

Subject No. 38 Flight Navigation General (Aeroplane & Helicopter)

NOTE: This syllabus is primarily based on regional/oceanic/global IFR navigation as applicable to navigating a multi engine turbine air transport type aeroplane or IFR capable 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 feedback to the examination candidate. These reference numbers are common across the subject levels and therefore may not be consecutive.

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

Sub Topic	Syllabus Item
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	Fundamentals of Air Navigation
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38.2	Form of the Earth
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38.2.2	Define and identify, on a diagram of the earth:
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- (a) great circles
- (b) small circles
- (c) rhumb lines
- (d) the equator
- (e) parallels of latitude
- (f) meridians of longitude
- (g) Greenwich (Prime) Meridian
- (h) the International Date Line.

38.4	Direction on the Earth
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38.4.2	Define, with reference to navigation at higher latitudes and polar areas:
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- (a) magnetic pole
- (b) true north
- (c) magnetic north
- (d) compass north.

38.4.4	Explain the processes, cautions and limitations when deriving track distances and bearings from a chart, with particular reference to navigation at higher latitudes and polar areas.
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38.6	Distance on the Earth
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38.6.2	Define units of distance used on aviation charts and the basis for these units.
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38.6.4	Explain the distance calculation basis used by GNSS and FMC systems.
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Sub Topic	Syllabus Item
38.6.6	Determine distances ($\pm 3\text{nm}$) on an appropriate oceanic navigational chart.
38.8	Speed and velocity
38.8.2	Define Mach number and associated computational formulae.
38.8.4	State the frame of reference for speed measurement provided by a GNSS and inertial system.
38.8.6	Explain how TAS and mach number are affected by changes in pressure altitude, air temperature and air density.
38.10	Position Referencing
38.10.2	Describe the grid system position reference method.
38.10.4	Describe the reference system used by a GNSS navigation system.
38.10.6	Plot and reference a position ($\pm 3\text{nm}$) on appropriate oceanic chart.
38.12	Altimetry
38.12.2	State the altimeter setting rules in oceanic airspace.
38.12.4	Explain the table of cruising levels and the application in oceanic airspace.
38.12.6	Explain the transition procedures between oceanic and domestic cruising levels.
38.12.8	State the change in temperature with altitude in the International Standard Atmosphere (ISA).
38.12.10	State the change in temperature with altitude in the Jet Standard Atmosphere (JSA).
38.16	Time
38.16.2	Explain the relationship between time and longitude.
38.16.4	Convert between arc and time.
38.20	Visibility
38.20.2	Define: <ul style="list-style-type: none"> (a) visibility (b) visual range (c) slant range (d) runway visual range (RVR).
38.20.4	Explain the factors which affect visibility and visual range.
38.20.6	Describe how visual range is determined from an aircraft in flight and by ground stations.

Sub Topic**Syllabus Item****Aeronautical Charts****38.22 Properties and Principles**

38.22.2 List the uses of:

- (a) a Mercator projection
- (b) a Lambert's conformal projection
- (c) current oceanic aeronautical charts.

38.22.4 Describe orthomorphism.

38.22.6 State the properties that a chart must possess to be considered orthomorphic.

38.22.8 Describe the relationship between a change in longitude and distance at a given latitude (departure).

38.22.10 State the departure formula.

38.22.12 Calculate the distance between two longitudes, at a given latitude.

38.22.14 Explain earth and chart convergence.

38.22.16 Describe the position of a great circle track relative to the rhumb line track between two points.

38.24 Scale

38.24.2 Define chart scale.

38.24.4 Calculate earth distance, given scale and chart distance.

38.24.6 Calculate chart distance, given scale and earth distance.

38.24.8 Calculate chart scale, given earth distance and chart distance.

38.26 Chart Reading

38.26.2 Interpret the features and symbols of appropriate aeronautical charts.

38.26.4 Derive navigation information from appropriate aeronautical charts.

Navigation Calculations**38.28 Computations**

38.28.2 Derive TAS, given Mach number and air temperature in degrees Celsius.

38.28.4 Calculate groundspeed given Mach number, wind component and air temperature in degrees Celsius.

38.28.6 Determine the outside air temperature, given an altitude or a flight level and a temperature deviation from ISA.

38.28.8 Derive TAS, given a Compressibility Correction Table, CAS, pressure altitude/flight level and air temperature in degrees Celsius.

Sub Topic	Syllabus Item
38.28.10	Calculate the equivalent still air distance, given total distance, mean TAS and mean wind component.
38.30	Relative Velocity
38.30.2	Calculate the closing/opening speeds of two aircraft on the same track.
38.30.4	Calculate the distance between two aircraft when they are 10 minutes apart on the same track.
38.30.6	Calculate the time that two aircraft will be 10 minutes apart on the same track.
38.30.8	Calculate the position of an aircraft along track when a following aircraft is 10 minutes behind it on the same track.
38.30.10	Calculate the time of passing of two aircraft on the same track, given relative positions and speeds.
38.30.12	Define line of constant bearing.
38.30.14	Calculate the distance two aircraft on diverging/converging tracks are apart at a given time.
38.30.16	Calculate the true, magnetic or relative bearing between two aircraft on diverging/converging tracks at a given time.
38.30.18	Determine whether the relative bearing between two aircraft on diverging/converging tracks will remain constant.
38.34	Triangle of Velocities
38.34.2	Solve triangle of velocity problems (given four of the six variables): <ul style="list-style-type: none"> (a) heading and track ($\pm 2^\circ$) (b) TAS and GS (± 2kts) (c) wind velocity ($\pm 3^\circ/\pm 2$kts) (d) drift ($\pm 1^\circ$).
	Navigation Procedures - IFR
38.54	Plotting
38.54.2	Plot and measure the initial great circle track between two points, in true and magnetic, on an oceanic chart.
38.58	En-route Diversion Calculations
38.58.2	Calculate, considering normal operations, depressurised and engine out scenarios: <ul style="list-style-type: none"> (a) time and distance to the PNR (b) time and distance to the ETP between two aerodromes on a track

Sub Topic	Syllabus Item
	(c) time and distance to the ETP between two aerodromes, one or both of which are not on track
	(d) time and distance to the ETP between two aerodromes, given multiple legs with separate wind components.

38.58.4 State the flight profile (speed) required to achieve a PNR as far as possible from the departure aerodrome.

38.58.6 Describe the effect of headwind/tailwind on the position of the PNR from the departure aerodrome.

38.58.8 Describe the effect of headwind/tailwind on the position of the ETP between the departure and destination aerodrome.

Flight Management

38.60 Flight Management

38.60.2 Discuss the factors to be considered when selecting altitudes at which to fly in the cruise.

38.60.4 Discuss the factors to be considered when selecting en-route and destination alternates.

38.60.6 Calculate the rate of climb required to make good a specified climb gradient.

38.60.8 Calculate the top of descent point to make good a specified height and distance, given a descent profile in nautical miles per 1000 feet.

38.60.10 Calculate groundspeed to make good a specified position at a specified time.

38.60.12 Describe the flight profile which provides greatest fuel efficiency.

38.60.14 Describe the flight profile which allows the longest time airborne before reaching minimum reserves.

38.60.16 Describe the flight profile which best utilises fuel before it is lost out of a leaking tank.

GNSS

38.70 Global Positioning System (GNSS)

38.70.2 Explain the precautions to be taken when inserting data with the keypad.

38.70.4 State the factors influencing GNSS reliability including RAIM prediction.

38.70.6 Explain the precautions to be taken managing the GNSS, autopilot and crew interfaces.

38.70.8 Explain Automatic dependent surveillance-broadcast (ADS-B).

38.70.10 Explain Differential Global Positioning System (DGPS).