from Metflight to gopreflight in Meteorology syllabus topic number 8.2.2<br>• Deleted reference to TREND forecasts in Meteorology syllabus topic number 8.2.4<br>• Standardised the layout to make it easier to read and made stylistic changes |
| AC61-3 Rev.29 | 2 October 2023 | Added a note on the online application process for initial licence issue, under *PPL Eligibility Requirements*.<br>Updated the Flight Navigation Syllabus Matrix. |
| AC61-3 Rev.30 | 15 April 2024 | Deleted sentence about medical certificate requirements in section under Night flying.<br>Delete references to Metflight at sections 8.50.2 and 8.50.4.<br>***Note 1:*** *On 19 September 2024, item 4.4 (kk) in Subject No. 4 PPL Air Law (Aeroplane and Helicopter), 4.4 Definitions was changed from "hover taxi" to "air-taxiing", to reflect a change in the AIPNZ. CAA would like to thank the participant who brought this to our attention.*<br>***Note 2:*** *On 5 November 2024, the last item in Subject No. 6 Air Navigation Subtopic 6.4.6 "relative bearing using the clock method" was amended to be included in the numbering sequence as item (q), since it had been inadvertently left off the list. CAA would like to thank the participant who brought this to our attention.* |

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| AC61-3 Rev.31 | 5 April 2025 | Makes changes to Subject No. 4, PPL Air Law (Aeroplane and Helicopter) and associated matrix.<br><br>Makes changes to align with redrafted rules under the CA Act 2023. New Act references have been updated.<br><br>Updates the note on page 4 relating to online applications.<br><br>Updates a website link to the flight test standards guide for the PPL cross-country demonstration of competency.<br><br>Corrects some minor stylistic errors.<br><br>***Note 1:*** *On 7 April 2025, we corrected a typo for Subject 14, Aircraft Technical Knowledge, Helicopter, in the Lubrication Systems – Engines section. CAA would like to thank the participant who brought this to our attention.*<br><br>***Note 2:*** *On 6 August 2026, in the PPL: Eligibility Requirements, Approved Equivalent section, we amended the date when the Human Factors examination requirement came into force from 5 November 1992 to 1 July 1993.* |

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## Private Pilot Licence (PPL) Medical Requirements

**Rule 61.105** permits the PPL flight training syllabus and flight test to be completed by student pilots holding either a class 2 medical certificate (or higher) issued under the Civil Aviation Act or a NZTA (Waka Kotahi) drivers licence medical certificate (DL9), for commercial drivers, that is applicable for class 2, 3, 4 or 5 with passenger endorsement.

The New Zealand registered health practitioner conducting the assessment will need to be informed that you require a DL9 drivers licence medical certificate, with at least a Class 2 (2,3,4,5) medical certificate with passenger (P) endorsement. At the top of the DL9 is a space to record your NZ driver's licence number. Please add above this your CAA licence number if you have one.

The DL9 form states a validity period of 60 days from the issue date. This validity is for Land Transport use only. In relation to the PPL, the DL9 medical certificate is current for 5 years if, at the date of examination, the holder is under 40 years old, or current for 2 years if, at the date of examination, the holder is over 40.

The original DL9 medical certificate should be retained with the PPL by the holder.

A copy of the DL9 medical certificate must be submitted to CAA. (If a PPL or higher licence is not already held, a copy of the DL9 medical certificate is only submitted to CAA with the application for licence issue).

A copy of the DL9 medical certificate does not need to be submitted to the NZTA. NZTA do not require a copy if it is being used for aviation purposes.

When a DL9 is renewed (after a PPL has been issued) a copy must be submitted to CAA within 7 days.

***Note*****:** *Student pilots using a DL9 to undertake their first solo flight, will need to present a current DL9 to their flight instructor to be able to do so, do not send a copy to CAA. CAA only requires a current DL9 with the PPL issue application.*

If a holder of a medical certificate is aware of, or has reasonable grounds to suspect, any change in his or her medical condition (or the existence of any previously undetected medical condition that may interfere with the safe exercise of the privileges of the PPL), the PPL holder must not exercise the privileges of the licence unless a health practitioner confirms the PPL holder is fit to hold a medical certificate. (Refer to rule 61. 35D). The acceptable means of compliance with this requirement is to have a new DL9 issued by your medical examiner.

### PPL Eligibility Requirements

**Rules 61.153(a)(2)** provides for a PPL to be issued to the holder of at least a current Class 2 medical certificate or DL9 medical certificate, Class 2 with passenger endorsement. A person holding a lifetime licence and relying solely on a current DL9 medical will be subject to some privilege limitations (see section **Rule 61.155 Privileges and Limitations** below).

**Rules 61.153(a)(3), (4), and (5):** The flight time experience that is acceptable to the Director is set out in Appendices I, III and IV (for aeroplanes) or Appendix V (for helicopters) of this AC.

A PPL is not issued to the holder of a higher licence (CPL/ATPL). Refer to rule 61.41 **Use of lower pilot licence or rating.**

***Note**: Applications for initial issue may be completed online using **MyAviation**, CAA's online portal for licensing requests, instead of filling in paper forms. **MyAviation** is CAA's preferred way to submit applications and is the equivalent of using the applicable paper form. Click the 'Online services' button in the top right corner of the CAA home page to get started.*

## Written Examination Credit

**Rule 61.153(a)(6)** requires an applicant for a PPL to have a written examination credit, or approved equivalent, that covers air law (A) or (H) as appropriate, air navigation and flight planning, meteorology, aircraft technical knowledge (A) or (H) as appropriate, human factors, and flight radiotelephony. The written examination credit 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 from the date of issue as detailed in rules 61.17(c) and (d).

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 a private pilot licence flight test must provide the flight examiner with written examination KDRs and evidence of knowledge improvement 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 private pilot licence written examinations are based on the syllabuses detailed in Appendix II of this AC.

All applicants are required to hold an approved English Language Proficiency credit. This credit will be required to at least Level 4.

## Approved Equivalent

A person holding a current PPL(A) issued under Part 61 who wishes to gain a PPL(H) is required to pass the written examination subject PPL Aircraft Technical Knowledge (Helicopter). The holder's PPL(A) together with the PPL Aircraft Technical Knowledge (Helicopter) pass are an approved equivalent to the written examinations required for a PPL(H).

A person holding a current PPL(H) issued under Part 61 who wishes to gain a PPL(A) is required to pass the written examination subject PPL Aircraft Technical Knowledge (Aeroplane). The holder's PPL(H) together with the PPL Aircraft Technical Knowledge (Aeroplane) pass are an approved equivalent to the written examinations required for a PPL(A).

A person holding a current CPL(A), or an ATPL(A) issued under Part 61 who wishes to gain a PPL (H), is required to pass the written examination subject PPL Aircraft Technical Knowledge (Helicopter). The holder's CPL(A) or ATPL(A) together with the PPL Aircraft Technical Knowledge (Helicopter) pass are an approved equivalent to the written examinations required for a PPL(H).

A person holding a current CPL(H), or an ATPL(H) issued under Part 61 who wishes to gain a PPL(A), is required to pass the written examination subject PPL Aircraft Technical Knowledge (Aeroplane). The holder's CPL(H) or ATPL(H) together with the PPL Aircraft Technical Knowledge (Aeroplane) pass are an approved equivalent to the written examinations required for a PPL(A).

In addition, if the original licence held by a person wishing to use the provisions above was gained from 1 July 1993:

1) the person is required to pass the appropriate Human Factors written examination

2) if the person wishing to use the provisions above does not hold an approved English Language Proficiency credit, this credit will be required to at least Level 4.

Examination pass results gained by a RNZAF pilot, who has successfully completed at least the basic phase of the NZDF ground, and flight training for aeroplanes will be accepted as approved equivalents to the written examinations required by rule 61.153(a)(6), for the issue of a PPL(A), except for the required Air Law written examination.

Examination pass results gained by a RNZAF pilot who has successfully completed at least the basic phase of the NZDF ground and flight training for helicopters will be accepted as approved equivalents to the written examinations required by rule 61.153(a)(6) for the issue of a PPL(H) except for the required Air Law written examination.

All RNZAF applicants are required to hold an approved English Language Proficiency credit. This credit will be required to at least Level 4.

### PPL Flight Test

**Rule 61.153(a)(7)** requires an applicant for a PPL to successfully demonstrate competence and knowledge to a flight examiner in a flight test in the appropriate category of aircraft. The flight test syllabus is detailed in Appendix VII of this AC and the standards required for a demonstration of competence are detailed in the appropriate *Flight Test Standards Guide* (FTSG).

### Recognition of Foreign Pilot Licence

**Rule 61.153(b):** The requirements that must be met before the Director will recognise a foreign pilot licence (issued by an ICAO Contracting State) are:

The person must:

1) hold a current unrestricted (ICAO State) foreign PPL or higher licence for the appropriate category of aircraft

2) meet Part 61 minimum flight experience requirements

3) present themselves to the holder of a Category A or B flight instructor rating who is employed by a New Zealand flight training organisation, and

~~4)~~ pass a New Zealand Biennial Flight Review in accordance with rule 61.39 with the flight instructor mentioned above.

Detailed information regarding the recognition of foreign licences is available on the CAA website. This is for pilots from other countries (and Australian PPL holders) regarding getting your licence recognised in New Zealand.

### Rule 61.155 Privileges and limitations

Rule 61.155 states the privileges that may be exercised by the holder of a PPL with at least a current Class 2 medical certificate issued under the Act. In addition, the reduced privileges that apply to any licence holder using a current DL9 medical certificate are stated. Below is advice on how to apply the reduced privileges whilst using a current DL9, as per rule 61.155(b), (bb), (bd) and (bf). Please read the rule in conjunction with this AC.

A licence holder relying solely on a current DL9 must not act as pilot- in-command or co-pilot of:

- any aircraft being operated for remuneration and/or hire or reward
- any single-engine or multi-engine aeroplane or helicopter with a MCTOW exceeding 2,730 kg
- an aircraft carrying more than 5 passengers (unless performing aerobatic manoeuvres, then no passenger is allowed)
- any aircraft operating at night exceeding 25 nm of a lit aerodrome (regardless of night privileges held on the PPL or higher licence)
- an aircraft operating under instrument flight rules (IFR) (regardless of any Instrument Rating endorsed on the PPL or higher licence)
- an aircraft performing aerobatics (or spinning) below 3000 feet AGL or whilst carrying a passenger (regardless of any Aerobatic Rating held and/or endorsed on the licence)
- any aeroplane or helicopter conducting agricultural operations
- any aeroplane or helicopter conducting banner or drogue towing below 500 feet AGL
- any aircraft conducting parachute operations above 10,000 feet AMSL
- operating into or out of a controlled aerodrome unless in radio contact with the appropriate ATS unit at all times, unless the pilot had already successfully passed a Colour Vision Deficiency (CVD) test and the operation is approved by ATS, or
- any NZ registered aircraft operating outside NZ airspace, unless a foreign country permits the licence holder to operate in that country.

# Appendix I—Private Pilot Licence Experience Requirements

## Aeroplane

Total flight experience

At least 50 hours in aeroplanes, or 40 hours in aeroplanes in the case of applicants who do not undertake the cross-country training, with appropriate cross-crediting of experience as detailed.

These times are to include at least the minimum flight time requirements that follow:

**Dual instruction**

15 hours in aeroplanes

**Solo flight time**

15 hours in aeroplanes.

**Dual instrument instruction**

5 hours in aeroplanes in accordance with the syllabus at Appendix III of this AC.

**Terrain and weather awareness**

5 hours' dual flight training to include at least:

- 2 hours' low flying
- 2 hours' terrain and weather awareness training in aeroplanes in accordance with Appendix IV of this AC.

The following wording would be acceptable for such certification:

*I hereby certify that ..... has satisfactorily completed the syllabus of training for aeroplane terrain and weather awareness and has demonstrated competence.*

*Signed.....Date .....*

*Instructor Category .....Client number .....*

For other applicants who need to meet this requirement for the issue of a New Zealand licence.

Where an appropriately qualified instructor or flight examiner (terrain awareness endorsed), can determine from logbook evidence and flight assessment that competence in terrain and weather awareness flying exceeds the above minimum requirements, that instructor/examiner may certify the logbook accordingly.

In making this determination the instructor or examiner is to make three successful assessments.

(1) Assess the applicant's logbook flight time for mountain flying experience to see that it exceeds the intent and standard for terrain and weather awareness required and certify each entry as assessed.

(2) By oral questioning assess that the knowledge of terrain and weather awareness is satisfactory in lieu of briefings stated in Appendix IV of this AC.

(3) Assess by inflight demonstration of competence that knowledge, skill and attitude in terrain and weather awareness meets or exceeds the appropriate requirements. This assessment may form part of any biennial flight review requirement.

The logbook must then be certified that this process has been completed satisfactorily by the instructor or examiner concerned.

**Advanced dual instruction**

5 hours in aeroplanes in accordance with the syllabus that follows:

- circuit joining procedures
- steep turns
- slow flight
- compass headings turning on to and maintaining compass headings
- stalling power off, power on, flap down power off, flap down power on
- forced landing without power
- minimum length fields taking-off and landing
- poor visibility low flying, including precautionary landings
- crosswind taking-off and landing

**Pilot cross-country navigation training**

10 hours in aeroplanes in accordance with the syllabus in Appendix VI of this AC.

An applicant who does not meet the cross-country requirements does not comply with rule 61.153(a)(3)(i) and may not exercise the privileges of a private pilot on cross-country flight.

**Night flying**

***Note:*** *Only the holder of at least a current Class 1 or 2 medical certificate may exercise night flying privileges exceeding 25 nm of a lit aerodrome.*

Students must have a minimum of 2 hours' instrument flight time in aeroplanes, including at least the full panel requirements of Appendix III of this AC before undertaking night flight training.

5 hours in aeroplanes: this is to include 2 hours of dual instruction and 2 hours of solo flight.

The following wording, which may be in the form of a logbook sticker, would be acceptable for certification:

*I hereby certify that.....has satisfactorily completed the syllabus of night flying for PPL (Aeroplane).*

*Signed.....Date.....*

*Instructor Category.....Client number.....*

An applicant who does not meet this experience requirement does not comply with rule 61.153(a)(4) and may not exercise the privileges of a private pilot by night.

**Cross-crediting**

Where an applicant produces acceptable evidence of piloting experience in helicopters, gliders, powered gliders, or three-axis microlights, half the pilot-in-command (PIC) time experienced within the immediately preceding 12 months, up to a maximum of 10 hours' total, may be credited towards the total flight experience required, but not to the specific experiences.

## Helicopter

***Total flight experience***

At least 50 hours' total flight experience in helicopters, except for allowable cross-crediting.

These times are to include at least the minimum flight time requirements that follow:

**Dual instruction**

20 hours in helicopters. The applicant may accumulate the required flight experience in an amateur-built helicopter if they are the constructor or owner of the helicopter.

**Solo flight time**

15 hours in helicopters. The applicant may accumulate flight experience in an amateur-built helicopter if they are the constructor or the owner of the helicopter. Not more than 5 hours may be in amateur-built helicopters if the applicant is not the constructor or owner of the helicopter.

**Mountainous terrain awareness training**

Mountainous terrain awareness training, consisting of at least 5 hours' theory ground instruction and at least 5 hours' flight experience in helicopters.

The training is to be conducted in accordance with the theory and flight components of the Helicopter Mountainous Terrain Awareness syllabus set out in Appendix V of this AC. The flight experience requirement is to include at least 3 hours' dual instruction. At least one dual exercise is to include flight to the greater of 6,000 feet AMSL or 3,000 feet AGL. Each mountainous terrain awareness training flight is to be clearly identified in the "details" column of the pilot's logbook.

Flight experience gained in meeting other minimum requirements may not be cross-credited towards the mountainous terrain awareness training requirement and vice versa.

At the successful completion of helicopter mountainous terrain awareness training, a flight instructor is to certify in the pilot's logbook that the pilot has demonstrated competence to:

- fly a pre-planned route between 500 feet and 1,000 feet AGL through or within mountainous terrain, following major valley systems or distinctive terrain features, and crossing saddles and ridges
- at an open, flat area, not at an aerodrome but in mountainous terrain without a natural horizon, and in winds up to 15 knots: perform a reconnaissance, determine the wind direction and report it, then carry out a circuit including a power check and normal approach to a hover or landing as applicable, and take-off.

The following wording, which may be in the form of a stick-on label or a rubber stamp, would be acceptable for such certification:

*I hereby certify that ..... has satisfactorily completed the syllabus of training for helicopter mountainous terrain awareness and has demonstrated competence.*

*Signed.....Date .....*

*Instructor Category .....Client number .....*

***For other applicants who need to meet this requirement for the issue of a New Zealand licence:***

Where a qualified instructor or flight examiner can determine from logbook evidence and flight assessment (which may be completed during the BFR) that competence in mountainous terrain awareness flying exceeds the above minimum requirements, that instructor/examiner may certify the logbook accordingly.

**Cross-country navigation training**

10 hours in helicopters this is to have been conducted in accordance with the syllabus set out in Appendix VI of this AC.

An applicant who does not meet the cross-country requirements does not comply with rule 61.153(a)(3)(i) and may not exercise the privileges of a private pilot on cross-country flight.

**Advanced dual instruction:**

5 hours in helicopters in accordance with the syllabus that follows:

- emergencies including autorotative approaches with power recovery to the hover and engine failure in the hover, forced landings, fire in the air, and ditching
- hovering turns 180º and 360º right and left
- figure S turn
- slope landing
- pattern flying with constant heading
- quick stops
- bad weather low flying low visibility techniques

- crosswind take-off and landing
- minimum power take-off and roll-on landing.

**Carriage of sling loads**

5 hours of sling load training in helicopters which is to include 3 hours' dual instruction and 1 hour of solo flight time. An applicant who does not meet this requirement does not comply with rule 61.153(a)(5) and may not exercise the privileges of a PPL(H) for sling load operations.

**Night flying**

***Note:*** *Only the holder of at least a current Class 1 or 2 medical certificate may exercise night flying privileges exceeding 25 nm of a lit aerodrome.*

Students must have 2 hours' dual instrument flight time in helicopters including the following instrument flight manoeuvres before undertaking night flight training:

- straight and level flight maintain heading to a required accuracy of ± 5º, ± 100 feet altitude and in-balance
- medium & rate 1 turns at least 180º turns left and right, in-balance, to within ± 10º of pre-selected roll-out heading with a maximum altitude variation of ± 100 feet
- climbing and descending to pre-selected altitudes (level flight to be re-established at the pre-selected altitude ± 100 feet)
- unusual attitude prompt and correct recovery from unusual attitudes
- emergencies establish autorotation and turn into wind.

Helicopters used for the instrument flight training should have operational instruments consisting of at least an airspeed indicator, an altimeter, a turn and slip indicator, a magnetic compass and a VSI.

**For night operations within 25 nm of a lighted heliport or aerodrome**

2 hours' dual instrument flight instruction in helicopters (as above)

5 hours' night flight time in helicopters including at least:

- 2 hours' dual instruction
- 2 hours' solo.

An applicant who does not meet this night flying experience requirement does not comply with rule 61.153(a)(4) and may not exercise those privileges of a PPL(H) at night. In addition, the holder of a NZ lifetime licence must hold at least a current class 2 medical certificate before exercising any night flight privileges.

**For night operations beyond 25 nm of a lighted heliport or aerodrome (night cross-country)**

5 hours' dual instrument instruction in helicopters

10 hours' night flight time in helicopters including

- 3 hours' night dual cross-country training conducted in accordance with the syllabus set out in Appendix VI of this AC.

An applicant who does not meet these night flying experience requirements does not comply with rule 61.153(a)(4) and may not exercise those privileges of a PPL(H) at night beyond 25 nm of a lighted heliport or aerodrome. In addition, the holder of a NZ lifetime licence must hold at least a current class 2 medical certificate before exercising any night flight privileges exceeding 25 nm of a lit aerodrome.

**Cross-crediting**

Where an applicant produces acceptable evidence of piloting experience in aeroplanes, gliders, powered gliders, or three-axis microlights, half the PIC time experienced within the immediately preceding 12 months, up to a maximum of 10 hours in total, may be credited towards the total flight experience required, but not to the specific experiences.

Where an applicant produces acceptable evidence of flight training experience in a tethered helicopter that has been accepted by the Director for the purpose of helicopter flight training, a maximum of 10 hours may be credited towards the total flight experience required, but not to the specific experiences.

# Appendix II—Private Pilot Licence Written Examination Syllabus

## Subject No. 2 Flight Radiotelephony

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 feedback to the examination candidate.

| Sub Topic | Syllabus Item |
|---|---|
| **2.2** | **Basic Radio Wave Propagation** |
| 2.2.2 | Describe the basic characteristics of High Frequency (HF) and Very High Frequency (VHF) in terms of:<br>(a) range;<br>(b) surface interference;<br>(c) clarity of reception. |
| | **Radio Equipment** |
| **2.4** | **Transceivers** |
| 2.4.2 | Describe the purpose, correct manipulation and adjustment of the controls of commonly used aeronautical transceivers. |
| 2.4.4 | Describe the correct operation of:<br>(a) the headset/boom microphone combination; and<br>(b) the handheld microphone. |
| **2.6** | **SSR Transponders** |
| 2.6.2 | Describe the manipulation and adjustment of the controls of commonly used transponders. |
| 2.6.4 | Describe the function of the following terms, and explain the procedures to transmit:<br>(a) Mode A information; and<br>(b) Mode C information. |
| 2.6.6 | State the emergency codes and explain when they should be used. |
| 2.6.8 | Demonstrate proficiency in transponder terminology and describe the actions and responses expected from a pilot, following ATC transponder instructions. |
| 2.6.10 | List the documents that identify transponder mandatory airspace. |
| 2.6.12 | Describe the procedures for operations in transponder mandatory airspace when the aircraft transponder is inoperative. |

| Sub Topic | Syllabus Item |
|---|---|
| **2.8** | **Emergency Locator Transmitter (ELT, aka ELBA or ELB).** |
| 2.8.2 | State the frequency(ies) on which the ELT transmits. |
| 2.8.4 | State the requirements for the carriage of an ELT. |
| 2.8.6 | Explain how an ELT can be activated:<br>(a) automatically in the event of an impact; and<br>(b) manually. |
| 2.8.8 | Describe the management of the ELT following a forced landing. |
| 2.8.10 | Describe the requirements associated with ELT testing. |
| 2.8.12 | Explain the procedures to follow in the case of inadvertent ELT activation. |
| **2.10** | **Practices and Rules** |
| 2.10.2 | Demonstrate proficiency in transmitting and receiving spoken messages competently and in accordance with prescribed procedures, including<br>(a) language to be used;<br>(b) word spelling;<br>(c) transmission of numerals;<br>(d) procedure words and phrases;<br>(e) time system;<br>(f) establishment of communications;<br>(g) frequencies to be used;<br>(h) identification of service;<br>(i) radiotelephony aircraft callsigns;<br>(j) procedures for exchange of messages;<br>(k) corrections and repetition tests;<br>(l) listening out;<br>(m) readability scale. |
| 2.10.4 | Demonstrate a good working knowledge of the following Civil Aviation Rules:<br>(a) rule 91.217 (5);<br>(b) rule 91.243;<br>(c) rule 91.245 (b), (c) and (d); |

| Sub Topic | Syllabus Item |
|---|---|
| | (d) rule 91.247; |
| | (e) rule 91.249 (a) and (b); |
| | (f) rule 91.513; |
| | (g) rule 91.515; |
| | (h) rule 91.529. |
| 2.10.6 | AIPNZ Volume 1, describe the radio procedures, requirements, and functions associated with: |
| | (a) UNICOM; |
| | (b) ATIS; |
| | (c) AFRU; |
| | (d) AWIB. |
| 2.10.8 | AIPNZ demonstrate a good working knowledge of the phraseology used for, and by, VFR aircraft. |
| 2.10.10 | Demonstrate a good working knowledge of the AIPNZ and AC172-1 with regard to: |
| | (a) communication services; |
| | (b) communication aspects in the Search and Rescue section. |
| **2.12** | **Phraseology and Procedures** |
| 2.12.2 | Demonstrate proficiency in standard radiotelephony phraseologies and procedures for: |
| | (a) all VFR operations in controlled and uncontrolled airspace; |
| | (b) taxi, take-off, approach and landing at controlled aerodromes, Flight Service aerodromes, aerodromes served by UNICOM, and uncontrolled aerodromes; and |
| | (c) read-back instructions. |
| 2.12.4 | State the limitations on pilots with regard to: |
| | (a) unauthorised transmissions; |
| | (b) secrecy of communications. |
| **2.14** | **Distress and Urgency Communications** |
| 2.14.2 | Describe the degrees of emergency that warrant: |
| | (a) a distress call (MAYDAY); and |

| Sub Topic | Syllabus Item |
|---|---|
| | (b) an urgency call (PAN PAN). |
| 2.14.4 | Explain the procedures and phraseology involved in transmitting a MAYDAY and PAN call with emphasis on: |
| | (a) radio frequencies; |
| | (b) station(s) to call; |
| | (c) contents of the call; |
| | (d) enforcing radio silence. |
| 2.14.6 | Describe the actions by stations not involved in the emergency with regard to: |
| | (a) radio silence; and |
| | (b) provision of assistance. |
| 2.14.8 | Describe the procedure involved in terminating emergency communications. |
| **2.16** | **Loss of Communications - Aircraft Equipment** |
| 2.16.2 | Describe the checks that should be followed when becoming aware of an aircraft communication system failure, including a check of: |
| | (a) radio power source; |
| | (b) function settings (frequency, squelch and similar); |
| | (c) microphone or headset. |
| 2.16.4 | Detail the actions to be taken when experiencing loss of communications in: |
| | (a) controlled airspace; |
| | (b) uncontrolled airspace; |
| | (c) special use airspace. |
| 2.16.6 | Describe corrective actions that could be taken, including: |
| | (a) change of frequency or station; |
| | (b) transmitting blind; |
| | (c) increase in altitude. |
| 2.16.8 | Detail the speechless technique using unmodulated transmissions. |
| 2.16.10 | State the meaning of light signals used by ATC. |
| **2.18** | **Loss of Communications - ATS Equipment Failure** |
| 2.18.2 | State the occasions when TIBA (traffic information broadcasts by aircraft) might be introduced. |

| Sub Topic | Syllabus Item |
|---|---|
| 2.18.4 | Detail the TIBA procedures with respect to:<br>(a) VHF frequencies to be used;<br>(b) listening watch;<br>(c) times of broadcasts. |

**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 | |
| 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. 4 PPL 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 feedback 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** |
| **4.2** | **Aviation Legislation** |
| 4.2.2 | Describe the requirements to hold an aviation document, as laid down in the CA Act 2023, sections 55 and 78. |
| 4.2.4 | Describe the criteria for the fit and proper person test, as laid down in the CA Act 2023, section 80.<br><br>***Note**: The criteria for 'fit and proper' have changed slightly in the CA Act 2023, compared to the 1990 Act.* |
| 4.2.6 | Describe the duties of the PIC, as laid down in the CA Act 2023, sections 14, 15 and 16. |
| 4.2.8 | Describe the responsibilities of a licence holder with respect to changes in their medical condition, as laid down in the CA Act 2023, Schedule 2, clause 8. |
| 4.2.10 | Describe the responsibilities of a licence holder with respect to the surrender of a medical certificate as laid down in the CA Act 2023, Schedule 2, clause 8. |
| 4.2.12 | Describe the responsibilities of a licence holder with respect to safety offences, as laid down in the CA Act 2023, sections 40, 41 and 103. |
| **4.4** | **Definitions**<br><br>***Note**: Since some definitions in Part 1 have changed to align with the CA Act 2023, participants are encouraged to check the new Part 1.*<br><br>CAR Part 1 (unless otherwise noted)<br><br>State the definition of:<br><br>(a) accident;<br><br>(b) Act;<br><br>(c) aerobatic flight;<br><br>(d) aerodrome;<br><br>(e) aerodrome elevation;<br><br>(f) aerodrome traffic circuit;<br><br>(g) aeronautical information circular;<br><br>(h) aeronautical information publication; |

| Sub Topic | Syllabus Item |
|---|---|
| | (i) AIP supplement; |
| | (j) air traffic control service; |
| | (k) airworthiness certificate; |
| | (l) airworthy condition; |
| | (m) alerting service; |
| | (n) altitude; |
| | (o) apron; |
| | (p) ATC clearance; |
| | (q) ATC instruction; |
| | (r) aviation event; |
| | (s) AWIB service; |
| | (t) basic weather report; |
| | (u) ceiling; |
| | (v) controlled flight; |
| | (w) cross-country flight; |
| | (x) dangerous goods; |
| | (y) day; |
| | (z) dual flight time; |
| | (aa) emergency locator transmitter; |
| | (bb) final reserve fuel; |
| | (cc) fit and proper person; |
| | (dd) flight information service; |
| | (ee) flight manual; |
| | (ff) flight plan; |
| | (gg) flight time; |
| | (hh) height; |
| | (ii) air-taxiing (Helicopter candidates only); (AIP GEN) |
| | (jj) incident; |

| Sub Topic | Syllabus Item |
|---|---|
| | (kk) landing area; |
| | (ll) night |
| | (mm) night vision imaging system |
| | (nn) NOTAM; |
| | (oo) passenger; |
| | (pp) personal locator beacon; |
| | (qq) pilot-in-command; |
| | (rr) rating; |
| | (ss) SARTIME; |
| | (tt) simultaneous operations – visual conditions; (AIP GEN) |
| | (uu) take-off weight; |
| | (vv) threshold; (Rule 121.3) |
| | (ww) Technical Instructions; |
| | (xx) type; |
| | (yy) UNICOM service; |
| | (zz) VFR flight; |
| | (aaa) vicinity of an aerodrome; (AIP GEN) |
| | (bbb) visibility; |
| | (ccc) visual meteorological conditions; |
| | (ddd) visual reference (AIP GEN). |

**4.6 Abbreviations**

CAR Part 1 (unless otherwise noted)

State the meaning of the following abbreviations:

(a) ABN; (AIP GEN)

(b) AGL;

(c) AFIS; (AIP GEN)

(d) AFRU;

(e) AMSL;

| Sub Topic | Syllabus Item |
|---|---|
| | (f) ATIS; |
| | (g) AWIB; |
| | (h) AWS; (AIP GEN) |
| | (i) BWR; (AIP GEN) |
| | (j) CAR; |
| | (k) DTHR; (AIP GEN) |
| | (l) ECT; (AIP GEN) |
| | (m) ELT; |
| | (n) FATO (Helicopter candidates only); (AIP GEN) |
| | (o) ME1; |
| | (p) ME2; |
| | (q) MCT; (AIP GEN) |
| | (r) NVIS; |
| | (s) POB; (AIP GEN) |
| | (t) QNH; |
| | (u) TALO (Helicopter candidates only); (AIP GEN) |
| | (v) TLOF (Helicopter candidates only); (AIP GEN) |
| | (w) VFR; |
| | (x) VPC; (AIP GEN). |
| | **Personnel Licensing** |
| **4.10** | **Requirements for Licences and Ratings** |
| 4.10.2 | State the requirements for holding a pilot's licence. CAR Part 61 |
| 4.10.4 | State the requirements for a PIC to hold a type rating on the type of aircraft being flown. CAR Part 61 |
| 4.10.6 | State the general requirements for entering flight details into a pilot's logbook. CAR Part 61 |
| **4.12** | **Eligibility, Privileges and Limitations** |
| 4.12.2 | Describe the allowance for a person who does not hold a current pilot licence to fly dual with a flying instructor. CAR Part 61 |

| Sub Topic | Syllabus Item |
|---|---|
| 4.12.4 | State the solo flight requirements on a person who does not hold a current pilot licence. CAR Part 61 |
| 4.12.6 | State the limitations on a person who does not hold a current pilot licence. CAR Part 61 |
| 4.12.8 | State the eligibility requirements for the issue of a private pilot licence. CAR Part 61 |
| 4.12.10 | State the privileges of holding a private pilot licence. CAR Part 61 |
| 4.12.12 | State the limitations on the holder of a private pilot licence. CAR Part 61 |
| 4.12.14 | State the requirements and limitations of a PPL holder sharing the cost of a flight. CAR Part 91 |
| 4.12.16 | List the limitations of a PPL holder operating solely on a Land Transport (DL9) medical. |
| **4.14** | **Competency, Currency and Recency** |
| 4.14.2 | State the recent experience requirements of a PIC, by day and by night, who is the holder of a private pilot licence. CAR Part 61 |
| 4.14.4 | State the requirements for the completion of a biennial flight review. CAR Part 61 |
| **4.16** | **Medical Requirements** |
| 4.16.2 | State the requirements for holding a medical certificate. CAR Part 61 |
| 4.16.4 | State the requirements on a person applying for a medical certificate. CAR Part 67 |
| 4.16.6 | State the requirements for maintaining medical fitness following the issue of a medical certificate. CA Act 2023, Schedule 2, clause 8 |
| 4.16.8 | State the normal currency period of the Class 2 medical certificate for a PPL holder who is under the age of 40. CAR Part 67 |
| 4.16.10 | State the normal currency period of the Class 2 medical certificate for a PPL holder who is 40 years of age or more on the date that the certificate is issued. CAR Part 67 |
| 4.16.12 | State the normal currency period of the Land Transport medical certificate (DL9) for a holder who is under the age of 40. CAR Part 61 |
| 4.16.14 | State the normal currency period of the Land Transport medical certificate (DL9) for a holder who is 40 years of age or more on the date that the certificate is issued. CAR Part 61 |
| | **Airworthiness of Aircraft and Aircraft Equipment** |
| **4.20** | **Documentation** |
| 4.20.2 | State the documents which must be carried in aircraft operated in New Zealand. CAR Part 91 |

| Sub Topic | Syllabus Item |
|---|---|
| **4.22** | **Aircraft Maintenance** |
| 4.22.2 | Describe the maintenance requirements of an aircraft operator. CAR Part 91 |
| 4.22.4 | State the requirement for annual and 100-hour inspections. CAR Part 91 |
| 4.22.6 | State the requirement for a review of airworthiness. CAR Part 91 |
| 4.22.8 | State the requirements for maintenance records. CAR Part 91 |
| 4.22.10 | State the requirements for and contents of a technical log. CAR Part 91 |
| 4.22.12 | State the requirements for entering defects into a technical log. CAR Part 91 |
| 4.22.14 | State the requirements for clearing defects from a technical log. CAR Part 91 |
| 4.22.16 | State the limitations and requirements on a person undertaking ‘pilot maintenance’. CAR Part 43 |
| 4.22.18 | State the requirements for conducting an operational flight check on an aircraft. CAR Part 91 |
| 4.22.20 | State the inspection period for radios. CAR Part 91 |
| 4.22.22 | State the inspection period for altimeters. CAR Part 91 |
| 4.22.24 | State the inspection period for transponders. CAR Part 91 |
| 4.22.26 | State the normal inspection period for the ELT. CAR Part 91 |
| **4.24** | **Instruments and Avionics** |
| 4.24.2 | State the minimum instrument requirements for a day VFR flight. CAR Part 91 |
| 4.24.4 | State the minimum instrument requirements for a night VFR flight. CAR Part 91 |
| 4.24.6 | State the radio equipment requirements for a VFR flight. CAR Part 91 |
| 4.24.8 | State the communications and navigation equipment requirements for a VFR over water flight. CAR Part 91 |
| **4.26** | **Equipment** |
| 4.26.2 | State the equipment requirements for a night VFR flight. CAR Part 91 |
| 4.26.4 | State the equipment requirements for flight over water. CAR Part 91 |
| 4.26.6 | State the requirements for indicating the time in flight. CAR Part 91 |
| 4.26.8 | State the requirements for emergency equipment in aircraft with seating capacity for less than 10 passengers. CAR Part 91 |
| 4.26.10 | State the requirements for an ELT. CAR Part 91 |
| | **General Operating and Flight Rules** |

| Sub Topic | Syllabus Item |
|---|---|
| **4.30** | **General Operating Requirements** |
| 4.30.2 | Describe the requirements of passengers to comply with instructions and commands. CAR Part 91 |
| 4.30.4 | State the requirements for operating an aircraft in simulated instrument flight. CAR Part 91 |
| 4.30.6 | State the requirements of a PIC with respect to the safe operation of an aircraft. CAR Part 91 |
| 4.30.8 | Describe the authority of the PIC. CAR Part 91 |
| 4.30.10 | State the requirements for crew occupation of seats and wearing safety belts. CAR Part 91 |
| 4.30.12 | State the requirements for the occupation of seats and wearing of restraints. CAR Part 91 |
| 4.30.14 | State the requirements for the use of oxygen equipment. CAR Part 91 |
| 4.30.16 | State the requirements for briefing passengers prior to flight. CAR Part 91 |
| 4.30.18 | State the requirements for familiarity with operating limitations and emergency equipment. CAR Part 91 |
| 4.30.20 | State the requirements for carrying appropriate aeronautical publications and charts in flight. CAR Part 91 |
| 4.30.22 | State the requirements for operating on and in the vicinity of an aerodrome. CAR Part 91 |
| 4.30.24 | Describe the standard overhead joining procedure, and state when it should be used. AIP AD |
| 4.30.26 | State and describe the application of the right of way. CAR Part 91 |
| 4.30.28 | Explain the requirement for aircraft lighting. CAR Part 91 |
| 4.30.30 | State the requirements for wearing/holding identity documentation in certain areas. CAR Part 139 |
| **4.32** | **General Operating Restrictions** |
| 4.32.2 | State the restrictions on smoking in an aircraft. CA Act 2023, section 402 |
| 4.32.4 | State the restrictions associated with the abuse of drugs and alcohol. CAR Part 91, rule 91.118. |
| 4.32.6 | State the restrictions on the use of portable electronic devices in flight. CAR Part 91 |
| 4.32.8 | State the restrictions on the carriage and discharge of firearms on aircraft. CAR Part 91 |
| 4.32.10 | Explain the restrictions on stowage of carry-on baggage. CAR Part 91 |

| Sub Topic | Syllabus Item |
|---|---|
| 4.32.12 | Explain the restrictions on the carriage of cargo. CAR Part 91 |
| 4.32.14 | State the restrictions applicable to aircraft flying near other aircraft. CAR Part 91 |
| 4.32.16 | State the restrictions on the dropping of objects from aircraft in flight. CAR Part 91 |
| 4.32.18 | State the speed limitation on aircraft operating under VFR. CAR Part 91 |
| 4.32.20 | State the minimum heights for VFR flights (A) or (H). CAR Part 91 |
| 4.32.22 | State the restrictions when operating VFR in icing conditions. CAR Part 91 |
| 4.32.24 | State the restrictions applicable to operating an aircraft in aerobatic flight. CAR Part 91 |
| 4.32.26 | State the restrictions applicable to parachute-drop operations. CAR Part 91 |
| 4.32.28 | State the restrictions applicable to aircraft towing gliders. CAR Part 91 |
| 4.32.30 | State the restrictions applicable to aircraft towing objects other than gliders. CAR Part 91 |
| **4.34** | **General Meteorological Requirements and Restrictions** |
| 4.34.2 | State the met minima for VFR flight (A) or (H) in various airspace. CAR Part 91 |
| 4.34.4 | State the restrictions and met minima for Special VFR flight (A) or (H). CAR Part 91 |
| **4.36** | **Carriage of Dangerous Goods** |
| 4.36.2 | State the restriction for the carriage of dangerous goods in an aircraft. CAR Part 92 |
| 4.36.4 | State the requirements for the carriage of non-dangerous goods in an aircraft. CAR Part 92 |
| | **Flight Planning and Preparation** |
| **4.50** | **Flight Preparation** |
| 4.50.2 | Explain the requirements for obtaining and considering relevant information prior to flight. CAR Part 91 |
| 4.50.4 | Describe the publications and their content that provide operational route and aerodrome information. |
| 4.50.6 | Derive operational information from charts and publications that provide route and aerodrome information. |
| **4.54** | **Fuel Requirements** |
| 4.54.2 | State the minimum fuel reserve (A) or (H) required for a day VFR flight. CAR Part 91 |
| 4.54.4 | State the minimum fuel reserve (A) or (H) required for a night VFR flight. CAR Part 91 |
| **4.56** | **Flight Plans** |

| Sub Topic | Syllabus Item |
|---|---|
| 4.56.2 | State the requirements for the filing of a flight plan for flight under VFR. CAR Part 91 |
| 4.56.4 | State the requirements for notification of changes to the filed flight plan. CAR Part 91 |
| 4.56.6 | State the requirements for the terminating a flight plan. CAR Part 91 |
| 4.56.8 | Describe the difference between ETA and SARTIME. CAR Part 91 |
| 4.56.10 | State the time search and rescue action would be initiated if a flight plan is not terminated before SARTIME. AIP ENR |
| | **Air Traffic Services** |
| **4.60** | **Communications** |
| 4.60.2 | Derive from operational publications, the required radio frequency for communicating with specified ATC units. |
| 4.60.4 | State the requirements for making position reports to an ATS unit. CAR Part 91 & AIP ENR |
| 4.60.6 | State the content of a VFR position report. AIP ENR |
| 4.60.8 | State the purpose of Universal Communications Services (UNICOM). AIP GEN |
| 4.60.10 | State the purpose of an Aerodrome Frequency Response Unit (AFRU). AIP GEN |
| 4.60.12 | State the purpose of Aerodrome and Weather Information Broadcasts (AWIB). AIP GEN |
| 4.60.14 | State the meaning of the various light signals from a control tower. CAR Part 91 & AIP AD |
| 4.60.16 | State the communications requirements when TIBA procedures are in force. AIP ENR |
| **4.62** | **Clearances** |
| 4.62.2 | State the requirements for complying with ATC clearances and instructions. CAR Part 91 & AIP ENR |
| 4.62.4 | State the requirements for coordinating with an aerodrome flight information service. CAR Part 91 |
| 4.62.6 | State the requirements for receiving an ATC clearance prior to entering various types of airspace, and ground manoeuvring area. CAR Part 91 & AIP ENR |
| 4.62.8 | State the requirements for receiving an ATC clearance prior to re-entering controlled airspace. CAR Part 91 & AIP ENR |
| **4.63** | **Separation** |
| 4.63.2 | Describe the method of passing traffic information using the clock code. |
| 4.63.4 | Describe the situations where Air Traffic Control is responsible for the provision of separation between VFR, SVFR and IFR traffic. AIP ENR |

| Sub Topic | Syllabus Item |
|---|---|
| 4.63.6 | Describe the situations where the PIC is responsible for maintaining separation from other traffic. AIP ENR |
| 4.63.8 | Describe the normal separation standards applied by ATC. AIP ENR |
| 4.63.10 | Describe the situations where the normal separation may be reduced. AIP ENR |
| 4.63.12 | State the wake turbulence separation requirements for light aircraft in non-radar environment. AIP AD |
| **4.66** | **Radar Services** |
| 4.66.2 | Describe the radar services available to VFR flights. AIP ENR |
| | **Airspace, Aerodromes and Heliports** |
| **4.70** | **Altimetry** |
| 4.70.2 | Explain the altimeter setting requirements for flight under VFR. CAR Part 91 & AIP ENR |
| 4.70.4 | 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 |
| 4.70.6 | Describe QNH zones and state when zone QNH should be used. AIP ENR |
| **4.72** | **Cruising Levels** |
| 4.72.2 | State the altitude requirements when cruising VFR within the New Zealand FIR. CAR Part 91 & AIP ENR |
| 4.72.4 | Describe situations where ATC may assign cruising altitudes not in accordance with the VFR table of cruising altitudes. AIP ENR |
| **4.74** | **Transponders** |
| 4.74.2 | State the requirements for the operation of transponders within the New Zealand FIR. CAR Part 91 & AIP ENR |
| 4.74.4 | Describe the procedures required of pilots operating transponders. AIP ENR |
| 4.74.6 | State the requirements and limitations on an aircraft operating under VFR in transponder mandatory airspace without an operating transponder. CAR Part 91 & AIP ENR |
| **4.75** | **Airspace** |
| 4.75.2 | State the rules pertaining to operating VFR in the various classes of airspace. CAR Part 91 & AIP ENR |
| 4.75.4 | Describe the vertical limits and purpose of control zones (CTR). CAR Part 71 |
| 4.75.6 | Describe the vertical limits and purpose of control areas (CTA). CAR Part 71 |
| 4.75.8 | State the status and conditions relating to flight in VFR transit lanes. AIP ENR |

| Sub Topic | Syllabus Item |
|---|---|
| 4.75.10 | Describe the status and purpose of a general aviation area (GAA). CAR Part 91 & AIP ENR |
| 4.75.12 | Describe visual reporting points |
| 4.75.14 | Describe the status of controlled airspace when ATC go off duty. AIP GEN |
| 4.75.16 | State the restrictions on operating an aircraft in a restricted area. CAR Part 91 & AIP ENR |
| 4.75.18 | State the restrictions on operating an aircraft in a military operating area (MOA). CAR Part 91 & AIP ENR |
| 4.75.20 | State the restrictions and operating considerations relating to operating an aircraft in a mandatory broadcast zone (MBZ). CAR Part 91 & AIP ENR |
| 4.75.22 | State the restrictions and operating considerations relating to operating an aircraft in a volcanic hazard zone (VHZ). CAR Part 91 & AIP ENR |
| 4.75.24 | State the restrictions and operating considerations relating to operating an aircraft in a danger area. CAR Part 91 & AIP ENR |
| 4.75.26 | State the restrictions and operating considerations relating to operating an aircraft in a designated low flying zone (LFZ). CAR Part 91 & AIP ENR |
| 4.75.28 | State the operating considerations relating to operating an aircraft in a common frequency zone (CFZ). AIP ENR |
| 4.75.30 | State the operating considerations relating to operating an aircraft over or close to temporary hazards/airspace. AIP ENR |
| 4.75.32 | Interpret airspace information on aeronautical charts used for VFR flights |
| **4.76** | **Aerodromes and Heliports** |
| 4.76.2 | Describe the limitations on the use of a place as an aerodrome or heliport. CAR Part 91 |
| 4.76.4 | Describe the method of runway designation. AIP AD |
| 4.76.6 | Describe the movement area of an aerodrome. CAR Part 1 |
| 4.76.8 | Describe the meaning of the various aerodrome ground signals. |
| 4.76.10 | Interpret information on aerodrome/heliport charts. AIP GEN & AIP Volume 4 |
| 4.76.12 | Interpret runway and taxiway signs and markings. CAR Part 139 |
| **4.78** | **Aerodromes Lighting** |
| 4.78.4 | Describe the following lighting systems:<br>(a) Runway edge lighting (REDL);<br>(b) Runway landing threshold lighting (RTHL); |

| Sub Topic | Syllabus Item |
|---|---|
| | (c) Runway end lighting (RENL); |
| | (d) Runway centreline lighting system (RCLL); |
| | (e) Runway end identifier lighting (REIL); |
| | (f) Circling guidance lighting (CGL); |
| | (g) Runway lead in lighting (RLLS); and, |
| | (h) Pilot activated lighting (PAL) |
| 4.78.6 | Describe aerodrome beacons. |
| | **Emergencies; Incidents; and Accidents** |
| **4.80** | **Responsibilities of Pilots** |
| 4.80.2 | State the requirement for the notification of accidents. CAR Part 12 |
| 4.80.4 | State the requirement for the notification of incidents. CAR Part 12 |
| 4.80.6 | State the extent to which a pilot may deviate from the CA Act or rules in an emergency situation. CA Act 2023, section 15(1) and 16(1)&(2) |
| 4.80.8 | State the pilot action required following deviation from the CA Act or rules in an emergency situation. CA Act 2023, sections 15(2) and 16(3) |
| **4.82** | **Communications and Equipment** |
| 4.82.2 | State the transponder code a pilot should set to indicate an emergency condition. AIP ENR |
| 4.82.4 | State the transponder code a pilot should set to indicate a loss of communications. AIP ENR |
| 4.82.6 | State the transponder code a pilot should set to indicate that the aircraft is being subjected to unlawful interference. AIP ENR |
| 4.82.8 | Describe the means by which ATC will verify the transmission of an emergency SSR transponder code. AIP ENR |
| 4.82.10 | Describe the use of the speechless technique using unmodulated transmissions. AIP ENR |
| 4.82.12 | Describe and interpret ground-air visual signal codes. AIP GEN |
| 4.82.14 | Describe the procedures for directing a surface craft to a distress incident. AIP GEN |
| 4.82.16 | State the procedures for the emergency activation of an ELT. AIP GEN |
| 4.82.18 | State the pilot action required following the inadvertent transmission of an ELT. AIP GEN |
| 4.82.20 | State the requirements for the operational testing of an ELT. AIP GEN |

| Sub Topic | Syllabus Item |
|---|---|
| 4.82.22 | State the procedures to be followed on receiving an ELT signal. AIP GEN |

| 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 | **√** | | | |
| | | | | | | |
| | | | | | | |
| **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 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 | | | | √ |
| | En route Diversion Calculation | 58 | | √ | | √ |
| | | | | | | |
| **Flight Management** | Flight Management | 60 | √ | | | |
| | Fuel Management | 62 | √ | | | |
| | | | | | | |
| **GNSS** | Global Navigation Satellite System | 70 | √ | √ | | |
| | | | | | | |
| **Radar** | Procedures | 72 | √ | | | |

## Subject No. 6 Air Navigation and Flight Planning

***Note:*** *This syllabus is principally based on VFR navigation as applicable to a single piston-engine General Aviation type aeroplane or 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 feedback to the examination candidate. These reference numbers are common across the subject levels and therefore may not be consecutive.

| Sub Topic | Syllabus Item |
|---|---|
| | **Fundamentals of Air Navigation** |
| **6.2** | **Form of the Earth** |
| 6.2.2 | Describe the general shape of the earth. |
| 6.2.4 | Define and identify, on a diagram of the earth:<br>(a) axis and direction of rotation;<br>(b) geographic and magnetic poles;<br>(c) the equator;<br>(d) parallels of latitude;<br>(e) meridians of longitude;<br>(f) Greenwich (Prime) Meridian;<br>(g) latitude/longitude. |
| **6.4** | **Direction on the Earth** |
| 6.4.2 | Describe the 360º method of indicating direction. |
| 6.4.4 | Describe the earth's magnetic field. |
| 6.4.6 | Define:<br>(a) true north;<br>(b) magnetic north;<br>(c) compass north;<br>(d) the cardinal directions of the earth;<br>(e) the inter- cardinal directions of the earth;<br>(f) true direction;<br>(g) magnetic direction;<br>(h) compass direction; |

| Sub Topic | Syllabus Item |
|---|---|
| | (i) magnetic variation; |
| | (j) magnetic dip; |
| | (k) an isogonal; |
| | (l) compass deviation; |
| | (m) true bearing; |
| | (n) magnetic bearing; |
| | (o) compass bearing; |
| | (p) relative bearing; |
| | (q) relative bearing using the clock method. |
| 6.4.8 | Convert between true, magnetic and compass directions. |
| 6.4.10 | Convert between relative, true, magnetic and compass bearings. |
| 6.4.12 | Explain the processes, cautions and limitations when deriving track distances and bearings from a chart. |
| **6.6** | **Distance on the Earth** |
| 6.6.2 | Define: |
| | (a) statute mile; |
| | (b) nautical mile; |
| | (c) kilometre; |
| | (d) metre; |
| | (e) foot. |
| 6.6.4 | Calculate the conversion between a statute mile, a nautical mile and a kilometre. |
| 6.6.6 | Measure distances up to 300nm (± 1%) on an appropriate chart. |
| **6.8** | **Speed and Velocity** |
| 6.8.2 | Define: |
| | (a) a knot (kt); |
| | (b) ground speed (GS); |
| | (c) indicated airspeed (IAS); |
| | (d) calibrated airspeed (CAS); |
| | (e) true airspeed (TAS). |

| Sub Topic | Syllabus Item |
|---|---|
| 6.8.4 | Explain the difference between speed and velocity. |
| **6.10** | **Position Referencing** |
| 6.10.2 | Define:<br>(a) ground position;<br>(b) DR position;<br>(c) fix;<br>(d) position line. |
| 6.10.4 | Describe and apply the following position reference methods:<br>(a) place name;<br>(b) place/bearing/distance;<br>(c) latitude and longitude;<br>(d) position of another aircraft or point using relative bearing and the clock face method. |
| **6.12** | **Altimetry** |
| 6.12.2 | Define:<br>(a) height;<br>(b) altitude;<br>(c) mean sea level (MSL);<br>(d) AMSL;<br>(e) ground level;<br>(f) AGL;<br>(g) elevation;<br>(h) pressure altitude (PA);<br>(i) QNH. |
| 6.12.4 | Explain the effect of a change in mean sea level air pressure on the altimeter reading of a transiting aircraft. |
| 6.12.6 | Explain the effect of a change in temperature on the altimeter reading of a transiting aircraft. |
| 6.12.8 | State and apply the altimeter setting rules in New Zealand. |
| 6.12.10 | Explain and apply the table of cruising levels. |

| Sub Topic | Syllabus Item |
|---|---|
| **6.14** | **Principles and Terminology** |
| 6.14.2 | Define: |

(a) true and magnetic track required;

(b) wind velocity (W/V);

(c) head/tail wind;

(d) cross wind;

(e) true heading;

(f) magnetic heading;

(g) compass heading;

(h) drift (planned & actual);

(i) track made good;

(j) port;

(k) starboard;

(l) wind correction angle;

(m) deduced (dead) reckoning;

(n) track error (TE);

(o) closing angle (CA);

(p) estimated time of departure (ETD);

(q) actual time of departure (ATD);

(r) estimated elapsed time (EET);

(s) estimated time of arrival (ETA);

(t) actual time of arrival (ATA).

| | |
|---|---|
| 6.14.4 | Explain and apply the 1:60 rule. |
| **6.16** | **Time** |
| 6.16.2 | Describe the six figure systems of indicating date/time groups. |
| 6.16.4 | Define: |

(a) Coordinated Universal Time (UTC);

(b) Standard Time (NZST);

| Sub Topic | Syllabus Item |
|---|---|
| | (c) Daylight Time (NZDT). |
| 6.16.6 | Calculate ETD and ETA in UTC given planned flight time details and reference time in NZST and\or NZDT. |
| **6.18** | **Twilight** |
| 6.18.2 | Define: |
| | (a) sunrise; |
| | (b) sunset; |
| | (c) daylight; |
| | (d) twilight; |
| | (e) morning civil twilight (MCT); |
| | (f) evening civil twilight (ECT). |
| 6.18.4 | Describe the factors that affect the times of sunrise and sunset (daylight). |
| 6.18.6 | Describe the factors that affect the duration of twilight. |
| 6.18.8 | Describe the factors that affect daylight conditions. |
| 6.18.10 | Derive or calculate the MCT and ECT at a given location (UTC, NZST and NZDT). |
| | **Aeronautical Charts** |
| **6.22** | **Properties and Principles** |
| 6.22.2 | Define scale and the relationship between chart and earth distances. |
| 6.22.4 | Describe the appropriate use of: |
| | (a) NZ Aeronautical Charts; |
| | (b) Aerodrome Chart. |
| **6.26** | **Chart Reading** |
| 6.26.2 | Interpret the features and symbols of a NZ Aeronautical Chart. |
| 6.26.4 | Describe the method of indicating relief on a NZ Aeronautical Chart. |
| 6.26.6 | Interpret information from Aerodrome Charts and Operational Data pages in the AIPNZ Volume 4. |
| | **Circular Slide Rule** |
| **6.28** | **Computations** |
| 6.28.2 | Compute TAS, given CAS, pressure altitude and air temperature in degrees Celsius. |

| Sub Topic | Syllabus Item |
|---|---|
| 6.28.4 | Solve mathematical equations:<br>(a) multiplication (± 2%);<br>(b) division (± 2%);<br>(c) proportion (± 2%). |
| 6.28.6 | Derive time, speed, or distance, given two factors. |
| 6.28.8 | Compute time and distance to climb/descend, given groundspeed, rate of climb/descend and height to climb/descend. |
| 6.28.10 | Compute rate of descent required to achieve a given height loss over time. |
| 6.28.12 | Compute fuel consumption, given the burn rate and time. |
| 6.28.14 | Compute fuel burn rate, given the consumption and time. |
| 6.28.16 | Compute fuel endurance, given the fuel quantity and burn rate. |
| 6.28.18 | Convert between:<br>(a) degrees Fahrenheit and Celsius (± 2%);<br>(b) nautical miles, statute miles and kilometres (± 2%);<br>(c) metres and feet (± 2%);<br>(d) pounds and kilograms (± 2%);<br>(e) litres, imperial and US gallons (± 2%);<br>(f) a volume of fuel (in litres, imperial or US gallons) and a mass of fuel (in pounds or kilograms) (± 2%). |
| **6.32** | **Wind Components** |
| 6.32.2 | Calculate the headwind/tailwind component, given runway alignment and wind velocity. |
| 6.32.4 | Calculate the crosswind component, given runway alignment and wind velocity. |
| **6.34** | **Triangle of Velocities** |
| 6.34.2 | Identify and label the three vectors of the triangle of velocities. |
| 6.34.4 | Using a navigation computer, solve triangle of velocity problems (given four of the six variables):<br>(a) heading and track (± 2°);<br>(b) TAS and GS (± 2kts);<br>(c) wind velocity (± 3°/± 3kts); |

| Sub Topic | Syllabus Item |
|---|---|
| | (d) drift (± 1°). |
| **6.36** | **The 1 in 60 rule** |
| 6.36.2 | 1:60 rule computations. |
| | **Deduced Reckoning** |
| **6.38** | **In-flight Revisions** |
| 6.38.2 | Estimate: |
| | (a) a heading change, using the 1:60 rule (± 2º); |
| | (b) a heading change, using drift lines (± 2º); |
| | (c) a heading to make good a reciprocal track; |
| | (d) a ground speed change; |
| | (e) an ETA change, using proportional method. |
| 6.38.4 | Describe: |
| | (a) the effect of variations in heading speed and altitude; |
| | (b) the limitations affecting navigation in conditions of reduced visibility. |
| | **Flight Planning** |
| **6.40** | **Route Selection** |
| 6.40.2 | List the factors to be considered when selecting a VFR cross-country navigation route. |
| 6.40.4 | List the factors to be considered when selecting altitudes at which to fly in the cruise. |
| 6.40.6 | List the factors to be considered when selecting alternate routes and destination alternates. |
| **6.42** | **Chart Preparation** |
| 6.42.2 | Mark the following on a map: |
| | (a) departure aerodrome, turning points, and destination aerodrome; |
| | (b) tracks; |
| | (c) heading change markings, either 1:60 or drift lines; |
| | (d) ETA amendment markings. |
| 6.42.4 | Fold a map in a manner appropriate for a VFR cross-country flight. |

| Sub Topic | Syllabus Item |
|---|---|
| **6.44** | **Plan Preparation** |
| 6.44.2 | Complete a navigation log / flight plan for a VFR cross-country, including calculating the following values:<br>(a) TAS;<br>(b) tracks;<br>(c) estimated wind velocities;<br>(d) headings;<br>(e) groundspeeds;<br>(f) distances;<br>(g) EET;<br>(h) ETA;<br>(i) SARTIME. |
| 6.44.4 | Calculate the latest time of departure for a given VFR cross-country flight or a given leg. |
| **6.46** | **Fuel Planning** |
| 6.46.2 | Derive, from an *Aircraft Flight Manual*, the fuel consumption rate for a given leg. |
| 6.46.4 | Calculate the expected fuel burn on a given leg. |
| 6.46.6 | Calculate the minimum fuel required on a given VFR cross-country flight. |
| 6.46.8 | State the legal minimum fuel reserves required on a VFR cross-country flight. |
| 6.46.10 | Calculate the maximum fuel endurance. |
| | **Navigation Procedures - VFR** |
| **6.48** | **VFR Flight Navigation** |
| 6.48.2 | Describe the techniques and procedures for:<br>(a) setting heading;<br>(b) cruise routine / activity cycle;<br>(c) maintaining a flight log;<br>(d) turning points;<br>(e) approaching / rejoining at a destination aerodrome. |
| 6.48.4 | Describe the techniques for map reading in flight. |

| Sub Topic | Syllabus Item |
|---|---|
| 6.48.6 | Describe and apply techniques for:<br>(a) position fixing;<br>(b) changing heading to make good the desired track;<br>(c) changing heading to make good next turning point or destination;<br>(d) amending ETA. |
| 6.48.8 | Calculate a heading to make good a reciprocal track. |
| 6.48.10 | Calculate an aircraft's position given bearing and distance from an identified ground position. |
| **6.50** | **Special Procedures** |
| 6.50.2 | Describe the techniques and procedures for:<br>(a) re-establishing position if lost or unsure of position;<br>(b) diverting from the pre-planned route or destination;<br>(c) navigating at low level when forced to do so by bad weather.<br>(d) navigating in mountainous terrain. |
| | **Flight Management** |
| **6.60** | **Flight Management** |
| 6.60.2 | Describe the requirements and procedures to manage SARTIME. |
| **6.62** | **Fuel Management** |
| 6.62.2 | Describe the procedures and techniques to safely manage the fuel for a given flight. |
| | **GNSS** |
| **6.70** | **GNSS Global Navigation Satellite System** |
| 6.70.2 | Explain the limitations of using GPS/GNSS to supplement normal visual navigation. |
| 6.70.4 | Explain the precautions to be taken when:<br>(a) inserting data with the keypad.<br>(b) operating/reading the unit while maintaining a proper lookout.<br>(c) operating/reading the unit in marginal weather conditions. |
| 6.70.6 | State the factors influencing GPS/GNSS reliability. |

| Sub Topic | Syllabus Item |
|---|---|
| | **Radar** |
| **6.72** | **Radar Procedures** |
| 6.72.2 | State the two types of radar currently used in New Zealand. |
| 6.72.4 | Describe the method of operation of each type of radar. |
| 6.72.6 | Explain what is meant by transponder Mode A and Mode C. |
| 6.72.8 | List and explain radar services that may be available to VFR flights. |

## Meteorology Syllabus Matrix

| | | Topic No. | PPL | CPL | ATPL |
|---|---|---|---|---|---|
| | | | **8** | **20** | **42** |
| **Meteorological services reports and forecasts** | Domestic services, reports and forecasts | **2** | * | | |
| | Regional services, reports and forecasts | **2** | | * | |
| | International services, reports and forecasts | **2** | | | * |
| | | | | | |
| **Weather maps** | Interpretation of weather maps and charts | **4** | * | * | * |
| | | | | | |
| **Fundamentals of the Atmosphere** | The atmosphere | **6** | * | * | * |
| | Temperature and heat exchange processes | **8** | * | * | * |
| | Pressure and density | **10** | * | * | * |
| | Wind | **12** | * | * | * |
| | Local winds | **14** | * | * | |
| | Water vapour | **16** | * | * | * |
| | Atmospheric stability | **18** | * | * | * |
| | Inversions | **20** | * | | |
| | Clouds | **22** | * | * | * |
| | Precipitation | **24** | * | * | |
| | Visibility and fog | **26** | * | * | |
| | | | | | |
| **Meteorological conditions** | Aircraft icing | **28** | * | * | * |
| | Thunderstorms | **30** | * | * | * |
| | Mountain weather | **32** | * | | |

| | | | | | |
|---|---|---|---|---|---|
| | Anticyclones | **34** | | * | |
| | Air masses, fronts and depressions | **36** | * | * | * |
| | Upper air meteorology | **38** | | | * |
| | Turbulence | **40** | * | * | * |
| | Other hazardous meteorological conditions | **42** | | * | * |
| | | | | | |
| **New Zealand weather** | New Zealand weather | **44** | * | | |
| | | | | | |
| **Regional and global meteorology** | The general circulation | **46** | | * | * |
| | Tropical meteorology | **48** | | * | * |
| | | | | | |
| **Satellite, radar and non-aviation-specific weather information** | Satellite, radar and non-aviation specific weather information | **50** | * | * | * |
| | Domestic meteorological services reports and forecasts | **52** | * | | |

## Subject No. 8 PPL Meteorology

***Note:*** *This syllabus is principally based on the meteorology as applicable to flying a single piston-engine general aviation type aeroplane or helicopter, within New Zealand at altitudes at or below 13,000 feet.*

*Detailed acronyms and service provider titles (e.g. SKC, MetService) are indicative of the area of knowledge required and do not limit this syllabus to those specifically listed.*

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 feedback to the examination candidate. These reference numbers are common across the subject levels and therefore may not be consecutive.

### 8.2 Decode Domestic Meteorological Reports and Forecasts

8.2.2 Demonstrate how to access aviation meteorological information for New Zealand through the gopreflight internet website.

8.2.4 In plain language, decode the information contained in the following forecasts and reports:

(a) GRAFOR;

(b) TAF;

(c) METAR;

(d) SPECI;

(e) METAR AUTO;

(f) SIGMET;

(g) ATIS;

(h) AWIB;

(i) BWR;

(j) Pilot Reports;

(k) AAW;

(l) GSM;

(m) GNZSIGWX.

### 8.4 Weather Maps

8.4.2 Identify the following features found on surface weather maps:

(a) isobars;

(b) anticyclone (“high”);

(c) depression (“low” or “cyclone”);

(d) ridge of high pressure;

(e) trough of low pressure;

(f) col;

(g) fronts (cold, warm (warm sectors), occluded and stationary);

(h) tropical cyclones.

8.4.4 Explain the most common weather characteristics of each feature.

8.4.6 Define pressure gradient.

8.4.8 Identify areas of light, moderate and strong winds on a weather map.

**8.6 The Atmosphere**

8.6.2 Describe the structure of the troposphere and lower stratosphere.

8.6.4 Outline the characteristics of the troposphere in terms of:

(a) horizontal and vertical motions;

(b) vertical variation of density;

(c) vertical variation of temperature;

(d) depth.

8.6.6 List the percentages of the following gases in the troposphere:

(a) nitrogen;

(b) oxygen;

(c) all other trace gases combined.

8.6.8 Describe the presence and importance of the following in the atmosphere:

(a) water vapour;

(b) aerosols.

**8.8 Temperature and Heat Exchange Processes**

8.8.2 Outline the measurement of surface air temperature in New Zealand (as reported in aviation observations), and relate that to actual temperatures experienced above a sealed or grass runway.

8.8.4 Define solar and terrestrial radiation.

8.8.6 Outline the balance of incoming solar radiation versus outgoing terrestrial radiation.

8.8.8 Explain the effect of solar and terrestrial radiation on the daily temperature range.

8.8.10 Describe the effect of the following on daily air temperature:

(a) latitude;

(b) season;

(c) strong winds;

(d) wind direction;

(e) cloud cover;

(f) coastal or inland location;

(g) surface type.

8.8.12 Describe the transfer of heat in the atmosphere with reference to the processes of:

(a) conduction;

(b) convection;

(c) advection.

**8.10 Atmospheric Pressure and Density**

8.10.2 Define ‘atmospheric pressure’.

8.10.4 State the pressure units used in New Zealand aviation.

8.10.6 State the significance of air pressure to aviation.

8.10.8 Define ‘pressure lapse rate’.

8.10.10 State the approximate pressure lapse rate in the atmosphere below 10,000ft.

8.10.12 Explain how surface pressure rises when air is added to the vertical column above the ground, and vice versa.

8.10.14 Define the International Standard Atmosphere (ISA).

8.10.16 Describe how New Zealand conditions differ from ISA.

8.10.18 Explain how deviation from ISA values influences performance of aircraft and aircraft engines.

8.10.20 Define:

(a) QNH and altitude;

(b) QFE and height.

8.10.22 Explain the effects of changes in MSL pressure on aircraft in flight, and why a pressure altimeter requires a subscale adjustment.

8.10.24 Explain the importance of correct subscale setting.

**8.12 Wind**

8.12.2 Define the measurement of the standard surface wind in aviation meteorological reports and forecasts.

8.12.4 State the units used to describe wind speed.

8.12.6 State the units used to describe wind direction with reference to:

(a) forecasts and observations issued by MetService;

(b) spot winds relayed to pilots by Air Traffic Control.

8.12.8 List the three forces acting to generate wind at low levels.

8.12.10 Outline the cause of Coriolis force.

8.12.12 List the three properties of Coriolis force.

8.12.14 Define the 'geostrophic wind'.

8.12.16 Explain how friction affects the surface wind velocity.

8.12.18 Explain what is meant by the 'friction layer'.

8.12.20 Describe the elements that influence the depth of the 'friction layer'.

8.12.22 Define the following terms:

(a) gust;

(b) squall;

(c) veering;

(d) backing.

8.12.24 Describe the diurnal variation of the surface wind over the:

(a) land;

(b) sea.

8.12.26 Describe the changes in wind velocity when climbing out of, or descending through, the friction layer.

8.12.28 Describe the limitations of windsocks in New Zealand.

8.12.30 Describe how an approximate wind direction can be determined from:

(a) ripples on water;

(b) wind lanes on water;

(c) wind shadow on bodies of water;

(d) cloud shadows.

8.12.32 State Buys Ballot's Law.

8.12.34 Explain how applying Buys Ballot's Law can:

(a) determine the location of high and low pressure areas;

(b) be used as a basic forecasting tool.

**8.14 Local Winds**

8.14.2 Describe the development of sea breezes with reference to:

(a) horizontal and vertical limits around New Zealand;

(b) timing of the occurrence;

(c) average strength of the sea breeze;

(d) associated cloud and precipitation;

(e) associated turbulence.

8.14.4 Describe the development of katabatic winds with reference to:

(a) timing of the occurrence;

(b) average strength of katabatic winds over New Zealand.

8.14.6 Describe the effect of local obstructions on wind flow.

8.14.8 Describe terrain channelling in New Zealand.

8.14.10 Explain how atmospheric stability enhances terrain channelling.

**8.16 Water Vapour**

8.16.2 Explain how the temperature of air influences its capacity to hold water vapour.

8.16.4 Define the term ‘relative humidity’.

8.16.6 Define the term ‘dew point’.

8.16.8 Explain the effect of moisture content of air on the dew point.

8.16.10 Explain why ‘dew point’ is a better measure than ‘relative humidity’ for aviation purposes.

8.16.12 Describe each of the following processes with regard to the changes of state of water:

(a) condensation;

(b) evaporation;

(c) deposition;

(d) sublimation;

(e) melting;

(f) freezing.

8.16.14 Explain how water vapour enters the atmosphere by the process of:

(a) evaporation;

(b) transpiration.

8.16.16 State the effect of the following on the rate of evaporation:

(a) air and water temperature;

(b) moisture content of air;

(c) wind speed.

8.16.18 Define ‘latent heat’.

8.16.20 State the significance of the release of latent heat into the atmosphere during the cloud formation process.

**8.18 Atmospheric Stability**

8.18.2 Define:

(a) stable air;

(b) unstable air;

(c) conditionally unstable air.

8.18.4 Describe how the stability of a rising (or sinking) parcel of air is determined by its temperature compared with the temperature of the surrounding environment.

8.18.6 Describe what is meant by ‘environment lapse rate’ (ELR).

8.18.8 Explain how the environmental temperature and dew point lapse rates are found.

8.18.10 Outline the term ‘adiabatic process’.

8.18.12 State the value of the dry adiabatic lapse rate (DALR) at low-levels in mid latitudes.

8.18.14 State the approximate value of the saturated adiabatic lapse rate (SALR) at low levels in mid-latitudes.

8.18.16 State the conditions needed for conditionally unstable air to be forced to become unstable.

8.18.18 Define:

(a) inversion;

(b) isothermal layer.

8.18.20 Explain why inversions and isothermal layers are atmospherically stable.

8.18.22 Determine atmospheric stability by applying basic lifting scenarios with given ELRs.

**8.20 Inversions**

8.20.2 Explain the factors involved in the development of a:

(a) radiation inversion;

(b) turbulence inversion;

(c) subsidence inversion;

(d) frontal inversion.

8.20.4 Explain the effect of inversions on:

(a) formation of cloud;

(b) visibility;

(c) turbulence;

(d) dew point;

(e) the increased risk of carburettor icing;

(f) the presence of wind shear;

(g) aircraft performance.

**8.22 Clouds**

8.22.2 Describe the cloud formation process.

8.22.4 Describe the operational characteristics of the cloud sensor used in Automatic Weather Stations (AWS) and reported in METAR AUTO reports.

8.22.6 State the approximate altitude limits (in New Zealand latitudes) of:

(a) high cloud;

(b) middle cloud;

(c) low cloud.

8.22.8 Describe the meaning of the following cloud terms:

(a) cumulus or cumulo (prefix);

(b) stratus or strato (prefix);

(c) alto (prefix);

(d) nimbo (prefix) or nimbus (suffix);

(e) cirrus or cirro (prefix).

8.22.10 Describe the following lifting mechanisms found in the atmosphere:

(a) orographic;

(b) convection (including ‘thermals’);

(c) turbulence;

(d) widespread ascent (including fronts).

8.22.12 List the cloud types associated with each lifting mechanism.

8.22.14 Describe the following cloud types including likely associated turbulence and precipitation:

(a) stratocumulus;

(b) stratus;

(c) cumulus;

(d) cumulonimbus/towering cumulus;

(e) lenticular.

8.22.16 Visually identify the following cloud types:

(a) towering cumulus;

(b) cumulonimbus.

8.22.18 Explain how, in well-mixed conditions, changes in surface temperature and/or dew point relate to the cloud base.

8.22.20 Describe the processes that lead to cloud dissipation.

**8.24 Precipitation**

8.24.2 Define:

(a) precipitation;

(b) virga.

8.24.4 Describe the following types of precipitation:

(a) rain;

(b) drizzle;

(c) snow;

(d) sleet;

(e) hail.

8.24.6 State the difference between large drizzle and small rain droplets.

8.24.8 Describe the following terms in relation to precipitation:

(a) continuous rain;

(b) intermittent rain;

(c) showers.

8.24.10 Define the following precipitation rates:

(a) light;

(b) moderate;

(c) heavy.

**8.26 Visibility and Fog**

8.26.2 Define prevailing visibility.

8.26.4 Explain why illumination from the sun or moon has no effect on prevailing visibility.

8.26.6 Describe the operational characteristics of the visibility sensor used in Automatic Weather Stations (AWS), and reported in METAR AUTO reports.

8.26.8 Describe the effect on visibility, of the following:

(a) precipitation;

(b) fog and mist;

(c) haze and smoke;

(d) sea spray;

(e) blowing snow;

(f) sun glare.

8.26.10 Explain the factors involved in slant range.

8.26.12 List the types of fog, classified by their method of formation.

8.26.14 Describe the meteorological conditions required for the formation and dispersal of:

(a) radiation fog;

(b) advection fog.

8.26.16 Explain how katabatic winds may enhance or inhibit radiation fog depending on their strength.

8.26.18 Describe the operational problems associated with fog.

**8.28 Aircraft Icing**

8.28.2 List the hazards of airframe icing to aircraft in flight.

8.28.4 Explain the processes involved in the formation of hoar frost on an aircraft on the ground and in flight.

8.28.6 State the dangers of hoar frost and the actions required to alleviate these dangers on the ground and in flight.

8.28.8 Explain why flight in cloud above the freezing-level can be very hazardous.

8.28.10 Explain how to avoid or alleviate all forms of airframe icing other than hoar frost.

8.28.12 State the hazards for light aircraft from:

(a) snow;

(b) sleet;

(c) hail.

8.28.14 Explain the environmental factors involved in carburettor icing, including;

(a) moisture content;

(b) temperature;

(c) temperature gradient (inversions).

8.28.16 State the temperature range that carburettor ice typically forms in.

8.28.18 Explain how the accretion rate of carburettor ice is influenced by the throttle setting.

8.28.20 Explain the conditions that can cause carburettor icing while on the ground.

**8.30 Thunderstorms**

8.30.2 State the three conditions required for the development of thunderstorms.

8.30.4 Describe the three stages in the life-cycle of a thunderstorm.

8.30.6 List the hazards associated with thunderstorms.

8.30.8 Explain why light aircraft should always avoid flight in the vicinity of thunderstorms.

**8.32 Mountain Weather**

8.32.2 Define the Föhn wind.

8.32.4 In Föhn wind conditions, describe the typical weather:

(a) to windward of the mountain range;

(b) above the mountain range;

(c) on the lee side of the mountain range.

8.32.6 Describe the mountain lee-wave (standing wave) development process.

8.32.8 Describe the formation of rotor zones.

8.32.10 Explain the associated dangers of rotor zones to aircraft operations.

8.32.12 With regard to VFR flight in a light aircraft in mountainous terrain, describe the meteorological factors that should be considered during the flight planning phase and en route, including:

(a) cloud base;

(b) turbulence;

(c) adverse and favourable winds;

(d) visibility;

(e) track selection;

(f) the anticipated timing of any expected weather change.

**8.36 Air-masses and Fronts**

8.36.2 Define an ‘air-mass’.

8.36.4 State the two air-masses that routinely affect the New Zealand region.

8.36.6 Define a ‘front’.

8.36.8 Describe the formation processes of the following frontal types:

(a) cold;

(b) warm;

(c) occluded;

(d) stationary.

8.36.10 Describe the range of weather conditions typically associated with fronts in the New Zealand region.

8.36.12 State the similarities and differences between cold and warm fronts, with reference to changes in:

(a) temperature;

(b) air pressure;

(c) wind;

(d) cloud;

(e) precipitation.

8.36.14 Describe the typical associated factors for a southerly flow onto New Zealand:

(a) stability;

(b) cloud types;

(c) likely precipitation;

(d) visibility reductions;

(e) turbulence.

8.36.16 Describe the typical associated factors for a northerly flow onto New Zealand.

(a) stability;

(b) cloud types;

(c) likely precipitation;

(d) visibility reductions;

(e) turbulence.

**8.40 Turbulence**

8.40.2 Define the term ‘wind shear’.

8.40.4 Describe the effects of low-level wind-shear on aircraft operations in the:

(a) take-off; and

(b) approach and landing phases of flight.

8.40.6 Describe the cause(s), factors involved, and dangers associated with:

(a) convective (thermal) turbulence;

(b) mechanical turbulence – small scale and large scale;

(c) wake turbulence.

8.40.8 Describe the techniques commonly used to avoid or minimise:

(a) convective (thermal) turbulence;

(b) mechanical turbulence;

(c) wake turbulence.

**8.44 New Zealand Weather**

8.44.2 Describe how the following factors determine the general weather features found around New Zealand:

(a) latitude;

(b) oceanic surroundings;

(c) topography.

8.44.4 Identify ‘westerly situations’ and ‘easterly situations’ on a weather map.

8.44.6 Describe the impact of ‘westerly situations’ and ‘easterly situations’ on flying weather around New Zealand.

8.44.8 For any area or location in New Zealand, determine:

(a) the wind direction(s) which expose that location to very poor flying conditions;

(b) the wind direction(s) which result in sheltering.

**8.50 Assess satellite and radar Imagery, and non-aviation-specific weather information**

8.50.2 With respect to NZ VFR operations, using satellite imagery, identify the following:

(a) areas of stable and unstable air;

(b) frontal cloud bands;

(c) positions of lows and anticyclones.

8.50.4 With respect to NZ VFR operations, interpret radar imagery in terms of:

(a) likely cloud types;

(b) precipitation types and intensity;

(c) speed of movement and timing and the expected impact at given locations.

8.50.6 Describe the limitations of non-aviation-specific weather information.

**8.52 Interpret Domestic Meteorological Services, Reports and Forecasts**

8.52.2 Using information from domestic meteorological services, reports and forecasts decide which should be considered for an indicated flight between given locations.

8.52.4 Use information from domestic meteorological services, reports and forecasts to demonstrate sound planning and decision making.

8.52.6 State the significance of forecast or observed low-level moisture to flight.

**Human Factors Matrix**

| | | Topic No. | PPL | CPL | ATPL |
|---|---|---|---|---|---|
| | | | 10 | 34 | 46 |
| **Human Factors - General** | Airmanship and Responsibility | 2 | √ | √ | √ |
| | Human Factors Models and Programmes | 4 | √ | √ | √ |
| | | | | | |
| **Physiology and the Effects of Flight** | The Atmosphere | 6 | √ | √ | √ |
| | Circulation and Respiratory Systems | 8 | √ | √ | √ |
| | Hypoxia | 10 | √ | √ | √ |
| | Hyperventilation | 12 | √ | √ | √ |
| | Entrapped Gases | 14 | √ | √ | √ |
| | Decompression Sickness | 16 | √ | √ | √ |
| | Vision and Visual Perception | 18 | √ | √ | √ |
| | Hearing and Balance | 20 | √ | √ | √ |
| | Spatial Orientation | 22 | √ | √ | |
| | Gravitational Forces | 24 | √ | √ | |
| | Motion Sickness | 26 | √ | √ | |
| | Flight Anxiety | 28 | √ | √ | |
| **Flying and Health** | | | | | |
| | Fitness to Fly | 30 | √ | √ | √ |
| | Alcohol and Drugs | 32 | √ | √ | √ |
| | Blood Donation | 34 | √ | √ | |
| | Environmental Hazards | 36 | √ | √ | √ |
| | Stress Management | 38 | √ | √ | √ |
| | Sleep and Fatigue | 40 | √ | √ | √ |
| | Ageing | 42 | √ | √ | √ |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Aviation Psychology** | Information Processing | 44 | √ | √ | √ |
| | Situational Awareness | 46 | √ | √ | √ |
| | Judgement and Decision Making | 48 | √ | √ | √ |
| | Social Psychology and Flight Deck Management | 50 | √ | √ | √ |
| | Threat and Error Management | 52 | √ | √ | √ |
| | Culture | 54 | √ | √ | √ |
| | | | | | |
| **Ergonomics** | Flight Deck Design | 56 | | √ | √ |
| | Design of Controls | 58 | | √ | √ |
| | Instrumentation, Displays and Alerts | 60 | √ | √ | √ |
| | Documents and Procedures | 62 | √ | √ | √ |
| | | | | | |
| **First Aid and Survival** | First Aid | 64 | √ | √ | |
| | Survival | 66 | √ | √ | |

## Subject No. 10 Human Factors

**Note:** *This syllabus is based on Private and Recreational operations.*

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 feedback to the examination candidate.

| Sub Topic | Syllabus Item |
|---|---|
| | **Human Factors - General** |
| **10.2** | **Airmanship and Responsibility** |
| 10.2.2 | Describe key features of good and safe airmanship. |
| **10.4** | **Human Factors Models and Programmes** |
| 10.4.2 | Define human factors as used in an aviation context. |
| 10.4.4 | Explain the role of human factors programmes in promoting aviation safety. |
| | **Physiology and the Effects of Flight** |
| **10.6** | **The Atmosphere** |
| 10.6.2 | State the gases that make up the atmosphere. |
| 10.6.4 | Describe the variation of pressure as altitude increases. |
| **10.8** | **Circulation and Respiratory Systems** |
| 10.8.2 | Describe the basic anatomy of the respiratory system. |
| 10.8.4 | Describe the physiology of the respiratory system. |
| 10.8.6 | Describe the basic anatomy of the circulatory system. |
| 10.8.8 | Describe the physiology of the circulatory system. |
| 10.8.10 | Describe the role of the lungs in oxygen and carbon dioxide transfer. |
| **10.10** | **Hypoxia** |
| 10.10.2 | Define hypoxia. |
| 10.10.4 | State the partial pressure of oxygen both inside and outside the lungs at sea level. |
| 10.10.6 | Explain the mechanical effect of the partial pressure of oxygen on oxygen transfer in the lungs. |
| 10.10.8 | Explain the causes of hypoxia. |
| 10.10.10 | Describe the common symptoms of hypoxia. |
| 10.10.12 | Explain the reasons hypoxia symptoms are difficult to detect. |

| Sub Topic | Syllabus Item |
|---|---|
| 10.10.14 | Explain the relationship between hypoxic onset and both vision and cognitive performance. |
| 10.10.16 | Describe how hypoxia can be prevented. |
| 10.10.18 | State the factors that affect the likelihood of suffering from hypoxia. |
| 10.10.20 | Describe how hypoxia can be treated. |
| **10.12** | **Hyperventilation** |
| 10.12.2 | Define hyperventilation. |
| 10.12.4 | Explain the causes of hyperventilation. |
| 10.12.6 | Describe the symptoms of hyperventilation. |
| 10.12.8 | Describe how hyperventilation can be treated. |
| 10.12.10 | Describe the differences between hyperventilation and hypoxia. |
| **10.14** | **Entrapped Gasses** |
| 10.14.2 | Define barotrauma. |
| 10.14.4 | Explain the causes of barotrauma. |
| 10.14.6 | Describe the symptoms of barotrauma. |
| 10.14.8 | Describe the effects of barotrauma on the various parts of the body. |
| **10.16** | **Decompression Sickness** |
| 10.16.2 | Define decompression sickness. |
| 10.16.4 | Explain the causes of decompression sickness. |
| 10.16.6 | Describe the symptoms of decompression sickness. |
| 10.16.8 | Explain how decompression sickness can be prevented. |
| 10.16.10 | Describe how decompression sickness can be treated. |
| 10.16.12 | Explain the dangers of flying after diving. |
| **10.18** | **Vision and Visual Perception** |
| 10.18.2 | Identify the following eye structure components:<br>(a) lens<br>(b) cornea<br>(c) retina<br>(d) fovea |

| Sub Topic | Syllabus Item |
|---|---|
| | (e) optic nerve disc |
| | (f) cone cells |
| | (g) rod cells. |
| 10.18.4 | Distinguish between rod and cone cell functions and distribution in the retina. |
| 10.18.6 | Describe the limitations of the eye in terms of: |
| | (a) the ability to discern objects at night |
| | (b) the ability to discern objects in daylight, including wires and other aircraft |
| | (c) poor lighting |
| | (d) glare |
| | (e) lack of contrast |
| | (f) the blind spot |
| | (g) colour perception. |
| 10.18.8 | Explain the process of dark adaptation. |
| 10.18.10 | State the normal time for full night vision adaptation. |
| 10.18.12 | Identify precautionary actions to protect night vision adaptation. |
| 10.18.14 | Describe the factors associated with the selection of suitable sunglasses for flying. |
| 10.18.16 | Describe the visual system resting state focus and its effects on object detection. |
| 10.18.18 | Explain effective visual search techniques. |
| 10.18.20 | Explain the see and avoid method of avoiding mid-air collisions. |
| 10.18.22 | Explain the use of visual cues during landing. |
| 10.18.24 | Explain the following visual illusions: |
| | (a) autokinesis |
| | (b) stroboscopic illumination illusion/flicker vertigo |
| | (c) the break-off phenomenon |
| | (d) the black hole phenomenon. |
| 10.18.26 | Describe methods of avoiding and/or coping with: |
| | (a) autokinesis |
| | (b) stroboscopic illumination illusion/flicker vertigo |

| Sub Topic | Syllabus Item |
|---|---|
| | (c) the break-off phenomenon |
| | (d) the black hole phenomenon. |
| 10.18.28 | Describe conditions which can lead to the creation of a false horizon. |
| 10.18.30 | Explain the effect of a false horizon on visual perception. |
| 10.18.32 | Explain relative motion. |
| 10.18.34 | Explain the effect of fog, haze, and/or dust on visual perception. |
| 10.18.36 | Describe the optical characteristics of the windshield. |
| 10.18.38 | Explain the effect of sloping terrain on visual perception. |
| 10.18.40 | Explain the effect of the following factors on visual perception during the following approach situations: |
| | (a) steep/shallow approach angles |
| | (b) length, width and texture of the runway |
| | (c) the intensity of the approach lights. |
| **10.20** | **Hearing and Balance** |
| 10.20.2 | Describe the basic anatomy of the ear. |
| 10.20.4 | Describe the physiology of the ear. |
| 10.20.6 | Describe the effect of prolonged noise exposure on hearing. |
| 10.20.8 | Describe methods of protecting hearing. |
| 10.20.10 | Explain the effects of age induced hearing loss (presbycusis). |
| 10.20.12 | Explain the effects of pressure changes on the middle ear and eustachian tubes. |
| 10.20.14 | Explain the effects of colds; hay fever; and/or allergies on the sinuses and eustachian tubes. |
| **10.22** | **Spatial Orientation** |
| 10.22.2 | Define spatial orientation. |
| 10.22.4 | Define disorientation. |
| 10.22.6 | Outline the basic anatomy of the motion, orientation and gravitational sensory organs, including: |
| | (a) the semi-circular canals |
| | (b) vestibular sac/tubes. |

| Sub Topic | Syllabus Item |
|---|---|
| 10.22.8 | Outline the physiology of the motion, orientation and gravitational sensory organs, including:<br>(a) the semi-circular canals<br>(b) vestibular sac/tubes. |
| 10.22.10 | Explain the interconnection between the visual and kinaesthetic senses in maintaining accurate spatial orientation. |
| 10.22.12 | Explain the body's limitations in maintaining spatial orientation when vision is adversely affected. |
| 10.22.14 | Explain the effects of the following spatial illusions:<br>(a) the leans and sub-threshold stimulation<br>(b) somatogravic illusion<br>(c) somatogyral illusion<br>(d) cross coupled turning (Coriolis effect)<br>(e) pressure vertigo. |
| 10.22.16 | Explain how disorientation can be prevented. |
| **10.24** | **Gravitational Forces** |
| 10.24.2 | Explain the effects of positive and negative accelerations on:<br>(a) the circulatory system<br>(b) vision<br>(c) consciousness. |
| 10.24.4 | Explain the causes and symptoms of black-out. |
| 10.24.6 | Explain the causes and symptoms of red-out. |
| **10.26** | **Motion Sickness** |
| 10.26.2 | Explain the causes of motion sickness. |
| 10.26.4 | Describe how motion sickness can be prevented. |
| 10.26.6 | Describe how motion sickness can be treated. |
| **10.28** | **Flight Anxiety** |
| 10.28.2 | Explain the causes of flight anxiety. |
| 10.28.4 | Recognise the signs of flight anxiety in passengers. |
| 10.28.6 | Describe how flight anxiety can be prevented. |

| Sub Topic | Syllabus Item |
|---|---|
| | **Flying and Health** |
| **10.30** | **Fitness to Fly** |
| 10.30.2 | Describe the term fitness to fly. |
| 10.30.4 | Explain the responsibilities of pilots towards medical fitness for flight. |
| 10.30.5 | Explain the responsibilities of pilots operating on a Land Transport medical with regard to a known change in medical condition. |
| 10.30.6 | Identify symptoms and circumstances that would lead you to consult your aviation medical examiner prior to further flight. |
| 10.30.8 | Describe the IMSAFE method of assessing fitness for flight. |
| 10.30.10 | Describe the problems associated with pregnancy and flying. |
| 10.30.12 | With regard to the following factors, describe their effects on pilot performance and methods by which they may be minimised/managed:<br>(a) arterial disease<br>(b) blood pressure<br>(c) diet<br>(d) exercise<br>(e) obesity<br>(f) smoking<br>(g) respiratory tract infection/allergies (including colds, sinus, hay fever, influenza, asthma)<br>(h) food poisoning and gastroenteritis<br>(i) neurological factors (including fits/epilepsy, brain injury, fainting, headaches, migraines)<br>(j) emotional factors (including depression and anxiety)<br>(k) dehydration |
| **10.32** | **Alcohol and Drugs** |
| 10.32.2 | Explain the effects of alcohol on pilot performance. |
| 10.32.4 | Explain the restriction associated with the consumption of alcohol and flying. |
| 10.32.6 | Explain the effects of drugs on pilot performance. |
| 10.32.8 | Describe considerations associated with the taking of over the counter medication and flying. |

| Sub Topic | Syllabus Item |
|---|---|
| 10.32.10 | Explain why illegal/recreational drugs are unacceptable for pilots. |
| **10.34** | **Blood Donation** |
| 10.34.2 | Describe the effect on the body of donating blood. |
| 10.34.4 | State the recommended time period between the donation of blood and flying. |
| **10.36** | **Environmental Hazards** |
| 10.36.2 | Describe the symptoms, effects and immediate treatments for the following hazards present in the aviation environment:<br>(a) carbon monoxide<br>(b) fuel<br>(c) lubricating oils<br>(d) hydraulic fluids. |
| 10.36.4 | State the source of carbon monoxide poisoning in general aviation aircraft. |
| 10.36.6 | Describe reliable methods for the detection of carbon monoxide. |
| 10.36.8 | Describe methods of eliminating carbon monoxide from the cockpit. |
| **10.38** | **Stress Management** |
| 10.38.2 | Define stress. |
| 10.38.4 | Describe a simple model of stress. |
| 10.38.6 | Define arousal. |
| 10.38.8 | Explain the relationship between stress and arousal. |
| 10.38.10 | Describe how the following environmental stressors affect pilot performance:<br>(a) heat<br>(b) cold<br>(c) noise<br>(d) vibration<br>(e) humidity. |
| 10.38.12 | Explain methods of identifying stress. |
| 10.38.14 | Explain the difference between acute and chronic stress. |
| 10.38.16 | Describe the physiological effects of stress. |
| 10.38.18 | Describe the psychological effects of stress. |

| Sub Topic | Syllabus Item |
|---|---|
| 10.38.20 | Describe the factors that improve personal stress tolerance. |
| 10.38.22 | Describe the relationship between stress and fatigue. |
| 10.38.24 | Explain methods of managing stress. |
| **10.40** | **Sleep and Fatigue (Alertness Management)** |
| 10.40.2 | Explain how individuals differ in their requirement for sleep. |
| 10.40.4 | Explain the effects of the following alertness management techniques:<br>(a) napping<br>(b) caffeine consumption<br>(c) taking sedatives<br>(d) taking stimulants other than caffeine. |
| 10.40.6 | Describe sleep disorders and their effects on pilot performance. |
| 10.40.8 | Define fatigue. |
| 10.40.10 | Explain the causes of fatigue and its effect on pilot performance. |
| 10.40.12 | Describe the symptoms of fatigue. |
| 10.40.14 | Explain the difference between acute and chronic fatigue. |
| **10.42** | **Ageing** |
| 10.42.2 | Describe the effects of the normal process of human ageing on:<br>(a) the sensitivity and acuity of the sensory system<br>(b) muscular strength<br>(c) resilience and reaction times<br>(d) sleep/wakefulness patterns<br>(e) cognitive or mental functioning<br>(f) the acquisition of new information<br>(g) the retention and retrieval of stored information in memory<br>(h) the rate of information processing<br>(i) insight and self-awareness of your individual capabilities. |

| Sub Topic | Syllabus Item |
|---|---|
| | **Aviation Psychology** |
| **10.44** | **Information Processing** |
| 10.44.2 | Identify the human sensors pilots depend on for information acquisition. |
| 10.44.4 | Describe a basic model of information processing. |
| 10.44.6 | Describe the following types of memory:<br>(a) short term/working memory<br>(b) long term memory. |
| 10.44.8 | Describe the limitations of memory. |
| 10.44.10 | Explain the following methods of retaining and retrieving information from memory:<br>(a) mnemonics<br>(b) checklists. |
| 10.44.12 | Define perception. |
| 10.44.14 | Describe the effect of the following on perception:<br>(a) expectation<br>(b) experience. |
| **10.46** | **Situational Awareness** |
| 10.46.2 | Define situational awareness. |
| 10.46.4 | Describe strategies to maintain and enhance situational awareness. |
| **10.48** | **Judgement and Decision Making** |
| 10.48.2 | Describe hazardous attitudes. |
| 10.48.4 | Describe methods of countering hazardous attitudes. |
| 10.48.6 | Describe the error/poor judgement chain. |
| 10.48.8 | Explain clues or red flags that can assist in identifying the error/poor judgement chain. |
| 10.48.10 | Outline the general concepts behind decision making. |
| 10.48.12 | Describe methods of enhancing decision making skills. |
| 10.48.14 | Explain the application of the following decision-making models used in aviation:<br>(a) DECIDE |

| Sub Topic | Syllabus Item |
|---|---|
| | (b) SADIE |
| | (c) FDODAR. |
| 10.48.16 | Identify specific factors that influence the decision-making process. |
| 10.48.18 | Explain the setting of personal limitations and decision points. |
| 10.48.20 | Outline the dangers of get-home-itis. |
| **10.50** | **Social Psychology and Flight Deck Management** |
| 10.50.2 | Explain how outside resources, such as ATC, engineers and other pilots can contribute to a pilot's management of a flight. |
| **10.52** | **Threat and Error Management** |
| 10.52.2 | Explain the role of human error in aviation accidents. |
| 10.52.4 | Explain the degree to which human error can be eliminated. |
| 10.52.6 | Describe the main types of threats which could potentially affect a safe flight. |
| 10.52.8 | Explain the basic elements and features of the Reason Model. |
| 10.52.10 | Describe threat management, including means of: |
| | (a) recognising threats |
| | (b) avoiding threats |
| | (c) mitigating the effects of threats. |
| **10.54** | **Culture** |
| 10.54.2 | Identify the elements in a safety culture. |
| 10.54.4 | List the key reasons for safety reporting in aviation. |
| 10.54.6 | Explain the rationale for mandatory reporting of incidents as required by Part 12. |
| 10.54.8 | Distinguish between normal error, at risk behaviour and high culpability behaviour. |
| 10.54.10 | Distinguish between negligent and reckless behaviour. |
| 10.54.12 | Describe the role of punitive sanction. |
| | **Ergonomics** |
| **10.60** | **Instrumentation, Displays and Alerts** |
| 10.60.2 | Explain the importance of the following in the design of instrumentation, displays and alerts: |
| | (a) position |

| Sub Topic | Syllabus Item |
|---|---|
| | (b) layout |
| | (c) use of colour |
| | (d) illumination. |
| 10.60.4 | Describe parallax error. |
| 10.60.6 | Describe potential errors in the interpretation of three pointer altimeters. |
| 10.60.8 | Describe the basic requirements of alerts. |
| 10.60.10 | Describe how colour coding conventions are used in aviation on instruments and displays. |
| **10.62** | **Documents and Procedures** |
| 10.62.2 | Explain the rationale behind consistent and thorough checklist use as opposed to reliance on memory. |
| 10.62.4 | Distinguish between normal and emergency checklists. |
| 10.62.6 | Identify the phases of flight where a checklist plays an important role. |
| 10.62.8 | Describe the reasons for checklist complacency. |
| 10.62.10 | Describe the possible ramifications of checklist complacency. |
| | **First Aid and Survival** |
| **10.64** | **First Aid** |
| 10.64.2 | Describe the basic principles of first aid. |
| 10.64.4 | Describe the basic principles of cardiopulmonary Resuscitation. |
| **10.66** | **Survival** |
| 10.66.2 | State the components of a pre-flight passenger briefing by a pilot with respect to aircraft safety features and equipment. |
| 10.66.4 | Explain the basic steps in post-crash survivor management. |
| 10.66.6 | List the priorities of survival in order of importance. |
| 10.66.8 | Explain survival items that could be carried on a cross-country flight over bush clad and mountainous terrain in order to manage survival threats. |
| 10.66.10 | Explain the process of hypothermia. |

## Aircraft Technical Knowledge Syllabus Matrix

| | Subject 12 (Aeroplane) | Sub Topic | Subject 14 (Helicopter) | Sub Topic | 12 | 14 |
|---|---|---|---|---|---|---|
| **Section 1 General** | | | | | | |
| **General Technical Knowledge** | 2 Definitions and Units | 2.2 | 2 Definitions and Units | 2.2 | ✓ | ✓ |
| | | 2.4 | | 2.4 | ✓ | ✓ |
| | 4 The Atmosphere | 4.2 | 4 The Atmosphere | 4.2 | ✓ | ✓ |
| | | 4.4 | | 4.4 | ✓ | ✓ |
| | | 4.6 | | 4.6 | ✓ | ✓ |
| | | 4.8 | | 4.8 | ✓ | ✓ |
| | | 4.10 | | 4.10 | ✓ | ✓ |
| | | 4.12 | | 4.12 | ✓ | ✓ |
| | | 4.14 | | 4.14 | ✓ | ✓ |
| | | 4.16 | | 4.16 | ✓ | ✓ |
| | 6 Basic Aerodynamic Theory | 6.2 | 6 Basic Aerodynamic Theory | 6.2 | ✓ | ✓ |
| | | 6.4 | | 6.4 | ✓ | ✓ |
| | | 6.6 | | 6.6 | ✓ | ✓ |
| | | 6.8 | | 6.8 | ✓ | ✓ |
| | | 6.10 | | 6.10 | ✓ | ✓ |
| | | 6.12 | | 6.12 | ✓ | ✓ |
| | | 6.14 | | 6.14 | ✓ | ✓ |
| | | 6.16 | | 6.16 | ✓ | ✓ |
| | | 6.18 | | 6.18 | ✓ | ✓ |
| | | 6.20 | | 6.20 | ✓ | ✓ |
| | | 6.22 | | 6.22 | ✓ | ✓ |
| | | 6.24 | | 6.24 | ✓ | ✓ |
| | | 6.26 | | 6.26 | ✓ | ✓ |
| | | 6.28 | | 6.28 | ✓ | ✓ |
| | | 6.30 | | 6.30 | ✓ | ✓ |
| | | 6.32 | | 6.32 | ✓ | ✓ |
| | | 6.34 | | 6.34 | ✓ | ✓ |
| | | 6.36 | | 6.36 | ✓ | ✓ |
| | | 6.38 | | 6.38 | ✓ | ✓ |
| | | 6.40 | | 6.40 | ✓ | ✓ |
| | | 6.42 | | 6.42 | ✓ | ✓ |
| | | 6.44 | | 6.44 | ✓ | ✓ |
| | | 6.46 | | 6.46 | ✓ | ✓ |
| | 8 Reserved | | 8 Reserved | | | |
| **Powerplant and Systems** | 10 Engines - General Piston Engines | 10.2 | 10 Engines - General Piston Engines | 10.2 | ✓ | ✓ |
| | | 10.4 | | 10.4 | ✓ | ✓ |
| | | 10.6 | | 10.6 | ✓ | ✓ |
| | | 10.8 | | 10.8 | ✓ | ✓ |
| | | 10.10 | | 10.10 | ✓ | ✓ |
| | | 10.12 | | 10.12 | ✓ | ✓ |

| | Subject 12 (Aeroplane) | Sub Topic | Subject 14 (Helicopter) | Sub Topic | 12 | 14 |
|---|---|---|---|---|---|---|
| **Powerplant and Systems (cont.)** | 12 Carburation | 12.2 | 12 Carburation | 12.2 | ✓ | ✓ |
| | | 12.4 | | 12.4 | ✓ | ✓ |
| | | 12.6 | | 12.6 | ✓ | ✓ |
| | | 12.8 | | 12.8 | ✓ | ✓ |
| | | 12.10 | | 12.10 | ✓ | ✓ |
| | | 12.12 | | 12.12 | ✓ | ✓ |
| | | 12.14 | | 12.14 | ✓ | ✓ |
| | | 12.16 | | 12.16 | ✓ | ✓ |
| | | 12.18 | | 12.18 | ✓ | ✓ |
| | | 12.20 | | 12.20 | ✓ | ✓ |
| | | 12.22 | | 12.22 | ✓ | ✓ |
| | 14 Fuel Injection | 14.2 | 14 Fuel Injection | 14.2 | ✓ | ✓ |
| | | 14.4 | | 14.4 | ✓ | ✓ |
| | | 14.6 | | 14.6 | ✓ | ✓ |
| | | 14.8 | | 14.8 | ✓ | ✓ |
| | 16 Fuel | 16.2 | 16 Fuel | 16.2 | ✓ | ✓ |
| | | 16.4 | | 16.4 | ✓ | ✓ |
| | | 16.6 | | 16.6 | ✓ | ✓ |
| | | 16.8 | | 16.8 | ✓ | ✓ |
| | 18 Exhaust System | 18.2 | 18 Exhaust System | 18.2 | ✓ | ✓ |
| | | 18.4 | | 18.4 | ✓ | ✓ |
| | | 18.6 | | 18.6 | ✓ | ✓ |
| | 20 Ignition System - Magneto Ignition | 20.2 | 20 Ignition System - Magneto Ignition | 20.2 | ✓ | ✓ |
| | | 20.4 | | 20.4 | ✓ | ✓ |
| | | 20.6 | | 20.6 | ✓ | ✓ |
| | | 20.8 | | 20.8 | ✓ | ✓ |
| | | 20.10 | | 20.10 | ✓ | ✓ |
| | 22 Ignition System - Solid State | 22.2 | 22 Ignition System - Solid State | 22.2 | ✓ | ✓ |
| | | 22.4 | | 22.4 | ✓ | ✓ |
| | | 22.6 | | 22.6 | ✓ | ✓ |
| | | 22.8 | | 22.8 | ✓ | ✓ |
| | 24 Engine Management - Piston | 24.2 | 24 Engine Management - Piston | 24.2 | ✓ | ✓ |
| | | 24.4 | | 24.4 | ✓ | ✓ |
| | | 24.6 | | 24.6 | ✓ | ✓ |
| | | 24.8 | | 24.8 | ✓ | ✓ |
| | | 24.10 | | 24.10 | ✓ | ✓ |
| | | 24.12 | | 24.12 | ✓ | ✓ |
| | | 24.14 | | 24.14 | ✓ | ✓ |

| | Subject 12 (Aeroplane) | Sub Topic | Subject 14 (Helicopter) | Sub Topic | 12 | 14 |
|---|---|---|---|---|---|---|
| **Ancillary Systems** | 26 Electrical System - DC | 26.2 | 26 Electrical System - DC | 26.2 | ✓ | ✓ |
| | | 26.4 | | 26.4 | ✓ | ✓ |
| | | 26.6 | | 26.6 | ✓ | ✓ |
| | | 26.8 | | 26.8 | ✓ | ✓ |
| | | 26.10 | | 26.10 | ✓ | ✓ |
| | 28 Fuel System Components | 28.2 | 28 Fuel System Components | 28.2 | ✓ | ✓ |
| | | 28.4 | | 28.4 | ✓ | ✓ |
| | 30 Fuel Tanks | 30.2 | 30 Fuel Tanks | 30.2 | ✓ | ✓ |
| | | 30.4 | | 30.4 | ✓ | ✓ |
| | | 30.6 | | 30.6 | ✓ | ✓ |
| | | 30.8 | | 30.8 | ✓ | ✓ |
| | 32 Lubrication Systems - Engines | 32.2 | 32 Lubrication Systems - Engines | 32.2 | ✓ | ✓ |
| | | 32.4 | | 32.4 | ✓ | ✓ |
| | | 32.6 | | 32.6 | ✓ | ✓ |
| | | 32.8 | | 32.8 | ✓ | ✓ |
| | | 32.10 | | 32.10 | ✓ | ✓ |
| | | 32.12 | | 32.12 | ✓ | ✓ |
| | | 32.14 | | 32.14 | ✓ | ✓ |
| | | 32.16 | | 32.16 | ✓ | ✓ |
| **Instruments** | 34 Engine Instruments | 34.2 | 34 Engine Instruments | 34.2 | ✓ | ✓ |
| | 36 Pressure Instruments | 36.2 | 36 Pressure Instruments | 36.2 | ✓ | ✓ |
| | | 36.4 | | 36.4 | ✓ | ✓ |
| | | 36.6 | | 36.6 | ✓ | ✓ |
| | | 36.8 | | 36.8 | ✓ | ✓ |
| | | 36.10 | | 36.10 | ✓ | ✓ |
| | | 36.12 | | 36.12 | ✓ | ✓ |
| | | 36.14 | | 36.14 | ✓ | ✓ |
| | | 36.16 | | 36.16 | ✓ | ✓ |
| | 38 Magnetic Instruments | 38.2 | 38 Magnetic Instruments | 38.2 | ✓ | ✓ |
| | | 38.4 | | 38.4 | ✓ | ✓ |
| | | 38.6 | | 38.6 | ✓ | ✓ |
| | | 38.8 | | 38.8 | ✓ | ✓ |
| | | 38.10 | | 38.10 | ✓ | ✓ |
| | 40 Gyroscopic Instruments | 40.2 | 40 Gyroscopic Instruments | 40.2 | ✓ | ✓ |
| | | 40.4 | | 40.4 | ✓ | ✓ |
| | | 40.6 | | 40.6 | ✓ | ✓ |
| | | 40.8 | | 40.8 | ✓ | ✓ |
| | | 40.10 | | 40.10 | ✓ | ✓ |
| | | 40.12 | | 40.12 | ✓ | ✓ |
| | | 40.14 | | 40.14 | ✓ | ✓ |
| | | 40.16 | | 40.16 | ✓ | ✓ |

| | Subject 12 (Aeroplane) | Sub Topic | Subject 14 (Helicopter) | Sub Topic | 12 | 14 |
|---|---|---|---|---|---|---|
| **Instruments (cont.)** | 42 GNSS Instruments | 42.2 | 42 GNSS Instruments | 42.2 | ✓ | ✓ |
| | | 42.4 | | 42.4 | ✓ | ✓ |
| | 44 TCAS | 44.2 | 44 TCAS | 44.2 | ✓ | ✓ |
| | 46 TWAS Systems | 46.2 | 46 TWAS Systems | 46.2 | ✓ | ✓ |
| | 48 EFIS Instrument Displays | 48.2 | 48 EFIS Instrument Displays | 48.2 | ✓ | ✓ |
| | | 48.4 | | 48.4 | ✓ | ✓ |
| | | 48.6 | | 48.6 | ✓ | ✓ |
| | 50 ELT Systems | 50.2 | 50 ELT Systems | 50.2 | ✓ | ✓ |
| **Section 2 Aeroplane / Helicopter** | | | | | | |
| **Ancillary Systems** | 52 Cooling Systems | 52.2 | 52 Cooling Systems | 52.2 | ✓ | ✓ |
| | | 52.4 | | 52.4 | ✓ | ✓ |
| | | 52.6 | | | ✓ | |
| **Undercarriage** | 54 Landing Gear - Fixed | 54.2 | 54 Landing Gear - Fixed | 54.2 | ✓ | ✓ |
| | | 54.4 | | | ✓ | |
| | | 54.6 | | | ✓ | |
| **Aerodynamics** | 56 Aeroplane Aerodynamic Theory | 56.2 | 56 Helicopter Aerodynamic Theory | 56.2 | ✓ | ✓ |
| | 58 Basic Flying Controls | 58.2 | 58 Hovering | 58.2 | ✓ | ✓ |
| | | 58.4 | | 58.4 | ✓ | ✓ |
| | | 58.6 | | | ✓ | |
| | | 58.8 | | | ✓ | |
| | | 58.10 | | | ✓ | |
| | | 58.12 | | | ✓ | |
| | | 58.14 | | | ✓ | |
| | | 58.16 | | | ✓ | |
| | | 58.18 | | | ✓ | |
| | | 58.20 | | | ✓ | |
| | | 58.22 | | | ✓ | |
| | | 58.24 | | | ✓ | |
| | | 58.26 | | | ✓ | |
| | 60 Straight and Level Flight | 60.2 | 60 Forward Flight | 60.2 | ✓ | ✓ |
| | | 60.4 | | 60.4 | ✓ | ✓ |
| | | 60.6 | | 60.6 | ✓ | ✓ |
| | | 60.8 | | 60.8 | ✓ | ✓ |
| | 62 Climbing Flight | 62.2 | 62 Climbing Flight | 62.2 | ✓ | ✓ |
| | | 62.4 | | 62.4 | ✓ | ✓ |
| | | 62.6 | | | ✓ | |
| | | 62.8 | | | ✓ | |
| | | 62.10 | | | ✓ | |

| | Subject 12 (Aeroplane) | Sub Topic | Subject 14 (Helicopter) | Sub Topic | 12 | 14 |
|---|---|---|---|---|---|---|
| **Aerodynamics (cont.)** | 64 Descending Flight | 64.2 | 64 Descending Flight | 64.2 | ✓ | ✓ |
| | | 64.4 | | 64.4 | ✓ | ✓ |
| | | 64.6 | | | ✓ | |
| | | 64.8 | | | ✓ | |
| | 66 Turning Flight | 66.2 | 66 Turning Flight | 66.2 | ✓ | ✓ |
| | | 66.4 | | 66.4 | ✓ | ✓ |
| | | 66.6 | | 66.6 | ✓ | ✓ |
| | | 66.8 | | 66.8 | ✓ | ✓ |
| | | 66.10 | | | ✓ | |
| | | 66.12 | | | ✓ | |
| | | 66.14 | | | ✓ | |
| | | 66.16 | | | ✓ | |
| | 68 Stalling and Spinning | 68.2 | 68 Autorotation | 68.2 | ✓ | ✓ |
| | | 68.4 | | 68.4 | ✓ | ✓ |
| | | 68.6 | | 68.6 | ✓ | ✓ |
| | | 68.8 | | 68.8 | ✓ | ✓ |
| | | 68.10 | | 68.10 | ✓ | ✓ |
| | | 68.12 | | | ✓ | |
| | | 68.14 | | | ✓ | |
| | | 68.16 | | | ✓ | |
| | | 68.18 | | | ✓ | |
| **Structure and Systems** | 70 Airframe Structure | 70.2 | 70 Transmission Systems | 70.2 | ✓ | ✓ |
| | | 70.4 | | 70.4 | ✓ | ✓ |
| | | 70.6 | | 70.6 | ✓ | ✓ |
| | | 70.8 | | | ✓ | |
| | | 70.10 | | | ✓ | |
| | 72 Propellers | 72.2 | 72 Main Rotor System | 72.2 | ✓ | ✓ |
| | | 72.4 | | 72.4 | ✓ | ✓ |
| | | 72.6 | | | ✓ | |
| | | 72.8 | | | ✓ | |
| | | 72.10 | | | ✓ | |
| | | 72.12 | | | ✓ | |
| | | 72.14 | | | ✓ | |
| | | 72.16 | | | ✓ | |
| | Reserved | | 74 Tail Rotor Systems | 74.2 | | ✓ |
| | 76 Control Systems | 76.2 | 76 Helicopter Controls | 76.2 | ✓ | ✓ |
| | | 76.4 | | 76.4 | ✓ | ✓ |
| | | 76.6 | | 76.6 | ✓ | ✓ |
| | Reserved | | Reserved | | | |

| | Subject 12 (Aeroplane) | Sub Topic | Subject 14 (Helicopter) | Sub Topic | 12 | 14 |
|---|---|---|---|---|---|---|
| **Helicopter Rotor Discs** | Reserved | | 80 Terminology | 80.2 | | ✓ |
| | | | 82 Forces Acting on a Helicopter Rotor | 82.2 | | ✓ |
| | | | | 82.4 | | ✓ |
| | | | | 82.6 | | ✓ |
| | | | | 82.8 | | ✓ |
| | | | | 82.10 | | ✓ |
| | | | | 82.12 | | ✓ |
| | | | | 82.14 | | ✓ |
| | | | | 82.16 | | ✓ |
| | | | 84 Anti-torque Tail Rotor | 84.2 | | ✓ |
| | | | | 84.4 | | ✓ |
| | | | | 84.6 | | ✓ |
| | | | | 84.8 | | ✓ |
| | | | | 84.10 | | ✓ |
| | | | | 84.12 | | ✓ |
| | | | | 84.14 | | ✓ |
| | | | | 84.16 | | ✓ |
| | | | 86 Hazardous Flight Conditions | 86.2 | | ✓ |
| | | | | 86.4 | | ✓ |
| | Reserved | | Reserved | | | |
| **Performance** | 100 Performance Factors | 100.2 | 100 Performance Factors | 100.2 | ✓ | ✓ |
| | | 100.4 | | 100.4 | ✓ | ✓ |
| | | 100.6 | | 100.6 | ✓ | ✓ |
| | | 100.8 | | 100.8 | ✓ | ✓ |
| | | 100.10 | | 100.10 | ✓ | ✓ |
| | | 100.12 | | 100.12 | ✓ | ✓ |
| | | 100.14 | | 100.14 | ✓ | ✓ |
| | | 100.16 | | | ✓ | |
| | | 100.18 | | | ✓ | |
| | 102 Take Off Performance | 102.2 | 102 Take Off Performance | 102.2 | ✓ | ✓ |
| | | 102.4 | | | ✓ | |
| | 104 Landing Performance | 104.2 | 104 Landing Performance | 104.2 | ✓ | ✓ |
| | | 104.4 | | | ✓ | |
| **Weight and Balance** | 106 Definitions, Terminology and Abbreviations | 106.2 | 106 Definitions, Terminology and Abbreviations | 106.2 | ✓ | ✓ |
| | 108 Weight and Loading | 108.2 | 108 Weight and Loading | 108.2 | ✓ | ✓ |
| | 110 Centre of Gravity | 110.2 | 110 Centre of Gravity | 110.2 | ✓ | ✓ |
| | | 110.4 | | 110.4 | ✓ | ✓ |

## Subject No. 12 Aircraft Technical Knowledge (Aeroplane)

**Note:** *This syllabus is primarily based on a single piston-engine GA-type aeroplane.*

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 feedback to the examination candidate. These reference numbers are common across the subject levels and therefore may not be consecutive.

Section 1 is common to both Subject 12 (Aeroplane) and Subject 14 (Helicopter)

| Sub Topic | Syllabus Item |
|---|---|
| | **Section 1 General Technical Knowledge** |
| **12.2** | **Definitions, Terminology, Units and Abbreviations** |
| 12.2.2 | State the International System (SI) and ICAO units used to express:<br>(a) distance;<br>(b) time;<br>(c) velocity;<br>(d) mass;<br>(e) volume;<br>(f) temperature;<br>(g) altitude. |
| 12.2.4 | Define and where appropriate show the relevant relationships between:<br>(a) mass, weight and gravitational force (g);<br>(b) inertia;<br>(c) momentum;<br>(d) equilibrium;<br>(e) force vectors, couples and components;<br>(f) Newton's Third Law;<br>(g) distance, time, acceleration and velocity;<br>(h) kinetic and potential energy;<br>(i) force, work and power;<br>(j) forces involved in the motion of an object travelling in a circular path. |
| **12.4** | **The Atmosphere** |
| 12.4.2 | Name the principal gases which constitute the atmosphere. |
| 12.4.4 | Define air density. |

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| 12.4.6 | Explain how air density varies with altitude within the atmosphere. |
| 12.4.8 | State the relationship between pressure/temperature and the density of an air mass. |
| 12.4.10 | Describe how pressure, temperature and density normally vary within the atmosphere. |
| 12.4.12 | Explain the basis for the International Standard Atmosphere (ISA). |
| 12.4.14 | State the ISA sea level pressure and temperature conditions. |
| 12.4.16 | State the approximate temperature lapse rate up to the tropopause. |
| **12.6** | **Basic Aerodynamic Theory** |
| 12.6.2 | Describe what an aerofoil is and distinguish between different aerofoil designs. |
| 12.6.4 | Define:<br>(a) leading edge;<br>(b) trailing edge;<br>(c) chord;<br>(d) chord line;<br>(e) thickness;<br>(f) camber. |
| 12.6.6 | Define relative airflow and angle of attack. |
| 12.6.8 | Explain Bernoulli's Theorem in simple terms. |
| 12.6.10 | Describe streamline airflow around an aerofoil. |
| 12.6.12 | Explain the changes which occur to dynamic and static pressure wherever the speed of the airflow is:<br>(a) increased;<br>(b) decreased. |
| 12.6.14 | With the aid of diagrams, explain:<br>(a) venturi effect;<br>(b) the pressure distribution around an aerofoil which is producing lift. |

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| 12.6.16 | Define the terms:<br>(a) total reaction (TR);<br>(b) centre of pressure (CP). |
| 12.6.18 | Describe how TR and CP change with increasing angle of attack for a lifting aerofoil. |
| 12.6.20 | Show how movement of the CP varies between symmetrical and non-symmetrical aerofoils. |
| 12.6.22 | Define the Lift and Drag components of Total Reaction. |
| 12.6.24 | With respect to lift:<br>(a) State the lift formula;<br>(b) summarise the factors affecting lift. (i.e. angle of attack, aerofoil shape, IAS). |
| 12.6.26 | Identify the primary factors determining the coefficient of lift (CL) for an aerofoil. |
| 12.6.28 | Describe a typical CL versus angle of attack curve (graph). |
| 12.6.30 | On a typical CL versus angle of attack curve, identify the critical stalling angle. |
| 12.6.32 | State the precaution against flying with ice, frost, snow or other contamination of the aerofoil surfaces. |
| 12.6.34 | Distinguish between induced drag, parasite and profile drag. |
| 12.6.36 | List the elements of profile drag. |
| 12.6.38 | State the factors affecting parasite drag, and profile (form and skin friction) drag. |
| 12.6.40 | Explain how induced drag varies depending on:<br>(a) angle of attack of the aerofoil;<br>(b) aspect ratio. |
| 12.6.42 | Identify curves of parasite, profile, induced and total drag versus aerofoil airspeed. |
| 12.6.44 | Describe a typical curve of lift/drag (L/D) ratio versus angle of attack for a symmetrical aerofoil. |
| 12.6.46 | Identify the approximate angle for best L/D ratio. |

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| | **Power Plant and Systems** |
| **12.10** | **Engines – General Piston Engines** |
| 12.10.2 | Identify typical cylinder configurations used for aircraft piston engines. |
| 12.10.4 | Explain the function of the main components of a four-stroke cycle piston engine including:<br>(a) cylinders;<br>(b) cylinder heads;<br>(c) pistons;<br>(d) connecting rods;<br>(e) crankshaft;<br>(f) valves;<br>(g) valve operating mechanism;<br>(h) camshaft;<br>(i) spark plugs;<br>(j) injectors. |
| 12.10.6 | Explain the basic principle of operation of a four-stroke internal combustion engine. |
| 12.10.8 | Describe the correlation between engine rpm and power output. |
| 12.10.10 | Explain the need for valve timing (i.e. valve lead, lag and overlap). |
| 12.10.12 | Explain the basic differences between compression ignition (diesel) engines and conventional ignition engines. |
| **12.12** | **Carburation** |
| 12.12.2 | Explain the principle of carburation. |
| 12.12.4 | Explain the basic principle of operation of a simple float-type carburettor. |
| 12.12.6 | State the function and/or purpose of the following within the carburettor:<br>(a) atomisation and diffusion;<br>(b) idling circuit;<br>(c) acceleration enrichment;<br>(d) enrichment at high power settings;<br>(e) mixture control; |

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| | (f) idle cut-off. |
| 12.12.8 | Explain the function of a manual mixture control and idle cut-off. |
| 12.12.10 | Explain the correct operational use of a manual mixture control and idle cut-off. |
| 12.12.12 | Explain the consequences of operating with:<br>(a) over-rich mixture settings;<br>(b) over-lean mixture settings. |
| 12.12.14 | Describe the abnormal combustion conditions of detonation and pre-ignition, and distinguish between them. |
| 12.12.16 | Explain the causes and likely effects of detonation and pre-ignition and the measures which can be taken to avoid them. |
| 12.12.18 | Explain the formation of refrigeration, throttle and impact ice in a carburettor and intake system. |
| 12.12.20 | Describe the:<br>(a) atmospheric and throttle setting conditions conducive to the formation of carburettor ice;<br>(b) symptoms of carburettor ice formation;<br>(c) correct use of carburettor heat for de-icing, and as an anti-icing measure (i.e. normal operation) including interpretation and use of a carburettor air temperature gauge. |
| 12.12.22 | Describe the function of the inlet manifold. |
| **12.14** | **Fuel Injection** |
| 12.14.2 | State the advantages/disadvantages of fuel injection versus carburetor systems. |
| 12.14.4 | Explain the:<br>(a) function and principles of a fuel injection system;<br>(b) difference between direct and indirect injection. |
| 12.14.6 | Explain the operating principle of a simple fuel injection system. |
| 12.14.8 | State the purpose of the following components in a basic fuel injection system:<br>(a) fuel delivery pump system;<br>(b) fuel distribution system;<br>(c) fuel injectors. |

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| **12.16** | **Fuel** |
| 12.16.2 | State the common types of fuels and their colour identification. |
| 12.16.4 | Distinguish between the different characteristics of AVGAS, MOGAS and AVTUR (Jet A1). |
| 12.16.6 | State the precautions regarding the use of MOGAS in aero-engines. |
| 12.16.8 | State the common fuel contaminants and the precautions which can be taken to avoid them. |
| **12.18** | **Exhaust System** |
| 12.18.2 | Describe the function of the exhaust manifold. |
| 12.18.4 | Explain the importance of proper sealing of the exhaust manifold. |
| 12.18.6 | Describe the possible sources, indications and associated danger of carbon monoxide gas. |
| **12.20** | **Ignition Systems – Magneto Ignition** |
| 12.20.2 | Describe the principal features of a typical magneto ignition system (dual, independent, engine-driven magneto systems with two spark plugs per cylinder). |
| 12.20.4 | State the purpose and principle of an impulse coupling. |
| 12.20.6 | Describe the operation and correct handling of typical ignition/starter switches (including the starter warning light). |
| 12.20.8 | Explain the purpose and the typical procedure for conducting magneto checks. |
| 12.20.10 | Describe the procedures and the precautions to be taken when hand-swinging a propeller to start an engine. |
| **12.22** | **Ignition systems – Solid State** |
| 12.22.2 | Describe the principal features and components of a typical solid-state ignition system. |
| 12.22.4 | Explain the advantages/disadvantages of solid-state ignition systems. |
| 12.22.6 | Explain the purpose and a typical procedure for conducting ignition integrity checks. |
| 12.22.8 | Describe the operation and correct handling of ignition/starter switch systems. |

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| **12.24** | **Engine Management - Piston** |
| 12.24.2 | State the safety precautions to be taken before starting the engine. |
| 12.24.4 | In general terms, explain the procedures for:<br>(a) staring the engine in cold temperatures;<br>(b) starting an over-primed engine;<br>(c) staring a hot engine;<br>(d) controlling an engine fire on start-up;<br>(e) checking oil pressure after start;<br>(f) stopping the engine. |
| 12.24.6 | Explain the reasons for avoidance of rapid power changes. |
| 12.24.8 | Explain the need for monitoring and cross-checking engine instrument indications. |
| 12.24.10 | State the possible causes for rough running or excessive engine vibration. |
| 12.24.12 | State the actions that the pilot may take to identify and rectify rough running or excessive engine vibration. |
| 12.24.14 | State the possible causes of a sudden engine failure in flight, and the remedies which may be available to a pilot during subsequent trouble checks. |
| | **Ancillary Systems** |
| **12.26** | **Electrical System - DC** |
| 12.26.2 | Describe the types of systems which are typically electrically operated in a light aircraft. |
| 12.26.4 | Explain the function of the following components in a typical light aircraft electrical system:<br>(a) battery;<br>(b) alternator and generator;<br>(c) bus bar;<br>(d) voltage regulator, voltmeter, or over voltage light;<br>(e) ammeter;<br>(f) master switch and battery/alternator switches;<br>(g) fuses and circuit breakers. |

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| 12.26.6 | Explain the precautions to take during normal operation of the electrical system, including:<br>(a) avoiding continuous operation of high-power systems on the ground before start;<br>(b) starting with radios and other unnecessary equipment switched off;<br>(c) avoiding prolonged operation of the starter motor;<br>(d) releasing the starter once the engine is running;<br>(e) checking satisfactory operation of the system after start, and monitoring during flight;<br>(f) switching off ancillary equipment before shut-down;<br>(g) switching the battery master switch off before leaving the aircraft. |
| 12.26.8 | Identify the cockpit indications of the following electrical system malfunctions:<br>(a) excessive alternator/generator charge rate;<br>(b) lack of alternator/generator charge;<br>(c) blown fuse or popped circuit breaker. |
| 12.26.10 | State the actions available to the pilot to deal with:<br>(a) excessive alternator/generator charge rate;<br>(b) lack of alternator/generator charge;<br>(c) blown fuse or popped circuit breaker. |
| **12.28** | **Fuel System Components** |
| 12.28.2 | Describe the function of the following components of a simple fuel system:<br>(a) fuel selector valve, supply line, strainer and strainer drain;<br>(b) fuel primer, engine-driven pump, auxiliary (boost) pumps. |
| 12.28.4 | Describe the correct management of the fuel system, including fuel selection and handling of priming and auxiliary pumps. |
| **12.30** | **Fuel Tanks** |
| 12.30.2 | Describe the function of the following components of a simple fuel system:<br>(a) fuel tank, sump, drain point, supply line standpipe, vents, overflow drain;<br>(b) fuel quantity indicators;<br>(c) fuel tank construction and associated limitations. |
| 12.30.4 | Describe the procedure to be used for a fuel drain check. |

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| 12.30.6 | State the general rules for fuelling of aircraft, including the special precautions for the use of drum stock, and plastic containers. |
| 12.30.8 | Explain the importance of aircraft earthing during refuelling. |
| **12.32** | **Lubrication Systems - Engines** |
| 12.32.2 | State the functions of an engine lubrication system. |
| 12.32.4 | Explain the term viscosity. |
| 12.32.6 | Explain the effect of temperature on the lubricating qualities of oil. |
| 12.32.8 | Briefly describe the function of the following components of an oil system:<br>(a) wet sump;<br>(b) dry sump, scavenge pump, tank;<br>(c) engine-driven pump, pressure relief valve;<br>(d) oil lines, passages and galleries;<br>(e) oil cooler, bypass valves and filters;<br>(f) oil pressure and temperature gauges. |
| 12.32.10 | Explain the importance of:<br>(a) using the correct type and grade of oil for a particular aircraft;<br>(b) checking the correct oil quantity before flight. |
| 12.32.12 | Identify the possible oil system malfunctions indicated by:<br>(a) low/zero oil pressure;<br>(b) high oil pressure;<br>(c) fluctuating oil pressure;<br>(d) low oil temperature;<br>(e) high oil temperature. |
| 12.32.14 | State the actions (if any) that the pilot can take to rectify:<br>(a) low/zero oil pressure;<br>(b) high oil pressure;<br>(c) fluctuating oil pressure;<br>(d) low oil temperature;<br>(e) high oil temperature. |
| 12.32.16 | Describe the correct oil replenishment procedure for a typical aircraft. |

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| | **Instruments** |
| **12.34** | **Engine Instruments** |
| 12.34.2 | Describe the function and principle of operation of the following instruments:<br>(a) tachometers (rpm) gauges (centrifugal and drag cup);<br>(b) manifold pressure and boost gauges;<br>(c) direct reading oil pressure gauges;<br>(d) vacuum gauges;<br>(e) outside air temperature gauges;<br>(f) fuel quantity gauges. |
| **12.36** | **Pressure Instruments** |
| 12.36.2 | Identify the three basic instruments which rely on air pressure for their operation. |
| 12.36.4 | Describe static pressure and dynamic pressure, and the main factors which affect them. |
| 12.36.6 | Explain the operation of a pitot-static system, including:<br>(a) static vent(s);<br>(b) pitot tube;<br>(c) combined pitot-static head;<br>(d) drain holes, heating, and pitot cover;<br>(e) alternate pressure source. |
| 12.36.8 | With respect to the airspeed indicator, describe the:<br>(a) basic principle of operation and serviceability checks;<br>(b) colour coding, and the meaning of VSO, VS1, VFE, VNO and VNE;<br>(c) IAS/TAS/groundspeed relationship;<br>(d) errors affecting the ASI, and how position error correction is applied. |
| 12.36.10 | With respect to the altimeter, describe the:<br>(a) basic principle of operation and serviceability checks;<br>(b) subscale settings and the meaning of QNH and QFE;<br>(c) errors affecting the altimeter, including subscale setting error. |
| 12.36.12 | With respect to the vertical speed indicator, describe the: |

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| | (a) basic principle of operation;<br>(b) errors affecting the VSI. |
| 12.36.14 | Indicate the normal checks for serviceability of the pitot-static system, both pre-flight and during operation. |
| 12.36.16 | Identify the cockpit indications of the following pitot-static system malfunctions, and state the actions available to the pilot to deal with the problem:<br>(a) blockage of the pitot tube;<br>(b) blockage of the static source. |
| **12.38** | **Magnetic Instruments** |
| 12.38.2 | Given a sample deviation card, show how to apply corrections. |
| 12.38.4 | Briefly:<br>(a) describe the construction of a present-day direct-reading compass;<br>(b) define lubber line;<br>(c) the functions of the fluid in the compass bowl. |
| 12.38.6 | With respect to magnetic dip:<br>(a) describe what it is;<br>(b) state how it is compensated for;<br>(c) define residual dip. |
| 12.38.8 | State the effects of:<br>(a) acceleration error;<br>(b) turning error. |
| 12.38.10 | State the compass pre-flight serviceability checks, and the precautions when carrying magnetic items in an aircraft. |
| **12.40** | **Gyroscopic Instruments** |
| 12.40.2 | Outline the basic principle of operation of the vacuum system. |
| 12.40.4 | State the likely effects of reduced or nil suction in the vacuum system. |
| 12.40.6 | Describe the gyroscopic properties of:<br>(a) rigidity;<br>(b) precession. |

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| 12.40.8 | With respect to the turn indicator/coordinator:<br>(a) explain the basic principle of a rate gyroscope;<br>(b) differentiate between the different indications of the turn indicator and turn coordinator;<br>(c) state the function, indication and correct use of the coordination (balance) ball. |
| 12.40.10 | With respect to the attitude indicator (or artificial horizon) explain:<br>(a) the basic principle of operation (earth gyroscope);<br>(b) how pitch attitude and bank angle are displayed;<br>(c) the pilot checks for serviceability. |
| 12.40.12 | With respect to the heading indicator (or DGI), explain the:<br>(a) advantages of a gyroscopic heading indicator (versus a compass);<br>(b) need for, and method of synchronising the HI with the compass;<br>(c) pilot checks for serviceability. |
| 12.40.14 | Briefly explain the errors likely to occur if:<br>(a) the gyro rotor rpm is low;<br>(b) there is an indication of a power failure on an electrically-driven gyro. |
| 12.40.16 | Describe the indications of toppling. |
| **12.42** | **GNSS Instruments** |
| 12.42.2 | Describe the basic principles and operation of a GNSS (Global Navigation Satellite System). |
| 12.42.4 | Describe the limitations and failure indications of a GNSS system. |
| **12.44** | **TCAS** |
| 12.44.2 | Briefly describe the basic function and operation of TCAS. |
| **12.46** | **TAWS Systems** |
| 12.46.2 | Briefly describe the basic function and operation of TAWS (Terrain Awareness and Warning System). |
| **12.48** | **EFIS Instrument Displays** |
| 12.48.2 | Describe the function and operation of a typical EFIS cockpit display system. |

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| 12.48.4 | Describe the function of the:<br>(a) air data computer;<br>(b) signal generator;<br>(c) input data sources to a typical basic EFIS flight display system. |
| 12.48.6 | Describe the function and operation of a typical basic AHRS (Attitude Heading Reference System). |
| **12.50** | **ELT Systems** |
| 12.50.2 | Describe the function and operation of an aircraft ELT. |
| | **Section 2 Aeroplane Technical Knowledge** |
| | **Ancillary Systems** |
| **12.52** | **Cooling Systems** |
| 12.52.2 | Describe the principal components of aircraft engine air and liquid cooling systems. |
| 12.52.4 | Explain the precautions to be taken in flight to prevent engine:<br>(a) overheating;<br>(b) overcooling. |
| 12.52.6 | Explain the correct handling of engine cowl flaps when fitted. |
| | **Undercarriage** |
| **12.54** | **Landing Gear - Fixed** |
| 12.54.2 | Describe the two common types of undercarriage system (tricycle/tail wheel). |
| 12.54.4 | Explain typical steering and braking systems. |
| 12.54.6 | Explain the precautions for the use of each type. |
| | **Aerodynamics** |
| **12.56** | **Aeroplane Aerodynamic Theory** |
| 12.56.2 | Show how CL varies with use of flaps and control surfaces. |

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| **12.58** | **Basic Flying Controls** |
| 12.58.2 | Define the aircraft axes of rotation, pitch, roll and yaw. |
| 12.58.4 | Name the flying controls used to affect movement about each axis. |
| 12.58.6 | Explain how each flying control operates to achieve control of the:<br>(a) pitch attitude;<br>(b) bank angle;<br>(c) yaw. |
| 12.58.8 | Explain the cross-coupling (further) effects of control in roll and yaw. |
| 12.58.10 | Explain the effects of airspeed and power settings on control effectiveness and aircraft attitude. |
| 12.58.12 | Explain the function of a basic trim control. |
| 12.58.14 | Explain the requirement for the balancing of controls. |
| 12.58.16 | Explain the correct method for the use of trim controls. |
| 12.58.18 | State the methods used to obtain aerodynamic balance. |
| 12.58.20 | Explain the requirement for using anti-balance tabs on an all-moving tailplane. |
| 12.58.22 | Describe the principle of operation of anti-balance tabs. |
| 12.58.24 | Explain the purpose of wing flaps. |
| 12.58.26 | Describe the principle of operation of wing flaps. |
| **12.60** | **Straight and Level Flight** |
| 12.60.2 | Define the four main forces acting in flight. |
| 12.60.4 | For level flight describe how the four main forces change as IAS is varied. |
| 12.60.6 | Describe the pitching moments in flight, and how longitudinal stability is achieved. |
| 12.60.8 | Given a basic graph of power available (PA) and power required (PR) versus TAS in level flight, show the derivation of:<br>(a) maximum and minimum level flight speed;<br>(b) maximum-range speed; |

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| | (c) maximum endurance speed. |
| 12.60.10 | Explain the basic operational considerations which apply to flying an aeroplane for range, or endurance. |
| **12.62** | **Climbing Flight** |
| 12.62.2 | Using a diagram, show and name the forces acting in a steady climb. |
| 12.62.4 | Distinguish between:<br>(a) maximum angle of climb;<br>(b) maximum rate of climb;<br>(c) cruise climb |
| 12.62.6 | Define the meaning of Vx (max angle) and Vy (max rate). |
| 12.62.8 | Using a PA/PR (power available/power required) graph, show the derivation of maximum rate of climb speed. |
| 12.62.10 | Briefly explain the factors which affect climb performance. |
| **12.64** | **Descending Flight** |
| 12.64.2 | Identify and name the forces acting in a glide. |
| 12.64.4 | Explain how the forces in a glide become modified in a constant speed power on descent. |
| 12.64.6 | Explain how the lift/drag ratio determines a constant speed glide angle. |
| 12.64.8 | Briefly explain the effects of weight, IAS, wind, and flap extension on the glide angle. |
| **12.66** | **Turning Flight** |
| 12.66.2 | Define centripetal force. |
| 12.66.4 | Explain the components of lift which provide the:<br>(a) turning force;<br>(b) force required opposing weight. |
| 12.66.6 | Define load factor “g”. |
| 12.66.8 | In a level turn, state the relationship between bank angle and lift, drag, and load factor. |

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| 12.66.10 | State the relationship between the turn radius and rate of turn at a given;<br>(a) airspeed;<br>(b) bank angle. |
| 12.66.12 | Describe a rate 1 turn, and a rule-of-thumb method of calculating the bank angle required. |
| 12.66.14 | Explain the effect of bank on rate of climb in a climbing turn, and the tendency to "overbank". |
| 12.66.16 | Explain the effect of bank on rate of descent in a descending turn, and the tendency to "underbank". |
| **12.68** | **Stalling and Spinning** |
| 12.68.2 | Describe the stalling angle of attack, with reference to:<br>(a) disruption of streamline flow over the upper surface of the aerofoil;<br>(b) reduction of lift and increase of drag. |
| 12.68.4 | Describe the symptoms of a developing stall. |
| 12.68.6 | Explain how:<br>(a) the stall is associated with a particular angle of attack and not a particular airspeed;<br>(b) a reduction in angle of attack is critical to recovery. |
| 12.68.8 | Explain how the stalling IAS is affected by:<br>(a) load factor;<br>(b) aircraft weight;<br>(c) altitude;<br>(d) power;<br>(e) flap extension;<br>(f) damage, ice, frost, or other contamination of the wings. |
| 12.68.10 | Describe the possible consequences of using ailerons near, during and in the recovery from a stall. |
| 12.68.12 | Define the term autorotation and the conditions leading to it. |
| 12.68.14 | Define a spin, with reference to:<br>(a) stalled condition of flight; |

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| | (b) simultaneous motion about three axes (rolling, pitching, yawing);<br>(c) high rate of descent at low airspeed;<br>(d) the difference between a spin and a spiral dive. |
| 12.68.16 | State what actions can be taken to avoid a spin. |
| 12.68.18 | Explain the 'standard' recovery action from a developed spin. |
| | **Structure and Systems** |
| **12.70** | **Airframe Structure** |
| 12.70.2 | Identify and explain the basic function of the major components of a conventional airframe. |
| 12.70.4 | Explain the components and distribution of the load on a wing:<br>(a) on the ground;<br>(b) in the air, and state the function of spars and struts in opposing these loads. |
| 12.70.6 | Describe the precautions required to preserve the structural integrity of the following airframes:<br>(a) aluminium;<br>(b) composite;<br>(c) fabric covered. |
| 12.70.8 | Describe the indications of damage or failure of airframes constructed of;<br>(a) aluminium;<br>(b) composite;<br>(c) fabric covering. |
| 12.70.10 | Describe the procedure to tie down (or picket) a light aircraft. |
| **12.72** | **Propellers** |
| 12.72.2 | With respect to propeller terminology, define the meaning of the following:<br>(a) blade section;<br>(b) blade angle;<br>(c) helix (or pitch) angle;<br>(d) angle of attack. |

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| 12.72.4 | Explain the reason for blade (or helical) twist. |
| 12.72.6 | With the aid of a diagram, identify and define the following for a rotating blade section:<br>(a) direction of rotation;<br>(b) relative airflow;<br>(c) total reaction, with its components;<br>(d) thrust and propeller torque. |
| 12.72.8 | For a fixed-pitch propeller at a constant throttle setting, explain the relationship between airspeed, angle of attack and rpm. |
| 12.72.10 | Briefly explain the factors which affect the ability of a fixed-pitch propeller to convert engine power into useful thrust. |
| 12.72.12 | Explain the basic principle of operation for a constant-speed propeller, and the normal procedure for changing power settings with the manifold pressure and pitch controls. |
| 12.72.14 | State the principal advantage of a constant-speed versus a fixed-pitch propeller. |
| 12.72.16 | Describe the function and operation of a typical reduction gearbox. |
| **12.76** | **Control Systems** |
| 12.76.2 | Explain the common methods of the mechanical operation of the:<br>(a) primary flight controls;<br>(b) trim tab;<br>(c) flap systems. |
| 12.76.4 | Describe the function of control locks and precautions for removal before flight. |
| 12.76.6 | Describe the normal operational use of flaps, including limitations. |
| | **Performance** |
| **12.100** | **Performance Factors** |
| 12.100.2 | Describe the general effects of altitude on aircraft performance. |
| 12.100.4 | Define pressure altitude. |
| 12.100.6 | Calculate aerodrome pressure altitude, given aerodrome elevation and prevailing QNH. |

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| 12.100.8 | Explain how to determine pressure altitude by using an altimeter. |
| 12.100.10 | Explain the general effect of temperature on performance. |
| 12.100.12 | Define density altitude. |
| 12.100.14 | Given a pressure altitude and ambient temperature, calculate the:<br>(a) ISA deviation;<br>(b) density altitude. |
| 12.100.16 | Explain the effect of the following factors on TODR (Take Off Distance Required) and LDR (Landing Distance Required):<br>(a) aircraft weight;<br>(b) temperature and pressure (i.e. density altitude);<br>(c) humidity;<br>(d) runway slope;<br>(e) runway surface condition;<br>(f) headwind/tailwind component;<br>(g) use/misuse of flaps;<br>(h) power available;<br>(i) frost or other contaminants/damage of lifting surfaces. |
| 12.100.18 | Describe the hazards of windshear in the initial climb-out path, and on the approach path. |
| **12.102** | **Take-off Performance** |
| 12.102.2 | Given typical performance data, demonstrate the ability to determine TODR |
| 12.102.4 | Explain the difference between take-off distance required (TODR) and take-off distance available (TODA). |
| **12.104** | **Landing Performance** |
| 12.104.2 | Given typical performance data, demonstrate the ability to determine LDR. |
| 12.104.4 | Explain the difference between landing distance required (LDR) and landing distance available (LDA). |

| Sub Topic | Syllabus Item |
|---|---|
| | **Weight and Balance** |
| 12.106 | **Definitions, Terminology and Abbreviations** |
| 12.106.2 | Define the following terms:<br>(a) arm (moment arm);<br>(b) datum;<br>(c) moment (including units used);<br>(d) centre of gravity (C of G);<br>(e) longitudinal C of G range and associated limits;<br>(f) station;<br>(g) basic aircraft empty weight (standard empty weight);<br>(h) zero fuel weight (ZFW);<br>(i) gross weight (AUW);<br>(j) maximum certified take-off weight (MCTOW). |
| **12.108** | **Weight and Loading** |
| 12.108.2 | Given a basic aircraft load sheet/data, demonstrate the ability to:<br>(a) calculate the C of G position;<br>(b) use a typical loading graph to determine C of G position;<br>(c) use index units. |
| **12.110** | **Centre of Gravity (C of G)** |
| 12.110.2 | State the reasons for operating an aircraft within the C of G limits. |
| 12.110.4 | State the effect on the stability and control of an aircraft if flown with the C of G at the:<br>(a) forward limit;<br>(b) aft limit. |

## Subject No. 14 Aircraft Technical Knowledge (Helicopter)

**Note:** *This syllabus is generally based on a typical light piston-engine 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 feedback to the examination candidate. These reference numbers are common across the subject levels and therefore may not be consecutive.

Section 1 is common to both Subject 12 (Aeroplane) and Subject 14 (Helicopter)

Section 1 generic references to 'aircraft' are to be interpreted as 'helicopter'.

| Sub Topic | Syllabus Item |
|---|---|
| | **Section 1 General Technical Knowledge** |
| **14.2** | **Definitions, Terminology, Units and Abbreviations** |
| 14.2.2 | State the International System (SI) and ICAO units used to express:<br>(a) distance;<br>(b) time;<br>(c) velocity;<br>(d) mass;<br>(e) volume;<br>(f) temperature;<br>(g) altitude. |
| 14.2.4 | Define and where appropriate show the relevant relationships between:<br>(a) mass, weight and gravitational force (g);<br>(b) inertia;<br>(c) momentum;<br>(d) equilibrium;<br>(e) force vectors, couples and components;<br>(f) Newton's Third Law;<br>(g) distance, time, acceleration and velocity;<br>(h) kinetic and potential energy;<br>(i) force, work and power;<br>(j) forces involved in the motion of an object travelling in a circular path. |
| **14.4** | **The Atmosphere** |
| 14.4.2 | Name the principal gases which constitute the atmosphere. |
| 14.4.4 | Define air density. |

| Sub Topic | Syllabus Item |
|---|---|
| 14.4.6 | Explain how air density varies with altitude within the atmosphere. |
| 14.4.8 | State the relationship between pressure/temperature and the density of an air mass. |
| 14.4.10 | Describe how pressure, temperature and density normally vary within the atmosphere. |
| 14.4.12 | Explain the basis for the International Standard Atmosphere (ISA). |
| 14.4.14 | State the ISA sea level pressure and temperature conditions. |
| 14.4.16 | State the approximate temperature lapse rate up to the tropopause. |
| **14.6** | **Basic Aerodynamic Theory** |
| 14.6.2 | Describe what an aerofoil is and distinguish between different aerofoil designs. |
| 14.6.4 | Define:<br>(a) leading edge;<br>(b) trailing edge;<br>(c) chord;<br>(d) chord line;<br>(e) thickness;<br>(f) camber. |
| 14.6.6 | Define relative airflow and angle of attack. |
| 14.6.8 | Explain Bernoulli's Theorem in simple terms. |
| 14.6.10 | Describe streamline airflow around an aerofoil. |
| 14.6.12 | Explain the changes which occur to dynamic and static pressure wherever the speed of the airflow is:<br>(a) increased;<br>(b) decreased. |
| 14.6.14 | With the aid of diagrams, explain:<br>(a) venturi effect;<br>(b) the pressure distribution around an aerofoil which is producing lift. |

| Sub Topic | Syllabus Item |
|---|---|
| 14.6.16 | Define the terms:<br>(a) total reaction (TR);<br>(b) centre of pressure (CP). |
| 14.6.18 | Describe how TR and CP change with increasing angle of attack for a lifting aerofoil. |
| 14.6.20 | Show how movement of the CP varies between symmetrical and non-symmetrical aerofoils. |
| 14.6.22 | Define the Lift and Drag components of Total Reaction. |
| 14.6.24 | With respect to lift:<br>(a) state the lift formula;<br>(b) summarise the factors affecting lift. (i.e. angle of attack, aerofoil shape, IAS) |
| 14.6.26 | Identify the primary factors determining the coefficient of lift (CL) for an aerofoil. |
| 14.6.28 | Describe a typical CL versus angle of attack curve (graph). |
| 14.6.30 | On a typical CL versus angle of attack curve, identify the critical stalling angle. |
| 14.6.32 | State the precaution against flying with ice, frost, snow or other contamination of the aerofoil surfaces. |
| 14.6.34 | Distinguish between induced drag, parasite and profile drag. |
| 14.6.36 | List the elements of profile drag. |
| 14.6.38 | State the factors affecting parasite drag, and profile (form and skin friction) drag. |
| 14.6.40 | Explain how induced drag varies depending on:<br>(a) angle of attack of the aerofoil;<br>(b) aspect ratio. |
| 14.6.42 | Identify curves of parasite, profile, induced and total drag versus aerofoil airspeed. |
| 14.6.44 | Describe a typical curve of lift/drag (L/D) ratio versus angle of attack for a symmetrical aerofoil. |
| 14.6.46 | Identify the approximate angle for best L/D ratio. |

| Sub Topic | Syllabus Item |
|---|---|
| | **Power Plant and Systems** |
| **14.10** | **Engines – General Piston Engines** |
| 14.10.2 | Identify typical cylinder configurations used for aircraft piston engines. |
| 14.10.4 | Explain the function of the main components of a four-stroke cycle piston engine including:<br>(a) cylinders;<br>(b) cylinder heads;<br>(c) pistons;<br>(d) connecting rods;<br>(e) crankshaft;<br>(f) valves;<br>(g) valve operating mechanism;<br>(h) camshaft;<br>(i) spark plugs;<br>(j) injectors. |
| 14.10.6 | Explain the basic principle of operation of a four-stroke internal combustion engine. |
| 14.10.8 | Describe the correlation between engine rpm and power output. |
| 14.10.10 | Explain the need for valve timing (i.e. valve lead, lag and overlap). |
| 14.10.12 | Explain the basic differences between compression ignition (diesel) engines and conventional ignition engines. |
| **14.12** | **Carburation** |
| 14.12.2 | Explain the principle of carburation. |
| 14.12.4 | Explain the basic principle of operation of a simple float-type carburettor. |
| 14.12.6 | State the function and/or purpose of the following within the carburettor:<br>(a) atomisation and diffusion;<br>(b) idling circuit;<br>(c) acceleration enrichment;<br>(d) enrichment at high power settings;<br>(e) mixture control; |

| Sub Topic | Syllabus Item |
|---|---|
| | (f) idle cut-off. |
| 14.12.8 | Explain the function of a manual mixture control and idle cut-off. |
| 14.12.10 | Explain the correct operational use of a manual mixture control and idle cut-off. |
| 14.12.12 | Explain the consequences of operating with:<br>(a) over-rich mixture settings;<br>(b) over-lean mixture settings. |
| 14.12.14 | Describe the abnormal combustion conditions of detonation and pre-ignition, and distinguish between them. |
| 14.12.16 | Explain the causes and likely effects of detonation and pre-ignition and the measures which can be taken to avoid them. |
| 14.12.18 | Explain the formation of refrigeration, throttle and impact ice in a carburettor and intake system. |
| 14.12.20 | Describe the:<br>(a) atmospheric and throttle setting conditions conducive to the formation of carburettor ice;<br>(b) symptoms of carburettor ice formation;<br>(c) correct use of carburettor heat for de-icing, and as an anti-icing measure (i.e. normal operation) including interpretation and use of a carburettor air temperature gauge. |
| 14.12.22 | Describe the function of the inlet manifold. |
| **14.14** | **Fuel Injection** |
| 14.14.2 | State the advantages/disadvantages of fuel injection versus carburettor systems. |
| 14.14.4 | Explain the:<br>(a) function and principles of a fuel injection system;<br>(b) difference between direct and indirect injection. |
| 14.14.6 | Explain the operating principle of a simple fuel injection system. |
| 14.14.8 | State the purpose of the following components in a basic fuel injection system:<br>(a) fuel delivery pump system;<br>(b) fuel distribution system;<br>(c) fuel injectors. |

| Sub Topic | Syllabus Item |
|---|---|
| **14.16** | **Fuel** |
| 14.16.2 | State the common types of fuels and their colour identification. |
| 14.16.4 | Distinguish between the different characteristics of AVGAS, MOGAS and AVTUR (Jet A1). |
| 14.16.6 | State the precautions regarding the use of MOGAS in aero-engines. |
| 14.16.8 | State the common fuel contaminants and the precautions which can be taken to avoid them. |
| **14.18** | **Exhaust System** |
| 14.18.2 | Describe the function of the exhaust manifold. |
| 14.18.4 | Explain the importance of proper sealing of the exhaust manifold. |
| 14.18.6 | Describe the possible sources, indications and associated danger of carbon monoxide gas. |
| **14.20** | **Ignition Systems – Magneto Ignition** |
| 14.20.2 | Describe the principal features of a typical magneto ignition system (dual, independent, engine-driven magneto systems with two spark plugs per cylinder). |
| 14.20.4 | State the purpose and principle of an impulse coupling. |
| 14.20.6 | Describe the operation and correct handling of typical ignition/starter switches (including the starter warning light). |
| 14.20.8 | Explain the purpose and the typical procedure for conducting magneto checks. |
| 14.20.10 | Describe the procedures and the precautions to be taken when hand-swinging a propeller to start an engine. (Aeroplane only) |
| **14.22** | **Ignition Systems – Solid State** |
| 14.22.2 | Describe the principal features and components of a typical solid-state ignition system. |
| 14.22.4 | Explain the advantages/disadvantages of solid-state ignition systems. |
| 14.22.6 | Explain the purpose and a typical procedure for conducting ignition integrity checks. |
| 14.22.8 | Describe the operation and correct handling of ignition/starter switch systems. |

| Sub Topic | Syllabus Item |
|---|---|
| **14.24** | **Engine Management - Piston** |
| 14.24.2 | State the safety precautions to be taken before starting the engine. |
| 14.24.4 | In general terms, explain the procedures for:<br>(a) staring the engine in cold temperatures;<br>(b) starting an over-primed engine;<br>(c) staring a hot engine;<br>(d) controlling an engine fire on start-up;<br>(e) checking oil pressure after start;<br>(f) stopping the engine. |
| 14.24.6 | Explain the reasons for avoidance of rapid power changes. |
| 14.24.8 | Explain the need for monitoring and cross-checking engine instrument indications. |
| 14.24.10 | State the possible causes for rough running or excessive engine vibration. |
| 14.24.12 | State the actions that the pilot may take to identify and rectify rough running or excessive engine vibration. |
| 14.24.14 | State the possible causes of a sudden engine failure in flight, and the remedies which may be available to a pilot during subsequent trouble checks. |
| | **Ancillary Systems** |
| **14.26** | **Electrical System - DC** |
| 14.26.2 | Describe the types of systems which are typically electrically operated in a light aircraft. |
| 14.26.4 | Explain the function of the following components in a typical light aircraft electrical system:<br>(a) battery;<br>(b) alternator and generator;<br>(c) bus bar;<br>(d) voltage regulator, voltmeter, or over voltage light;<br>(e) ammeter;<br>(f) master switch and battery/alternator switches;<br>(g) fuses and circuit breakers. |

| Sub Topic | Syllabus Item |
|---|---|
| 14.26.6 | Explain the precautions to take during normal operation of the electrical system, including:<br>(a) avoiding continuous operation of high-power systems on the ground before start;<br>(b) starting with radios and other unnecessary equipment switched off;<br>(c) avoiding prolonged operation of the starter motor;<br>(d) releasing the starter once the engine is running;<br>(e) checking satisfactory operation of the system after start, and monitoring during flight;<br>(f) switching off ancillary equipment before shut-down;<br>(g) switching the battery master switch off before leaving the aircraft. |
| 14.26.8 | Identify the cockpit indications of the following electrical system malfunctions:<br>(a) excessive alternator/generator charge rate;<br>(b) lack of alternator/generator charge;<br>(c) blown fuse or popped circuit breaker. |
| 14.26.10 | State the actions available to the pilot to deal with:<br>(a) excessive alternator/generator charge rate;<br>(b) lack of alternator/generator charge;<br>(c) blown fuse or popped circuit breaker. |
| **14.28** | **Fuel System Components** |
| 14.28.2 | Describe the function of the following components of a simple fuel system:<br>(a) fuel selector valve, supply line, strainer and strainer drain;<br>(b) fuel primer, engine-driven pump, auxiliary (boost) pumps. |
| 14.28.4 | Describe the correct management of the fuel system, including fuel selection and handling of priming and auxiliary pumps. |
| **14.30** | **Fuel Tanks** |
| 14.30.2 | Describe the function of the following components of a simple fuel system:<br>(a) fuel tank, sump, drain point, supply line standpipe, vents, overflow drain;<br>(b) fuel quantity indicators;<br>(c) fuel tank construction and associated limitations. |
| 14.30.4 | Describe the procedure to be used for a fuel drain check. |

| Sub Topic | Syllabus Item |
|---|---|
| 14.30.6 | State the general rules for fuelling of aircraft, including the special precautions for the use of drum stock, and plastic containers. |
| 14.30.8 | Explain the importance of aircraft earthing during refuelling. |
| **14.32** | **Lubrication Systems - Engines** |
| 14.32.2 | State the functions of an engine lubrication system. |
| 14.32.4 | Explain the term viscosity. |
| 14.32.6 | Explain the effect of temperature on the lubricating qualities of oil. |
| 14.32.8 | Briefly describe the function of the following components of an oil system:<br>(a) wet sump;<br>(b) dry sump, scavenge pump, tank;<br>(c) engine-driven pump, pressure relief valve;<br>(d) oil lines, passages and galleries;<br>(e) oil cooler, bypass valves and filters;<br>(f) oil pressure and temperature gauges. |
| 14.32.10 | Explain the importance of:<br>(a) using the correct type and grade of oil for a particular aircraft;<br>(b) checking the correct oil quantity before flight. |
| 14.32.12 | Identify the possible oil system malfunctions indicated by:<br>(a) low/zero oil pressure;<br>(b) high oil pressure;<br>(c) fluctuating oil pressure;<br>(d) low oil temperature;<br>(e) high oil temperature. |
| 14.32.14 | State the actions (if any) that the pilot can take to rectify:<br>(a) low/zero oil pressure;<br>(b) high oil pressure;<br>(c) fluctuating oil pressure;<br>(d) low oil temperature;<br>(e) high oil temperature. |
| 14.32.16 | Describe the correct oil replenishment procedure for a typical aircraft. |

| Sub Topic | Syllabus Item |
|---|---|
| | **Instruments** |
| **14.34** | **Engine Instruments** |
| 14.34.2 | Describe the function and principle of operation of the following instruments:<br>(a) tachometers (rpm) gauges (centrifugal and drag cup);<br>(b) manifold pressure and boost gauges;<br>(c) direct reading oil pressure gauges;<br>(d) vacuum gauges;<br>(e) outside air temperature gauges;<br>(f) fuel quantity gauges. |
| **14.36** | **Pressure Instruments** |
| 14.36.2 | Identify the three basic instruments which rely on air pressure for their operation. |
| 14.36.4 | Describe static pressure and dynamic pressure, and the main factors which affect them. |
| 14.36.6 | Explain the operation of a pitot-static system, including:<br>(a) static vent(s);<br>(b) pitot tube;<br>(c) combined pitot-static head;<br>(d) drain holes, heating, and pitot cover;<br>(e) alternate pressure source. |
| 14.36.8 | With respect to the airspeed indicator, describe the:<br>(a) basic principle of operation and serviceability checks;<br>(b) colour coding, and the meaning of VSO, VS1, VFE, VNO and VNE;<br>(c) IAS/TAS/groundspeed relationship;<br>(d) errors affecting the ASI, and how position error correction is applied. |
| 14.36.10 | With respect to the altimeter, describe the:<br>(a) basic principle of operation and serviceability checks;<br>(b) subscale settings and the meaning of QNH and QFE;<br>(c) errors affecting the altimeter, including subscale setting error. |
| 14.36.12 | With respect to the vertical speed indicator, describe the: |

| Sub Topic | Syllabus Item |
|---|---|
| | (a) basic principle of operation;<br>(b) errors affecting the VSI. |
| 14.36.14 | Indicate the normal checks for serviceability of the pitot-static system, both pre-flight and during operation. |
| 14.36.16 | Identify the cockpit indications of the following pitot-static system malfunctions, and state the actions available to the pilot to deal with the problem:<br>(a) blockage of the pitot tube;<br>(b) blockage of the static source. |
| **14.38** | **Magnetic Instruments** |
| 14.38.2 | Given a sample deviation card, show how to apply corrections. |
| 14.38.4 | Briefly:<br>(a) describe the construction of a present-day direct-reading compass;<br>(b) define lubber line;<br>(c) state the functions of the fluid in the compass bowl. |
| 14.38.6 | With respect to magnetic dip:<br>(a) describe what it is;<br>(b) state how it is compensated for;<br>(c) define residual dip. |
| 14.38.8 | State the effects of:<br>(a) acceleration error;<br>(b) turning error. |
| 14.38.10 | State the compass pre-flight serviceability checks, and the precautions when carrying magnetic items in an aircraft. |
| **14.40** | **Gyroscopic Instruments** |
| 14.40.2 | Outline the basic principle of operation of the vacuum system. |
| 14.40.4 | State the likely effects of reduced or nil suction in the vacuum system. |
| 14.40.6 | Describe the gyroscopic properties of:<br>(a) rigidity;<br>(b) precession. |

| Sub Topic | Syllabus Item |
|---|---|
| 14.40.8 | With respect to the turn indicator/coordinator:<br>(a) explain the basic principle of a rate gyroscope;<br>(b) differentiate between the different indications of the turn indicator and turn coordinator;<br>(c) state the function, indication and correct use of the coordination (balance) ball. |
| 14.40.10 | With respect to the attitude indicator (or artificial horizon) explain:<br>(a) the basic principle of operation (earth gyroscope);<br>(b) how pitch attitude and bank angle are displayed;<br>(c) the pilot checks for serviceability. |
| 14.40.12 | With respect to the heading indicator (or DGI), explain the:<br>(a) advantages of a gyroscopic heading indicator (versus a compass);<br>(b) need for, and method of synchronising the HI with the compass;<br>(c) pilot checks for serviceability. |
| 14.40.14 | Briefly explain the errors likely to occur if:<br>(a) the gyro rotor rpm is low;<br>(b) there is an indication of a power failure on an electrically-driven gyro. |
| 14.40.16 | Describe the indications of toppling. |
| **14.42** | **GNSS Instruments** |
| 14.42.2 | Describe the basic principles and operation of a GNSS (Global Navigation Satellite System). |
| 14.42.4 | Describe the limitations and failure indications of a GNSS system. |
| **14.44** | **TCAS** |
| 14.44.2 | Briefly describe the basic function and operation of TCAS. |
| **14.46** | **TAWS Systems** |
| 14.46.2 | Briefly describe the basic function and operation of TAWS (T*errain Awareness and Warning System).* |
| **14.48** | **EFIS Instrument Displays** |
| 14.48.2 | Describe the function and operation of a typical EFIS cockpit display system. |

| Sub Topic | Syllabus Item |
|---|---|
| 14.48.4 | Describe the function of the:<br>(a) air data computer;<br>(b) signal generator;<br>(c) input data sources to a typical basic EFIS flight display system. |
| 14.48.6 | Describe the function and operation of a typical basic AHRS (Attitude Heading Reference System). |
| **14.50** | **ELT Systems** |
| 14.50.2 | Describe the function and operation of an aircraft ELT. |
| | **Section 2 Helicopter Technical Knowledge** |
| | **Ancillary Systems** |
| **14.52** | **Cooling Systems** |
| 14.52.2 | Describe the main means for air cooling an engine, including:<br>(a) cooling fans;<br>(b) baffles;<br>(c) fins. |
| 14.52.4 | State the importance of having an engine rundown period after flight. |
| | **Undercarriage** |
| **14.54** | **Landing Gear - Fixed** |
| 14.54.2 | Describe the construction of typical fixed landing skids on a light helicopter. |
| | **Aerodynamics** |
| **14.56** | **Helicopter Aerodynamic Theory** |
| 14.56.2 | Explain how induced drag varies depending on:<br>(a) angle of attack of the rotor blade;<br>(b) aspect ratio. |
| **14.58** | **Hovering** |
| 14.58.2 | Explain the effect of the following factors on hovering flight:<br>(a) density altitude; |

| Sub Topic | Syllabus Item |
|---|---|
| | (b) helicopter gross weight;<br>(c) ground effect. |
| 14.58.4 | Describe:<br>(a) over pitching, and the recovery from it;<br>(b) recirculation. |
| **14.60** | **Forward Flight** |
| 14.60.2 | Identify the forces acting on the helicopter in steady forward flight. |
| 14.60.4 | Explain the following;<br>(a) dissymmetry of lift;<br>(b) flap-back (or blow-back)<br>(c) translational lift. |
| 14.60.6 | State the meaning of best:<br>(a) range speed;<br>(b) endurance speed. |
| 14.60.8 | Explain how the flare results in changes to the following:<br>(a) airspeed and groundspeed;<br>(b) rotor rpm. |
| **14.62** | **Climbing Flight** |
| 14.62.2 | Define:<br>(a) rate of climb;<br>(b) angle of climb. |
| 14.62.4 | State the effect of wind on angle of climb. |
| **14.64** | **Descending Flight** |
| 14.64.2 | State how changes in airspeed influence angle of descent (constant power/zero wind). |
| 14.64.4 | State the effect of wind on angle of descent. |
| **14.66** | **Turning Flight** |
| 14.66.2 | Identify the forces acting on a helicopter in a level turn. |

| Sub Topic | Syllabus Item |
|---|---|
| 14.66.4 | State the effect of angle of bank on rate and radius of turn, load factor and power required. |
| 14.66.6 | Describe a rate 1 turn, and a rule-of-thumb method of calculating the bank angle required. |
| 14.66.8 | For climbing and descending turns, describe the:<br>(a) effect of bank on the rate of climb/descent;<br>(b) requirement for increased power. |
| **14.68** | **Autorotation** |
| 14.68.2 | Define autorotation. |
| 14.68.4 | Identify the stalled, driving and driven regions (sections) of the rotor disc in autorotation. |
| 14.68.6 | Explain the need to lower the collective at the start of an autorotation. |
| 14.68.8 | Explain the effect of the following factors on the range and endurance in autorotation:<br>(a) airspeed;<br>(b) altitude;<br>(c) helicopter gross weight;<br>(d) wind velocity. |
| 14.68.10 | Explain the principal features of a Height-Velocity diagram (avoid curve). |
| | **Structure and Systems** |
| **14.70** | **Transmission Systems** |
| 14.70.2 | State the purpose of a helicopter transmission system. |
| 14.70.4 | Describe the function(s) and operation of the following transmission system components:<br>(a) main rotor gearbox;<br>(b) clutch (belt drive and centrifugal);<br>(c) freewheeling unit;<br>(d) rotor brake;<br>(e) tail rotor drive and gearbox;<br>(f) chip detectors. |

| Sub Topic | Syllabus Item |
|---|---|
| 14.70.6 | Describe the purpose and basic principle of operation of the:<br>(a) swash plate;<br>(b) pitch link advance angle. |
| **14.72** | **Main Rotor Systems** |
| 14.72.2 | Describe the construction of current rotor blades. |
| 14.72.4 | Outline the basic features of the following systems:<br>(a) rigid rotor;<br>(b) semi-rigid rotor;<br>(c) fully articulated rotor. |
| **14.74** | **Tail Rotor Systems** |
| 14.74.2 | Describe the basic features of the tail rotor. |
| **14.76** | **Helicopter Controls** |
| 14.76.2 | With respect to helicopter controls, explain the purpose and the basic principle of operation of the following:<br>(a) collective control;<br>(b) cyclic control;<br>(c) twist grip throttle including its effect on manifold pressure and rpm;<br>(d) tail rotor pedals;<br>(e) rotor brake. |
| 14.76.4 | Explain the typical markings and correct interpretation of a dual needle tachometer. |
| 14.76.6 | Explain the need for reporting any damage to rotor components that has not been marked as being previously assessed. |
| | **Rotor Discs** |
| **14.80** | **Terminology** |
| 14.80.2 | Explain the meaning of:<br>(a) tip path;<br>(b) tip path plane;<br>(c) axis of rotation; |

| Sub Topic | Syllabus Item |
|---|---|
| | (d) shaft axis;<br>(e) blade (or pitch) angle;<br>(f) feathering axis;<br>(g) coning angle;<br>(h) disc area;<br>(i) flapping;<br>(j) lead-lag (dragging). |
| **14.82** | **Forces Acting on a Helicopter Rotor** |
| 14.82.2 | For a nil-wind hovering condition identify the following vectors:<br>(a) rotational flow;<br>(b) induced flow;<br>(c) relative airflow. |
| 14.82.4 | For a nil-wind hovering condition identify:<br>(a) pitch angle;<br>(b) inflow angle;<br>(c) angle of attack. |
| 14.82.6 | For a given blade section identify the total aerodynamic reaction force (TR) and its components; rotor thrust and rotor drag. |
| 14.82.8 | Define total rotor thrust, and total rotor drag (torque). |
| 14.82.10 | Explain the balance of forces in steady hovering flight between;<br>(a) total rotor thrust and gross weight;<br>(b) total rotor drag and engine power. |
| 14.82.12 | State the effect of the following on total rotor thrust:<br>(a) air density (altitude);<br>(b) rotor rpm;<br>(c) blade angle;<br>(d) disc area. |
| 14.82.14 | Explain the effect of total rotor thrust and centrifugal force in determining coning angle. |
| 14.82.16 | Explain the need to apply washout in the design of rotor blades. |

| Sub Topic | Syllabus Item |
|---|---|
| **14.84** | **Anti-torque Tail Rotor** |
| 14.84.2 | Describe the torque couple (origin, direction, and strength). |
| 14.84.4 | State the purpose of the anti-torque (tail) rotor. |
| 14.84.6 | Describe the demand of anti-torque for power. |
| 14.84.8 | Describe the effect of wind on tail rotor thrust, including:<br>(a) possible loss of tail rotor effectiveness;<br>(b) effect on power required to hover. |
| 14.84.10 | Explain translating tendency (tail rotor drift) and common design methods used to correct for it. |
| 14.84.12 | Explain rolling tendency and the design features/procedures used to reduce it. |
| 14.84.14 | Describe the effect of tail rotor failure in flight. |
| 14.84.16 | Describe pilot actions that may eliminate or reduce the effects of tail rotor failure in flight. |
| **14.86** | **Hazardous Flight Conditions** |
| 14.86.2 | Briefly state the conditions leading to, the symptoms of, and the pilot actions to avoid and/or recover from the following:<br>(a) vortex ring state;<br>(b) loss of tail rotor effectiveness;<br>(c) ground resonance;<br>(d) blade sailing;<br>(e) dynamic rollover;<br>(f) cyclic limitations;<br>(g) mast bumping;<br>(h) exceeding rotor rpm limits;<br>(i) rotor stalls. |
| 14.86.4 | Describe the need for imposing limitations on rotor rpm. |

| Sub Topic | Syllabus Item |
|---|---|
| | **Performance** |
| **14.100** | **Performance Factors** |
| 14.100.2 | State the general effect of variation in the following on helicopter performance:<br>(a) QNH;<br>(b) ambient temperature;<br>(c) humidity. |
| 14.100.4 | Define pressure altitude. |
| 14.100.6 | Calculate aerodrome pressure altitude, given aerodrome elevation and prevailing QNH. |
| 14.100.8 | Explain how to determine pressure altitude by using an altimeter. |
| 14.100.10 | Define density altitude. |
| 14.100.12 | Given a pressure altitude and ambient temperature, calculate the:<br>(a) ISA deviation;<br>(b) density altitude. |
| 14.100.14 | State the effect of the following variables on helicopter take-off and/or landing performance:<br>(a) helicopter gross weight;<br>(b) pressure altitude;<br>(c) temperature;<br>(d) wind velocity. |
| **14.102** | **Take-off Performance** |
| 14.102.2 | Given performance data/graphs from a typical flight manual for a single-engine helicopter, demonstrate an ability to calculate take-off performance, under given conditions. |
| **14.104** | **Landing Performance** |
| 14.104.2 | Given performance data/graphs from a typical flight manual for a single-engine helicopter, demonstrate an ability to calculate landing performance, under given conditions. |

| Sub Topic | Syllabus Item |
|---|---|
| | **Weight and Balance** |
| **14.106** | **Definitions, Terminology and Abbreviations** |
| 14.106.2 | Explain the meaning of the following terms:<br>(a) arm (moment arm);<br>(b) datum;<br>(c) moment (including units used);<br>(d) centre of gravity (C of G);<br>(e) longitudinal C of G range and limits;<br>(f) lateral C of G range and limits;<br>(g) station;<br>(h) basic empty weight (empty helicopter weight);<br>(i) zero fuel weight (ZFW);<br>(j) gross weight (AUW);<br>(k) maximum certified take-off weight (MCTOW). |
| **14.108** | **Weight and Loading** |
| 14.108.2 | Given loading data/graphs for a typical light piston-engine helicopter, demonstrate an ability to calculate helicopter gross weight and C of G position on take-off and landing. |
| **14.110** | **Centre of Gravity (C of G)** |
| 14.110.2 | State the reasons for operating a helicopter within the C of G limits. |
| 14.110.4 | State the effect on the stability and control of a helicopter if flown with the C of G at:<br>(a) the forward limit;<br>(b) the aft limit;<br>(c) a lateral limit. |

# Appendix III Aeroplane—Instrument Training Syllabus

***Acceptable means of simulating instrument flight conditions:***

A hood, foggles or screens that prevent peripheral external visual reference to the student must be used.

**Dual instrument instruction:**

Five hours in aeroplanes, except that two hours may be instrument time in an approved synthetic flight training device, in accordance with the syllabus that follows:

***Full panel - using AH and DI plus all available instruments.***

Straight and level flight, maintaining compass headings to a required accuracy of ± 10º.

Level turns (using up to 30º angle of bank) through at least 180º left and right to roll out within ± 20º of a pre-selected heading with a maximum altitude variation of ± 250 feet.

Climbing and descending to pre-selected altitudes. Level flight to be re-established at the pre-selected altitude not more than ±250 feet.

***Unusual attitude recovery - full panel***

Recovery from the start of a power-on spiral dive.

Recovery from the approach to a stall (stall onset) in a climbing turn.

***Limited panel*** - using basic instruments only (that is; airspeed indicator, altimeter, turn and slip indicator, magnetic compass and VSI). For electronic flight displays, using only those instruments available following a failure of the attitude and heading reference system.

Straight and level flight.

Rate 1 turns on to compass headings.

***Required accuracy in still air conditions:***

Airspeed ± 10 knots, altitude ± 250 feet and compass turns ± 20º on roll out.

**Certification:**

The flight instructor completing such training is to endorse that fact in the applicants' logbook when the syllabus of instrument flight instruction has been satisfactorily completed.

The following wording, which may be in the form of a stick-on label or a rubber stamp, would be acceptable:

*I hereby certify that ..... has satisfactorily completed the syllabus of instrument flight instruction for the PPL(A) and demonstrated competence.*

*Signed .....Date.....*

*Instructor Category ..... Client number .....*

# Appendix IV—Aeroplane Terrain and Weather Awareness Syllabus

***Acceptable performance parameters, for the guidance of flight instructors, are published in the CAA's "Mountain Flying Training Standards Guide."***

## General Requirements

A minimum of 5 hours' dual low flying and terrain awareness training to include at least:

- 2 hours' low flying training; and
- 2 hours' terrain and weather awareness training.

It is recommended that the additional hour be terrain awareness practically applied on cross country training flights.

## Training Programme Requirements

Training organisations are required to develop terrain and weather awareness training in accordance with this syllabus. This training should expand on the syllabus requirements of low flying to incorporate an increased level of experience and understanding of flying near terrain and the effects of weather, especially wind.

Training organisations shall ensure that instructors giving terrain and weather awareness training in accordance with this syllabus have the following minimum experience:

- Category C out of direct supervision;
- 300 hours' total time in aeroplanes;
- 20 hours' pilot in command instructing in a low flying area in aeroplanes;
- 50 hours' of PPL/CPL instruction in aeroplanes;
- Have completed a course of terrain and weather awareness ground and flight training; and
- Have demonstrated competence in terrain and weather awareness training to an appropriately qualified flight examiner and on successful completion have had their logbook endorsed.

**Note:** *Instructors may include low flying instructor experience gained prior to the introduction of this requirement provided such low flying is clearly logged and verified by the appropriately qualified flight examiner.*

## Recommendations

Terrain and weather awareness training does not require high mountains to establish the basic principles. The Stage I exercise could be completed in most low flying areas. For Stage II & III selection of a valley or gully that safely enables turning in the valley and saddle/ridge crossings is appropriate. Opportunities for scenario-based decision making should be maximised. Terrain awareness training should focus (whenever the opportunity presents itself) on recognising the significance of weather, especially wind relative to the terrain and its impact on flight conditions and flight path.

It is desirable that the student experience flight:

- In the clean and poor visibility configuration;
- In both calm and light wind conditions (less than15kts);
- In clear conditions and in conditions of some precipitation; and
- Performing turns through 180° and 360° both clockwise and anti-clockwise.

### Stage I - Operating in a Simulated Confined Space

***Aim:*** Initially this is a simple exercise exploring the pilot's and the aircraft's capability to operate in a confined area.

***Exercise:*** Define a simulated confined area free of obstacles with clearly defined boundaries. A flat paddock of approximately 500 metres by 500 metres would suit most light training aircraft. Using both a 'clean' and the 'poor visibility configuration' fly the boundaries using minimum angle of bank while using all the available space. Commencing with a larger area, gradually reducing to the desired confined size will assist students in managing the exercise.

***Principles:*** The essential principle is to develop awareness of space and inertia while operating in a confined space. Use all the available room, thereby minimizing the bank angle and consequently minimizing the stall speed increase whilst maintaining a safe speed between Va and Vs appropriate to conditions and loading when clean, and appropriate power for the poor visibility configuration. Ensure every opportunity is utilised to enhance 'threat and error management' (TEM) and 'wind awareness', especially wind strength and direction.

### Stage II - Operating in a Confined Space

***Aim:*** Apply the technique and skill experienced in the first stage to an actual area confined by terrain to develop further the awareness of space and inertia.

***Exercise:*** Relocate from the obstacle free simulated confined area above to a suitable valley to carry out the Stage I Exercise, but with surrounding terrain and consequently a less defined horizon.

***Principles:*** Identify a useable imaginary horizon by visualizing where the sky meets the sea as if the terrain or obstacle to the visual horizon were transparent. Use this horizon line to reference the nose attitude whether in straight and level flight or level turning flight. Appropriately position the aircraft to execute level 180° and 360° turns using all the available space, minimizing the bank angle and using only sufficient power to maintain safe speed between Va and Vs appropriate to conditions and loading. Develop awareness of TEM principles and the significance of wind velocity relative to the terrain.

### Stage III - Crossing Ridges, Spurs, Saddles or Passes

***Aim:*** To safely cross ridges, spurs, saddles or passes applying appropriate TEM and decision making to determine the safest compromise of options and principles involved.

***Exercise:*** Using the ridges to the valley in Stage II or other suitable ridges/saddles, assess the appropriate flight path for approach, crossing, and after crossing that applies the safest compromise of the options and principles involved. Experience where safely possible, the merits of approaching both left to right and right to left, and returning back over an area just crossed.

***Principles:*** Apply sound decision making, including TEM to the process of assessing the approach to the saddle, the crossing of the saddle, and the flight path after crossing, from the perspective

of having escape routes available at all times (except when committed to the actual ridge crossing) in both calm and windy conditions.

## References

- For more in-depth resource material of the topic, exercise, aim, technique, principles to experience and the performance criteria required, refer to the *CAA Mountain Flying Training Standards Guide*.
- Additional references:
    - *Flight Instructor Guide*
    - *Mountain Flying*
    - *In, Out and Around Milford*
    - *In, Out and Around Mount Cook*
    - *In, Out and Around Queenstown*
    - *Mountain Flying DVD*

# Appendix V—Helicopter Mountainous Terrain Awareness Syllabus

## Theory Component

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|---|---|
| **1.0** | **AIRCRAFT HANDLING** |
| **1.1.0** | **Horizon awareness** |
| 1.1.1 | Define the natural horizon and estimate where a virtual horizon should be on a variable background |
| 1.1.2 | Outline the illusions associated with inaccurate horizon definition |
| **1.2.0** | **Height and altitude considerations** |
| 1.2.1 | State the visual cues used for lateral and vertical clearances |
| 1.2.2 | Outline how a barometric altimeter is used to gauge height above terrain |
| 1.2.3 | Describe the effect of density altitude on the following aspects of performance: |
| a | power available/required |
| b | effect on TAS, rate of climb, turn radius |
| c | inertia |
| d | Vne and other limitations |
| e | collective pitch angle, retreating blade stall |
| 1.2.4 | State the conditions conducive for engine inlet/carburettor icing |
| **2.0** | **WEATHER PATTERNS AND WIND AWARENESS** |
| **2.1.0** | **Mountain weather** |
| 2.1.1 | Evaluate the general weather situation and pressure systems in terms of likely mountain weather |
| 2.1.2 | Outline typical seasonal differences in mountain weather |
| 2.1.4 | Describe the likely flying conditions associated with various cloud types |
| 2.1.5 | Outline the rapidity of weather changes, including the importance of those behind the aircraft |
| 2.1.6 | State how free air and surface temperature vary with altitude |
| 2.1.7 | State the environmental factors that influence visibility plus the effect of precipitation on windscreen |

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| **2.2.0** | **Wind awareness** |
| 2.2.1 | Describe, in fluid terms, the flow of air that is obstructed by terrain |
| 2.2.2 | Describe the difference between wind over flat land and in the mountains |
| 2.2.3 | Outline the formation and characteristics of local winds, including katabatic and anabatic winds |
| 2.2.4 | Describe updraughts, down draughts, funnelling, mechanical/thermal turbulence, gusts and turbulence, rotors and lee waves |
| 2.2.5 | Describe the behaviour of wind at less than ~15kts and above 15kts |
| 2.2.6 | Define the demarcation line |
| 2.2.7 | Outline the following methods of wind-finding: |
| a | Cloud shadows as indicators of upper winds |
| b | indicators of lower level wind, e.g.: |
| | (1) smoke/dust/precipitation |
| | (2) drift and groundspeed/airspeed correlation |
| | (5) movement of vegetation |
| | (6) water ripples/lanes/shadows on bodies of water |
| **3.0** | **TRANSIT FLYING** |
| **3.1.0** | **Pre-flight planning** |
| 3.1.1 | Select the appropriate map (type & scale) for the intended flight |
| 3.1.2 | Select an appropriate route and height, taking into account: |
| a | VFR minima |
| b | terrain & map interpretation |
| c | wind, turbulence etc |
| d | cloud base |
| e | sun/shadow |
| f | power available |
| g | forced landing areas |
| h | wires |
| i | radio coverage |

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| j | alternate/escape routes |
| k | legal requirements (incl. the minimum height/lateral separation specified in rule 91.311) |
| **3.2.0** | **Flying techniques** |
| 3.2.1 | Describe valley flying techniques for: |
| a | entering and manoeuvring in a wide valley |
| b | selecting where in valley, and how far up the side, to fly |
| c | anticipating the effect of sudden shadow / sun effects |
| d | flying up a valley compared to flying down a valley |
| 3.2.2 | Describe techniques for maintaining orientation: |
| a | how to maintain situational awareness: map reading, sun, valley alignment, compass. Note the limitations of GNSS |
| b | using a kneeboard and map. Map folding |
| c | lost procedure: escape route downstream |
| 3.2.3 | Describe saddle/ridge crossing techniques: |
| a | the variables determining how to cross, and the relative importance of each. |
| b | assessing up and down draughts |
| c | safest approach direction and escape route |
| d | difference between a knife edge saddle and a prolonged commitment area saddle |
| e | aircraft attitude and altitude at saddle/ridge |
| f | anticipation of turbulence |
| g | estimating a safe height to cross by appropriate use of parallax and horizon |
| h | effect of different backgrounds |
| 3.2.4 | State the importance of prompt and effective decision making for crossing saddles/ridges, including the consideration of the following factors: |
| a | identify and consider all options |
| b | select the best approach direction |
| c | select and review a fixed committal point |

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|---|---|
| d | identify a safe escape route |
| e | consider the helicopter position and options after crossing |
| **4.0** | **APPROACH AND LANDING TO UNPREPARED SITE** |
| **4.1.0** | **Reconnaissance** |
| 4.1.1 | State how permission to land/approach is obtained |
| 4.1.3 | State the requirement to conduct a low approach and overshoot |
| **4.2.0** | **Power checks** |
| 4.2.1 | Use flight manual/supplements/performance graphs and tables to accurately determine power requirements |
| 4.2.2 | State the appropriate height above touchdown point to conduct a power check |
| 4.2.3 | State why OGE power should be available for all approach or landings to any unprepared site in the mountains |
| **4.3.0** | **Wind direction & demarcation line** |
| 4.3.1 | Illustrate the general wind flow and local disturbances over a mountain feature and identify the demarcation line |
| **4.6.0** | **Aiming point/hover or touchdown point** |
| 4.6.1 | State the need to positively identify the point |
| 4.6.2 | State the factors to be considered in assessing suitability of the point |
| **4.7.0** | **Typical terrain features** |
| 4.7.1 | Describe the following typical terrain features and associated considerations: |
| a | river flat, open ground above the tree line |
| **4.8.0** | **Main/tail rotor awareness** |
| 4.8.1 | Describe the techniques for landing on uneven ground and considerations for clearances |
| **5.0** | **TAKE OFF FROM UNPREPARED SITE** |
| **5.1.0** | **Power checks** |
| 5.1.1 | Use flight manual/supplements/performance graphs and tables to accurately determine power requirements |
| 5.1.2 | State why sufficient power should normally be available to conduct at least a shallow towering take-off from any unprepared site in the mountains. |

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| 5.1.3 | State the requirement to maintain RRPM within the normal operating range. |
| 5.1.4 | State the requirement to check hover power available |
| **5.2.0** | **Take-off and climb-out** |
| 5.2.1 | Describe how to safely lift from rough terrain into the hover |
| 5.2.2 | Describe the standard take-off technique; including take-off direction with respect to wind, when to transition forward, the height to climb to or when a descent may be initiated, and the climb-out path to follow |
| 5.2.4 | Outline tail rotor considerations |
| **6.0** | **EMERGENCIES** |
| **6.1.0** | **Controlled flight into terrain** |
| 6.1.1 | Outline the consequences of poor decision making, resulting in reaction instead of anticipation |
| 6.1.3 | Describe how to recover from the loss of visual reference or entry into inadvertent IMC |
| **6.2.0** | **Forced/Precautionary Landings** |
| 6.2.1 | Describe the actions to be taken in the event of a complete engine failure or catastrophic failure requiring immediate landing: |
| a | immediate actions |
| | (1) lower collective, or as required by flight manual |
| | (2) effect of altitude on: collective position; RRPM; ROD |
| b | know the (often limited) options, including: |
| | (1) wind direction/strength/turbulence |
| | (2) possibility that no open flat ground is available |
| | (3) landing on valley floor versus ridgeline |
| | (4) landing upslope/downslope |
| | (5) type of engine-off landing |
| | (6) autorotation distance |
| c | have a plan |
| 6.2.2 | Describe the actions to be taken in the event of a partial engine failure or other helicopter or weather emergencies requiring landing as soon as possible including; Loss of Tail Rotor Effectiveness, low or high RRPM, low G, exceeding Vne |

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|---|---|
| a | immediate actions |
| b | know the options |
| c | have a plan |
| **7.0** | **HUMAN FACTORS** |
| **7.1.0** | **Situational awareness** |
| 7.1.1 | Describe the importance of correct orientation and how to maintain it |
| 7.1.2 | Outline the impact of the scale of the landscape and clear visibility on estimating heights and distances |
| 7.1.3 | Describe the psychological stresses of operating in the mountains, particularly for inexperienced pilots |
| **7.2.0** | **Aircraft management** |
| 7.2.1 | Outline the additional factors required in fuel planning |
| 7.2.2. | Detail the factors that lead to airframe/engine icing and how to avoid or minimise them |
| **7.3.0** | **Airmanship** |
| 7.3.1 | Explain the need for positive action rather than reaction to events |
| 7.3.2 | Explain the need for, and techniques of, effective decision-making |
| 7.3.3 | Outline the need to apply fundamental principles: aviate- navigate – communicate |
| 7.3.4 | Outline radio communications/flight follow considerations |
| 7.3.6 | Outline the requirements to ensure the care, comfort and safety of passengers |
| **7.4.0** | **Aviation medicine** |
| 7.4.1 | Outline the physiological effects relating to pressure & temperature |
| 7.4.2 | Outline the causes and effects of hypoxia/anxiety/load-shedding |
| 7.4.3 | Outline the effect of glare on effective vision |
| 7.4.4 | Describe the type of clothing/footwear that should be worn |
| **7.5.0** | **SAR aspects** |
| 7.5.1 | Outline typical aircraft and personal survival kits, their use and contents with respect to basic principles of survival, the area of operations and the likely time before pickup |

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| 7.5.2 | Outline the principles of survival: First Aid; Protection; Location; Water; Food; Will to Survive |

**Flight Component**

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|---|---|
| **1.0** | **AIRCRAFT HANDLING** |
| 1.1 | Fly at constant height above a contour line for: |
| | horizon identification & to maintain appropriate disc/nose attitude |
| | maintaining constant altitude |
| | awareness of lateral and vertical distance from terrain |
| | appreciation of inertia |
| | appreciation of available escape routes |
| 1.2 | Estimate height by visual means, use of barometric or radio altimeters |
| 1.3 | Fly above greater of 6,000 feet AMSL or 3,000 feet AGL |
| **2.0** | **WEATHER PATTERNS AND WIND AWARENESS** |
| 2.1 | Recognise up and down draughts and areas of likely turbulence |
| 2.2 | Estimate wind strength and direction using visual indicators |
| 2.3 | Estimate wind strength and direction using groundspeed/airspeed correlation |
| **3.0** | **TRANSIT FLYING** |
| 3.1 | Fly at an appropriate height for the conditions |
| 3.2 | Select and fly an appropriate route/position for wind or weather conditions etc |
| 3.3 | Fly in a confined valley |
| 3.4 | Cross a ridge/saddle |
| **4.0** | **APPROACH AND LANDING TO UNPREPARED SITE** |
| 4.1 | Carry out a reconnaissance and power check |
| 4.2 | Accurately determine the surface wind |
| 4.3 | Conduct an approach to an open flat area (normal circuit) |
| 4.4 | Execute an overshoot to the pre-planned escape route |

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| **5.0** | **TAKE OFF FROM UNPREPARED SITE** |
| 5.1 | Calculate power required and check power available in hover |
| 5.2 | Conduct a towering take-off directly into wind |
| **6.0** | **EMERGENCIES** |
| 6.1 | Enter and sustain an autorotation from high altitude, recovering as required |
| 6.2 | Experience LTE and low RRPM and recovery from both |
| **7.0** | **HUMAN FACTORS** |
| 7.1 | Maintain situational awareness |
| 7.2 | Demonstrate good aircraft management |
| 7.3 | Demonstrate good airmanship |
| 7.4 | Carry a personal first aid and survival kit |

# Appendix VI—Aeroplane and Helicopter, Day/Night, Cross-Country Navigation Syllabus

**Note:** *The student should be denied access to GNSS information throughout this syllabus of basic training to embed the principles of pilot navigation. Additional training will be required in the use of GNSS for navigation, if the training aircraft is appropriately equipped, due to its impact on human factors, decision making and threat and error management. Such additional training is encouraged but outside the scope of this syllabus.*

Rule 61.105(a)(9)(ii) requires a student to hold a valid written examination credit (passes in all appropriate PPL subjects) prior to being authorised for a solo cross-country flight.

## Stage I Elementary Navigation Exercises

**Experience:**

Hold a written examination credit for PPL subjects and receive;

At least 1 hour's dual flight instruction and 1 hour's solo flight time.

**Instruction:**

Preparation of charts and in-flight log, weather evaluation, NOTAMs, fuel and oil requirements, fuel management, maintenance of heading and map reading.

## Stage II Basic Navigation Exercises

**Experience:**

At least 2 hours' dual flight instruction and 2 hours' solo flight time.

**Instruction:**

To include at least one landing at a controlled aerodrome (which may be deferred to stage III if operationally appropriate) and one landing at a non-controlled aerodrome at least 25 nm from the point of departure.

**Pre-flight preparation:**

Weather evaluation with emphasis on the go/no go decision, selection of routes, cruising levels, minimum safe altitudes and check points, preparation of an in-flight log and lodging of flight plan, oil and fuel requirements and reserves, relevant air traffic rules and procedures including entry, transit, and exit lanes through controlled airspace, radio communication procedures, emergency and diversion procedures, and action on becoming uncertain of position.

**In-flight procedures:**

Log keeping, map reading, maintenance of compass heading by cross reference to DI, elimination of track errors by adjustments to heading, appropriate RTF communication, revisions of ETA, position reporting and adherence to air traffic clearances.

**Solo basic navigation**

The same route in reverse may be utilised. The flight should not be authorised unless the forecasts are at least 2,000 foot ceiling and 16 kilometres visibility.

**Post flight procedure:**

Termination of flight plan, recording of flight time (including aircraft logbooks), recording and notification of defects, securing the aircraft.

In addition, after a flight as PIC, the pilot is to submit map, flight plan, relevant weather and completed flight log to the supervising instructor.

## Stage III Advanced Navigation Exercises

**Experience:**

At least 2 hours' dual flight instruction and 2 hours' solo flight time.

**Instruction:**

Dual instruction including a diversion requiring low-level navigation (incorporating terrain awareness principles) with at least one landing en route.

At least 1 solo cross-country flight is to be made into controlled airspace in an aircraft equipped with a functioning two-way radio.

**Pre-flight preparation:**

As for Stage II.

**In-flight procedures:**

As for Stage II but with emphasis on a demonstration of competence in cross-country navigation procedures and techniques (in accordance with the *PPL Cross-Country Demonstration of Competency Guide*).

Introduction to emergencies such as deteriorating weather with a resulting low level diversion and unscheduled landing under simulated meteorological conditions of 600 foot cloud base and flight visibility less than 5,000 metres.

**Post flight procedures:**

As for Stage II.

**Solo advanced navigation:**

Not necessarily over the same route with an intermediate landing en route. This exercise should not include low level navigation. This flight should not be authorised until the student has successfully completed the PPL cross-country demonstration of competency.

## PPL Cross-Country Demonstration of Competence (Day)

This is to be carried out by a Category A, B or C flight instructor (out of 'direct' supervision) and may be counted as dual instruction toward the total cross-country flight time requirement. This flight is to be flown at medium level and meet the requirements of the *PPL Cross-Country Demonstration of Competency Guide*. The candidate will be given the route to fly but will be expected to carry out all of the pre-flight preparation. This demonstration is combined with Stage III of training using a similar dual instruction concept to the BFR (further training may be required).

**Logbook certification:**

When the syllabus of cross-country navigation flight training has been satisfactorily completed, the successful demonstration of competence is to be endorsed in the applicants' logbook by the instructor who observed the demonstration of competency. The following wording, which may be in the form of a stick-on label or a rubber stamp, would be acceptable:

*I hereby certify that ..... has satisfactorily completed the Aeroplane/Helicopter (delete as applicable) syllabus of cross-country navigation flight training for the PPL and demonstrated competence by Day/Night (delete as applicable).*

*Signed.....Date .....*

*Instructor Category .....Client number .....*

## PPL Cross-Country Navigation Training (Night)

Prior to undertaking night cross country navigation training the applicant (including the holder of a CPL or ATPL who wish to exercise the privileges of a PPL by night VFR) is to have completed (for the appropriate category of aircraft) the day navigation training syllabus, the appropriate competency demonstration (day) and have met the PPL instrument and night flight experience requirements for the carriage of passengers within 25 nautical miles of a lighted aerodrome or heliport.

The minimum recommended night flight time in the appropriate category of aircraft is:

- a total of 10 hours (including 10 take-offs, (or translation) circuits and landings at night.
- at least 5 hours' dual; and
- at least 3 hours' dual night cross-country flight instruction.

**Meteorological conditions (night)**

Navigation training solo flights are not to be undertaken at night unless the forecasts are at least 3,000 foot ceiling and 16 kilometres visibility.

## PPL Cross-Country Demonstration of Competence (Night)

This demonstration is to be carried out by an appropriately night qualified Category A or B flight instructor. The candidate (including the holder of a CPL or ATPL who wishes to exercise cross-country privileges of a PPL by night VFR) will be given the route to fly but will be expected to carry out all of the pre-flight preparation. The flight is to be at least 25 nautical miles in a straight line from the aerodrome of departure in the appropriate category of aircraft (in addition to the training requirement), be flown at medium level and meet the requirements of the *PPL Cross-Country Demonstration of Competence Guide.*

Alternatively, the holder of a pilot licence issued under Part 61, may have their flight experience assessed for equivalence of the night flying training and night competency demonstration requirements above, by the holder of a General Aviation Flight Examiner rating. In this case the logbook certification above may have the words "*has satisfactorily completed*" struck through and the word *"meets"* inserted.

## Cross Crediting

**Aeroplane to helicopter:**

The holder of a PPL(A), whose logbook is certified (as above) as meeting the cross-country training and demonstration of competence (by day), is not required to undergo further cross-country training (by day) but must meet the demonstration of competency (day) requirements of the PPL(H) and the mountainous terrain awareness training (H) before exercising the privileges of a PPL(H) by day beyond 25 nm of the departure aerodrome.

In this case, where only the demonstration of competence is required, the logbook entry will be as per the logbook certification above except the words “flight training” may be struck through.

Cross crediting for night does not apply.

**Helicopter to aeroplane:**

The holder of a PPL(H), whose logbook is certified (as above) as meeting the cross-country training and demonstration of competence (by day), is required to undergo further cross-country training (by day) in an aeroplane comprising 2 hours’ dual and 2 hours’ solo and meet the demonstration of competency (day) requirements of the PPL(A) before exercising the privileges of a PPL(A) by day beyond 25 nm of the departure aerodrome.

Cross crediting for night does not apply.

### *PPL Cross-Country Demonstration of Competence Guide* (Day or Night as Applicable)

This guide is available free to instructors at this link on the CAA website: Flight Test Standards Guide (FTSG) – PPL Cross-Country Demonstration of Competency – Aeroplane/Helicopter – Day/Night

# Appendix VII—Aeroplane and Helicopter Issue Flight Test Syllabus

***Acceptable performance parameters, for the guidance of flight examiners, are published in the CAA "Flight Test Standards Guide Private Pilot Licence Issue and Biennial Flight Review (BFR)".***

## General Requirements

The test is conducted in accordance with the *Recreational and Private Pilot Licence Issue and Biennial Flight Review (BFR) Aeroplane* or the *Private Pilot Licence Issue and Biennial Flight Review (BFR) Helicopter - Flight Test Standards Guide* (as applicable) and is to include an oral general knowledge test followed immediately by the pilot competency test. Failure to pass 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.

The candidate is to arrive 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 log book, current medical certificate, written exam credits, knowledge deficiency reports (KDRs) with evidence of content improvement completed and certified, current AIPNZ Volume 4 and appropriate Visual Navigation Chart.

## Aircraft, Equipment and Facilities required for the Flight Test

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, and
- intercommunication equipment of an approved type.

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

## General Knowledge Test

The candidate will be able to:

**Licence privileges:**

Demonstrate an understanding of the applicable aircraft category PPL privileges and currency requirements.

**Aircraft documents:**

Demonstrate a working knowledge of the certificate of airworthiness, technical log, flight manual and associated pilot's operating handbook.

**Weather and AIP:**

Obtain and interpret the AFOR for the period of the flight test or a hypothetical cross-country flight (as required by the examiner) including a TAF and METAR (with associated SPECIs and SIGMETs as applicable).

Obtain and demonstrate knowledge of the applicable NOTAMs and supplements.

Make a go/no go decision based on all available pre-flight planning data.

**Aircraft performance and operating requirements:**

Demonstrate a working knowledge of the effect of seasonal conditions on aircraft performance and the application of the performance group rating system.

Calculate the take-off and landing distances relating to private operations considering density altitude, wind, terrain and other relevant conditions (within a reasonable time).

**Fuel:**

Accurately calculate fuel requirements including reserves for a private operation.

Establish oil and fuel on board and calculate endurance.

**Aircraft loading:**

Demonstrate a working knowledge of the aircraft's weight limitations, including fuel, oil, baggage, load distribution and security.

Accurately calculate the centre of gravity position for take-off and landing (within a reasonable time).

**Pre-flight:**

Demonstrate a working knowledge of aircraft type specific systems, features, protrusions, intakes and aerials.

Demonstrate a practical pilot's pre-flight inspection, including internal and external serviceability checks, in accordance with the aircraft's pilot operating handbook.

**Emergency equipment:**

Supervise passenger(s) on the movement area and in the aircraft.

Brief the passenger(s) on the location and operation of all emergency equipment including doors and hatches, seat belts and shoulder harness, and the ELT.

Brief the passenger(s) on the rules regarding smoking in aircraft and the actions in event of an emergency landing (and/or ditching if appropriate).

## Piloting Technique Test for Aeroplanes

The candidate will be able to:

**Engine start and warm-up:**

Ensure that the aircraft is positioned to taxi and that the area is clear before starting.

Demonstrate, setting the brakes, the correct use of primer and/or auxiliary fuel pump(s) (as applicable), starting the engine, checking engine instruments and only taxiing when temperatures and pressures have stabilised in accordance with the *Aircraft Flight Manual.*

Verbalise or demonstrate the actions required in the event of an engine fire during or after start (at examiner discretion).

**Air traffic service procedure:**

Obtain ATIS information when appropriate and available.

Read back appropriate instructions, information and clearances.

Comply with ATS clearances and instructions when appropriate and request/suggest alternatives when considered necessary, in an appropriately assertive communication style, using the correct aeronautical phraseology.

**Taxiing and brake check:**

Perform a brake and instrument serviceability check in accordance with recommended procedures.

Control the aircraft's speed without excessive use of brakes, avoid hazards, and position the aircraft's controls for the prevailing wind in accordance with the *Aircraft Flight Manual*.

**Engine checks, run-up and operation:**

Carry out the pre-flight engine run up and checks in accordance with the *Aircraft Flight Manual* or check list.

Demonstrate, in flight, smooth operation of the throttle and use of the mixture, carburettor heat control and auxiliary fuel pump (if applicable) in accordance with the *Aircraft Flight Manual* or checklist. Select appropriate fuel tanks and monitor fuel consumption.

**Pre take-off checks:**

Carry out the pre take-off checks in accordance with the *Aircraft Flight Manual* or checklist.

Verbalise, for the examiner's benefit, the departure procedure to be followed (if applicable) and the actions to be taken in the event of an engine failure during and after take-off.

**Normal take-off:**

Complete the line-up checks in accordance with recommended procedures.

Ensure the take-off path is clear and advance the throttle(s) to maximum allowable power, checking engine instruments and airspeed increasing.

Use correct elevator inputs for nose wheel or tail wheel type aeroplanes, rotate at the appropriate Vr and maintain a straight take-off and climb out path.

Establish and maintain the recommended climb speed, trimming to maintain the nose attitude accurately and completing after take-off checks as applicable.

**Crosswind take-off:**

Determine or estimate (at examiner discretion) the crosswind component.

Demonstrate, if conditions permit a crosswind take-off, positioning the flight controls to compensate for crosswind in accordance with the *Aircraft Flight Manual*, reducing windward aileron with effective speed increase to a positive clean lift-off, and maintaining a straight take-off and climb out path.

Establish and maintain the recommended climb speed, trimming to maintain the nose attitude accurately and completing after take-off checks as applicable.

**Short field take-off:**

Demonstrate a maximum performance take-off from a (simulated) field of minimum length, utilising full runway length.

While holding against the brakes ensure minimum static RPM is achieved and that engine pressures and temperatures are normal.

Rotate at the recommended Vr and initially achieve the best angle of climb speed.

When clear of (simulated) obstacles raise flap (if applicable) in accordance with the *Aircraft Flight Manual* and recommended procedures to achieve and maintain the best rate of climb speed (Vy). Maintain a straight take-off and climb out path throughout.

Modify the Vr and Vx (in accordance with recommended procedures) when the conditions warrant, and trim to maintain the nose attitude accurately.

Complete after take-off checks as applicable.

**Engine failure techniques:**

React appropriately to a simulated abandoned take-off and/or EFATO (at examiner discretion).

During the aborted take-off close the throttle fully, maintain direction, apply brakes as required and verbalise the subsequent actions.

During a simulated EFATO lower the aircraft's nose, close the throttle, select a suitable (or most suitable) landing area within range, use flap as required to achieve the landing and carry out FMI trouble checks (including MAYDAY) if time permits.

Alternatively or subsequently (as time permits) verbalise the FMI securing checks, delaying 'master off' if electric flap is involved.

React correctly (power first) and promptly to the examiner's "go around" command.

**Climbing:**

Maintain the nominated climb speed, accurately trim to maintain the climb attitude, maintain engine temperatures and pressures within their normal ranges.

Comply with recommended procedures for clearing the flight path ahead.

**Straight and level flight:**

Achieve and maintain level flight at the nominated altitude.

Maintain the nominated (DI) heading and accurately trim for level flight.

**Slow flight**

Maintain level flight while reducing airspeed to a minimum of 1.2 Vs and manoeuvre in various configurations at that speed including changing direction from an established turn to a turn in the opposite direction using up to 20º angle of bank and re-establishing normal cruise.

**Medium turns:**

Clear the area in accordance with recommended procedures and demonstrate an accurately coordinated level medium turn through 180º left and right, using and maintaining an accurate bank angle of 30º.

**Descent:**

Enter and maintain the (examiner) nominated descent, maintain the nominated speed, accurately trim to maintain the descent attitude, warm or clear the engine as appropriate.

Clear the flight path ahead in accordance with recommended procedures.

**Stalls in basic and power-on configurations:**

Demonstrate basic and power on (with or without flap at examiner discretion) stall entry from level flight with recovery at onset (the examiner may nominate the specific onset symptom at which recovery is to be initiated).

Carry out HASELL and HELL checks as appropriate, ensuring adequate height to recover.

During entry maintain level flight, preventing yaw, and during the recovery, minimise the height loss through the application of full power (preventing yaw) and return to straight and level flight.

**Wing drop stall:**

Demonstrate a wing drop stall (the examiner may nominate the aircraft configuration).

Carry out HASELL and HELL checks as appropriate, ensuring adequate height to recover.

During entry maintain level flight and during the recovery, maintain ailerons neutral, prevent further yaw with rudder and minimise the height loss through the application of full power, then return to straight and level flight.

**Magnetic compass headings:**

Clear the area in accordance with recommended procedures and (with the DI covered or de-synchronised) demonstrate turns onto compass headings (as nominated by the examiner) in level, climbing or descending flight (at examiner discretion).

**Steep turns:**

Clear the area in accordance with recommended procedures.

Demonstrate a coordinated level steep turn through 360º left and right, using a bank angle of 45º.

During the entry, increase power appropriately, and on exit, return to straight and level flight coincident with achieving the reference point, maintaining the nominated altitude throughout.

**Forced landing with power:**

From approximately 500 feet AGL, when confronted with simulated conditions (at examiner discretion) that would make a forced landing with power advisable, react promptly and decisively. The examiner will specify the simulated cloud base, visibility and remaining daylight (as applicable).

Configure the aircraft appropriately, in accordance with recommended procedures, and nominate a suitable landing area with due regard to wind, terrain, obstructions and other relevant factors.

If this demonstration is carried out in a designated low flying area, initiate the missed approach at the minimum safe height (or higher as directed by the flight examiner).

**Forced landing without power:**

Demonstrate an adequate knowledge of the factors affecting the choice of a suitable forced landing area. Subsequently, the examiner will nominate the field to be used and simulate the engine failure from altitude (examiner's discretion).

Carry out the initial actions, plan the descent/approach pattern and execute the plan maintaining the nominated glide speed.

During the subsequent actions attempt to determine the cause of the engine failure through trouble checks and assuming no response from a partial power check, simulate a Mayday call, brief the passengers and simulate the shut-down checks.

Initiate the missed approach, not below minimum safe altitude.

**Flap usage or sideslipping:**

Use correct flap extension and retraction procedures, carried out within the appropriate speed range.

When applicable to aircraft type demonstrate a straight sideslip and sideslipping whilst turning (with an appropriate speed increase to the recommended glide speed).

**Low flying in simulated poor visibility:**

Carry out the appropriate checks prior to entering the low flying area (if applicable).

Use flap and power to configure the aircraft appropriately for simulated poor visibility conditions in accordance with recommended procedures and maintain the nominated airspeed and altitude.

Carry out weather avoidance, coastal or restricted terrain reversal turns (at the examiner's discretion) in accordance with the recommended procedure using no more than 45º angle of bank (when required).

Maintain an appropriate lookout throughout.

**Rejoining and circuiting:**

Demonstrate joining the circuit using an appropriate procedure (as nominated by the flight examiner).

Carry out rejoining and circuit checks, obtain ATIS information and ATS clearances (as and when applicable), maintain an adequate lookout and listening watch throughout, and demonstrate an acceptable level of situational awareness.

**Normal approach and landing:**

Carry out appropriate circuit checks and demonstrate a normal approach and landing using full flap (provided the conditions are appropriate).

Maintain the nominated approach speed, obtain an ATS clearance (as and when applicable), maintain a straight landing roll and use brakes as required.

**Flapless approach and landing:**

Demonstrate a flapless approach and landing maintaining an appropriate nominated approach speed.

Obtain an ATS clearance (as and when applicable), maintain a straight landing roll and use brakes appropriately.

**Crosswind approach and landing:**

Demonstrate a crosswind landing (if conditions permit), correcting for drift throughout the circuit and approach.

Give due consideration to personal and aircraft limitations, and make an appropriate decision to continue or abort the approach.

Establish an appropriate configuration and approach/threshold speed, and maintain the nominated speed(s).

Prior to touchdown, align the aircraft with the runway centre line and position controls correctly throughout the landing roll.

**Short field approach and landing:**

Demonstrate an approach and landing into a (simulated) field of minimum length, in accordance with the *Aircraft Flight Manual* or performance charts.

Nominate an approach and threshold speed appropriate to the conditions and progressively reduce the approach speed to the nominated threshold speed, or on final, stabilise the threshold speed at approximately 300 feet AGL (maximum).

Consider the effect of the modified threshold speed (if applicable) on the landing distance and make a sound decision to continue or divert.

Initiate a go-round at the decision height or point, if a landing cannot be assured; otherwise regulate the descent with power to a pre-selected touchdown point.

After touchdown, use brakes as required and maintain the runway centre line throughout the landing roll.

**Approach and go-round from below 50 feet:**

***Note:*** *The examiner will call for a go-round during at least one approach from below 50 feet.*

Initiate the go-round, leading with full power, confirming carburettor air cold and raising the flap progressively in accordance with the recommended procedure whilst tracking the runway centre line.

**Radiotelephony procedures:**

Demonstrate an adequate listening watch and communicate clearly and assertively using standard aviation phraseology.

**Lookout:**

Demonstrate an adequate lookout (both on the ground and in the air).

Maintain an adequate level of situational awareness by ensuring compliance with the minimum VMC requirements for VFR flight and building a mental picture of the relative position of traffic, which may potentially affect the flight.

**Flight orientation:**

Demonstrate adequate knowledge of the local area by navigating to and from the designated training area, via compulsory VFR reporting points (if applicable) and without infringing controlled airspace or becoming disorientated.

**Balance:**

Ensure all coordinated in-flight manoeuvres are conducted to within a ¼ ball (sustained) deflection.

**Post flight:**

Taxi clear of the active runway and complete after landing checks as appropriate.

Park the aircraft into wind (if applicable) with due attention to other aircraft or objects.

Carry out the engine shut down in accordance with the *Aircraft Flight Manual* or checklist, secure the aircraft and complete all post flight documentation.

## Piloting Technique Test for Helicopters

**Start-up, warm-up, clutch engagement:**

As in-flight manual.

**Run-up, functional checks:**

As in-flight manual.

**Lift-off to hover:**

Maintain correct attitude and heading, constant height, good RPM control and co-ordination, hover power check, centre of gravity position indicated by cyclic, control response.

**Hover taxiing:**

Steady walking pace, good height and RPM control, skids aligned with direction of movement.

**Constant heading pattern:**

Lift-off over spot, stabilise hover then maintain a constant heading around the pattern with good safe height, speed, directional, RPM and cyclic control, stabilise hover at each corner, look-out before rearward flight.

**Hover turns 180º and 360º:**

One turn each way, constant height, steady slow rate of turn, good RPM control, adequate use of cyclic to maintain position over reference point.

**Normal circuit:**

Good lift-off, hover, correct attitude during transition to normal climb ± 10 knots, turn at nominated height, downwind at nominated height ±100 feet, downwind checks, judgement of base turn, safe approach speed, minimum 45 knots down to approximately 200 foot height, reasonable approach angle to nominated touchdown spot, good RPM and directional control throughout, terminate at a hover then land vertically.

**Cross-wind circuit:**

Helicopter parked crosswind, good lift-off to hover, cyclic usage, circuit with allowances for drift, approach to hover and land crosswind.

**Running take-off:**

With maximum operating engine RPM determine power for hover, running take-off using approximately one and a half inches of mercury manifold air pressure (MAP) below this, good directional and cyclic control to unstick, attitude and speed control to unstick, attitude and speed control to 150 foot height, normal circuit to run-on landing.

**Run-on landing:**

Touchdown not above 10 knots ground speed, MAP to be minimum required, but not above running take-off minimum, maximum operating engine RPM, soft ground contact.

**Cushion creep take-off:**

With maximum operating engine RPM achieve a very low hover, correct use of cyclic to achieve transition without increase in power, normal circuit to hover and landing.

**Zero speed landing:**

Touchdown on nominated spot with zero ground speed and no hover, power minimum required, approximately that for a running take-off.

**Climb and descent at constant IAS, changing power:**

Nominated IAS ± 10 knots to 1000 foot height ± 100 feet with good RPM control, then power reduction to 13 inches of mercury MAP, adequate use of pedal, descent to 500 foot height, same limits, recover to climb to 800 feet approximately for autorotation.

**Compass turns:**

Turning onto compass headings, initially ±20º, reducing to±10º.

**Steep turns:**

Through 360º left and right, look-out, bank angle of 45º, correct power use during entry and roll-out, correct co-ordination and balance to within one quarter of a ball deflection, ± 100 feet.

**Autorotation:**

From approximately 800 foot height, perform a straight in autorotation with power recovery to a 3 foot hover, initial collective fully down, positive needle split (approximately 300 RPM), good speed and RPM control in descent, safe cyclic action, coordination of throttle, collective and anti-torque pedal.

**One hundred and eighty degree autorotation:**

From approximately 800 foot height perform a 180 autorotation with power recovery to the hover, control as for straight-in case.

**Low flying:**

At a nominated height and not below a nominated speed, maintain good RPM control whilst turning and following basic contours with use of the collective.

**Quick stops:**

From a nominated height, commencing at approximately 50 knots both into and out of wind, preform quick stops maintaining approximately the same height and terminating into wind.

**Slope landings and lift-offs:**

Demonstrate slope landings across and up slope, maximum engine operating RPM, gentle ground contact, correct handling of collective and cyclic throughout.

**Confined areas:**

As appropriate perform a high reconnaissance of selected confined areas and apply threat and error management, consider size, shape, wind, best approaches, obstructions, termination hover height and landing spot, surface, slope and overshoots, plan circuit, make power assessment, circuit and approach to hover or landing, and departure.

**Carriage of external rack loads:**

To be covered by an oral discussion and briefing.

**Engine failure from hover:**

From a height of approximately 2 feet in a stable hover, throttle off to produce a positive needle spilt, maintain a constant heading, and cushion the landing with collective.

**Rundown procedures:**

As in-flight manual.

**Emergencies:**

Hydraulic controls failure if applicable, tail rotor emergencies, uncommanded yaw, discussions on forced landings, fire in the air, ditching, and any other emergency applicable to the helicopter type being used for the test.

**Airmanship:**

The whole flight will be considered and an assessment made of pilot judgement, decision making, TEM and adequacy of lookout.

**Air traffic services:**

Comply with ATS practices and procedures and carry out the required communications with a degree of competency appropriate to the privileges of a PPL. Provided that, where the applicant is the holder of at least a PPL(A), the flight examiner may, at their discretion, substitute an oral

examination on air traffic services practices and procedures when the helicopter is not equipped with two-way radio or air traffic services are not available.

**Carriage of sling loads (optional):**

With the helicopter at or near its MCTOW and using a sling at least 4 metres long, position the helicopter on the ground, attach the sling to the hook, demonstrate a lift-off with maximum engine operating RPM, circuit, and approach to the hover over a nominated spot with manual release, maximum engine operating RPM on finals to the hover. This item is tested by a Category B or A flight instructor who certifies competence in the candidate's logbook.

**Radiotelephony tuning and procedures:**

Demonstrate an adequate listening watch and communicate clearly and assertively using standard aviation phraseology.