

Subject No 54 Flight Navigation - IFR

Note: This syllabus is based on IFR navigation as applicable to navigating a multi engine turbine air transport type aeroplane or IFR equipped turbine helicopter.

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

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

Sub Topic Syllabus Item**Fundamentals of Air Navigation****54.12 Altimetry**

54.12.2 Define:

- (a) indicated altitude;
- (b) calibrated altitude;
- (c) true altitude;
- (d) pressure altitude (PA);
- (e) density altitude (DA);
- (f) flight level (FL);
- (g) transition altitude;
- (h) transition layer;
- (i) transition level;
- (j) QNH;
- (k) QFE.

54.12.4 Explain and apply the table of IFR cruising levels below and above transition.

54.12.6 Explain how true and indicated altitudes are affected by changes in air pressure and air temperature.

54.12.8 Explain:

- (a) How changes in air pressure and air temperature affect the vertical profile during a non ILS approach;
- (b) The risks associated by low temperatures and QNH errors during a non ILS approach.

Sub Topic	Syllabus Item
54.12.10	Explain how true and indicated altitudes are related when using flight levels.
	Aeronautical Charts
54.22	Properties and Principles
54.22.2	List the aeronautical charts used in New Zealand for operations under IFR and VFR.
54.22.4	Identify the information published in the legends of aeronautical charts and in the CHART Symbols section of the AIPNZ Vol 2 & 3.
54.22.6	Explain the meaning of abbreviations and codes used in Operational Data for aerodromes in the AIPNZ.
54.22.8	Interpret information published on aerodrome Instrument Approach charts.
54.22.10	Demonstrate proficiency in determining distances on IFR enroute charts using the linear scales printed separately on the charts, and using the latitude scale along meridians.
54.22.12	Describe how magnetic tracks and distance are presented on enroute charts.
54.22.14	Define and plot a great circle and rhumb line on an appropriate chart.
54.22.16	Explain the function of the International date line.
54.22.18	Explain what is meant by: (a) ADEP; (b) ADES; (c) RNAV; (d) GNSS; (e) RNP; (f) RVSM; (g) waypoint; (h) SID; (i) STAR.
54.22.20	Define the following terms presented on enroute charts: (a) minimum enroute altitude (MEA);

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	<ul style="list-style-type: none">(b) minimum reception altitude (MRA);(c) minimum safe altitude (MSA);(d) route operating limitations (ROL);(e) minimum flight altitude (MFA);(f) compulsory reporting point;(g) non-compulsory reporting point;(h) VOR change-over point;(i) DME steps.
54.22.22	With regard to Standard Routes, describe in detail the: <ul style="list-style-type: none">(a) function of the routes;(b) associated standard route clearance system;(c) manner in which standard routes are highlighted on enroute charts;(d) designator allocated to individual standard routes;(e) documents where standard routes are published.
54.22.24	With regard to uncharted routes, state the: <ul style="list-style-type: none">(a) document, and section, where the routes are published;(b) designator allocated to the routes.
54.26	Chart Reading
54.26.2	Using a protractor, describe how non-published magnetic tracks can be drawn on enroute charts.
54.26.4	Describe how to identify, on appropriate enroute charts; <ul style="list-style-type: none">(a) different airspace classes and types;(b) airspace boundaries;(c) airspace vertical limits;(d) airspace controlling authority.
54.26.6	With regard to the World Geodetic System 1984 (WGS 84) datum, state: <ul style="list-style-type: none">(a) where this datum is published;

Sub Topic	Syllabus Item
	(b) the abbreviation used to denote the datum;
54.26.8	Describe the information contained in the following charts, tables and diagrams published in the AIPNZ VOL 2 & 3, and explain compliance procedures associated with: <ul style="list-style-type: none">(a) VOR/DME MRA Sector charts;(b) 25 DME Minimum Sector Altitude diagrams;(c) Standard Instrument Departure (SID) diagrams;(d) visual arrival charts;(e) Standard Arrival Route (STAR) charts;(f) ground movement charts;(g) instrument T/O procedure chart – rate of climb table;(h) IFR alternate aerodrome minima table.
	Flight Planning
54.40	Route Selection
54.40.2	For the preparation of a flight plan, determine: <ul style="list-style-type: none">(a) route details, including reporting points and turning points;(b) climb performance data including minimum climb gradients associated with published departure procedures;(c) descent performance data including rate of descent required to arrive at a position at a stipulated altitude, or to comply with published arrival procedures;(d) fuel consumption details during climb, cruise, descent, and during diversion (if different);(e) cruising level(s) considering topography, navigational and meteorological considerations;(f) ATC and Noise Abatement requirements;(g) speed limitations, if applicable;(h) requirement for, and availability of, alternate(s).
54.40.4	Define: <ul style="list-style-type: none">(a) point of no return (PNR);

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(b) equi-time point (ETP).

54.44 Plan Preparation

54.44.2 Prepare an IFR flight plan which contains the following details:

(a) point of departure including minimum departure altitude or departure instructions, if applicable;

(b) rate of climb required to comply with published climb gradient;

(c) location and altitude of top of climb and top of descent;

(d) each sector of the flight identified as From/To;

(e) point of arrival including minimum procedure commencement altitude, if applicable;

(f) the altitude and time of each sector including mean climb and mean descent altitude;

(g) each sector distance;

(h) outside air temperatures for the calculation of TAS during climb, cruise and descent;

(i) the wind velocity used for climb, cruise and descent, including split climb and split descent;

(j) TAS for each sector;

(k) track (°M) of each sector;

(l) heading (°M), groundspeed and time for each sector;

(m) climb, cruise and descent details of a diversion;

(n) time and distance to the point of no return (PNR);

(o) time and distance to the equi-time point (ETP);

(p) SARTIME.

54.46 Fuel Planning

54.46.2 Calculate total fuel load required including provision for diversion, reserve and contingency fuel.

Sub Topic	Syllabus Item
	Navigation Procedures - IFR
54.52	Properties and Principles
54.52.2	Define: <ul style="list-style-type: none">(a) drift, drift angle, drift correction;(b) track error, closing angle, total correction;(c) magnetic and true bearing;(d) radial;(e) position line;(f) fix.
54.52.4	Through the use of the navigation computer and mathematical means, solve problems involving: <ul style="list-style-type: none">(a) the triangle of velocity;(b) the 1 in 60 rule;(c) time/speed/distance;(d) time/fuel used/fuel consumption rate;(e) height/time/distance/rate of climb/rate of descent;(f) calculate the track miles flown on a segment of a DME arc.
54.52.6	Interpret meteorological information for IFR take-off minima.
54.52.8	Based on information derived from currently used ADF, VOR and DME displays, and from GNSS instrumentation, describe, determine or calculate: <ul style="list-style-type: none">(a) navigation aspects associated with published departure procedures;(b) magnetic headings required to maintain, or regain, required magnetic tracks;(c) determination of magnetic tracks to specified point(s);(d) CAS/TAS, drift and groundspeed;(e) estimated times of arrival at destination or intermediate positions;(f) requirements with respect TOC/TOD and rate of climb/rate of descent;(g) wind velocity;

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	(h) position in terms of a radial, magnetic or true bearing and distance to or from a navigation aid;
	(i) alteration in magnetic heading to make good a position or track;
	(j) fuel consumption, and operational details or requirements resulting from fuel flow information;
	(k) navigation aspects associated with published arrival procedures;
	(l) holding time over a navigation aid before diversion must be commenced;
	(m) DME steps;
	(n) DME arc procedure.
54.54	Chart Plotting
54.54.2	Describe the principles involved in obtaining an accurate fix.
54.54.4	Describe the information that should be displayed by ADF/ VOR/ DME instrumentation to confirm position in relation to: (a) a navigation aid or aids; or (b) a magnetic track.
54.54.6	Locate a position on a chart: (a) from an NDB given magnetic direction to and from; (b) from a VOR given radial and DME distance; (c) from a pair of NDB tracks or VOR radials.
54.54.8	Calculate the distance from a VOR/NDB, given track, groundspeed and two VOR/NDB radial/bearing fixes.
54.54.10	Calculate the lateral distance off track, given track error and distance from a navaid.
54.54.12	Using the transfer of position lines procedure (°M), determine a new position, given: (a) an initial position; (b) a track required from that position; (c) a magnetic heading, or information to determine a magnetic heading; (d) a TAS, or information to determine TAS;

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(e) distance(s), or information to determine distance(s);

(f) ADF, VOR, and/or DME information at specific times to calculate and plot position lines.

Note: *The new position may be required to be expressed in terms of lat/long, or as a bearing and distance from or to a navigation aid.*

54.54.14 Having established a new position using the transfer of position line procedure, calculate or determine any or all of the following:

(a) drift;

(b) track error;

(c) wind velocity;

(d) correction to heading to make good a point or track;

(e) estimated time of arrival at a point of a track.

54.56 Chart Reading

54.56.2 Determine:

(a) the type or class of airspace in which an IFR flight is operating;

(b) ATC aspects when operating IFR in controlled and uncontrolled airspace.

54.56.4 Interpret meteorological information for IFR approach minima.

54.56.6 Interpret, describe and explain the procedures involved during precision and non-precision instrument approaches.

54.56.8 Describe the procedures associated with published missed approaches.

54.58 En route Diversion Calculations

54.58.2 Calculate en route:

(a) time and distance to the point of no return (PNR) ;

(b) time and distance to the equi-time point (ETP).

Radio Aids**54.64 Automatic Direction Finder (ADF)**

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

54.64.4 Describe the purpose of each control on the ADF control panel.

Sub Topic	Syllabus Item
54.64.6	List the publications and charts that show NDB callsigns and frequencies.
54.64.8	Explain why it is important to check the NDB ident before using an NDB.
54.64.10	Explain what is meant by relative bearing.
54.64.12	Given an aircraft magnetic heading and a relative bearing, or an RMI presentation calculate: (a) magnetic bearing to an NDB; (b) magnetic bearing from an NDB.
54.64.14	Describe the track followed by an aircraft experiencing a crosswind when the ADF needle is kept on the 360°R position.
54.64.16	Explain how the ADF can be used to maintain track with drift correction applied: (a) when tracking to an NDB; (b) when tracking away from an NDB.
54.64.18	Identify aircraft position relative to NDB or multiple NDB's.
54.64.20	Describe the limitations associated with NDB navigation.
54.66	VOR
54.66.2	Describe the presentation and function of the VOR CDI on a fixed card, rotatable card and a HSI indicator.
54.66.4	Explain the importance of station identification before using the VOR.
54.66.6	List the publications and charts that show VOR callsigns and frequencies.
54.66.8	Describe what is meant by a (VOR) radial.
54.66.10	Describe how the VOR receiver can be used to: (a) establish orientation of that aircraft to and from a VOR station; (b) maintain a required track to a VOR station; (c) maintain a required track from a VOR station.
54.66.12	State the behaviour of the course deviation indicator (CDI) while the aircraft is off the selected radial, and the HDG °M and OBS selection are: (a) within 90° of each other; (b) more than 90° apart.

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