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

Advisory Circular AC66-2.4

Revision 4

2 October 2023

Aircraft Maintenance Engineer Licence— Examination Subject 4 Aeroplanes 1

General

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

Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate AC.

Purpose

This AC describes an acceptable means of compliance with the syllabus content in respect of written examinations for Subject 4 (Aeroplanes 1).

This AC also provides guidance material for recommended study material in respect of the examination syllabus in this AC.

Related Rules

This AC relates specifically to Civil Aviation Rule Part 66 Subpart B— 'Aircraft Maintenance Engineer Licence'.

Change Notice

Revision 4 updates the ASPEQ email address in the section **Examination Overview: Subject 4**. It also corrects out of date references and adds a version history.

Version History

The main changes are outlined below:

AC Revision No	Effective Date	Summary of changes
AC66-2.4, Rev 0	10 June 1997	Initial issue
AC66-2.4, Rev 1	1 Dec 2008	Incorporated an objectivised syllabus for Subject 4 (Aeroplanes 1) to supersede the outline syllabus previously promulgated in AC66-2.1 Revision 2. The information contained in Revision 0 of AC66-2.4 is now promulgated in AC66-2.33 (AMEL – Examination Curricula – Airframe Overhaul - Subject 009).

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AC66-2.4, Rev 2	29 June 2009	Removed the wording 'multi choice' (in respect of questions) from the Examination Overview Section of this AC.
AC66-2.4, Rev 3	10 March 2015	Updated the web address for Aviation Services Limited (ASL). Deleted reference to an AME sample question booklet being available for purchase from ASL. Removed reference to examination length and number of questions.
AC66-2.4, Rev 4	2 Oct 2023	Updates the ASPEQ email address in the section **Examination Overview: Subject 4.** Corrects out of date references and minor formatting errors. Adds a version history.

Table of Contents

Rule 66.53 Eligibility Requirements **5**

Examination Overview: Subject 4 ..... **6**
General Examining Objective 6
Knowledge Levels 6

Syllabus Layout **8**

Syllabus: Subject 4 (Aeroplanes 1) **9**

1 Theory of Flight **9**
Airflow 9
Icing 9
Aerofoils 9
Flight Stability 10

2 Aeroplane Structures **12**
General Structure 12
Fuselage, Doors, Nacelles, Engine Mounts and Landing Gear Attachment 12
Airframe Symmetry 13
Wings and Stabilisers 13
Inspection of Aeroplane Structure 14
Abnormal Flight or Ground Occurrences 15

3 Flight Control Surfaces **16**
Function and Construction 16

4 Flight Control Systems **17**
Types of Control System 17
Mechanical Control Components 17
Control Cable Systems 17
Control Chains 17
Typical Aeroplane Control System 18
Control System Maintenance 18

5 Hydraulics **20**
Hydraulic Pumps and Transfer Units 20
Hydraulic Power Supply – Basic System 20
Hydraulic Fluids and Seals 20
Hydraulic Lines and Fittings 21
Hydraulic System Maintenance 21

6 Landing Gear Systems **22**
Landing Gear Components and Operation 22
Landing Gear System Maintenance 22
Wheels, Tyres and Tubes 23
Aeroplane Brakes 24
Maintenance of Aeroplane Brakes 24

7 Fuel Systems **25**
Aviation Fuels 25
Fuel System Components 25
Fuel Tanks 25
Fuel System Maintenance 26

8 Heating and Ventilation **27**
Temperature Control and Air Distribution 27

9 Aeroplane Weight and Balance 28
Theory of Weight and Balance Control for Aeroplanes 28

10 Equipment and Furnishings 29
Emergency and Role Equipment 29

11 Ground Servicing 30
Aeroplane Inspection 30
Jacking and Levelling 30
Testing of Aeroplanes After Maintenance 30

Rule 66.53 Eligibility Requirements

Rule 66.53(a)(2) requires an applicant for an AMEL to have passed written examinations, that are acceptable to the Director, relevant to the duties and responsibilities of an aircraft maintenance engineer in the category of licence sought.

The written examinations acceptable to the Director for Subject 4 (Aeroplanes 1) should comply with the syllabus contained in this AC. Each examination will cover all topics and may sample any of the sub-topics.

The new syllabus has been developed after extensive industry consultation and the objectives reflect the knowledge required of current technology and international best work practice.

Examination Overview: Subject 4

The pass mark for Subject 4 (Aeroplanes 1) is 70%.

An application to sit an examination may be made directly to ASPEQ. Refer to https://caanz.aspeqexams.com/home for examination information.

General Examining Objective

The objective of the examination is to determine that the applicant for an AMEL has adequate knowledge of Subject 4 to permit the proper performance, supervision and certification of aircraft maintenance at a level commensurate with the privileges of the various AMEL categories.

Knowledge Levels

LEVEL 1: A familiarisation with the principal elements of the subject.

Objectives: The applicant should:

1. be familiar with the basic elements of the subject.
2. be able to give simple descriptions of the whole subject, using common words and examples.
3. be able to use typical terms.

LEVEL 2: A general knowledge of the theoretical and practical aspects of the subject.

An ability to apply the knowledge.

Objectives: The applicant should be able to:

1. understand the theoretical fundamentals of the subject.
2. give a general description of the subject using, as appropriate, typical examples.
3. use mathematical formulae in conjunction with physical laws describing the subject.
4. read and understand sketches, drawings and schematics describing the subject.
5. apply his/her knowledge in a practical manner using detailed procedures.

LEVEL 3: A detailed knowledge of the theoretical and practical aspects of the subject.

A capacity to combine and apply the separate elements of knowledge in a logical and comprehensive manner.

Objectives: The applicant should:

1. know the theory of the subject and the interrelationships with other subjects.
2. be able to give a detailed description of the subject using theoretical fundamentals and specific examples.
3. understand and be able to use mathematical formulae related to the subject.
4. be able to read, understand and prepare sketches, simple drawings and schematics describing the subject.
5. be able to apply his/her knowledge in a practical manner using manufacturer's instructions.
6. be able to interpret results and measurements from various sources and apply corrective action where appropriate.

***Note**: From October 2023, to add a new rating to your LAME licence, you can apply online for this through **MyAviation**, CAA's online portal for licensing requests, instead of filling in paper forms. Click the 'Online services' button on the CAA home page to get started.*

Recommended Study Material

The publication list below provides guidance material for suitable study references for the overall syllabus content. However, applicants may have to conduct further research using other references or sources (including the internet) or attend a formal course in order to gain a comprehensive understanding of all sub-topics in the syllabus.

Where applicable, publication references have been placed below each main topic or sub-topic heading in this syllabus.

Publication List

Study Ref	Book Title	Author	ISBN
1	A & P Technician General Textbook	Jeppesen	0-88487-203-3
2	A & P Technician Airframe Textbook	Jeppesen	0-88487-331-5
3	Aviation Maintenance Technicians Series - General	Dale Crane	1-56027-422-0
4	Aviation Maintenance Technicians Series, Airframe - Volumes 1 Structure & 2 Systems	Dale Crane	1-56027-339-9 1-56027-340-2
5	FAA AC43.13-B: Acceptable Methods, Techniques and Practices Aircraft Inspection and Repair. See: FAA website	FAA	0-89100-306-1
6	Mechanics of Flight	A.C. Kermode	978-1-4058-2359-3
7	Aeroplane Weight and Balance	Jeppesen	0-89100-096-8
8	Aeroplane Hydraulic Systems	Jeppesen	0-89100-058-5
9	Dictionary of Aeronautical Terms	Dale Crane	1-56027-287-2

Syllabus Layout

Topic Numbering – left hand column

The syllabus is set out by topics, each of which is identified by a single-digit number. Each topic is divided into a number of sub-topics, which are identified by two-digit numbers: the first and second digits of which refer to the topic and the sub-topic respectively.

Each sub-topic is further sub-divided into one or more sub-sub-topics, which are identified by three-digit numbers. Where applicable, sub-sub-topics may be further subdivided into paragraphs that are identified by four/five-digit alphanumeric sequences.

The three-digit sub-sub-topic numbers shown in the left hand column are used in the 'knowledge deficiency reports' to provide feedback on individual examinations.

Objective description – middle column

The middle column objectively describes each sub-sub-topic by stating, in plain language, its subject matter and the type of performance or activity required. The objectives are intended to be simple, unambiguous, and clearly-focussed outcomes to aid learning.

Knowledge levels – right-hand column

The right-hand column specifies the knowledge level for each sub-topic heading. The three levels of knowledge used in this syllabus are described above. Note that the knowledge levels indicate the depth of knowledge required NOT its safety importance.

Syllabus: Subject 4 (Aeroplanes 1)

1	**Theory of Flight**	
1.1	**Airflow** *Study Ref. 1,4 & 6*	
1.1.1	Describe airflow in relation to a body at rest or in motion.	2
1.1.2	Define and explain the following terms as they affect an aeroplane in flight: a. Airflow over an aerofoil and around a fuselage structure b. Boundary layer c. Free stream flow d. Laminar and turbulent flow e. Relative flow f. Stagnation g. Up-wash and down-wash h. Vortices.	2
1.2	**Icing** *Study Ref. 1 & 4*	
1.2.1	Specify the aerodynamic effects of ice, snow and frost on an aeroplane both on the ground and in flight.	2
1.3	**Aerofoils** *Study Ref. 1, 4 & 6*	
1.3.1	Describe the basic operation of an aerofoil section when subjected to laminar and turbulent airflows.	1
1.3.2	Describe the "flat plate effect" on an object in an air stream.	1
1.3.3	Specify the effects of changes in the following: a. Angle of attack on the pressure distribution around an aerofoil b. Angle of attack on centre of pressure movement c. Fineness ratio d. Wing shape and aspect ratio e. Airspeed on the lift of an aerofoil f. Induced drag and speed.	2
1.3.4	Describe the relationships between lift, weight, thrust and drag and the factors affecting these relationships.	2
1.3.5	Explain the following terms, their interaction with related forces, and their effects on the flight characteristics of an aeroplane: a. Camber b. Chord and chord line c. Mean aerodynamic chord (MAC) d. Angle of attack e. Lift coefficient f. Drag coefficient g. Shape of an aerofoil h. Wing area i. Induced drag (cause and effects) j. Profile/parasite drag (cause and effects)	2

	k. Centre of pressure l. Centre of gravity m. Angle of incidence n. Axes of an aeroplane (longitudinal, lateral and vertical) o. Stability and control p. Wash-in/wash-out q. Glide ratio r. Steady state flight s. Aspect ratio t. Performance u. Theory of the turn v. Lift augmentation w. Load factor x. Flight envelope y. Structural limitations VNE, VA, VNO, and VFE.	
1.3.6	State the centre of gravity expressed as a percentage of mean aerodynamic chord. (MAC)	2
1.3.7	Define the following terms as they relate to an aeroplane in flight: a. Centrifugal and centripetal force b. Gravitational force c. Sideslip d. Skidding e. Stall f. Wing loading.	2
1.3.8	Specify the effects on wing loading and stalling speed of changes in the following criteria: a. Angle of attack b. Angle of bank c. Thrust, weight, aerodynamic resultant d. Wing area.	3
1.3.9	Define the following terms and relate them to aeroplane operation: a. Ground speed (GS) b. True air speed (TAS) c. Indicated air speed (IAS).	1
1.3.10	Describe how lift and drag are generated with particular reference to angle of attack, lift coefficient, drag coefficient, and stall.	2
1.3.11	State the purpose and operation of a basic angle of attack indicator/detector.	1
1.4	**Flight Stability** *Study Ref. 1, 4 & 6*	
1.4.1	Define the following factors and describe how they relate to aeroplane design and performance: a. Anhedral b. Dihedral c. Longitudinal dihedral d. Sweepback e. Taper.	2
1.4.2	Specify the effects of angle of incidence on stability.	2
1.4.3	Define the following conditions and describe their effects on aeroplane performance: a. Asymmetric power/thrust b. Directional stability	2

	c. Dynamic stability d. Gyroscopic effect e. Lateral stability f. Longitudinal stability g. Slipstream h. Static stability i. Propeller torque effect.	
1.4.4	Describe stability in straight and level, climbing and gliding turns.	2
1.4.5	Describe the forces acting on an aeroplane in all flight configurations.	2
1.4.6	In relation to longitudinal, lateral, and directional stability, state the aeroplane axis about which these factors apply and the aeroplane structural features that provide stability about that axis.	2
1.4.7	Specify the effects on aeroplane stability/balance of trim tab movement on each of the primary control surfaces.	2
1.4.8	Describe flutter and the maintenance activities required to eliminate flutter from within the aeroplane's normal flight envelope.	2
1.4.9	Describe Dutch roll and pitch-up and state the methods used to control these conditions.	1

2	**Aeroplane Structures**	
	ATA 51, 52, 53, 55, 57	
2.1	**General Structure**	
	Study Ref. 2 & 4	
2.1.1	Define the following terms and relate them to metal aeroplane structure: a. Beam b. Bending c. Compression d. Fatigue life e. Fatigue strength f. Stress riser g. Shear h. Strain i. Stress j. Strut k. Tension l. Tie m. Torsion n. Rigidity o. Strength.	2
2.1.2	Identify load paths in wing, fuselage and empennage structure.	2
2.1.3	Identify structural defects that may occur in an aeroplane when subject to the above forces. Describe the source of each force.	2
2.1.4	Define with examples, primary, secondary and tertiary structural classifications.	2
2.1.5	Define “fail safe” structure. From given information identify methods of “fail safe” design as applied to aeroplane structure.	1
2.1.6	Define the concept of damage tolerance.	1
2.1.7	Identify airworthiness requirements for structural strength and strength to weight ratio.	2
2.1.8	Describe typical information found in structural repair manuals.	2
2.1.9	Specify methods of structural reinforcement including the design of simple repair schemes or modifications to restore or improve original strength.	2
2.1.10	Describe common structural assembly and disassembly techniques and processes.	2
2.2	**Fuselage, Doors, Nacelles, Engine Mounts and Landing Gear Attachment**	
	Study Ref. 2 & 4	
2.2.1	Specify the following types of fuselage design stating the advantages and disadvantages of each: a. Monocoque b. Semi-monocoque c. Truss. (Pratt truss and Warren truss) d. Tubular steel.	2
2.2.2	Describe the general constructional features of the above types of structure and identify load-carrying members.	2
2.2.3	Identify the propulsive stresses acting on an engine mount assembly.	2

2.2.4	Describe general constructional and maintenance features relating to the following: a. Doors b. Door operating mechanisms c. Door safety devices d. Engine nacelles e. Engine firewalls f. Floors g. Radomes h. Fairings i. Drains and vents j. Wing, empennage and engine attachment k. Undercarriage attachment l. Bulkheads m. Diaphragms n. Doublers o. Beams p. Seats, seat rails and seat operating/locking mechanisms q. Formers r. Stringers s. Longerons t. Frames.	2
2.2.5	Describe the drainage and ventilation provisions used to control moisture within the structure of an aeroplane.	2
2.3	**Airframe Symmetry**	
	Study Ref. 2 & 4	
2.3.1	Define the following terms: a. Cabane struts b. Decalage c. Interplane struts d. Rigging position e. Stagger.	1
2.3.2	Specify the methods used to make the following alignment and symmetry checks: a. Complete airframe for symmetry b. Fuselage for twist and bending c. Vertical stabiliser for alignment d. Wings and horizontal stabilisers for dihedral and incidence.	2
2.4	**Wings and Stabilisers**	
	Study Ref. 2	
2.4.1	Describe the following forms of wing and stabiliser construction stating the advantages and disadvantages of each: a. Monospar b. Multi-spar c. Box beam d. Conventional skin e. Milled planks.	2
2.4.2	Describe of the following types of aeroplane wing and stabiliser arrangement, where each is typically used, and their respective advantages and disadvantages: a. High wing b. Low wing c. Bi-plane	1

	d. Cantilever wing e. Braced wing using upper or lower struts f. Truss-type wings.	
2.4.3	Identify the best wing design to minimise induced drag.	2
2.4.4	Specify the effects of a concave wing under surface.	1
2.4.5	Identify the following components of a wing and describe their application to the structural integrity and flight performance of an aeroplane: a. Ribs, nose ribs b. Wing butt ribs c. Struts d. Single spar e. Multi-spar f. "I" Beam wing spar construction g. Drag wires and anti-drag wires h. Tie rods i. Stall strips j. Stringers k. Stressed skin l. Leading edges m. Trailing edges n. Wing tips.	2
2.4.6	State why it is normal to have thick spar caps and thin webs.	2
2.4.7	Specify structural bonding techniques and practices including the advantages, disadvantages and where such assembly processes would commonly be employed.	1
2.4.8	Describe the construction and sealing of "wet" wings (integral fuel tanks).	2
2.4.9	Describe the construction, function and aerodynamic effects of the following structure: a. Vertical stabiliser (fin) b. Horizontal stabiliser (tail plane) c. Winglets and modified tips d. Canards e. Foreplanes.	2
2.4.10	Describe general constructional features of primary and secondary control surfaces.	2
2.4.11	Describe the attachment of control surfaces and lift/drag devices.	2
2.4.12	Define the principle of "Load Alleviation".	2
2.4.13	Identify load paths within the various types of wing structure.	2
2.4.14	State how wing dihedral would be measured in practice.	2
2.4.15	Identify the criteria for vertical stabiliser alignment on a single engine aeroplane.	2
2.5	**Inspection of Aeroplane Structure**	
	Study Ref. 2 & 4	
2.5.1	Define the following terms used to determine the location of components on, within or around aeroplanes: a. Datum	2

	b. Butt or buttock lines c. Fuselage stations d. Water lines e. Wing stations f. Zones g. Aileron stations h. Flap stations i. Nacelle stations j. Horizontal and vertical stabiliser stations k. Powerplant stations l. Propeller stations.	
2.5.2	Describe the ATA-100 zoning system used to identify aeroplane component locations and access points.	2
2.5.3	State the factors to be considered when inspecting structures and developing rectification procedures for wear, damage and deterioration.	2
2.5.4	Describe ageing, fatigue and corrosion control programmes.	2
2.5.5	Identify the NDT programmes best suited to inspection of the various aeroplane structural components.	1
2.6	**Abnormal Flight or Ground Occurrences**	
	Study Ref. 2 & 4	
2.6.1	During abnormal flight conditions of an aeroplane, identify areas of high structural stress concentration and the adverse effects such loads could have on structural integrity.	2
2.6.2	Identify visual cues and inspection techniques appropriate to structural damage resulting from the following events: a. Flight or ground overloads such as flight through turbulence, heavy landings, taxiing or ground handling incidents b. High winds on the ground (effects on flight controls and control surfaces) c. Structural failure of adjacent members d. Lightning strikes e. Bird strikes f. Operation in extreme climatic, sandy, or other adverse conditions.	1
2.6.3	Specify the methods used to protect structure in the event of a lightning strike.	1
2.6.4	Specify common decontamination methods relating particularly to salt, sand, dust, fuel, oil, hydraulic fluids, common chemicals, mercury, water/moisture, birds and rodents.	1
2.6.5	Describe the classifications of damage and the repair or maintenance implications applicable to each.	1

3	Flight Control Surfaces	
	ATA 27	
3.1	**Function and Construction**	
	Study Ref. 2, 4 & 6	
3.1.1	Describe general constructional features of primary and auxiliary control surfaces.	2
3.1.2	Define the primary and secondary control groupings.	1
3.1.3	Specify the function, operating principles and effects on aeroplane performance of the following flight control components or assemblies: a. Ailerons and spoilers (roll control) b. Friese ailerons (and their balance features) c. Elevators and stabilators (pitch control) d. Rudders (yaw control) e. Elevons and ruddervators (two axis control) f. Common types of flaps; plain, split, slotted, Krueger and fowler g. Slotted trailing edge flaps h. Flapperons i. Leading edge flaps, slats and slots j. Balance (lagging) and anti-balance (leading) tabs k. Aerodynamic balance panels l. Bob weights m. Control surface bias using springs and fixed tabs in the control system n. Define aerodynamic balancing.	2
3.1.4	State the purpose and operation of flaps and the various flap operating systems and mechanisms.	2
3.1.5	State the purpose and operation of differential ailerons.	2
3.1.6	Describe the methods of control surface attachment to the aeroplane structure.	2
3.1.7	Specify the operation and effect of trim tabs, servo tabs and spring tabs particularly in regard to the relationship of tab and control surface movement. (Applies to tabs fitted to all control surfaces).	2
3.1.8	Describe the forms of aerodynamic balance including, overhang, Handley-Page and Friese.	2
3.1.9	Specify the principles of operation of simple stall protection systems.	2

4	Flight Control Systems	
	ATA 27	
4.1	**Types of Control System**	
	Study Ref. 2 & 4	
4.1.1	Describe the common types of systems including cables, push-pull rods, torque arms and torque tubes.	2
4.2	**Mechanical Control Components**	
	Study Ref. 2, 4 & 5	
4.2.1	Describe the following components, their purpose, function, and where applicable, adjustment procedures: a. Push-pull rods and their end fittings b. Bellcranks c. Levers d. Torque arms and torque tubes e. Primary and secondary control stops f. Cockpit control stops g. Fire and vapour seals for control systems h. Universal joints i. Quadrants j. Internal/external control locks and gust locks.	2
4.3	**Control Cable Systems**	
	Study Ref. 2, 4 & 5	
4.3.1	Describe the following components, their construction, function, identification, installation, safety locking, inspection and maintenance: a. Automatic cable tensioning devices b. Cables and strand arrangements c. Cable fittings and attachment methods d. Cable quick disconnect devices e. Spring connectors f. Cable guards g. Turnbuckles h. Fairleads and guides i. Pulleys j. Bowden cables and flexible shaft control systems.	2
4.3.2	Describe the means and limitations relating to achieving control cable directional changes.	2
4.3.3	Specify the effects of temperature variation on control cable tension in an all-metal aeroplane.	2
4.3.4	State how slippage of flight control cable swaged terminal fittings is detected.	2
4.3.5	Compare the advantages of “Lockclad” cables over conventional cables.	1
4.4	**Control Chains**	
	Study Ref. 4	
4.4.1	Describe the applications, constructional features, and dimensional terms with respect to control chains.	1

4.4.2	State the physical features of chain installations that provide correct running in endless and terminating chains, protection against incorrect assembly, and jamming on sprocket teeth.	2
4.4.3	Specify the methods used to assess wear and distortion of chains and sprockets. State how elongation of chains is assessed. Describe the corrosion protection and storage requirements of chains.	2
4.5	**Typical Aeroplane Control System**	
	Study Ref 2 & 4	
4.5.1	From given information, describe the following: a. Layout of a typical mechanical and hydraulic power operated flight control system b. The layout, coupling and principles of operation of a simple automatic pilot in a light aeroplane control system c. Procedures for rigging a typical control system for freedom, correct range of movement and correct cable tension.	2
4.6	**Control System Maintenance**	
	Study Ref. 2, 4 & 5	
4.6.1	State why control surface balancing is required.	2
4.6.2	State typical causes of control surface vibration, roughness or misalignment.	2
4.6.3	Specify the methods used to statically and aerodynamically balance control surfaces including the meaning of final flight configuration.	2
4.6.4	Describe underbalance, overbalance and neutral balance.	2
4.6.5	Describe typical types, locations and attachments of balance weights.	2
4.6.6	Show calculations relating to the balance of control surfaces to correct for a control imbalance following repair or repaint.	2
4.6.7	Describe typical control cable defects and how light corrosion would normally be removed off flight control cables. (Also includes checking a cable for broken or frayed strands).	2
4.6.8	State typical limits allowed for numbers of broken strands.	2
4.6.9	Identify and describe the correction of typical flying defects brought about by an incorrectly rigged wing, incorrectly rigged controls or defective flying control systems.	2
4.6.10	Specify the basic procedures and practices relating to the rigging of flight control systems including: a. the use of specialised tooling and rigging devices. b. control limits. c. angle of travel. d. range of movement. e. overtravel. f. springback. g. adjustment of control stops. h. safety locking of components. i. cable tension compensating for temperature using charts and tables.	2
4.6.11	State the purpose of aileron droop.	2

4.6.12	Describe the correct assembly, locking, adjustment and safety indication of push-pull control rods.	3
4.6.13	Identify defects in control rod assemblies including their bearings.	2
4.6.14	Specify the method of roller peening bearings in control rod assemblies and state the correct method of assembling control rods and attaching hardware.	2
4.6.15	Identify standards for control rod/cable clearances between fluid lines, electrical wiring and aeroplane structure/hardware.	2
4.6.16	Identify limits for the use of fairleads, cable guides, pulleys and bellcranks.	2
4.6.17	Describe the inspection and maintenance requirements, including corrosion and wear limits, for the following components: a. Cables b. Cable fittings c. Cable guards d. Fairleads e. Pulleys.	2
4.6.18	From given information on a control system, be able to: a. perform faultfinding. b. identify components. c. state inspection requirements. d. specify the reaction from a given control input.	2
4.6.19	Detail the requirements for a duplicate inspection of flying controls with particular respect to the following: a. By definition, know what constitutes a control system that would require a duplicate inspection b. Selection and training of persons to perform second inspections c. Determining the extent of the inspection d. Determining correct assembly, functioning, sense, freedom of operation and locking of all control systems on an aeroplane.	2

5	Hydraulics	
	ATA 29	
5.1	**Hydraulic Pumps and Transfer Units**	
	Study Ref. 2, 4 & 8	
5.1.1	Describe the construction and principles of operation of typical hand and engine powered hydraulic pumps found on light aeroplane.	2
5.2	**Hydraulic Power Supply – Basic System**	
	Study Ref. 2, 4 & 8	
5.2.1	Specify the operating principles, function, system location and interrelationship of the following hydraulic system components: a. Accumulators b. Bypass or off-loading valves c. Check valves d. Cut out valves e. Filters, micronic filters, filter maintenance and filter blockage indicators f. Pumps, fixed and variable delivery. g. Emergency hand pumps h. Reducing valves i. Regulating valves and system adjustment for both fixed and variable delivery pumps j. Relief valves k. Reservoirs and associated components l. Quick disconnect valves m. Actuating cylinders n. Selector valves o. Sequencing valves p. Undercarriage free-fall valves q. The shear section in a hydraulic pump drive.	2
5.3	**Hydraulic Fluids and Seals**	
	Study Ref. 2, 4 & 8	
5.3.1	Describe the generic requirements, desirable properties, composition, characteristics, precautions, seal compatibility and MIL specification of the following types of hydraulic fluids: a. Phosphate ester b. Mineral.	2
5.3.2	Identify the above types of hydraulic fluid by their physical colour.	2
5.3.3	With respect to aeroplane hydraulic fluids, describe the following criteria: a. Health and handling b. Foreign material contamination and contamination checks c. Compatibility with aeroplane materials d. Viscosity e. Chemical stability f. Flash point g. Fire point h. Intermixing with other types of fluid and action to be taken if different types of fluid are inadvertently mixed i. Cause and effects of fluid foaming j. Cause and effects of cavitation k. Cause and effects of line hammering.	2

5.3.4	Identify the seal materials that are compatible with the various types of hydraulic fluid in common aeroplane use.	2
5.3.5	Identify the types (shapes) of common hydraulic seals found in aeroplanes and describe the purpose, advantages, disadvantages and limitations of each.	2
5.3.6	Explain the principles relating to seal operation.	2
5.3.7	Describe seal maintenance practices, including storage life of seals.	2
5.3.8	Identify tools used for seal removal and installation.	2
5.4	**Hydraulic Lines and Fittings**	
	Study Ref. 1, 4 & 8	
5.4.1	Identify flexible hoses to determine pressure range, material of construction, and fluid compatibility.	2
5.4.2	State what identification information is printed on hoses.	2
5.4.3	Identify by name and state the uses of tube and hose end fittings and their component parts.	2
5.4.4	Specify the procedures, equipment used, and precautions to be observed when fabricating rigid and flexible fluid lines for use in aeroplanes.	2
5.4.5	Describe serviceability checks on rigid and flexible fluid lines.	2
5.4.6	Describe the life limitations and test requirements for flexible hose assemblies.	2
5.5	**Hydraulic System Maintenance**	
	Study Ref. 1, 4 & 8	
5.5.1	Specify common operating defects in hydraulic systems including pressure fluctuations, fluid degradation, common leakage points and filter blockages.	2
5.5.2	Outline general system maintenance practices.	1
5.5.3	Specify the effects of low accumulator air pressure on hydraulic system operation and how air is prevented from entering the fluid system in an accumulator.	2
5.5.4	Specify the effects of low hydraulic pressure on the operation of systems such as flaps and undercarriage.	2
5.5.5	State the precautions when removing or maintaining hydraulic accumulators.	2

6	**Landing Gear Systems**	
	ATA 32	
6.1	**Landing Gear Components and Operation**	
	Study Ref. 2 & 4	
6.1.1	Describe the constructional features, operating principles functions, and maintenance procedures relating to the following landings gear components and devices: a. Actuating cylinders b. Air-oil struts c. Metering pins d. Extension limiting devices e. Sequencing valves f. Drag braces g. Floats and skis h. Flat, solid or leaf spring legs i. Safety devices and indicators including safety switches and locks j. Shimmy and steer dampers k. Shock or bungee cords l. Spring steel struts m. Spring-oleo struts n. Nose and main when types. o. Tail wheel and tailskid assemblies p. Torque links q. Trunnion assembly r. Steering and castoring devices s. Undercarriage locking devices t. Attachment and retraction methods u. Airborne towing and release devices v. Ground towing equipment and attachment mechanisms w. Chocks and ground locks.	2
6.1.2	Specify the function of components, and principles of operation of the following: a. Fixed landing gear b. Retractable landing gear c. Emergency landing gear extension systems d. Nose wheel steering and steer dampers e. Electrical position indicating systems.	1
6.1.3	Define the terms “limit inertia vertical load factor” and “energy dissipation rate”.	1
6.2	**Landing Gear System Maintenance**	
	Study Ref. 2 & 4	
6.2.1	Determine the rectification of common faults in landing gear systems or specific landing gear components, including the interface with electrical and emergency systems.	2
6.2.2	Specify common procedures for servicing a landing gear shock strut including, replenishment, air charging, bleeding, establishing the correct fluid level and the requirement for extension and compression during replenishment.	2
6.2.3	Illustrate how rapid extension of an oleo is prevented during a bounce after landing impact.	2

6.2.4	Describe a typical retraction test after undercarriage servicing. This should include the following activities: a. Positioning the aeroplane b. Safety placards c. Power supplies d. Checking and adjusting safety devices/switches e. Retraction and extension sequencing and timing f. Checking door clearances and sequencing g. Travel and locking h. Adjustments i. Control operation and cockpit indication j. Alignment.	1
6.2.5	Determine typical landing gear system faults from wiring diagrams.	2
6.3	**Wheels, Tyres and Tubes** *Study Ref. 2 & 4*	
6.3.1	Describe the construction of new and retreaded aeroplane tyres, identify them by their markings, and state their applications.	2
6.3.2	Describe the following factors in respect of aircraft tyres: a. Types of tread pattern b. Tyre size classification c. Tyre construction d. Speed limits e. Identification and markings f. Pressures g. Valves h. Safety devices i. Inflation j. Inspection and maintenance practices.	2
6.3.3	Describe the various types of wheel assembly used on aeroplane, and state their application.	2
6.3.4	Describe the types of wheel componentry including bearings, grease and dust seals, spacers and locking devices.	2
6.3.5	Specify typical procedures for wheel bearing servicing and adjustment.	1
6.3.6	State how sealing is accomplished on split half wheel assemblies.	2
6.3.7	Specify the procedures and precautions to be observed during the fitment, deflation/inflation and balancing of wheel, tyre and tube assemblies.	2
6.3.8	State the purpose of vent holes in tubeless aeroplane tyres.	2
6.3.9	Explain the use of balance and slip marks and why the valve is located in a particular position relative to the tyre.	2
6.3.10	Determine faults and damage to tyres, including such things as uneven wear and creep.	2

6.3.11	Describe the common maintenance practices associated with the following: a. Nose wheel shimmy damping b. Toe-in c. Toe-out d. Camber (positive and negative),	2
6.3.12	Specify the handling and storage procedures associated with tyres and tubes.	2
6.4	**Aeroplane Brakes** *Study Ref. 2 & 4*	
6.4.1	Describe the construction, function and operation of the following basic braking systems: a. Disc brakes (single) b. Master cylinders c. Compensator valves d. Park brakes e. Single and dual-servo brakes f. Drum brakes.	2
6.4.2	State how pad pressure is equalised on single disk brakes.	2
6.4.3	Specify the cause, effects, and rectification of common brake faults including deterioration of brake hoses.	2
6.4.4	Specify common heat dissipation methods in simple aircraft braking systems.	2
6.5	**Maintenance of Aeroplane Brakes** *Study Ref. 2 & 4*	
6.5.1	Describe in general terms the following brake maintenance activities on light aeroplane: a. Bleeding b. Adjusting c. Checking pads for wear d. Oil decontamination e. Deglazing f. Checking discs for buckling, cracks, scoring and wear g. Rectification of; brake binding, uneven wear, slipping, leaking seals and uneven braking effect h. Equalisation of pad/disc pressures.	2

7	Fuel Systems	
	ATA 28	
7.1	**Aviation Fuels** *Study Ref. 2 & 4*	
7.1.1	Describe the following: a. Types, properties and applications of aviation fuels b. Fuel colour coding c. Fuel storage d. Common causes of fuel contamination e. Quality control of fuel including water testing procedures, proprietary test products and test equipment f. Storage life and fuel deterioration g. Fuel dispensers including hydrants, bowsers and hand pumps h. Pressure refuelling precautions i. Refuelling procedures including electrostatic bonding j. Reuse of drained or decanted fuel k. Disposal of fuel l. Drum refuelling precautions m. Fuel compatibility with seals n. Common sources of fuel system contamination o. Preventing/ rectifying fuel system contamination p. Fuel dispenser filtration devices q. Fuel-specific gravity r. Useable and unusable fuel.	2
7.2	**Fuel System Components** *Study Ref. 2 & 4*	
7.2.1	Describe the construction, operation, function, inspection and maintenance of the following fuel system components: a. Filters b. Fuel heaters c. Primers d. Fuel pumps (rotary vane and gear) e. Pumps - auxiliary/booster/ejector/jet f. Strainers g. Tanks (rigid, flexible, integral) cells and associated hardware h. Fuel tank scuppers and baffle plates i. Check valves, non-return valves, flapper valves and cocks j. Fuel pipes and hose assemblies k. Drains, water drains, sumps, and stack/stand pipes l. Flow meters m. Contents/pressure indicating and warning systems n. Cross feed, transfer and dump devices and systems o. Refuelling, defuelling and dump valves p. Fuel tank venting systems.	2
7.3	**Fuel Tanks** *Study Ref. 2 & 4*	

7.3.1	Describe the construction, operation and maintenance of the following types of fuel tanks: a. Integral fuel tanks b. Detachable fuel tanks c. Internal/external fuel tanks d. Bladder fuel cells.	2
7.4	**Fuel System Maintenance** *Study Ref. 2 & 4*	
7.4.1	From given information, identify the location and state the relationship of basic fuel system and cross feed system components for a typical fuel system supplying piston and gas turbine-engine aeroplane. Includes the electrical and instrument interfaces.	2
7.4.2	Describe the following maintenance activities: a. Fuel flow checks b. Fuel transfer checks c. Fuel system and dip stick calibration d. Fuel system decontamination e. Fuel tank/system leak testing and sealing, both internal and external f. Rectification of asymmetric fuel feeding g. Identification marking of fuel lines.	2
7.4.3	Explain why the airspaces are interconnected on gravity feed fuel tanks.	3
7.4.4	Describe the operation (electrical and mechanical) of a typical fuel system when feeding an engine and transferring fuel between tanks.	2
7.4.5	Describe the operation of a jet pump in an aeroplane fuel tank.	2
7.4.6	State the reasons a jet pump is used in lieu of an electrical or mechanical driven pump.	1
7.4.7	From given information, describe the effects on engine operation of faults in fuel supply system components.	1
7.4.8	Describe how vapour is removed from the fuel in a centrifugal booster pump.	2
7.4.9	Explain the safety precautions when working inside an aeroplane fuel tank. Includes breathing apparatus, lighting, vapour decontamination, safety lookouts and use of mechanical and electrical tools.	3
7.4.10	Describe the construction, maintenance and installation of bladder type fuel cells and their supporting hardware.	2

8	Heating and Ventilation	
	ATA 21	
8.1	**Temperature Control and Air Distribution** *Study Ref. 2 & 4*	
8.1.1	Specify the principles of operation, system layout, maintenance requirements and safety precautions relating to the following: a. Ventilation/circulation systems including the purpose of ventilating air b. Exhaust heat exchangers and exhaust gas cabin heating systems c. Combustion heaters (Example Janitrol) d. Valves (including air/fire valves), ducts and controls e. Expansion bellows and supports f. Vapour wick pre-heater elements g. Thermal cut-outs and glow plugs h. Electrical heaters i. Temperature control equipment.	2
8.1.2	Specify the essential requirements for the operation of a combustion heater.	2

9	Aeroplane Weight and Balance	
	ATA 8	
9.1	**Theory of Weight and Balance Control for Aeroplanes** *Study Ref. 2, 4 & 7*	
9.1.1	Describe the meaning and application of the following weight and balance terms and show appropriate calculations where required: a. Centre of gravity (CG) b. Aeroplane weight, total weight and empty weight c. Theory of weight and balance d. Weight limitations e. ~~Mean aerodynamic chord (~~MAC~~)~~ f. CG design limits g. Aeroplane loading aspects h. Aeroplane operating weight i. Overloaded aeroplane j. Empty weight CG range k. Useful load and loading for unaffected C of G l. Arm m. Datum/reference datum n. Main wheel centreline o. Moments (positive and negative) and total moment. Includes calculation of the moment of an item about the datum p. Total moment q. Aeroplane weighing configuration r. Weighing points s. Minimum fuel requirements t. Zero fuel weight u. Unusable fuel and oil v. Ballast w. Shifting weight x. Adverse-loaded CG y. Forward/rearward adverse-loading check z. Extreme condition check aa. Maximum gross weight check bb. Maximum takeoff weight cc. Maximum landing weight dd. Ramp weight ee. Tare weight ff. Fluid levels gg. Installed equipment.	2
9.1.2	Apply the formulae for making weight and balance calculations as follows: a. Calculation of ballast required to shift C of G by a specified amount b. Location of C of G for nose and tail wheel aeroplanes c. Empty weight changes d. Percentage of MAC e. Calculation of moments f. Shifting weight g. Addition and removal of equipment or ballast.	2

10	Equipment and Furnishings	
	ATA 25	
10.1	**Emergency and Role Equipment**	
	Study Ref 2, 4 & 5	
10.1.1	Specify the principles of operation, precautions, installation and maintenance requirements for the following equipment and furnishings: a. Life jackets b. Life rafts, dinghies and slides c. First aid kits and crash axes d. Emergency floatation equipment e. Portable fire extinguishers f. Emergency locator transmitters g. Cargo handling and retention devices h. Seats, seatbelts, harnesses (passengers and crew) i. Fire and smoke detection and warning systems j. Fire extinguisher squibs and pyrotechnics k. Floats, skis, panniers and stretchers l. Loud hailers.	1

11	Ground Servicing	
	ATA 5 & 7	
11.1	**Aeroplane Inspection**	
	Study Ref. 2 & 4	
11.1.1	Describe the various routine and special servicings commonly performed on aeroplane and define associated terms.	2
11.1.2	Describe lifting of components.	2
11.2	**Jacking and Levelling**	
	Study Ref. 2 & 4	
11.2.1	Explain the following criteria in regard to jacking and levelling an aeroplane: a. Jacking points b. Jacking procedures c. Maintenance of jacks d. Use of levelling equipment e. Identification of levelling points f. Levelling to the flying position.	2
11.3	**Testing of Aeroplanes After Maintenance**	
11.3.1	Specify the requirements for ground and flight-testing of aeroplanes.	1