CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

Advisory Circular
AC 61-3

Revision 9

1 August 2008

Pilot Licences and Ratings – Private Pilot Licence

General

Civil Aviation Authority Advisory Circulars contain information about standards, practices, and procedures that the Director has found to be an **Acceptable Means of Compliance (AMC)** with the associated rule.

An AMC is not intended to be the only means of compliance with a rule, and consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate Advisory Circular.

An Advisory Circular may also include **guidance material (GM)** to facilitate compliance with the rule requirements. Guidance material must not be regarded as an acceptable means of compliance.

Purpose

This Advisory Circular provides information on the flight time experience and on the examination syllabus content that is acceptable to the Director for meeting the Civil Aviation Rule requirements for the issue of Private Pilot Licences.

Related Rules

This Advisory Circular relates specifically to Civil Aviation Rule Part 61 Subpart D – *Private Pilot Licences*.

Change Notice

Revision 9 introduces an expanded syllabus of training for helicopter mountainous terrain awareness outlined on page 6 and Appendix V to this Advisory Circular.

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Rule 61.153 Eligibility requirements

PPL Flight time experience

61.153(a)(3),(4) and (5) The flight time experience that is acceptable to the Director is set out in Appendix I and II of this Advisory Circular.

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, 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 2 years and the written examination credit is valid for three years from the date of issue as detailed in rule 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 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 III of this Advisory Circular.

PPL Flight test

Rule 61.153(a)(7) requires an applicant for a PPL to demonstrate competence and knowledge to a flight examiner in a flight test in the appropriate category of aircraft. These are based on the standards set out in Appendix IV of this Advisory Circular.

The privileges and limitations mentioned in rule 61.153(a)(7)(ii) are those detailed in rule 61.155.

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 following:

The person must-

- hold a current unrestricted foreign PPL or higher licence for the appropriate category of aircraft; and
- meet the Part 61 minimum flight experience requirements, and
- 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
- pass a New Zealand Biennial Flight Review in accordance with rule 61.39 with the flight instructor mentioned above.

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, except that 2 hours may be instrument time in an approved synthetic flight trainer, in accordance with the syllabus that follows:

Limited panel -

Straight and level flight and Rate 1 turns on to compass headings using basic instruments only, that is; airspeed indicator, altimeter, turn and slip indicator, magnetic compass and VSI to the following accuracy in still air conditions; compass turns ± 20 degrees, airspeed ± 10 knots, and altitude ± 250 feet.

Full panel -

Straight and level flight: Maintaining compass headings to a required accuracy of ± 10 degrees.

Normal turns: At least 180 degrees left and right to within ± 20 degrees 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: From the start of a power-on spiral dive, and from the approach to a stall (stall onset) in a climbing turn.

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 and demonstrated competence.
Signed .....Date.....
Instructor Category ..... Licence number .....

Advanced dual instruction:

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

Circuit joining procedures.

Steep turns.

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.

Cross-wind: Taking-off and landing.

Pilot cross-country navigation training:

10 hours in aeroplanes in accordance with the syllabus in Appendix II, except that the holder of a PPL (H) is only required to complete 2 hours solo and 2 hours dual cross-country flight instruction in aeroplanes.

Rule 61.105(8)(ii) requires a student to hold a valid written examination credit (passes in all PPL subjects) prior to being authorised for a solo cross-country flight.

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:

5 hours in aeroplanes which is to include 2 hours of dual instruction, and 2 hours of solo flight time.

Students must have at least 2 hours instrument flight time in aeroplanes including the following instrument flight manoeuvres before undertaking night flight training:

Straight and level flight: Maintain heading to a required accuracy of ± 5 degrees, ± 100 feet altitude and in-balance.

Medium & rate 1 turns: At least 180 degrees turns left and right, in-balance, to within ± 10 degrees 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 ± no more than 100 feet.

Unusual attitude: Prompt and correct recovery from unusual attitudes.

An applicant who does not meet this 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 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 experience.

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

Dual instruction:

20 hours in helicopters other than in amateur built helicopters.

Solo flight time:

15 hours in helicopters of which not more than 5 hours may be in amateur built helicopters.

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 to this Advisory Circular. The flight experience requirement is to include at least 3 hours dual instruction and 1 hour solo flight time. 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 log book that the pilot has demonstrated competence to:

> fly a pre-planned route between 500'and 1,000' AGL through or within mountainous terrain, following major valley systems or distinctive terrain features, and crossing saddles and ridges; and
>
> 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 certify that ..... has satisfactorily completed the syllabus of training for helicopter mountainous terrain awareness and has demonstrated competence.*
> *Signed.....Date .....*
> *Instructor Category .....Licence number .....*

A person holding a private helicopter pilot licence issued after 31August 2008 should not land at, or make an approach to any area in mountainous terrain where, if necessary, a run-on landing cannot be safely conducted without first completing at least a basic mountain flying training course as set out in Advisory Circular 61-5.

Cross-country navigation training:

10 hours in helicopters which is to have been conducted in accordance with the syllabus set out in Appendix II, except that the holder of a PPL (A) is only required to successfully complete the PPL (H) cross-country flight test.

Rule 61.105(8)(ii) requires a student to hold a valid written examination credit (passes in all PPL subjects) prior to being authorised for a solo 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: 180 degree and 360 degree right and left.

Figure S turn.

Slope landing.

Pattern flying: With constant heading.

Quick stops.

Bad weather low flying: Low visibility techniques.

Cross-wind: 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:

Students must have 2 hours 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 ± 5 degrees, ± 100 feet altitude and in-balance.

Medium & rate 1 turns: At least 180 degrees turns left and right, in-balance, to within ± 10 degrees 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 ± no more than 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; and

5 hours night flight time in helicopters including:

- 2 hours dual instruction
- 2 hours solo

An applicant who does not meet these night flying requirements does not comply with Rule 61.153(a)(4) and may not exercise those privileges of a PPL(H) at night.

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

5 hours dual instrument instruction in helicopters; and

10 hours night flight time in helicopters including:

- 5 hours dual instruction
- 2 hours solo including 10 solo take-offs, translation circuits and landings at night
- 3 hours night cross-country training which is to have been conducted in accordance with the syllabus set out in Appendix II.

An applicant who does not meet these night flying 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.

Cross-crediting

Where an applicant produces acceptable evidence of piloting experience in aeroplanes, gliders, powered gliders, or three-axis microlights, half the pilot-in-command 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.

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 cross-country navigation syllabus

Stage 1 Elementary navigation exercises

Experience:

Hold a written examination credit for PPL subjects and receive;

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

Instruction:

Preparation of flight plan, weather evaluation, fuel requirements, fuel management, maintenance of heading, and map reading.

Stage 2 Basic navigation exercises

Experience:

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

Instruction:

Dual flight instruction and solo practice in basic cross-country navigation. To include at least one landing at a controlled or flight service aerodrome and one landing at a non-controlled aerodrome at least 25 nm from the point of departure.

Pre-flight preparation:

Weather evaluation, selection of routes, cruising levels, minimum safe altitudes and check points, preparation and lodging of flight plan, 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, elimination of track error, revisions of ETA, position reporting and adherence to air traffic clearances.

Meteorological conditions:

Navigation solo flights are not to be undertaken unless the forecasts are at least 2000 foot ceiling and 16 kilometres visibility.

Stage 3 Advanced navigation exercises

Experience:

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

Instruction:

Dual flight instruction in advanced navigation including part high level, and part low-level navigation, preferably with one landing en-route.

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

Pre-flight preparation:

As for Stage 2.

In-flight procedures:

As for Stage 2 but with emphasis on high level map reading, estimation of distances and revisions of ETA. Introduction to emergencies such as deterioration in weather with a resulting unscheduled landing and diversion back to base at low level under simulated meteorological conditions of 600 foot cloud base and flight visibility less than 5000 metres.

Solo advanced navigation:

Following dual flight instruction, this should include a period at high level only (at least 6000 feet for aeroplanes and 2000 feet for helicopters) but not necessarily over the same route and preferably with an intermediate landing en route. This exercise should not be authorised until the supervising instructor is satisfied with the student's ability to undertake such a flight.

Log book certification:

When the syllabus of cross-country navigation flight training has been satisfactorily completed, the flight instructor completing such training is to endorse that fact in the applicants' logbook. 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 cross-country navigation flight training for the PPL and demonstrated competence.*
> *Signed.....Date .....*
> *Instructor Category .....Licence number .....*

PPL Helicopter cross-country flight test (day)

This test is to be carried out by a Category B or Category A flight instructor and may be counted as dual instruction time. The candidate will be given the route to fly but will be expected to carry out all of the pre-flight preparation. The flight test is to be of approximately 2 hours duration and will be flown at medium level. The candidate will be expected to use current Visual Navigation Charts (VNC).

In the case of a PPL(A) cross crediting to a PPL(H) the logbook entry will be as per the log book certification example given above except the words "flight training" are replaced with "flight test".

PPL Helicopter cross-country navigation training (night)

Prior to undertaking night cross country training the applicant is to have completed the day navigation training and flight test. The minimum night cross-country navigation flight time is to be at least 2 hours dual flight instruction and 1 hour solo flight time.

PPL Helicopter cross-country flight test (night)

This test is to be carried out by an appropriately night qualified Category A or B flight instructor and may be counted as dual instruction time. The candidate will be given the route to fly but will be expected to carry out all of the pre-flight preparation. The test flight is to be of approximately one-hour duration and will be flown at medium level. The candidate will be expected to use current Visual Navigation Charts (VNC).

Pre-flight preparation:

Map preparation: selection and marking of maps.

Flight log preparation: preparation of a suitable log for in-flight use.

Flight plan: preparation and filing of an ATC flight plan.

ATC considerations: clearance requirements, use of entry, transit, and exit lanes if applicable.

NOTAM, AIPNZ supplements and airspace restrictions: checked and considered.

Weather: appropriate information obtained and correctly interpreted.

Fuel planning: accurately calculated to cover the flight plus reserves.

Aircraft loading and centre of gravity calculations: in accordance with flight manual.

Performance considerations: requirements for take-off, route, and landing.

In-flight procedures:

Pre-departure systems checks: aircraft systems required for flight are checked.

Departure: set heading procedure, and time noted.

Position reporting: standard, and timely.

Map reading: regular fixing of position, and competence in reading map.

Log keeping: regular recording of position and time.

Use of communications facilities: appropriate use of aircraft equipment to obtain relevant flight information, VOLMET, ATIS.

Use of navaids: correctly identified and appropriate use without over-reliance.

Tracking techniques: use of 1 in 60 rule, drift lines, line features, heading and time as appropriate.

Flying accuracy: adherence to planned heading (± 10 degrees), IAS (± 5 knots), altitude (± 100 feet).

ETA revision: at least one per leg.

Turning point procedures:

ETA achievement: within ± 3 minutes.

Identification of turning points: related to topography, spot heights, rivers, streams, roads, and tracks.

Away landing: performance considerations, circuit, approach, landing, take-off.

Radiotelephone procedures: standard.

Diversion:

Decision: prompt and appropriate after being given a hypothetical weather or fuel situation.

Track and distance estimation: correctly calculated from a positive fix of position.

ETA revision: calculated within ten minutes of set heading on diversion.

Fuel considerations: landing fuel calculated.

Airmanship considerations:

Pilot judgement: whole flight considered. Confident, competent handling of the flight with appropriate decisions made based on sound information.

Lookout: an effective lookout maintained for wires, other obstacles, and traffic.

ATS procedures: standard.

Lost procedures: oral discussion on ground.

Emergencies: oral discussion on ground.

Appendix III - Private pilot licence written examination syllabuses

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 feed back 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: (a) range; (b) surface interference; (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: (a) the headset/boom microphone combination; and (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: (a) Mode A information; and (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.
2.8	**Emergency Locator Transmitter (ELT, aka ELBA or ELB).**
2.8.2	State the frequency(ies) on which the ELT transmits.

Sub Topic	Syllabus Item
2.8.4	State the requirements for the carriage of an ELT.
2.8.6	Explain how an ELT can be activated: (a) automatically in the event of an impact; and (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 (a) language to be used; (b) word spelling; (c) transmission of numerals; (d) procedure words and phrases; (e) time system; (f) establishment of communications; (g) frequencies to be used; (h) identification of service; (i) radiotelephony aircraft callsigns; (j) procedures for exchange of messages; (k) corrections and repetition tests; (l) listening out; (m) readability scale.
2.10.4	Demonstrate a good working knowledge of the following Civil Aviation Rules: (a) Part 91.217 (5); (b) Part 91.243; (c) Part 91.245 (b), (c) and (d); (d) Part 91.247; (e) Part 91.249 (a) and (b); (f) Part 91.513;

Sub Topic	Syllabus Item
	(g) Part 91.515;
	(h) Part 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
	(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;

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

Subject No 4 Air Law

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

Sub Topic	Syllabus Item
4.2	**Aviation Legislation**
4.2.2	Describe the requirements to hold an aviation document, as laid down in CA Act 1990 S7.
4.2.4	Describe the criteria for the fit and proper person test, as laid down in CA Act 1990 S10.
4.2.6	Describe the duties of the pilot-in-command, as laid down in CA Act 1990 S13 and 13A.
4.2.8	Describe the responsibilities of a licence holder with respect to changes in their medical condition, as laid down in CA Act 1990 S27.
4.2.10	Describe the responsibilities of a licence holder with respect to the surrender of a medical certificate as laid down in CA Act 1990 S27.
4.2.12	Describe the responsibilities of a licence holder with respect to safety offences, as laid down in CA Act 1990 S43 and 44.
4.4	**Definitions**
	CAR Part 1(unless otherwise noted)
	State the definition of:
	(a) accident;
	(b) Act;
	(c) aerobatic flight;
	(d) aerodrome operational area;
	(e) aerodrome traffic circuit;
	(f) aeronautical information circular;
	(g) aeronautical information publications (AIP);
	(h) AIP supplement;
	(i) air traffic control (ATC) service;
	(j) airworthiness certificate;
	(k) airworthy condition;
	(l) alerting service;
	(m) altitude;
	(n) ATC clearance;
	(o) ATC instruction;
	(p) aviation event;
	(q) AWIB service;

Sub Topic	Syllabus Item
	(r) ceiling;
	(s) controlled flight;
	(t) cost sharing flight;
	(u) cross-country flight;
	(v) dangerous goods;
	(w) day;
	(x) dual flight time;
	(y) final reserve fuel;
	(z) fit and proper person;
	(aa) flight examiner;
	(bb) flight information service;
	(cc) flight manual;
	(dd) flight plan;
	(ee) flight time;
	(ff) height;
	(gg) incident;
	(hh) night;
	(ii) NOTAM;
	(jj) pilot-in-command;
	(kk) rating;
	(ll) SARTIME;
	(mm) takeoff weight;
	(nn) threshold; (CAR 121.3)
	(oo) type;
	(pp) Technical Instructions;
	(qq) UNICOM service;
	(rr) VFR flight;
	(ss) visibility;
	(tt) visual meteorological conditions.

4.6 Abbreviations

CAR Part 1(unless otherwise noted)

State the meaning of the following abbreviations:

(a) ABN; (AIP GEN)

(b) AGL;

(c) AMSL;

(d) ATIS;

Sub Topic	Syllabus Item
	(e) AWIB;
	(f) BWR; (AIP GEN)
	(g) CAR;
	(h) ELT;
	(i) QNH;
	(j) VFR.
	Personnel Licensing
4.8	**Requirements for Licences and Ratings**
4.8.2	State the requirements for holding a pilot's licence. CAR 61
4.8.4	State the requirements for a pilot-in-command to hold a type rating on the type of aircraft being flown. CAR 61
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4.10.14	State the requirements and limitations of a PPL holder sharing the cost of a flight. CAR 1
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4.14.8	State the normal currency period of the Class 2 medical certificate for a PPL holder who is under the age of 40. CAR 67
4.14.10	State the normal currency period of the Class 2 medical certificate for a PPL holder who is 40 years of age but less than 50 years of age on the date that the certificate is issued. CAR 67

Sub Topic	Syllabus Item
4.14.12	State the normal currency period of the Class 2 medical certificate for a PPL holder who is 50 years of age or more on the date that the certificate is issued. CAR 67
	Airworthiness of Aircraft and Aircraft Equipment
4.16	**Documentation**
4.16.2	State the documents which must be carried in aircraft operated in New Zealand. CAR 91
4.18	**Aircraft Maintenance**
4.18.2	Describe the maintenance requirements of an aircraft operator. CAR 91
4.18.4	State the requirement for annual and 100 hour inspections. CAR 91
4.18.6	State the requirement for an annual review of airworthiness. CAR 91
4.18.8	State the requirements for maintenance records. CAR 91
4.18.10	State the requirements for and contents of a technical log. CAR 91
4.18.12	State the requirements for entering defects into a technical log. CAR 91
4.18.14	State the requirements for clearing defects from a technical log. CAR 91
4.18.16	State the limitations and requirements on a person undertaking 'pilot maintenance'. CAR 43
4.18.18	State the requirements for conducting a maintenance test flight on an aircraft without a current airworthiness certificate. CAR 91
4.18.20	State the inspection period for radios. CAR 91
4.18.22	State the inspection period for altimeters. CAR 91
4.18.24	State the inspection period for transponders. CAR 91
4.18.26	State the inspection period for the ELT. CAR 91
4.20	**Instruments and Avionics**
4.20.2	State the minimum instrument requirements for a day VFR flight. CAR 91
4.20.4	State the minimum instrument requirements for a night VFR flight. CAR 91
4.20.6	State the radio equipment requirements for a VFR flight. CAR 91
4.20.8	State the communications and navigation equipment requirements for a VFR over water flight. CAR 91
4.22	**Equipment**
4.22.2	State the equipment requirements for a night VFR flight. CAR 91
4.22.4	State the equipment requirements for flight over water. CAR 91
4.22.6	State the requirements for indicating the time in flight. CAR 91
4.22.8	State the requirements for emergency equipment in aircraft with seating capacity for less than 10 passengers. CAR 91
4.22.10	State the requirements for an ELT. CAR 91
4.22.12	State the requirements for night flight. CAR 91

Sub Topic	Syllabus Item
	General Operating and Flight Rules
4.24	**General Operating Requirements**
4.24.2	Describe the requirements of passengers to comply with instructions and commands. CAR 91
4.24.4	State the requirements for operating an aircraft in simulated instrument flight. CAR 91
4.24.6	State the requirements of a pilot-in-command with respect to the safe operation of an aircraft. CAR 91
4.24.8	Describe the authority of the pilot-in-command. CAR 91
4.24.10	State the requirements for crew occupation of seats and wearing safety belts. CAR 91
4.24.12	State the requirements for the occupation of seats and wearing of restraints. CAR 91
4.24.14	State the requirements for the use of oxygen equipment. CAR 91
4.24.16	State the requirements for briefing passengers prior to flight. CAR 91
4.24.18	State the requirements for familiarity with operating limitations and emergency equipment. CAR 91
4.24.20	State the requirements for carrying appropriate aeronautical publications and charts in flight. CAR 91
4.24.22	State the requirements for operating on and in the vicinity of an aerodrome. CAR 91
4.24.24	Describe the standard overhead rejoin procedure, and state when it should be used. AIP AD
4.24.26	State the right of way rules. CAR 91
4.24.28	Explain the requirement for aircraft lighting. CAR 91
4.24.30	State the requirements for wearing/holding identity documentation in certain areas. CAR 19
4.26	**General Operating Restrictions**
4.26.2	State the restrictions on smoking in an aircraft. CA Act 1990 S65N
4.26.4	State the restrictions on the use of portable electronic devices in flight. CAR 91
4.26.6	State the restrictions on the carriage and discharge of firearms on aircraft. CAR 91
4.26.8	Explain the restrictions on stowage of carry-on baggage. CAR 91
4.26.10	Explain the restrictions on the carriage of cargo. CAR 91
4.26.12	State the restrictions applicable to aircraft flying near other aircraft. CAR 91
4.26.14	State the restrictions on the dropping of objects from an aircraft in flight. CAR 91
4.26.16	State the speed limitation on aircraft operating under VFR. CAR 91
4.26.18	State the minimum heights for VFR flights under CAR Part 91. CAR 91
4.26.20	State the restrictions when operating VFR in icing conditions. CAR 91
4.26.22	State the restrictions applicable to operating an aircraft in aerobatic flight. CAR 91

Sub Topic	Syllabus Item
4.26.24	State the restrictions applicable to parachute-drop operations. CAR 91
4.26.26	State the restrictions applicable to aircraft towing gliders. CAR 91
4.26.28	State the restrictions applicable to aircraft towing objects other than gliders. CAR 91
4.26.30	State the restrictions on intoxicating liquor and drugs. CAR 91 & CAR 19
4.28	**General Meteorological Requirements and Restrictions**
4.28.2	State the met minima for VFR flight in various airspace. CAR 91
4.28.4	State the restrictions and met minima for Special VFR flight. CAR 91
	Flight Planning and Preparation
4.30	**Flight Preparation**
4.30.2	Explain the requirements for obtaining and considering relevant information prior to flight. CAR 91
4.30.4	Describe the publications and their content, that provide operational route and aerodrome information.
4.30.6	Derive operational information from charts and publications that provide route and aerodrome information.
4.32	**Fuel Requirements**
4.32.2	State the minimum fuel reserve required for a day VFR flight. CAR 91
4.32.4	State the minimum fuel reserve required for a night VFR flight. CAR 91
4.34	**Flight Plans**
4.34.2	State the requirements for the filing of a flight plan for flight under VFR. CAR 91
4.34.4	State the requirements for notification of changes to the filed flight plan. CAR 91
4.34.6	State the requirements for the terminating a flight plan. CAR 91
4.34.8	State the time search and rescue action would be initiated if a flight plan is not terminated. AIP ENR
	Air Traffic Services
4.36	**Communications**
4.36.2	Derive from operational publications, the required radio frequency for communicating with specified ATC units.
4.36.4	Explain the use of aircraft radiotelephony callsigns. CAR 91
4.36.6	State the requirements for making position reports to an ATS unit. CAR 91 & AIP ENR
4.36.8	State the content of a VFR position report. AIP ENR
4.36.10	State the purpose of Universal Communications Services (UNICOM). AIP GEN
4.36.12	State the purpose of an Aerodrome Frequency Response Unit (AFRU). AIP GEN
4.36.14	State the purpose of Aerodrome and Weather Information Broadcasts (AWIB). AIP GEN
4.36.16	State the meaning of the various light signals from a control tower. CAR 91 & AIP AD

Sub Topic	Syllabus Item
4.36.18	State the communications requirements when TIBA procedures are in force. AIP ENR
4.38	**Clearances**
4.38.2	State the requirements for complying with ATC clearances and instructions. CAR 91 & AIP ENR
4.38.4	State the requirements for coordinating with an aerodrome flight information service. CAR 91
4.38.6	State the requirements for receiving an ATC clearance prior to entering various types of airspace, and ground manoeuvring area. CAR 91 & AIP ENR
4.38.8	State the requirements for receiving an ATC clearance prior to re-entering controlled airspace. CAR 91 & AIP ENR
4.40	**Separation**
4.40.2	Describe the method of passing traffic information using the clock code.
4.40.4	Describe the situations where Air Traffic Control is responsible for the provision of separation between VFR, SVFR and IFR traffic. AIP ENR
4.40.6	Describe the situations where the pilot-in-command is responsible for maintaining separation from other traffic. AIP ENR
4.40.8	Describe the normal separation standards applied by ATC. AIP ENR
4.40.10	Describe the situations where the normal separation may be reduced. AIP ENR
4.40.12	State the wake turbulence separation requirements for light aircraft in non-radar environment. AIP AD
4.42	**Radar Services**
4.42.2	Describe the radar services available to VFR flights. AIP ENR
	Airspace; Aerodromes; and Heliports
4.44	**Altimetry**
4.44.2	Explain the altimeter setting requirements for flight under VFR. CAR 91 & AIP ENR
4.44.4	State the altimeter setting to use when QNH is not available prior to takeoff. AIP ENR
4.44.6	Describe QNH zones and state when zone QNH should be used. AIP ENR
4.46	**Cruising Levels**
4.46.2	State the altitude requirements when cruising VFR within the New Zealand Domestic FIR. CAR 91 & AIP ENR
4.46.4	Describe situations where ATC may assign cruising altitudes not in accordance with the VFR table of cruising altitudes. AIP ENR
4.48	**Transponders**
4.48.2	State the requirements for the operation of transponders within the New Zealand Domestic FIR. CAR 91 & AIP ENR
4.48.4	Describe the procedures required of pilots operating transponders. AIP ENR
4.48.6	State the requirements and limitations on an aircraft operating under VFR in transponder mandatory airspace without an operating transponder. CAR 91 &

Sub Topic	Syllabus Item
	AIP ENR
4.50	**Airspace**
4.50.2	State the rules pertaining to operating VFR in the various classes of airspace. CAR 91 & AIP ENR
4.50.4	Describe the vertical limits and purpose of control zones (CTR). CAR 71
4.50.6	Describe the vertical limits and purpose of control areas (CTA). CAR 71
4.50.8	State the status and conditions relating to flight in VFR transit lanes. AIP ENR
4.50.10	Describe the status and purpose of a general aviation area (GAA). CAR 91 & AIP ENR
4.50.12	Describe control zone sectors. CAR 71
4.50.14	Describe visual reporting points.
4.50.16	Describe the status of controlled airspace when ATC go off duty. AIP GEN
4.50.18	State the restrictions on operating an aircraft in a restricted area. CAR 91 & AIP ENR
4.50.20	State the restrictions on operating an aircraft in a military operating area (MOA). CAR 91 & AIP ENR
4.50.22	*[Reserved]*
4.50.24	State the restrictions and operating considerations relating to operating an aircraft in a mandatory broadcast zone (MBZ). CAR 91 & AIP ENR
4.50.26	State the restrictions and operating considerations relating to operating an aircraft in a volcanic hazard zone (VHZ). CAR 91 & AIP ENR
4.50.28	State the restrictions and operating considerations relating to operating an aircraft in a danger area. CAR 91 & AIP ENR
4.50.30	*[Reserved]*
4.50.32	State the restrictions and operating considerations relating to operating an aircraft in a designated low flying zone (LFZ). CAR 91 & AIP ENR
4.50.34	State the restrictions and operating considerations relating to operating an aircraft in VFR special procedures areas (SPA). AIP ENR
4.50.36	State the operating considerations relating to operating an aircraft over or close to temporary hazards/airspace. AIP ENR
4.50.38	Interpret airspace information on aeronautical charts.
4.52	**Aerodromes and Heliports**
4.52.2	Describe the limitations on the use of a place as an aerodrome or heliport. CAR 91
4.52.4	Describe the method of runway designation. AIP AD
4.52.6	Describe the movement area of an aerodrome. CAR 1
4.52.8	Describe the meaning of the various aerodrome ground signals.
4.52.10	Interpret information on aerodrome/heliport charts. AIP GEN & AIP Volume 4

Sub Topic	Syllabus Item
4.54	**Carriage of Dangerous Goods**
4.54.2	State the restriction for the carriage of dangerous goods in an aircraft. CAR 92
4.54.4	State the requirements for the carriage of non-dangerous goods in an aircraft. CAR 92
	Emergencies; Incidents; and Accidents
4.56	**Responsibilities of Pilots**
4.56.2	State the requirement for the notification of accidents. CAR 12
4.56.4	State the requirement for the notification of incidents. CAR 12
4.56.6	State the extent to which a pilot may deviate from the CA Act or rules in an emergency situation. CA Act 1990 S13A
4.56.8	State the pilot action required following deviation from the CA Act or rules in an emergency situation. CA Act 1990 S13A
4.58	**Communications and Equipment**
4.58.2	State the transponder code a pilot should set to indicate an emergency condition. AIP ENR
4.58.4	State the transponder code a pilot should set to indicate a loss of communications. AIP ENR
4.58.6	State the transponder code a pilot should set to indicate that the aircraft is being subjected to unlawful interference. AIP ENR
4.58.8	Describe the means by which ATC will verify the transmission of an emergency SSR transponder code. AIP ENR
4.58.10	Describe the use of the speechless technique using unmodulated transmissions. AIP ENR
4.58.12	Describe and interpret ground-air visual signal codes. AIP GEN
4.58.14	Describe the procedures for directing a surface craft to a distress incident. AIP GEN
4.58.16	State the procedures for the emergency activation of an ELT. AIP GEN
4.58.18	State the pilot action required following the inadvertent transmission of an ELT. AIP GEN
4.58.20	State the requirements for the operational testing of an ELT. AIP GEN
4.58.22	State the procedures to be followed on receiving an ELT signal. AIP GEN

Subject No 6 Air Navigation and Flight Planning

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

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, and explain the meaning of the following:
	(a) axis and direction of rotation;
	(b) geographic poles;
	(c) great circles;
	(d) small circles;
	(e) rhumb lines;
	(f) the equator;
	(g) parallels of latitude;
	(h) meridians of longitude;
	(i) Greenwich (Prime) Meridian;
	(j) position.
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:
	(a) magnetic pole;
	(b) true north;
	(c) magnetic north;
	(d) compass north;
	(e) the cardinal directions of the earth;
	(f) the quadrantal directions of the earth;
	(g) true direction;
	(h) magnetic direction;

Sub Topic	Syllabus Item
	(i) compass direction;
	(j) magnetic variation;
	(k) an isogonal;
	(l) compass deviation;
	(m) true bearing;
	(n) magnetic bearing;
	(o) compass bearing;,
	(p) relative bearing.
6.4.8	Convert between true, magnetic and compass directions.
6.4.10	Convert between relative, true, magnetic and compass bearings.
6.4.12	Plot and measure tracks and bearings (± 1º) on a NZ Aeronautical Chart.
6.6	**Distance on the Earth**
6.6.2	Define a:
	(a) statute mile;
	(b) nautical mile (nm);
	(c) kilometre.
6.6.4	Calculate the conversion between a statute mile, a nautical mile and a kilometre.
6.6.6	State the number of feet and metres in a statute mile, a nautical mile and a kilometre.
6.6.8	Measure distances (± 1nm) on a NZ Aeronautical Chart.
6.8	**Speed**
6.8.2	Define:
	(a) a knot.
	(b) ground speed (GS);
	(c) indicated airspeed (IAS);
	(d) calibrated airspeed (CAS);
	(e) true airspeed (TAS).
6.10	**Position Referencing**
6.10.2	Define a:
	(a) ground position;

Sub Topic	Syllabus Item
	(b) air position;
	(c) DR position;
	(d) pinpoint;
	(e) fix.
6.10.4	Describe and apply the following position reference methods:
	(a) place name;
	(b) bearing and distance;
	(c) latitude and longitude.
6.10.6	Calculate the relative bearing of a position from an aircraft.
6.10.8	Calculate the bearing of an aircraft from a position.
6.12	**Altimetry**
6.12.2	Define:
	(a) height;
	(b) altitude;
	(c) mean sea level (MSL);
	(d) ground level;
	(e) elevation;
	(f) pressure altitude (PA);
	(h) 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	State and apply the altimeter setting rules in New Zealand.
6.12.8	Explain and apply the table of cruising levels.
6.14	**Principles and Terminology**
6.14.2	Define:
	(a) true and magnetic track / course;
	(b) wind velocity (W/V);
	(c) *head/tail wind;
	(d) *cross wind;
	(e) true heading;

Sub Topic	Syllabus Item
	(f) *magnetic heading;
	(g) *compass heading;
	(h) *drift (planned & actual);
	(i) *track / course made good (TMG / CMG);
	(j) port;
	(k) starboard;
	(l) dead (deduced) reckoning;
	(m) *track error (TE);
	(n) *closing angle (CA);
	(o) *estimated time of departure (ETD);
	(p) actual time of departure (ATD);
	(q) *estimated elapsed time (EET);
	(r) *estimated time of arrival (ETA);
	(s) actual time of arrival (ATA).
6.14.4	Explain and apply the 1:60 rule.
6.14.6	Calculate the values marked with an * in Syllabus Item 6.14.2.
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);
	(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	**Triangle of Velocities**
6.18.2	Identify and label the three vectors of the triangle of velocities.
6.18.4	Using a navigation computer, solve triangle of velocity problems (given four of the six variables):
	(a) heading and track (± 2º);
	(b) TAS and GS (± 2kts);

Sub Topic	Syllabus Item
	(c) wind velocity (± 3º/± 3kts);
	(d) drift (± 1º).
	Aeronautical Maps and Charts
6.20	**Properties and Principles**
6.20.2	Explain the difficulties associated with representing a spherical shape on a flat surface.
6.20.4	Define scale
6.20.6	List the uses of
	(a) a NZ Aeronautical Chart;
	(b) the Aerodrome Chart.
6.22	**Map Reading**
6.22.2	Interpret the features and symbols of a NZ Aeronautical Chart.
6.22.4	Describe the method of indicating relief on a NZ Aeronautical Chart.
6.22.6	Interpret information from Aerodrome Charts and Operational Data pages in the AIPNZ Volume 4.
	Circular Slide Rule
6.24	**Computations**
6.24.2	Derive TAS, given IAS, pressure altitude and air temperature in degrees Celsius.
6.24.4	Solve mathematical equations:
	(a) multiplication (±2%);
	(b) division (±2%); and,
	(c) proportion (±2%).
6.24.6	Derive time, speed, or distance, given two factors.
6.24.8	Calculate time and distance to climb, given groundspeed, rate of climb and height to climb.
6.24.10	Calculate rate of descent required to achieve a given height loss over time.
6.24.12	Calculate fuel consumption, given the burn rate and time.
6.24.14	Calculate fuel burn rate, given the consumption and time.
6.24.16	Calculate fuel endurance, given the fuel quantity and burn rate.
6.24.18	Convert between:
	(a) degrees Fahrenheit and Celsius;

Sub Topic **Syllabus Item**

(b) nautical miles, statute miles and kilometres (±1%);

(c) metres and feet (±2%);

(d) pounds and kilograms;

(e) litres, imperial and US gallons,

(f) a volume of fuel (in litres, imperial or US gallons) and a volume of fuel (in pounds or kilograms).

Mental Dead (Deduced) Reckoning

6.26 In-flight Revisions

6.26.2 Mentally estimate:

(a) a heading change, using the 1:60 rule (± 2º);

(b) a heading change, using driftlines (± 2º);

(c) a heading to make good a reciprocal track;

(d) an ETA change, using proportional division;

(e) the effect of inaccuracies in heading speed and height;

(f) navigation in conditions of limited visibility.

Flight Planning

6.28 Route Selection

6.28.2 List the factors to be considered when selecting a VFR cross-country navigation route.

6.28.4 List the factors to be considered when selecting altitudes at which to fly in the cruise.

6.28.6 List the factors to be considered when selecting alternate routes and destination alternates.

6.30 Map Preparation

6.30.2 Mark the following on a map:

(a) departure aerodrome, turning points, and destination aerodrome;

(b) tracks;

(c) heading change markings, either 1:60 or driftlines;

(d) ETA amendment markings.

6.30.4 Fold a map in a manner appropriate for a VFR cross-country flight.

Sub Topic	Syllabus Item
6.32	**Plan Preparation**
6.32.2	Complete a navigation log / flight plan for a VFR cross-country, including calculating the following values: (a) TASs; (b) tracks; (c) estimated wind velocities; (d) headings; (e) groundspeeds; (f) distances; (g) EETs; (h) ETAs;
6.34	**Fuel Planning**
6.34.2	Derive, from an Aircraft Flight Manual, the fuel consumption rate for a given leg.
6.34.4	Calculate the expected fuel burn on a given leg.
6.34.6	Calculate the minimum fuel required on a given VFR cross-country flight.
6.34.8	State the legal minimum fuel reserves required on a VFR cross-country flight.
6.34.10	Calculate the maximum holding time available for a given leg.
6.34.12	Calculate the latest time of departure for a given VFR cross-country flight or a given leg.
6.36	**Load Planning**
6.36.2	Calculate the take-off weight of a given aircraft on a VFR flight.
6.36.4	Calculate the landing weight of a given aircraft on a VFR flight.
6.36.6	Calculate the position of the Centre of Gravity of a given aircraft on a VFR flight.
6.36.8	Calculate the available payload of a given aircraft on a VFR flight.
	Visual Navigation Procedures
6.38	**Flight Management**
6.38.2	Describe the techniques and procedures for: (a) setting heading; (b) cruise routine / activity cycle; (c) maintaining a flight log;

Sub Topic	Syllabus Item
	(d) turning points;
	(e) approaching / rejoining at a destination aerodrome.
6.38.4	Describe the techniques for map reading in flight.
6.38.6	Describe techniques for:
	(a) pinpointing;
	(b) changing heading to make good the desired track;
	(c) changing heading to make good next turning point or destination;
	(d) amending ETA.
6.38.8	Estimate and calculate a heading to make good a reciprocal track.
6.38.10	Estimate and calculate an aircraft's position given bearing and distance from an identified ground position.
6.40	**Special Procedures**
6.40.2	Describe the techniques and procedures for:
	(a) re-establishing position if lost;
	(b) diverting from the pre-planned route;
	(c) navigating at low level when forced to do so by bad weather.

Subject No 8 Meteorology

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

Sub Topic	Syllabus Item
8.2	**The Atmosphere**
8.2.2	State the composition of the atmosphere
8.2.4	Describe the presence and importance of the following in the atmosphere: (a) carbon dioxide; (b) ozone; (c) water vapour.
8.2.6	Explain how temperature influences the ability of air to hold water vapour.
8.2.8	Define tropopause.
8.2.10	State how density of air affects the height of the tropopause in high, middle and low latitudes.
8.2.12	Describe the effect of latitude on the distribution of incoming solar radiation.
8.4	**Atmospheric Pressure**
8.4.2	Describe the cause of atmospheric pressure.
8.4.4	Explain the principle of operation of the barometer.
8.4.6	Define pressure lapse rate.
8.4.8	State the average pressure lapse rate in the lower atmosphere.
8.4.10	Explain the effect of temperature on pressure lapse rate.
8.4.12	Define: (a) isobar; (b) wind velocity; (c) anticyclone ("high"); (d) depression ("low"); (e) ridge of high pressure; (f) trough of low pressure; (g) col; (h) pressure gradient.
8.4.14	Explain the relationship between pressure gradient, isobars and wind velocity (airflow around pressure systems).
8.4.16	State the concept of convergence and divergence and describe how the associated subsidence or ascent of air influences the type of weather commonly associated with pressure systems.
8.4.18	State the unit of pressure commonly used in meteorology.
8.4.20	List the assumed conditions on which the International Standard Atmosphere (ISA) is based.

Sub Topic	Syllabus Item
8.4.22	Explain how deviation from ISA values influences performance of aircraft and their engines.
8.4.24	Define: (a) QNH; (b) QNE; (c) altitude; (d) height; (e) pressure altitude.
8.4.26	Explain why an altimeter requires a subscale adjustment.
8.4.28	Explain the importance of correct subscale setting.
8.6	**Temperature and Heat Exchange Processes**
8.6.2	Explain what is meant by solar radiation.
8.6.4	Describe the elements that influence or reject the amount of incoming solar radiation.
8.6.6	Explain what is meant by terrestrial radiation.
8.6.8	Describe the elements that influence or restrict the escape of terrestrial radiation.
8.6.10	Explain the effect of solar and terrestrial radiation on the air temperature (in the atmosphere).
8.6.12	Describe the: (a) conduction process; (b) convection process.
8.6.14	Define albedo.
8.6.16	Describe the diurnal variation of surface air temperature and explain the effect of different types of surface on the variation.
8.8	**Atmospheric Moisture**
8.8.2	Define: (a) condensation; (b) evaporation; (c) deposition; (d) sublimation; (e) melting; (f) freezing; (g) latent heat.
8.8.4	Explain the function of condensation nuclei during condensation.
8.8.6	State the effect of the following on the rate of evaporation: (a) air temperature; (b) moisture content of air;

Sub Topic	Syllabus Item
	(c) atmospheric pressure;
	(d) the wind.
8.8.8	Describe the processes that produce changes of state of moisture and explain how latent heat is involved in each.
8.8.10	Explain what is meant by relative humidity.
8.8.12	Explain the effect of changes in temperature and moisture content of air on relative humidity.
8.8.14	Explain what is meant by dew point.
8.8.16	Explain the effect of moisture content of air on the value of the dew point.
8.8.18	Explain how density of moist air affects aircraft and engine performance.
8.8.20	Explain how temperature, relative humidity and dew point values can be used to indicate differences in water content of air.
8.10	**The Wind**
8.10.2	State the direction in which the following two forces act:
	(a) pressure gradient;
	(b) coriolis force
8.10.4	State the effect of wind speed on the strength of the coriolis force.
8.10.6	Explain how the inter-relation between pressure gradient and coriolis force determine the circulation around pressure systems.
8.10.8	Explain what is meant by the “friction layer”, and describe the elements that influence the density of the layer.
8.10.10	Explain how the friction layer affects the surface wind velocity.
8.10.12	Define:
	(a) veering of the wind; and
	(b) backing of the wind.
8.10.14	Describe the diurnal variation of the surface wind:
	(a) over the land and
	(b) over the sea.
8.10.16	State the changes in wind velocity when climbing out of, or descending into, the friction layer.
8.10.18	State the function of the rotating cup anemometer.
8.10.20	Describe how an approximate wind velocity can be determined from a 25-knot windsock when at an angle of 30°, 45°, 75° and 90° from the vertical.
8.10.22	Describe how an approximate wind direction can be determined from:
	(a) ripples on water; and
	(b) wind lanes on water.
8.10.24	State Buys Ballot’s Law.

Sub Topic	Syllabus Item
8.10.26	Explain how applying Buys Ballot's Law can: (a) determine the location of high and low pressure areas; and (b) establish possible errors in altimeter reading.
8.10.28	Define wind shear.
8.10.30	Describe the effects of vertical and horizontal wind shear on aircraft operations.
8.12	**Stability of Air**
8.12.2	Explain what is meant by: (a) stable air; (b) unstable air; (c) neutrally stable air.
8.12.4	State the two factors that determine the stability of air.
8.12.6	Describe what is meant by "environment lapse rate" (ELR).
8.12.8	Explain the adiabatic process.
8.12.10	Draw graphs of steep and shallow environment lapse rates including inversions and isothermal layers.
8.12.12	State the dry adiabatic lapse rate (DALR).
8.12.14	Explain how the relationship between the ELR and DALR can be used to determine the stability or instability of unsaturated air.
8.12.16	State the saturated adiabatic lapse rate (SALR).
8.12.18	Explain how the relationship between the ELR and SALR can be used to determine the stability or instability of saturated air.
8.12.20	Explain the factors involved in thermal rising of air.
8.12.22	Describe how different dew point values determine the cloud base of cumulus cloud formed due to thermal rising.
8.12.24	Describe the effect of increasing surface temperature on the base of convective cloud, given a constant moisture content.
8.12.26	Describe the types of cloud that could be expected in: (a) stable saturated air; (b) unstable saturated air.
8.12.28	Describe weather conditions and degrees of visibility in: (a) stable air; and (b) unstable air.
8.14	**Local Winds**
8.14.2	Describe the sea breeze process, including typical: (a) timing of the occurrence; (b) average strength of the sea breeze; (c) horizontal and vertical limits; (d) associated cloud development;

Sub Topic	Syllabus Item
	(e) associated turbulence.
8.14.4	Describe the land breeze process, and state: (a) typical timing of the occurrence; (b) average speed of the wind; (c) most likely season for the occurrence.
8.14.6	Describe the katabatic and anabatic wind processes, and state the: (a) typical timing of each occurrence; (b) average strength of the winds; (c) effect of moist valley air on cloud/fog formation; (d) effect of gravity on katabatic winds; and (e) effect of adiabatic cooling and warming.
8.14.8	Define, and differentiate between, gusts and squalls.
8.14.10	Describe the fohn wind process.
8.14.12	Given environment temperatures, dew points and mountain heights, determine the: (a) cloud base on the windward side; (b) cloud base on the lee side; (c) temperature at stated datum's on the lee side.
8.14.14	Describe the flight conditions associated with fohn wind conditions.
8.14.16	Describe the mountain wave (standing, or lee wave) process.
8.14.18	Explain the wind and weather conditions, and associated main dangers to aircraft operations, in mountain wave conditions.
8.14.20	Describe the rotor streaming process and explain the associated dangers to aircraft operations.
8.14.22	Explain the dangers involved in attempting to out climb a slope in light aircraft, and describe the alternatives and remedies available under the circumstances.
8.16	**Inversions**
8.16.2	Define: (a) inversion; and (b) isothermal layer.
8.16.4	Explain the effect of inversions on: (a) the formation and development of cloud; (b) visibility; (c) turbulence; (d) the relative humidity and dew point; (e) the increased risk of carburettor icing; (f) the presence of wind shear.

Sub Topic	Syllabus Item
8.16.6	Describe the flight conditions in the presence of inversions.
8.16.8	Explain the factors involved in a: (a) radiation inversion; (b) turbulence inversion; (c) subsidence inversion; and (d) frontal inversion.
8.18	**Cloud**
8.18.2	Describe the basic cloud formation process.
8.18.4	State the most common method through which: (a) cloud is formed; and (b) air is cooled to produce cloud.
8.18.6	Explain what is meant by "buoyancy" of air.
8.18.8	Differentiate between cloud drops and rain/shower drops.
8.18.10	State the approximate altitude limits (in NZ latitudes) of: (a) high cloud; (b) middle cloud; and (c) low cloud.
8.18.12	Describe the following types of cloud and include a description of likely icing, turbulence and precipitation: (a) cirrostratus; (b) cirrocumulus; (c) cirrus; (d) altostratus; (e) altocumulus; (f) stratocumulus; (g) stratus; (h) cumulus; (i) cumulonimbus/towering cumulus; (j) nimbostratus.
8.18.14	Describe the terms used for reporting of cloud.
8.18.16	Describe the following methods whereby air is lifted, and include the effect of stability/instability on the type of cloud: (a) orographic lifting; (b) mechanical lifting; (c) convective lifting; (d) slow widespread ascent; (e) frontal lifting.

Sub Topic	Syllabus Item
8.18.18	Explain the processes that contribute to cloud dispersal.
8.20	**Precipitation**
8.20.2	Define: (a) precipitation; (b) virga (aka virgo).
8.20.4	Explain how cloud drops can grow through: (a) the presence of ice crystals; (b) coalescence
8.20.6	Describe the following types of precipitation: (a) rain; (b) drizzle; (c) snow; (d) sleet; (e) hail.
8.20.8	Describe the following characters of precipitation: (a) continuous; (b) intermittent; (c) showers.
8.22	**Visibility**
8.22.2	Define (meteorological) visibility.
8.22.4	Explain what is meant by transparency of air.
8.22.6	Explain the effect of illumination on visibility distance.
8.22.8	Differentiate between visibility distance and visibility range.
8.22.10	Describe the effects of the following on visibility distance: (a) precipitation; (b) fog or mist; (c) haze; (d) smoke; (e) sea spray.
8.22.12	Explain the factors involved in slant range.
8.24	**Fog**
8.24.2	Define fog.
8.24.4	Describe the principles of formation, required meteorological conditions, factors affecting extent of, and dispersal of: (a) radiation fog; (b) advection fog;

Sub Topic	Syllabus Item
	(c) valley fog;
	(d) sea fog;
	(e) steaming fog;
	(f) frontal fog.
8.24.6	Describe the operational problems associated with fog.
8.26	**Fronts and Depressions**
8.26.2	Describe the polar front theory.
8.26.4	Define airmass.
8.26.6	List the airmass categories.
8.26.8	Define source region and state the typical global areas where source regions are found.
8.26.10	Describe what is meant by:
	(a) cold advection;
	(b) warm advection.
8.26.12	Explain the typical weather conditions in New Zealand when affected by cold and warm advection.
8.26.14	Describe how divergence aloft affects the atmospheric pressure near sea level.
8.26.16	Describe the characteristics of the:
	(a) polar depression;
	(b) warm sector depression;
	(c) orographic depression;
	(d) thermal (heat type) depression.
8.26.18	Draw the symbols, and colour codes, used to describe the following fronts on weather charts:
	(a) cold front;
	(b) warm front;
	(c) occluded front;
	(d) stationary front.
8.26.20	Draw a cross section of the typical cold front including cloud, temperature and freezing level changes, precipitation, and typical width.
8.26.22	State the events before, at, and after, an idealised cold front in terms of:
	(a) pressure;
	(b) temperature;
	(c) wind velocity;
	(d) cloud;
	(e) precipitation;
	(f) visibility.

Sub Topic	Syllabus Item
8.26.24	Draw a cross section of the typical warm front including cloud, temperature and freezing level changes, precipitation, and typical width.
8.26.26	State the events before, at, and after, an idealised warm front in terms of: (a) pressure; (b) temperature; (c) wind velocity; (d) cloud; (e) precipitation; (f) visibility.
8.26.28	Draw a cross section of the following occlusions and explain how each type develops: (a) cold occlusion; (b) warm occlusion.
8.26.30	Describe the potential dangers to VFR flight through fronts.
8.26.32	Describe the techniques, and precautions that can be taken to reduce or eliminate the dangers of VFR flight through fronts.
8.28	**Thunderstorms**
8.28.2	Explain the conditions to be met for the development of thunderstorms.
8.28.4	Describe the three stages of thunderstorm development.
8.28.6	Explain the development, and describe the characteristics of: (a) orographic thunderstorms; (b) heat type thunderstorms; (c) frontal thunderstorms.
8.28.8	Describe the hazards associated with thunderstorms and explain why light aircraft should avoid them.
8.28.10	Explain the origin and development of tornadoes and state the main hazards.
8.30	**Icing**
8.30.2	Explain what is meant by supercooled water, and describe the influence of latent heat on the formation of ice.
8.30.4	Explain the process of freezing and melting.
8.30.6	With regard to airframe icing, explain the processes involved in the formation of: (a) clear ice; (b) rime ice; (c) hoar frost; (d) freezing rain.
8.30.8	State the types of cloud, and cloud drop size, that are conducive to the formation of each type of ice listed in 8.30.6

Sub Topic	Syllabus Item
8.30.10	State the altitudes relative to the freezing level where rime ice or clear ice can be expected in cloud.
8.30.12	Give examples of conditions that could cause: (a) freezing rain. (b) hoar frost
8.30.14	State the hazards for light aircraft from: (a) snow; (b) sleet; (c) hail.
8.30.16	Explain the influence of the following on the rate of ice accretion: (a) water content of cloud; (b) aircraft characteristics, components and airspeed.
8.30.18	State the dangers of icing to aircraft in flight and on the ground.
8.30.20	Explain the methods that can be used to minimise or eliminate the dangers of aircraft icing.
8.30.22	Explain the factors involved in carburettor icing.
8.30.24	State the maximum temperature range in which carburettor ice can form.
8.30.26	Explain how the accretion rate of carburettor ice is governed by: (a) moisture content of air; and (b) throttle setting.
8.30.28	Explain the conditions that can cause carburettor icing while on the ground.
8.30.30	Describe the methods commonly available in light aircraft to combat carburettor icing.
8.30.32	Explain the dangers and possible remedies for icing of engine and pitot system intakes.
8.32	**Turbulence**
8.32.2	Describe the cause(s), factors involved, dangers, and techniques commonly used to avoid or minimise: (a) thermal (convective) turbulence; (b) mechanical turbulence - small scale and large scale; (c) wind shear turbulence; (d) wake turbulence.
8.34	**New Zealand Climatology**
8.34.2	Describe how the following items govern the NZ climate: (a) latitude; (b) oceanic surroundings; (c) topography.

Sub Topic	Syllabus Item
8.34.4	In general terms, describe cloudiness, gustiness, visibility and turbulence at various locations within New Zealand during typical: (a) northwest wind regimes; (b) northeast wind regimes; (c) southwest wind regimes; (d) southeast wind regimes.
8.34.6	With regard to VFR flight in light aircraft over the Southern Alps, describe: (a) the need for through flight planning; (b) in-flight considerations; (c) adverse winds; (d) favourable winds; (e) selection of tracks.
8.36	**Meteorological Services for Aviation**
8.36.2	With respect to NZ Domestic VFR operations, interpret, understand and assess information of all descriptions contained in: (a) area forecast (ARFOR); (b) meteorological reports (METAR/SPECI); (c) trend forecasts (TTL); (d) aerodrome forecasts (TAF); (e) SIGMET; (f) special aerodrome reports (SPAR); (g) automatic terminal information service (ATIS); (h) aerodrome and weather information broadcasts (AWIB); (i) basic weather reports (BWR); (j) pilot reports.
8.36.4	Interpret, understand and assess weather information made available by television, Internet, newspapers and radio.

Subject No 10 Human Factors

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

Sub Topic	Syllabus Item
	Human Factors - General
10.2	**Airmanship and Responsibility**
10.2.2	Describe key features of good and safe airmanship.
10.2.4	List the common causes of fatal accidents for private general aviation pilots in New Zealand.
10.2.6	State the approximate proportion of aircraft accidents and incidents commonly attributed to human performance errors.
10.4	**Human Factors Models and Programmes**
10.4.2	Define human factors as used in an aviation context.
10.4.4	Describe the fundamentals of the SHEL Model in relation to the interaction of humans with other humans, hardware, information sources and the environment.
10.4.6	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	State the percentage of each gas in the atmosphere.
10.6.6	Describe the variation of pressure as altitude increases.
10.6.8	Explain how the partial pressure of oxygen changes as altitude increases.
10.8	**Circulation and Respiratory Systems**
10.8.2	Describe the anatomy and physiology of the respiratory system.
10.8.4	Describe the anatomy and physiology of the circulatory system.
10.8.6	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.
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.

Sub Topic	Syllabus Item
10.10.20	Describe how hypoxia can be treated.
10.10.22	Define the concept of 'time of useful consciousness'.
10.10.24	State the approximate time of useful consciousness at: (a) 10,000ft; (b) 14,000ft; (c) 18,000ft.
10.10.26	Explain oxygen paradox.
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.
10.14.10	Describe how barotrauma can be prevented.
10.14.12	Describe how barotrauma can be treated.
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	Describe the anatomy and physiology of the eye.
10.18.4	Identify the following eye structure components: (a) lens; (b) cornea; (c) retina; (d) fovea; (e) optic nerve disc; (f) cone cells;

Sub Topic	Syllabus Item
	(g) rod cells.
10.18.6	Distinguish between rod and cone cell functions and distribution in the retina.
10.18.8	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;
	(h) empty field myopia.
10.18.10	Explain the process of dark adaptation.
10.18.12	State the normal time for full night vision adaptation.
10.18.14	Identify precautionary actions to protect night vision adaptation.
10.18.16	Describe:
	(a) long sightedness;
	(b) short sightedness;
	(c) presbyopia;
	(d) astigmatism.
10.18.18	Describe the factors associated with the selection of suitable sunglasses for flying.
10.18.20	Describe the effects of hypoxia on vision.
10.18.22	Describe the visual system resting state focus and its effects on object detection.
10.18.24	Explain effective visual search techniques.
10.18.26	Explain the see and avoid method of avoiding mid-air collisions.
10.18.28	Explain the following visual illusions, and describe methods of avoiding and/or coping with:
	(a) autokinesis;
	(b) stroboscopic illumination illusion/flicker vertigo;
	(c) the break-off phenomenon;
	(d) the black hole phenomenon.
10.18.30	Describe conditions which can lead to the creation of a false horizon.
10.18.32	Explain the effect of a false horizon on visual perception.
10.18.34	Explain relative motion.
10.18.36	Explain the effect of fog, haze, and/or dust on visual perception.
10.18.38	Describe the optical characteristics of the windshield.
10.18.40	Explain the effect of sloping terrain on visual perception.

Sub Topic	Syllabus Item
10.18.42	Explain the effect of the following factors on visual perception during an approach: (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 anatomy and physiology of the ear.
10.20.4	Describe the effect of prolonged noise exposure on hearing.
10.20.6	Describe methods of protecting hearing.
10.20.8	Explain the effects of age induced hearing loss (presbycusis).
10.20.10	Explain the effects of pressure changes on the middle ear and eustachian tubes.
10.20.12	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 anatomy and physiology of the motion, orientation and gravitational sensory organs, including: (a) the semi-circular canals; (b) vestibular sac/tubes.
10.22.8	Explain the interconnection between the visual and kinasthetic senses in maintaining accurate spatial orientation.
10.22.10	Explain the body's limitations in maintaining spatial orientation when vision is adversely affected.
10.22.12	Describe and explain the effects of the following spatial illusions: (a) the leans and sub-threshold stimulation; (b) somatogravic illusion; (c) somatogyral illusion; (d) cross coupled turning (coriolis effect); (e) pressure vertigo.
10.24	**Gravitational Forces**
10.24.2	Explain the effects of positive and negative accelerations on: (a) the circulatory system; (b) vision; and, (c) consciousness.
10.24.4	Explain the causes and symptoms of black-out and red-out.

Sub Topic	Syllabus Item
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.
	Flying and Health
10.30	**Fitness to Fly**
10.30.2	Describe the term fitness to fly.
10.30.4	Explain the CAANZ system of assessing medical fitness, with regard to: (a) Medical Examiner Grade 1 and Grade 2; (b) means of obtaining medical examinations; (c) frequency of medical examinations; (d) responsibilities of pilots towards medical fitness for flight.
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	Describe the following factors, including their effects on pilot performance and methods by which they may be minimised/managed: (a) arterial disease; (b) blood pressure; (c) diet; (d) exercise; (e) obesity; (f) smoking; (g) respiratory tract infection/allergies (including colds, sinus, hay fever, influenza, asthma); (h) food poisoning and gastroenteritis; (i) neurological factors (including fits/epilepsy, brain injury, fainting, headaches, migraines); (j) emotional factors (including depression and anxiety).

Sub Topic	Syllabus Item
10.32	**Alcohol and Drugs**
10.32.2	Explain the effects of alcohol on pilot performance.
10.32.4	State the recommended time periods between the consumption of alcohol and flying.
10.32.6	Explain the effects of drugs on pilot performance.
10.32.8	State where information can be obtained about the suitability of over the counter and prescription medication for flying.
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: (a) carbon monoxide; (b) fuel; (c) lubricating oils; (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 the following environmental stressors: (a) heat; (b) cold; (c) noise; (d) vibration; (e) humidity.
10.38.12	Explain methods of identifying stress.

Sub Topic	Syllabus Item
10.38.14	Explain the difference between acute and chronic stress.
10.38.16	Describe the physiological and psychological effects of stress.
10.38.18	Describe the factors that improve personal stress tolerance.
10.38.20	Describe the relationship between stress and fatigue.
10.38.22	Explain methods of managing stress.
10.40	**Sleep and Fatigue (Alertness Management)**
10.40.2	Describe the stages of sleep.
10.40.4	Explain how individuals differ in their requirement for sleep.
10.40.6	Explain the effects of the following alertness management techniques: (a) napping; (b) caffeine consumption; (c) alcohol consumption; (d) taking sedatives; (e) taking stimulants other than caffeine.
10.40.8	Describe sleep disorders and their effects on pilot performance.
10.40.10	Define fatigue.
10.40.12	Explain the causes of fatigue and its effect on pilot performance.
10.40.14	Describe the symptoms of fatigue.
10.40.16	Explain the difference between acute and chronic fatigue.
10.40.18	Describe methods of managing fatigue.
10.42	**Ageing**
10.42.2	Identify normal physiological and behavioural changes with age that have a bearing on private pilot performance.
10.42.4	Describe methods by which age-related changes in memory and speed of information processing can be moderated by older pilots.
	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, including the concepts of: (a) attention; (b) sensory threshold; (c) sensitivity.

Sub Topic	Syllabus Item
10.44.6	Describe the following types of memory: (a) peripheral/sensory memory; (b) short term/working memory; (c) long term memory; (d) motor/skills memory.
10.44.8	Describe the limitations and failures of memory.
10.44.10	Explain the following methods of retaining and retrieving information from memory: (a) chunking; (b) mnemonics; (c) checklists.
10.44.12	Explain the concept of mental workload.
10.44.14	Define perception.
10.44.16	Describe the effect of the following on perception: (a) expectation; (b) experience.
10.44.18	Describe the formation of mental models.
10.46	**Situational Awareness**
10.46.2	Define situational awareness.
10.46.4	Explain the importance of situational awareness on different phases of flight.
10.46.6	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	Identify risk assessment techniques.
10.48.12	Outline the general concepts behind decision making.
10.48.14	Describe methods of enhancing decision making skills.
10.48.16	Identify common decision-making models used in aviation training (DECIDE, SADIE etc) and explain their application.
10.48.18	Identify specific factors that influence the decision making process.

Sub Topic	Syllabus Item
10.48.20	Explain the setting of personal limitations and decision points.
10.48.22	Outline the dangers of get-home-itis.
10.50	**Social Psychology and Flight Deck Management**
10.50.2	Define teamwork and team membership.
10.50.4	Identify the factors that affect team performance.
10.50.6	Describe group decision making.
10.50.8	Describe ideal leadership characteristics.
10.50.10	Describe a basic model of communications.
10.50.12	Describe the barriers to effective communication.
10.50.14	Identify techniques to reduce communication barriers.
10.50.16	Explain the following strategies used to reduce communication errors in aviation: (a) read-backs; (b) standard phraseology; (c) standard calls.
10.50.18	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 threats which could potentially affect a safe flight.
10.52.8	Explain the basic elements and features of the Reason Model.
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 CAR 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.

Sub Topic	Syllabus Item
	Ergonomics
10.56	**Flight Deck Design**
10.56.2	Describe the basic principles of control, display and workspace design.
10.56.4	Explain the importance of the following in cockpit design: (a) reach; (b) comfort; (c) posture; (d) lighting levels.
10.56.6	Define biomechanics.
10.56.8	Define anthropometry.
10.56.10	Describe applications of biomechanics in the design of a cockpit.
10.56.12	Explain the relevance of anthropometry in the design of a cockpit.
10.56.14	Describe the effects of a poorly designed cockpit on pilot performance.
10.56.16	Explain the importance of eye datum or eye design position.
10.56.18	Describe the problems associated with windshield design and visibility.
10.58	**Design of Controls**
10.58.2	Explain the importance of the following in control design: (a) size; (b) shape/recognition by touch; (c) location; (d) direction of movement; (e) visibility.
10.60	**Instrumentation, Displays and Alerts**
10.60.2	Explain the importance of the following in the design of instrumentation, displays and alerts: (a) size; (b) position; (c) layout; (d) visibility; (e) legibility; (f) scale; (g) use of colour; (h) illumination.

Sub Topic	Syllabus Item
10.60.4	Describe parallax error.
10.60.6	Describe common errors in display interpretation.
10.60.8	Describe potential errors in the interpretation of three pointer altimeters.
10.60.10	Describe potential errors in the interpretation of the artificial horizon.
10.60.12	Describe the basic requirements of alerts.
10.60.14	Describe problems associated with the presentation and misinterpretation of alerts.
10.60.16	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 and 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.
10.64.6	Identify basic items carried in a certificated general aviation aircraft first aid kit.
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	List additional useful but discretionary safety and survival items that could be carried on a cross-country flight over bush clad and mountainous terrain.
10.66.10	Explain the process of hypothermia.

Subject No 12 Aircraft Technical Knowledge (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 feed back to the examination candidate.

Sub Topic	Syllabus Item
	PART I Technical Knowledge
12.2	**Airframe**
12.2.2	Identify the major components of a conventional airframe (fuselage, wings, tail section, control surfaces, undercarriage, powerplant).
12.2.4	Identify and explain the basic function of the following components used in fuselage construction (frames, longerons, stringers, skin).
12.2.6	Identify and explain the basic function of the following components used in the construction of wings, tailplane and fin (ribs, spar(s), stringers, skin).
12.2.8	In simple terms, explain the load on the wings (a) on the ground and (b) in the air, and state the function of spars and struts in opposing these loads.
12.2.10	Explain the basic operation of the primary flight controls, trim tab and flap systems. State the function of control locks and precautions for removal before flight.
12.2.12	State the two types of undercarriage system (tricycle/tail wheel) and explain typical steering and braking systems with precautions for use.
12.4	**Engines - General**
12.4.2	Identify typical cylinder configurations used for aircraft piston engines (eg radial, in-line, horizontally opposed).
12.4.4	Identify and state the purpose of the major components of a four-stroke piston engine (cylinders, pistons, connecting rods, crankshaft, crankcase, camshaft, valves, spark plugs).
12.4.6	With the aid of diagrams, explain the basic principle of operation of the four stroke internal combustion engine.
12.4.8	In broad terms, explain the need for valve timing (valve lead, lag and overlap).
12.4.10	Describe the principal features of a typical ignition system (dual, independent, engine-driven magneto systems with two spark plugs per cylinder).
12.4.12	State the purpose and principle of an impulse coupling.
12.4.14	Describe the operation and correct handling of a rotary ignition/starter switch (including the starter warning light), and separate toggle ignition switches.
12.4.16	Explain the purpose and a typical procedure for conducting magneto checks.
12.4.18	State the correlation between engine rpm and power output.

Sub Topic	Syllabus Item
12.6	**Carburation**
12.6.2	State the purpose of carburation.
12.6.4	With the aid of a diagram, explain the operating principle of a simple float-type carburettor.
12.6.6	State the purpose of the following systems within the carburettor; atomisation and diffusion; idling; accelerating; enrichment (at high power); mixture control and idle cut-off.
12.6.8	Explain the correct operational use of a manual mixture control and idle cut-off.
12.6.10	Describe the effects of excessively rich or lean mixtures on engine operation.
12.6.12	In simple terms, describe the abnormal combustion conditions detonation and pre-ignition, and distinguish between them. State the causes and likely effects of these conditions and the measures which can be taken to avoid them.
12.6.14	Explain the formation of refrigeration, throttle and impact ice in a carburettor and intake system.
12.6.16	State the: (a) atmospheric and throttle setting conditions conducive to the formation of carburettor ice; (b) symptoms of carburettor ice formation; (c) correct use of carburettor heat for de-icing, and as an anti-icing measure (normal operation).
12.6.18	In simple terms, describe the operation of a fuel-injection system. State the advantages and disadvantages of fuel-injection versus carburettor systems.
12.8	**Fuel Systems and Fuel**
12.8.2	Describe the function of the following components of a simple fuel system: (a) fuel tank, sump, drain point, supply line standpipe, vents, overflow drain; (b) fuel selector valve, supply line, strainer and strainer drain; (c) fuel primer, engine-driven pump, auxiliary (boost) pumps; (d) fuel quantity indicators.
12.8.4	Describe the correct management of the fuel system, including fuel selection and handling of priming and auxiliary pumps.
12.8.6	State the common grades of AVGAS with their colour identification.
12.8.8	Distinguish between the different characteristics of AVGAS, MOGAS and AVTUR, and state the precautions regarding the use of MOGAS in aero-engines.
12.8.10	State the common contaminants of AVGAS and the precautions which can be taken to avoid them.
12.8.12	Describe the procedure to be used for a fuel drain check.

Sub Topic	Syllabus Item
12.8.14	State the general rules for fuelling of aircraft, including the special precautions for the use of drum stock, and plastic containers.
12.10	**Lubrication and Cooling**
12.10.2	State the functions of engine oil (lubrication – reduction of friction, assisting with cooling, removal of contaminants, and sealing).
12.10.4	Explain the term viscosity and the effect of temperature on the lubricating qualities of oil.
12.10.6	Briefly describe the function of the following components of an oil system: (a) wet sump; (b) dry sump, scavenge pump, tank; (c) engine-driven pump, pressure relief valve; (d) oil lines, passages and galleries; (e) oil cooler, bypass valves; (f) oil pressure and temperature gauges.
12.10.8	State the importance of using the correct type and grade of oil for a particular aircraft, and of checking the correct quantity before flight.
12.10.10	Identify cockpit indications of a possible oil system malfunction, and state the pilot actions (if any) that the pilot can take to rectify the problem.
12.10.12	Briefly describe the main means for air cooling an engine; cowling ducts, baffles, fins and cooling flaps (when fitted).
12.10.14	Briefly explain the precautions to be taken to prevent overheating and overcooling in flight, and explain the correct handling of engine cowl flaps when fitted.
12.12	**Engine Handling**
12.12.2	State the safety precautions to be taken before starting the engine.
12.12.4	In general terms, state the procedures for: (a) starting the engine in cold temperatures; (b) starting an over-primed engine; (c) starting a hot engine; (d) controlling an engine fire on start-up; (e) checking oil pressure after start; (f) stopping the engine.
12.12.6	Explain the reasons for avoidance of rapid power changes, and the need for monitoring and cross-checking instrument indications.
12.12.8	State the possible causes for rough running or excessive engine vibration and the actions (if any) that the pilot can take to rectify the problem.

Sub Topic	Syllabus Item
12.12.10	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.
Note:	Handling of the mixture and carburettor heat controls is covered under previous syllabus topics.
12.14	**Electrical System**
12.14.2	State the types of service which are typically electrically operated in a light aircraft.
12.14.4	Explain the function of the following components in a typical light aircraft electrical system: (a) battery; (b) alternator (and generator); (c) bus bar; (d) voltage regulator, voltmeter or overvoltage light; (e) ammeter (left zero and centre zero); (f) master switch (or battery/alternator switch); (g) fuses, circuit breakers and overload switches.
12.14.6	State the precautions to take during normal operation of the electrical system, including: (a) avoiding continuous operation of high-power systems on the ground before start; (b) starting with radios and other unnecessary equipment switched off; (c) avoiding prolonged operation of the starter motor; (d) releasing the starter once the engine is running; (e) checking satisfactory operation of the system after start, and monitoring during flight; (f) switching off ancillary equipment before shut-down; (g) switching the battery master switch off before leaving the aircraft.
12.14.8	Identify the cockpit indications of the following electrical system malfunctions, and state the actions available to the pilot to deal with the problem; (a) excessive alternator/generator charge rate; (b) lack of alternator/generator charge; (c) blown fuse or popped circuit breaker.
12.16	**Pressure Instruments**
12.16.2	Identify the three basic instruments which rely on air pressure for their operation.
12.16.4	Describe static pressure and dynamic pressure, and the main factors which affect them.
12.16.6	Explain the operation of a pitot-static system, including: (a) static vent(s);

Sub Topic	Syllabus Item
	(b) pitot tube; (c) combined pitot-static head; (d) drain holes, heating, pitot cover; (e) alternate pressure source.
12.16.8	With respect to the airspeed indicator, describe the: (a) basic principle of operation; (b) colour coding, and the meaning of VSO, VS1, VFE, VNO and VNE; (c) IAS/TAS/groundspeed relationship; (d) errors affecting the ASI, and how position error correction is applied.
12.16.10	With respect to the altimeter, describe the: (a) basic principle of operation; (b) subscale settings and the meaning of QNH, QFE and QNE; (c) errors affecting the altimeter, including subscale setting error.
12.16.12	With respect to the vertical speed indicator, describe the: (a) basic principle of operation; (b) errors affecting the VSI.
12.16.14	Indicate the normal checks for serviceability of the pitot-static system, both pre-flight and during operation.
12.16.16	Identify the cockpit indications of the following pitot-static system malfunctions, and state the actions available to the pilot to deal with the problem; (a) blockage of the pitot tube; (b) blockage of the static source.
12.18	**Gyroscopic Instruments**
12.18.2	Outline the basic principle of operation the vacuum system, and state the likely effects of reduced or nil suction.
12.18.4	Describe the gyroscopic properties of rigidity and precession.
12.18.6	With respect to the turn indicator/coordinator: (a) explain the basic principle of a rate gyroscope; (b) with the aid of a diagram, differentiate between the different indications of the turn indicator and turn coordinator; (c) state the function, indication and correct use of the coordination (balance) ball; (d) state the pilot checks for serviceability.
12.18.8	With respect to the attitude indicator (or artificial horizon); explain: (a) the basic principle of operation (earth gyroscope); (b) with the aid of a diagram, how pitch attitude and bank angle are displayed; (c) the pilot checks for serviceability; (d) the need for, and operation of, a caging device.

Sub Topic	Syllabus Item
12.18.10	With respect to the heading indicator (or DGI), explain the: (a) advantages of a gyroscopic heading indicator (versus a compass) (b) need for, and method of synchronisation; (c) pilot checks for serviceability.
12.18.12	Briefly explain the errors likely to occur if the gyro rotor rpm is low; the indication of power failure on electrically-driven instruments; and the indications of toppling.
12.20	**Magnetic Compass**
12.20.2	Describe the earth's magnetic field, and: (a) distinguish between the true and magnetic poles; (b) define magnetic variation, isogonals, and deviation; (c) given a sample deviation card, show how to apply corrections.
12.20.4	Briefly describe the construction of a modern direct-reading compass, and (a) define lubber line; (b) state the functions of the fluid in the bowl.
12.20.6	Explain magnetic dip; how it is compensated for; and define residual dip.
12.20.8	State the effects of: (a) acceleration error; and (b) turning error.
12.20.10	State the compass pre-flight serviceability checks, and the precautions when carrying magnetic items.
	Part II Principles of Flight
12.22	**The Atmosphere**
12.22.2	State the principal gases which constitute the atmosphere (nitrogen and oxygen, plus small amounts of others).
12.22.4	In general terms, describe air density, and how it varies with altitude in the atmosphere.
12.22.6	State the relationship between pressure/temperature and the density of an air mass.
12.22.8	Outline how pressure, temperature and density normally vary in the atmosphere.
12.22.10	Outline the basis for the International Standard Atmosphere, and state the assumed standard sea level pressure and temperature conditions, together with their lapse rates up to the tropopause.
12.24	**Basic Aerodynamic Theory**
12.24.2	State what an aerofoil is and distinguish between different aerofoil sections (high lift, high speed and general purpose).

Sub Topic	Syllabus Item
12.24.4	Define: (a) leading edge; (b) trailing edge; (c) chord; (d) thickness; (e) camber.
12.24.6	Define relative airflow and angle of attack.
12.24.8	State Bernoulli's Theorem in simple terms.
12.24.10	Define streamline flow around an aerofoil, and explain the changes which occur to dynamic and static pressure wherever the speed of the airflow is: (a) increased; (b) decreased.
12.24.12	With the aid of diagrams, explain: (a) venturi effect; (b) the pressure distribution around an aerofoil which is producing lift.
12.24.14	Define the terms total reaction (TR) and centre of pressure (CP), and describe how TR and CP change with increasing angle of attack (for a lifting aerofoil).
12.24.16	Define the lift and drag components (of TR).
12.24.18	Summarise the factors affecting lift (angle of attack, aerofoil shape, IAS).
12.24.20	Define in simple terms the coefficient of lift (CL) and: (a) describe a typical CL versus angle of attack curve; (b) show how CL varies with use of flaps and control surfaces.
12.24.22	State the precaution against flying with ice, frost, other contamination or damage to lifting surfaces.
12.24.24	Distinguish between induced drag and parasite drag, and list the elements of the latter (skin friction, form and interference drag). [Students should be aware that there are other ways of categorising drag.]
12.24.26	State the factors affecting skin friction, form, and interference drag.
12.24.28	Identify a curve of parasite drag versus airspeed.
12.24.30	Explain the cause of induced drag, and identify a curve of induced drag versus airspeed (and angle of attack).
12.24.32	Show how, by combining the induced and parasite drag curves, a curve for total drag versus airspeed (and angle of attack) is produced. Identify on this curve, the speed for minimum drag (and maximum L/D ratio).
12.24.34	Identify a curve of lift/drag (or CL/CD) versus angle of attack.

Sub Topic	Syllabus Item
12.26	**Flying Controls**
12.26.2	State the three aircraft axes of rotation, and define pitch, roll and yaw.
12.26.4	State the flying controls used to affect movement about each axis, and explain how each control operates to achieve control of the pitch attitude, bank angle, and yaw.
12.26.6	Explain the cross-coupling (further) effects of control in roll and yaw.
12.26.8	State the effects of airspeed and change of power on control effectiveness and aircraft attitude.
12.26.10	Explain the purpose and principle of operation of a basic trim control, and state the correct method of use.
12.26.12	Explain the requirement for balancing the controls and state the methods used to obtain aerodynamic balance (inset hinge, horn balance, balance tab).
12.26.14	Explain the requirement for using anti-balance tabs on an all-moving tailplane, and describe the principle of operation.
12.26.16	Explain the purpose and the principle of operation of basic wing flaps.
12.26.18	State the normal operational use of flaps, including the precautions against flying with flaps lowered above VFE, and raising flap before reaching a safe height on a baulked approach.
12.28	**Straight and Level Flight**
12.28.2	State the four main forces acting in flight, and describe, for level flight, how these forces change as IAS is varied.
12.28.4	Describe the pitching moments in flight, and how balance is achieved.
12.28.6	Given a basic graph of power available (PA) and power required (PR) versus TAS in level flight, show the derivation of: (a) maximum and minimum level flight speed; (b) maximum-range speed; (c) maximum endurance speed.
12.28.8	State the basic operational considerations which apply to flying a light aeroplane for range, or endurance.
12.30	**Climbing and Descending**
12.30.2	Given a diagram, name the forces acting in a steady climb.
12.30.4	Distinguish between a maximum angle climb; a maximum rate climb; and a normal climb. Recall the meaning of Vx and VY.
12.30.6	Using the PA/PR graph referred to in 12.28.6, show the derivation of maximum rate of climb speed.

Sub Topic	Syllabus Item
12.30.8	Briefly explain the factors which affect climb performance (power, airspeed, flap extension, weight, altitude, temperature, manoeuvring, and wind component - on climb angle).
12.30.10	Given a diagram, name the forces acting in a steady glide.
12.30.12	Demonstrate how the lift/drag ratio determines the steady-speed glide angle.
12.30.14	Briefly explain the effects of weight, IAS, wind, and flap extension on the glide angle.
12.30.16	Show how the forces in the diagram at 12.30.10 become modified in a steady-speed power on descent.
12.32	**Turning**
12.32.2	Define centripetal force.
12.32.4	Given a diagram, explain the components of lift which provide the: (a) turning (or manoeuvring) force; (b) force required to counteract weight.
12.32.6	Define load factor ("g") and, for a level turn, state the relationship between bank angle and lift, drag, and load factor.
12.32.8	State the relationship between the turn radius and rate of turn: (a) at a given airspeed; (b) at a given bank angle.
12.32.10	Describe a standard rate (rate 1) turn, and state the rule-of–thumb method of calculating the bank angle required.
12.32.12	Explain the effect of bank on rate of climb in a climbing turn, and the tendency to "overbank".
12.32.14	Explain the effect of bank on rate of descent in a descending turn, and the tendency to "underbank".
12.34	**Stalling and Spinning**
12.34.2	Describe the stalling angle of attack, with reference to: (a) disruption of streamline flow over the upper surface of the aerofoil; (b) reduction of lift and increase in drag.
12.34.4	Describe the symptoms of a developing stall.
12.34.6	State how: (a) the stall is associated with a particular angle of attack and not a particular airspeed; (b) a reduction in angle of attack is critical to recovery.

Sub Topic	Syllabus Item
12.34.8	Explain how the stalling IAS is affected by: (a) load factor; (b) aircraft weight; (c) altitude; (d) power; (e) flap extension; and (f) ice, frost, or other contamination of the wings.
12.34.10	State the precaution against using ailerons near, and during, the stall.
12.34.12	Define the term autorotation and the conditions leading to it.
12.34.14	Define a spin, with reference to: (a) stalled condition of flight; (b) simultaneous motion about three axes (rolling, pitching, yawing); (c) high rate of descent at low airspeed; (d) the difference between a spin and a spiral dive.
12.34.16	State the measures which can be taken to avoid a spin.
12.34.18	State the 'standard' recovery action from a developed spin.
12.36	**Propellers**
12.36.2	With respect to propeller terminology, state the meaning of the following : (a) blade section; (b) blade angle; (c) helix (or pitch) angle; (d) angle of attack.
12.36.4	Explain the reason for blade (or helical) twist.
12.36.6	Given a diagram, identify and define the following (for a rotating blade section): (a) direction of rotation; (b) relative airflow; (c) total reaction; with its components (d) thrust and propeller torque.
12.36.8	For a fixed-pitch propeller at a constant throttle setting, explain the relationship between airspeed, angle of attack and rpm.
12.36.10	Briefly state the factors which affect the ability of a fixed-pitch propeller to convert engine power into useful thrust.
12.36.12	State the principal advantage of a constant-speed versus a fixed-pitch propeller.
12.36.14	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.

Sub Topic	Syllabus Item
12.38	**Take-off and Landing Performance**
12.38.2	State the general effect of altitude on aircraft performance.
12.38.4	Define pressure altitude, and: (a) calculate aerodrome pressure altitude, given aerodrome elevation and prevailing QNH ; (b) explain how to determine pressure altitude by using an altimeter.
12.38.6	State the general effect of temperature on performance.
12.38.8	Define density altitude and, given pressure altitude: (a) calculate the deviation of ambient temperature from ISA ; (b) calculate the density altitude.
12.38.10	Define the following: (a) take-off distance required (TODR); (b) take-off distance available (TODA); (c) landing distance required (LDR); (d) landing distance available (LDA).
12.38.12	State the effect of the following factors on TODR and LDR; (a) aircraft weight; (b) temperature and pressure (i.e. density altitude); (c) humidity; (d) runway slope; (e) runway surface and condition; (f) headwind/tailwind component; (g) use/misuse of flaps, and power; (h) frost or other contaminants/damage of lifting surfaces.
12.38.14	Describe the hazards of a windshear in the initial climb-out path, and on the approach path.
12.38.16	Demonstrate the practical use of P-charts to determine TODR and LDR.
12.40	**Aircraft Loading**
12.40.2	State the general reasons for operating with correct loading (controllability, avoiding airframe overstress, satisfactory performance).
12.40.4	Define the following loading terms: (a) basic empty weight ; (b) zero fuel weight; (c) gross weight; (d) maximum certificated take-off weight (MCTOW) (e) maximum certificated landing weight (MCLW); (f) the moment of a force; and

Sub Topic	Syllabus Item
	(g) moment arm.
12.40.6	State the effect on stability and control of an aircraft if flown with the CG: (a) ahead of the forward limit; (b) behind the aft limit.
12.40.8	Define the meaning of: (a) aircraft datum; (b) positive and negative moments (about the datum); and (c) aircraft station (STA).
12.40.10	Given a basic aircraft load sheet/data, demonstrate an ability to: (a) calculate the CG position; (b) use a typical loading graph to determine CG position; (c) use index units.

Subject No 14 Aircraft Technical Knowledge (Helicopter)

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on 'knowledge deficiency reports' and will provide valuable feed back to the examination candidate. This is based on a typical light piston-engine helicopter.

Sub Topic	Syllabus Item
	PART I Technical Knowledge
14.2	**Engines - General**
14.2.2	Identify typical cylinder configurations used for aircraft piston engines (eg radial, in-line, horizontally opposed).
14.2.4	Identify and state the purpose of the major components of a four-stroke piston engine (cylinders, pistons, connecting rods, crankshaft, crankcase, camshaft, valves, spark plugs).
14.2.6	With the aid of diagrams, explain the basic principle of operation of the four stroke internal combustion engine.
14.2.8	In broad terms, explain the need for valve timing (i.e. valve lead, lag and overlap).
14.2.10	Describe the principal features of a typical ignition system (dual, independent, engine-driven magneto systems with two spark plugs per cylinder).
14.2.12	State the purpose and principle of an impulse coupling.
14.2.14	Describe the operation and correct handling of a rotary ignition/starter switch (including the starter warning light).
14.2.16	Explain the purpose and a typical procedure for conducting magneto checks.
14.2.18	State the correlation between engine rpm and power output.
14.4	**Carburation**
14.4.2	State the purpose of carburation.
14.4.4	With the aid of a diagram, explain the operating principle of a simple float-type carburettor.
14.4.6	State the purpose of the following systems within the carburettor; atomisation and diffusion; idling; accelerating; enrichment (at high power); mixture control and idle cut-off.
14.4.8	Explain the correct operational use of the idle cut-off.
14.4.10	Describe the effects of excessively rich or lean mixtures on engine operation.
14.4.12	In simple terms, describe the abnormal combustion conditions detonation and pre-ignition, and distinguish between them. State the causes and likely effects of these conditions and the measures which can be taken to avoid them.
14.4.14	Explain the formation of refrigeration, throttle and impact ice in a carburettor and intake system.

Sub Topic	Syllabus Item
14.4.16	State the: (a) atmospheric and throttle setting conditions conducive to the formation of carburettor ice; (b) symptoms of carburettor ice formation; (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.
14.4.18	In simple terms, describe the operation of a fuel-injection system. State the advantages and disadvantages of fuel-injection versus carburettor systems.
14.6	**Fuel Systems and Fuel**
14.6.2	Describe the function of the following components of a simple fuel system: (a) fuel tank, sump, drain point, supply line standpipe, vents, overflow drain; (b) fuel selector valve, supply line, strainer and strainer drain; (c) fuel primer, engine-driven pump, auxiliary (boost) pumps; (d) fuel quantity indicators.
14.6.4	Describe the correct management of the fuel system, including fuel selection and handling of priming and auxiliary pumps.
14.6.6	State the common grades of AVGAS with their colour identification.
14.6.8	Distinguish between the different characteristics of AVGAS, MOGAS and AVTUR, and state the precautions regarding the use of MOGAS in aero-engines.
14.6.10	State the common contaminants of AVGAS and the precautions which can be taken to avoid them.
14.6.12	Describe the procedure to be used for a fuel drain check.
14.6.14	State the general rules for fuelling of aircraft, including the use of dipsticks and the special precautions for the use of drum stock, and plastic containers.
14.8	**Lubrication and Cooling**
14.8.2	State the functions of engine oil (lubrication – reduction of friction, assisting with cooling, removal of contaminants, and sealing).
14.8.4	Explain the term viscosity and the effect of temperature on the lubricating qualities of oil.
14.8.6	Briefly describe the function of the following components of an oil system: (a) wet sump; (b) dry sump, scavenge pump, tank; (c) engine-driven pump, pressure relief valve; (d) oil lines, passages and galleries; (e) oil cooler, bypass valves; (f) oil pressure and temperature gauges.

Sub Topic	Syllabus Item
14.8.8	State the importance of using the correct type and grade of oil for a particular aircraft, and of checking the correct quantity before flight.
14.8.10	Identify the possible oil system malfunctions indicated by the following, and state the actions (if any) that the pilot can take to rectify the problem. (a) low/zero oil pressure; (b) high oil pressure; (c) fluctuating oil pressure; (d) low oil temperature; (e) high oil temperature.
14.8.12	Briefly describe the main means for air cooling an engine (cooling fans, baffles, and fins).
14.8.14	State the importance of having an engine rundown period after flight.
14.10	**Transmission Systems**
14.10.2	State the purpose of a helicopter transmission system.
14.10.4	Briefly describe the function(s) and operation of the following transmission system components: (a) main rotor gearbox; (b) clutch (belt drive, and centrifugal); (c) freewheeling unit; (d) rotor brake; (e) tail rotor drive and gearbox; (f) chip detectors.
14.12	**Rotor Systems**
14.12.2	Briefly describe the construction of modern rotor blades.
14.12.4	Explain the terms feathering, flapping, and lead-lag.
14.12.6	Outline the basic features of the following systems: (a) rigid rotor; (b) semi-rigid rotor; (c) fully articulated rotor; (d) tail rotor.
14.12.8	With respect to helicopter controls, explain the purpose and the basic principle of operation of the following: (a) collective control; (b) cyclic control; (c) twist grip throttle; including its effect on manifold pressure, and rpm; (d) tail rotor pedals; (e) rotor brake.

Sub Topic	Syllabus Item
14.12.10	Describe the purpose and basic principle of operation of the: (a) swashplate; (b) pitch link advance angle.
14.12.12	Describe the need for imposing limitations on rotor rpm, and explain the typical markings and correct interpretation of a dual needle tachometer.
14.12.14	Explain the need for reporting any damage to rotor components that has not been marked as being previously assessed.
14.14	**Electrical System**
14.14.2	State the types of service which are typically electrically operated in a light helicopter.
14.14.4	Explain the function of the following components in a typical light helicopter electrical system: (a) battery; (b) alternator (and generator); (c) bus bar; (d) voltage regulator, voltmeter or overvoltage light; (e) ammeter (left zero and centre zero); (f) master switch (or battery/alternator switch); (g) fuses, circuit breakers and overload switches.
14.14.6	State the precautions to take during normal operation of the electrical system, including: (a) avoiding prolonged operation of electrical systems on the ground before start; (b) starting with radios and other unnecessary equipment switched off; (c) avoiding prolonged operation of the starter motor; (d) releasing the starter once the engine is running; (e) checking satisfactory operation of the system after start, and monitoring during flight; (f) switching off ancillary equipment before shut-down; (g) switching the battery master switch off before leaving the aircraft.
14.14.8	Identify the cockpit indications of the following electrical system malfunctions, and state the actions available to the pilot to deal with the problem; (a) excessive alternator/generator charge rate; (b) lack of alternator/generator charge; (c) blown fuse or popped circuit breaker.
14.16	**Pressure Instruments**
14.16.2	Identify the three basic instruments which rely on air pressure for their operation.
14.16.4	Describe static pressure and dynamic pressure, and the main factors which affect them.

Sub Topic	Syllabus Item
14.16.6	Explain the operation of a pitot-static system, including: (a) static vent(s); (b) pitot tube; (c) combined pitot-static head; (d) drain holes, heating, pitot cover.
14.16.8	With respect to the airspeed indicator, describe the: (a) basic principle of operation; (b) colour coding, and the meaning of VNE; (c) IAS/TAS/groundspeed relationship; (d) errors affecting the ASI.
14.16.10	With respect to the altimeter, describe the: (a) basic principle of operation; (b) subscale settings and the meaning of QNH, QFE and QNE; (c) errors affecting the altimeter, including subscale setting error.
14.16.12	With respect to the vertical speed indicator, describe the: (a) basic principle of operation; (b) errors affecting the VSI.
14.16.14	Indicate the normal checks for serviceability of the pitot-static system, both pre-flight and during operation.
14.16.16	Identify the cockpit indications of the following pitot-static system malfunctions: (a) blockage of the pitot tube; (b) blockage of the static source.
14.18	**Gyroscopic Instruments**
14.18.2	Outline the basic principle of operation of the vacuum system, and state the likely effects of reduced or nil suction.
14.18.4	Describe the gyroscopic properties of rigidity and precession.
14.18.6	With respect to the turn indicator/coordinator: (a) explain the basic principle of a rate gyroscope; (b) with the aid of a diagram, differentiate between the different indications of the turn indicator and turn coordinator; (c) state the function, indication and correct use of the coordination (balance) ball;
14.18.8	With respect to the attitude indicator (or artificial horizon); explain: (a) the basic principle of operation (earth gyroscope); (b) with the aid of a diagram, how pitch attitude and bank angle are displayed; (c) the pilot checks for serviceability;
14.18.10	With respect to the heading indicator (or DGI), explain: (a) the advantages of a gyroscopic heading indicator (versus a compass)

Sub Topic	Syllabus Item
	(b) the need for, and method of synchronising the HI with the compass; (c) the pilot checks for serviceability.
14.18.12	Briefly explain the errors likely to occur if the gyro rotor rpm is low; the indication of power failure on electrically-driven instruments; and the indications of toppling.
14.20	**Magnetic Compass**
14.20.2	Describe the earth's magnetic field, and: (a) distinguish between the true and magnetic poles; (b) define magnetic variation, isogonals, and deviation; (c) given a sample deviation card, show how to apply corrections.
14.20.4	Briefly describe the construction of a modern direct-reading compass.
14.20.6	Explain magnetic dip; how it is compensated for; and define residual dip.
14.20.8	State the effects of: (a) acceleration error; and (b) turning error.
14.20.10	State the compass pre-flight serviceability checks, and the precautions when carrying magnetic items.
	Part II Principles of Flight
14.22	**The Atmosphere**
14.22.2	State the principal gases which constitute the atmosphere (nitrogen and oxygen, plus small amounts of others).
14.22.4	In general terms, describe air density, and how it varies with altitude in the atmosphere.
14.22.6	State the relationship between pressure/temperature and the density of an air mass.
14.22.8	Outline how pressure, temperature and density normally vary in the atmosphere.
14.22.10	Outline the basis for the International Standard Atmosphere, and state the assumed standard sea level pressure and temperature conditions, together with their lapse rates up to the tropopause.
14.24	**Basic Aerodynamic Theory**
14.24.2	State what an aerofoil is and distinguish between symmetrical and non-symmetrical sections.
14.24.4	Define: (a) leading edge; (b) trailing edge; (c) chord;

Sub Topic	Syllabus Item
	(d) thickness; (e) camber.
14.24.6	Define relative airflow and angle of attack.
14.24.8	State Bernoulli's Theorem in simple terms.
14.24.10	Define streamline flow around an aerofoil, and explain the changes which occur to dynamic and static pressure wherever the speed of the airflow is: (a) increased; (b) decreased.
14.24.12	With the aid of diagrams, explain: (a) venturi effect; (b) the pressure distribution around an aerofoil which is producing lift.
14.24.14	Define the terms total reaction (TR) and centre of pressure (CP), and describe how TR and CP change with increasing angle of attack (for a lifting aerofoil).
14.24.16	Show how movement of the CP varies between symmetrical and non-symmetrical aerofoils.
14.24.18	Define the lift and drag components (of TR).
14.24.20	State the lift formula and summarise the factors affecting lift (angle of attack, aerofoil shape, IAS).
14.24.22	Define in simple terms, the coefficient of lift (CL) and describe a typical CL versus angle of attack curve. On this curve, identify the critical (stalling) angle.
14.24.24	State the precaution against flying with ice, frost, snow or other contamination of the aerofoil surfaces.
14.24.26	Distinguish between parasite drag, induced drag, and profile drag, and list the elements of the latter (form drag and skin friction).* *[Students should be aware that there are other ways of categorising drag.]
14.24.28	State the factors affecting parasite drag, and profile (form and skin friction) drag.
14.24.30	Explain the cause of induced drag, and state how induced drag is related to blade tip vortices, and varies depending on: (a) CL and angle of attack of the rotor blade; (b) aspect ratio.
14.24.32	With the aid of a diagram, identify curves of parasite, profile, induced, and total drag versus airspeed.
14.24.34	Identify a curve of lift/drag (L/D) ratio versus angle of attack for a symmetrical aerofoil, and state the approximate angle for best L/D ratio.

Sub Topic	Syllabus Item
14.26	**Rotary Wing Aerodynamics**
14.26.2	With respect to a helicopter rotor, define the following terms: (a) tip path; (b) tip path plane; (c) axis of rotation; (d) shaft axis; (e) chord line; (f) blade (or pitch) angle; (g) angle of attack; (h) feathering axis; (i) coning angle; (j) disc area; (k) flapping; (l) lead-lag (dragging).
14.26.4	For a nil-wind hovering condition, and with the aid of a diagram: (a) identify the following vectors – rotational flow, induced flow, and relative airflow; (b) identify pitch angle, inflow angle, and angle of attack.
14.26.6	For a given blade section, and with the aid of a diagram, identify the total aerodynamic reaction force (TR) and its components, rotor thrust and rotor drag.
14.26.8	Define total rotor thrust, and rotor drag (torque). For steady hovering flight, explain the balance of forces between rotor thrust and gross weight, rotor drag and engine power.
14.26.10	State the effect of the following on total rotor thrust: (a) air density (altitude); (b) rotor rpm; (c) blade angle; (d) disc area.
14.26.12	Explain the effect of total rotor thrust and centrifugal force in determining coning angle, and the need to apply wash-out in the design of rotor blades.
14.28	**The Anti Torque (Tail) Rotor**
14.28.2	Briefly describe the torque couple (origin, direction, and strength).
14.28.4	State the purpose of the anti-torque (tail) rotor, and describe the demand of anti torque for power.
14.28.6	Describe the effect of wind on tail rotor thrust, including: (a) possible loss of tail rotor effectiveness; (b) effect on power required to hover.

Sub Topic	Syllabus Item
14.28.8	Explain translating tendency (tail rotor drift) and common design methods used to correct for it.
14.28.10	Explain rolling tendency and the design features/procedures used to reduce it.
14.28.12	Describe the effect of tail rotor failure in flight, and actions available to the pilot to reduce or eliminate the effect.
14.30	**Hovering Flight**
14.30.2	Briefly explain the effect of the following factors on hovering flight: (a) density altitude; (b) weight; (c) ground effect.
14.30.4	Describe: (a) recirculation; (b) overpitching, and the recovery from it.
14.32	**Forward Flight**
14.32.2	Identify the forces acting on the helicopter in steady forward flight.
14.32.4	Briefly explain the following: (a) dissymmetry of lift; (b) flap-back (or blow-back); (c) translational lift.
14.32.6	State the meaning of: (a) best range speed; and (b) best endurance speed.
14.32.8	Explain how the flare results in changes to the following: (a) airspeed and groundspeed; (b) rotor rpm.
14.34	**Climbing and Descending**
14.34.2	Define; (a) rate of climb; (b) angle of climb.
14.34.4	State the effect of wind on angle of climb.
14.34.6	State how changes in airspeed influence angle of descent (constant power/zero wind).
14.34.8	State the effect of wind on angle of descent.

Sub Topic	Syllabus Item
14.36	**Turning**
14.36.2	With the aid of a diagram, identify the forces acting on a helicopter in a level turn.
14.36.4	State the effect of angle of bank on power required, rate and radius of turn, and load factor.
14.36.6	Define standard rate (rate 1) and double standard rate (rate 2) turns.
14.36.8	For climbing and descending turns, describe: (a) the effect of bank on rate of climb/descent; (b) the requirement for increased power.
14.38	**Autorotative Flight**
14.38.2	Define autorotation.
14.38.4	With the aid of a diagram, identify the stalled, driving and driven regions of the rotor disc.
14.38.6	Explain the need to lower the collective at the start of an autorotation.
14.38.8	Briefly describe the effect of variation of the following on rate of descent and distance covered in an autorotation: (a) airspeed; (b) all-up-weight; (c) altitude; (d) wind velocity.
14.38.10	Explain the principle features of a height-velocity diagram.
14.40	**Hazardous Flight Conditions**
14.40.2	Briefly state the conditions leading to, the symptoms, and pilot actions to avoid and/or recover from the following: (a) vortex ring state; (b) loss of tail rotor effectiveness; (c) ground resonance; (d) blade sailing; (e) dynamic rollover; (f) cyclic limitations; (g) mast bumping; (h) exceeding rotor rpm limits; (i) rotor stalls.
14.42	**Performance**
14.42.2	State the general effect of variation in the following on helicopter performance: (a) QNH;

Sub Topic	Syllabus Item
	(b) ambient temperature; (c) humidity.
14.42.4	Define pressure altitude, and: (a) calculate aerodrome pressure altitude, given aerodrome elevation and prevailing QNH; (b) explain how to determine pressure altitude by using an altimeter.
14.42.6	Define density altitude and, given pressure altitude, calculate the: (a) deviation of ambient temperature from ISA; (b) density altitude.
14.42.8	State the effect of the following variables on helicopter take-off and/or landing performance: (a) gross weight; (b) pressure altitude; (c) temperature; (d) moisture content of the air.
14.44	**Aircraft Loading**
14.44.2	State the general reasons for operating with correct loading (controllability, avoiding structural overstress, satisfactory performance).
14.44.4	Define the following loading terms: (a) basic empty weight ; (b) zero fuel weight; (c) gross weight; (d) maximum certificated take-off weight (MCTOW); (e) the moment of a force; and (f) moment arm.
14.44.6	State the effect on stability and control of a helicopter if flown with the CG: (a) at the forward limit; (b) at the aft limit; (c) at a lateral limit.
14.44.8	Define the meaning of: (a) datums (longitudinal and lateral); (b) moments (about those datums); and (c) aircraft station (STA).
14.44.10	With the aid of typical loading and performance data/graphs from a typical manual for a single-engine helicopter, demonstrate an ability to calculate: (a) aircraft AUW; (b) take-off and landing performance, under given conditions.

Appendix IV - Private pilot licence 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 Flight Test Standards Guide PPL Aeroplane, 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, their summarised and certified pilot's log book, written exam credits, knowledge deficiency reports (KDR's) 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, and
- those instruments essential to the manoeuvres planned to be demonstrated during the flight visible to both pilots without excessive parallax error, and
- 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 aircraft's certificate of airworthiness, technical log, flight manual and associated pilot's operating handbook.

Weather and AIP:

Obtain and interpret the meteorological forecast 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 SPARs, SPECIs and SIGMETs as applicable).

Obtain and demonstrate knowledge of the applicable NOTAMs.

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 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's 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's flight manual.

Engine checks, run-up and operation:

Carry out the pre-flight engine run up and checks in accordance with the aircraft's 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's 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's 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's 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's 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.

Medium turns:

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

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 360 degrees left and right, using a bank angle of 45 degrees.

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 45 degrees 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's 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 touch-down 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:

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 tuning and 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's Flight Manual or checklist, secure the aircraft and complete all post flight documentation.

Piloting technique test for helicopters

Pre-flight inspection:

As in checklist.

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 180 and 360 degree:

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.

Steep turns:

Through 360 degrees left and right, look-out, bank angle of 45 degrees, 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, co-ordination of throttle, collective and anti-torque pedal.

One hundred and eighty degree autorotation:

From approximately 800 foot height perform a 180 degree 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 height nominated, perform quick stops into wind, commencing at approximately 50 knots into wind without needle split and maintaining approximately same height with good co-ordination of RPM and heading.

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, 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 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 log book.

Appendix V – Helicopter mountainous terrain awareness training syllabus

Theory component

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 & surface temperature vary with altitude
2.1.7	State the environmental factors that influence visibility plus the effect of precipitation on windscreen
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:
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
j	alternate/escape routes
k	legal requirements (incl. the minimum height/lateral separation specified in CAR 91.311)
3.2.0	**Flying techniques**
3.2.1	Describe valley flying techniques for:
a	entering & 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
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 & 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 & 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.
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
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
7.5.2	Outline the principles of survival: First Aid; Protection; Location; Water; Food; Will to Survive

Flight component

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' AMSL or 3,000'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
4.4	Conduct an approach to an open flat area (normal circuit)
4.6	Execute an overshoot to the pre-planned escape route
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