

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
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	Human Factors - General
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10.2	Airmanship and Responsibility
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10.2.2	Describe key features of good and safe airmanship.
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10.2.4	List the common causes of fatal accidents for private general aviation pilots in New Zealand.
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10.2.6	State the approximate proportion of aircraft accidents and incidents commonly attributed to human performance errors.
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10.4	Human Factors Models and Programmes
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10.4.2	Define human factors as used in an aviation context.
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10.4.4	Describe the fundamentals of the SHELL Model in relation to the interaction of humans with other humans, hardware, information sources and the environment.
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10.4.6	Explain the role of human factors programmes in promoting aviation safety.
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	Physiology and the Effects of Flight
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10.6	The Atmosphere
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10.6.2	State the gases that make up the atmosphere.
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10.6.4	State the percentage of each gas in the atmosphere.
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10.6.6	Describe the variation of pressure as altitude increases.
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10.6.8	Explain how the partial pressure of oxygen changes as altitude increases.
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10.8	Circulation and Respiratory Systems
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10.8.2	Describe the anatomy and physiology of the respiratory system.
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10.8.4	Describe the anatomy and physiology of the circulatory system.
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10.8.6	Describe the role of the lungs in oxygen and carbon dioxide transfer.
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10.10	Hypoxia
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10.10.2	Define hypoxia.
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10.10.4	State the partial pressure of oxygen both inside and outside the lungs at sea level.
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10.10.6	Explain the mechanical effect of the partial pressure of oxygen on oxygen transfer in the lungs.
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10.10.8	Explain the causes of hypoxia.
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Sub Topic	Syllabus Item
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.
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: <ul style="list-style-type: none"> (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.

Sub Topic	Syllabus Item
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: <ul style="list-style-type: none"> (a) lens; (b) cornea; (c) retina; (d) fovea; (e) optic nerve disc; (f) cone cells; (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: <ul style="list-style-type: none"> (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: <ul style="list-style-type: none"> (a) long sightedness; (b) short sightedness;

Sub Topic	Syllabus Item
	(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.
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.

Sub Topic	Syllabus Item
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: <ul style="list-style-type: none"> (a) the semi-circular canals; (b) vestibular sac/tubes.
10.22.8	Explain the interconnection between the visual and kinesthetic 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: <ul style="list-style-type: none"> (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: <ul style="list-style-type: none"> (a) the circulatory system; (b) vision; and, (c) consciousness.
10.24.4	Explain the causes and symptoms of black-out and red-out.
10.26	Motion Sickness
10.26.2	Explain the causes of motion sickness.
10.26.4	Describe how motion sickness can be prevented.
10.26.6	Describe how motion sickness can be treated.
10.28	Flight Anxiety
10.28.2	Explain the causes of flight anxiety.

Sub Topic	Syllabus Item
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: <ul style="list-style-type: none"> (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: <ul style="list-style-type: none"> (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).
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.

Sub Topic	Syllabus Item
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: <ul style="list-style-type: none"> (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: <ul style="list-style-type: none"> (a) heat; (b) cold; (c) noise; (d) vibration; (e) humidity.
10.38.12	Explain methods of identifying stress.
10.38.14	Explain the difference between acute and chronic stress.

Sub Topic	Syllabus Item
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: <ul style="list-style-type: none"> (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: <ul style="list-style-type: none"> (a) attention; (b) sensory threshold;

Sub Topic	Syllabus Item
	(c) sensitivity.
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.

Sub Topic	Syllabus Item
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.
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: <ul style="list-style-type: none"> (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

Sub Topic	Syllabus Item
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behaviour.

10.54.10 Distinguish between negligent and reckless behaviour.

10.54.12 Describe the role of punitive sanction.

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;

Sub Topic	Syllabus Item
	(c) layout;
	(d) visibility;
	(e) legibility;
	(f) scale;
	(g) use of colour;
	(h) illumination.
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

Sub Topic	Syllabus Item
	carried on a cross-country flight over bush clad and mountainous terrain.
10.66.10	Explain the process of hypothermia.