Advisory Circular
AC66-2.2

Revision 1 (3)

05 February 2017

Aircraft Maintenance Engineer Licence - Examination Subject 2 Aircraft Engineering Knowledge

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** with the associated rule.

An acceptable means of compliance 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** to facilitate compliance with the rule requirements. Guidance material must not be regarded as an acceptable means of compliance.

This advisory circular is intended to be read in conjunction with Part 66 Subpart B of the rule. If there are any conflicts between the advisory circular and the rule, the rule takes precedence.

Purpose

This advisory circular provides an acceptable means of compliance for the syllabus content in respect of written examinations for Subject 2 (Aircraft Engineering Knowledge).

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

Related Rules

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

Change Notice

Subject to "Memorandum for Technical Cooperation" between the CAA of Mongolia and New Zealand on mutual cooperation in implementation of the International Civil Aviation Organization Resolution of Global Rule Harmonization, which urges States to promote global harmonization of national rules, dated 6th of May, 1999, Mongolian Civil Aviation Safety Regulation has been reconciled to the Civil Aviation Regulation of New Zealand.

Amendment 164 of Annex 1 to the Chicago Convention on International Civil Aviation urges flight crew members, ATC personnel and aircraft maintenance engineers to comply with the language proficiency requirements; and

Under Article 14 of the Civil Aviation Law of Mongolia 1999, "Use of foreign language in civil aviation" the AC has been released in English version only, in order to prevent any mistranslation and misuse of the aviation safety related documents.

Table of Contents

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 2 (Aircraft Engineering Knowledge) should comply with the syllabus contained in this advisory circular. 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 2

The pass mark for Subject 2 (Aircraft Engineering Knowledge) is 70%.

Application to sit an examination may be made directly to PEL office.

General Examining Objective

The objective of the examination is to determine that the applicant for an AMEL has adequate knowledge of Subject 2 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:

1. be able to understand the theoretical fundamentals of the subject.
2. be able to give a general description of the subject using, as appropriate, typical examples.
3. be able to use mathematical formulae in conjunction with physical laws describing the subject.
4. be able to read and understand sketches, drawings and schematics describing the subject.
5. be able to 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.

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	Aviation Maintenance Technicians Series - General	Dale Crane	1-56027-422-0
3	A & P Technician Airframe Textbook	Jeppesen	0-88487-205-1
4	Aviation Maintenance Technicians Series, Airframe - Volumes 1 Structures & 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	Standard Aircraft Handbook	Larry Reithmaier	0-07-134836-0
7	Dictionary of Aeronautical Terms	Dale Crane	1-56027-287-2
8	Aircraft Structural Technician	Dale Hurst	0-9708109-0-3

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 2 (Aircraft Engineering Knowledge)

1	**Aircraft Drawings**	
1.1	**Drawing Interpretation** ***Study Ref. 1 &. 2***	
1.1.1	Describe the following diagrams/drawings, a. Detail, assembly and installation drawings b. Electrical wiring diagrams c. Logic flowcharts used in trouble shooting d. Oblique, isometric and orthographic presentations e. Schematic diagrams f. Pictorial diagrams g. Electrical wire charts h. Pie charts, bar graphs, pictographs and broken line graphs i. Patterns with metric or inch dimensions	1
1.1.2	Given examples, interpret information contained in diagrams/drawings listed in 1.1.1.	2
1.1.3	State where each of the diagrams/drawings listed in 1.1.1 could be found in an aeronautical application.	1
1.1.4	State any advantages and disadvantages of the diagrams/drawings listed in 1.1.1.	2
1.2	**Working Drawings** ***Study Ref. 2***	
1.2.1	Describe the following working drawings a. Detail Drawing b. Assembly drawing c. Installation drawing d. Perspective drawings e. Block diagrams f. Blue prints	1
1.2.2	Specify where each of the working drawings listed above is used.	1
1.3	**Sectional Drawings** ***Study Ref. 2***	
1.3.1	Describe the following sectional drawings: a. Revolved section b. Removed section c. Complete section d. Half section	1
1.3.2	Specify where each of the sectional drawings listed above is used	1
1.3.3	Specify the purpose and uses of exploded-view drawings.	1
1.4	**Drawing Conventions - Lines** ***Study Ref. 1 & 2***	
1.4.1	Given an aircraft drawing, identify the following lines by style and thickness: a. Outline or visible lines b. Hidden lines c. Centre lines d. Extension lines e. Dimension lines f. Cutting-plane and viewing plane lines g. Phantom lines h. Short break lines i. Long break lines	1

	j. Leader lines k. Sectioning lines l. Break lines m. Stitch lines	
1.4.2	Describe the meaning of each of the lines listed above	1
1.5	**Drawing Information and Data Display** ***Study Ref. 1 & 2***	
1.5.1	Describe the following drawing features: a. Title block b. Title box c. Revision block d. Size e. Drawing or print number f. Universal numbering system g. Reference and dash numbers h. Scale and weight i. Page number j. Responsibility k. Standards l. Bill of materials m. Application revision block n. Notes o. Zone and station numbers p. Surface finish and finish marks q. Wing and fuselage station numbering r. Identification of paired parts. (e.g. two identical halves of an engine cowl) s. Assembly notation for bulkhead electrical connectors on a wiring diagram t. Standard paper sizes	1
1.5.2	Describe how each of the drawing features listed above may be presented on an aircraft drawing.	2
1.6	**Drawing Convention - Lettering, Numbering, Dimensioning, Fits Clearances, Tolerances and Allowances** ***Study Ref. 1 & 2***	
1.6.1	Define the following in relation to drawing conventions: a. Terms b. Tolerance c. Allowance	1
1.6.2	Show how each of the items listed in 1.6.1 is displayed on a drawing. a. Terms b. Tolerance c. Allowance	2
1.6.3	Calculate from given information maximum and minimum dimensions of a part.	3
1.6.4	Determine tolerance and allowance from information displayed on an aeronautical drawing.	2
1.6.5	Describe the system of fits and clearances used in aeronautical engineering and give examples of where each fit may be used including: a. Force/interference b. Driving c. Push d. Running	2

1.6.6	Determine drill sizes for boltholes to obtain a desired class of fit.	2
1.6.7	From given information, determine limits for: a. Bow b. Twist c. Wear	2
1.6.8	Describe standard methods for checking fits and clearances for: a. Shafts b. Bearings c. Other parts	2
1.6.9	Describe standard methods of dimensioning	2
1.6.10	Show how dimensions are placed on a drawing.	2
1.6.11	Identify the types of lettering and numbering used on a drawing and give examples of each.	2
1.7	**Care of Drawings** ***Study Ref. 1 & 2***	
1.7.1	Describe drawing handling and storage practices.	2
1.7.2	Specify procedures for amending, correcting and approving aeronautical drawings.	2
1.8	**Basic Drawing Techniques** ***Study Ref. 1 & 2***	
1.8.1	Show the following drawing functions: a. Bisect a line b. Find the centre of a circle c. Divide a line into equal parts d. Bisect an angle e. Construct an ellipse f. Construct a truncated cone g. Construct duct or flute intersections	2
1.9	**Drawing Sketches** ***Study Ref. 1 & 2***	
1.9.1	Identify the principles of orthographic and pictorial sketching.	2
1.9.2	Outline where orthographic and pictorial sketches may be used.	2
1.9.3	Describe proportioning in relation to sketching.	1
1.10	**Electronic Drawing Media** ***Ref. 1 & 2***	
1.10.1	Specify the use of microfilm, microfiche and computerised presentations.	1
1.11	**International Standards** ***Study Ref. 7 & 8***	
1.11.1	Identify the following international standards: a. ISO b. SAE c. AN d. MS e. NAS f. MIL	1

1.11.2	Outline the relevance of the international standards listed above to aeronautical engineering.	1
1.11.3	Give examples of where each of the international standards listed in 1.11.1 may be used.	1
1.11.4	Explain the following in relation to the Air Transport Association of America Specifications 100 and 2100 a. use of b. format and principles	2
1.12	**Hardware Representation on Drawings** ***Study Ref. 5***	
1.12.1	Show drawing representation for: a. Holes b. Threads c. Bolts d. Nuts e. Rivets	2
1.13	**Drawing Equipment** ***Study Ref.1 & 2***	
1.13.1	Outline the care and use of drawing instruments and associated equipment.	1
1.14	**Shop Terms and Processes**	
1.14.1	Describe the relationship between drawing and manufacturing processes.	1
1.14.2	Describe special features on drawings depicting the following assemblies: a. Castings b. Forgings c. Machined parts d. Sheet metal parts e. Welded constructions	1

2	**Metrology**	
2.1	**Precision Measuring Devices** Study ***Ref. 1, 2 & 6***	
2.1.1	Explain the construction, scale markings, principles of operation, units of accuracy in both English and Metric terms, of the following precision measuring devices: a. Outside micrometer b. Inside micrometer c. Depth micrometer d. Thread micrometer e. Vernier scale micrometer f. Vernier callipers g. Vernier height gauge h. Vernier protractor i. Combination sets including the stock head, protractor head and the centre head j. Dial test indicators or dial gauge k. Clinometer	3
2.1.2	Explain typical uses for each of the above measuring devices and their common ranges.	3
2.1.3	Explain how a DTI reading is corrected when the gauge is not positioned at right angles to the contact surface.	3
2.1.4	Determine calibration (including calibration standards), testing, and handling and storage precautions relating to the above precision measuring devices.	3
2.2	**Gauges** ***Study Ref. 1 & 2***	
2.2.1	Describe the physical characteristics, applications and correct usage of the following devices: a. Bore gauge b. Depth gauge c. Go no-go gauge d. Thread gauge e. Optical flats f. Slip gauges (includes Johannsen type) g. Thickness (feeler) gauge h. Divider i. Inside and outside callipers j. Odd-leg (hermaphrodite) calliper k. Telescopic gauge l. Small hole gauge m. English and metric steel rules (or scales) n. Scriber	2
2.2.2	Using the measuring devices identified above, assess how typical gauging or measuring techniques would be used during aircraft or component maintenance to check for such things as: a. bow b. Twist c. Bending d. Buckling e. Distortion and deformation f. Internal and external wear g. Parallelism or taper h. Stepping i. Shear j. Concentricity k. Flatness (including the use of engineer's blue)	2

3	**Engineering Tooling**	
3.1	**Workshop Tooling and Equipment** ***Study Ref. 1, 2 & 6***	
3.1.1	Describe the features, types, uses, maintenance, calibration, storage and operating precautions relating to the following workshop equipment and general-purpose hand tools: a. Surface plates b. Surface tables c. Vee blocks d. Engineering squares e. Chisels including, flat cold, single bevel point, double bevel point, round nose, cape and diamond point. State cutting edge angles for types of chisel and materials to be cut f. Scrapers g. Clamps, vices and presses h. Hammers and mallets including ball peen and straight peen i. Pliers such as slip-joint, interlocking, vice-grip, duckbill, needle nose and lock-wire (safety-wire) pliers j. Punches including centre, prick, starting, pin, aligning and hollow shank gasket punch k. Screw drivers including the types of drive slot such as slot, cross point, tri-wing, posidrive, torx and Phillips and Reed and Prince l. Hand snips such as circle snips, aviation snips, hawks-bill snips and nibblers m. Wrenches including open-end, box- end, combination, flare-nut, adjustable, standard sockets, deep sockets, flex sockets, crowsfoot sockets, handles, ratchet handles, adapters, speed handles, breaker bars, extensions, universal joints and impact drivers n. Grease guns, oil cans and lubrication methods	2
3.2	**Special Cutting Tools** ***Study Ref. 3***	
3.2.1	Outline the construction, characteristics, use and precautions associated with the following tools. a. Deburring tool b. Trepanning tool (chassis punch) c. Counter bore d. Broach e. Spot-facer f. Microshaver	2
3.2.2	In relation to the tools listed above, state typically when each tool and their associated process would be used on aircraft.	2
3.2.3	Identify the hole cutting tools which produce the least to the best results in terms of finish and accuracy.	1
3.3	**Twist Drill Bits** ***Study Ref. 1, 2 & 6***	
3.3.1	Describe a common metal twist drill bit in respect of the following features: a. Purpose of spiral flutes b. Shank, body and heel (point) c. The lands and margin d. Lip relief or heel angle e. Cutting edge f. Lip angle g. Split point	2

3.3.2	Explain the process for hand sharpening a twist drill bit.	3
3.3.3	Describe the cutting and lip angles for drilling different materials such as: a. Heat-treated steel b. Stainless steel c. Aluminium/magnesium alloys d. Lead e. Plastics, plexiglass and perspex	2
3.3.4	Determine size notation for number, letter and fractional drills.	2
3.3.5	Describe drill size identification stamp on shank.	2
3.3.6	Outline the uses of the following drills. a. Parallel b. Taper c. Square shank	1
3.3.7	Describe the information contained on a drill chart with respect to the following: a. Tap size b. Tap drill c. Clearance drill d. Body drill	2
3.3.8	Describe the drill speeds and feed speeds for various aircraft materials.	2
3.3.9	Identify the types of lubricant specified for drilling various materials.	
3.3.10	Diagnose the cause and prevention of various hole defects which may occur when drilling metal.	3
3.3.11	Detail precautions relating to the metal drilling process with particular regard to: a. Protective/safety equipment b. Unprotected hair and loose clothing c. Drive belts d. Chuck keys e. Material security and clamping f. Overheating g. Prevention of excessive work hardening h. Bit breakthrough i. Drilling into blind spaces j. Drilling around flammable/explosive materials	3
3.4	**Hole Cutters** ***Study Ref. 1 & 2***	
3.4.1	Describe the construction, characteristics, identification and operation of the following hole-cutters: a. Hole saw b. Fly cutter c. Countersink including a standard and stop countersink (micro countersink) d. Spiggoted countersink	1
3.5	**Reamers and Reaming** ***Study Ref. 1 & 2***	
3.5.1	Describe the characteristics and uses of the following types of reamer: a. Tapered (straight flute) b. Tapered (spiral flute) c. Bottoming d. Expanding	2

	e. Adjustable f. Stepped	
3.5.2	Determine the common reaming allowance provided for in a drilled hole.	3
3.5.3	Specify where and when reaming is commonly carried out during aircraft component maintenance.	2
3.5.4	Determine the correct reaming operation and associated precautions.	3
3.5.5	Diagnose the cause of common reaming defects including chattering and scoring.	3
3.5.6	Explain the care and storage of reamers and how to detect and rectify unserviceable reamers.	3
3.5.7	Describe the purpose, characteristics and uses of high-speed steel and carbon-steel reamers.	1
3.5.8	Compare the difference between hand and machine reamers.	1
3.6	**Files and Filing** ***Study Ref. 1, 2 & 6***	
3.6.1	Describe the component parts of a file including the following: a. Tang b. Heel c. Face d. Edge e. Length f. Point	1
3.6.2	Differentiate between double and single cut files, including teeth angles.	1
3.6.3	Describe the coarseness of a file including the following: a. Coarse b. Bastard c. Second d. Smooth e. Dead smooth	1
3.6.4	Give examples of the metal removal and finish capability of each type of file.	2
3.6.5	Outline the characteristics and uses of the following types of files: a. Mill b. Half round c. Knife-edge d. Wood rasp e. Hand f. Three-square g. Round h. Vixen i. Hand-taper j. Pillar k. Warding files	1
3.6.6	Describe the purpose of a safe-edge on a file and when it would be used.	2
3.6.7	Describe the following proper filing techniques with examples of when each technique would be used: a. Draw-filing b. Cross-filing c. Rounding corners	2

	d. Removing burred and slivered edges e. Lathe filing	
3.6.8	Specify proper care and protection of files, including the use of a file card.	1
3.6.9	Identify the types of file most suitable for cutting various types of hard and soft aircraft materials.	2
3.6.10	State the three distinguishing features which identify a file.	1
3.7	**Hacksaws** ***Study Ref. 1 & 2***	
3.7.1	Outline the construction and use of the common hacksaw.	1
3.7.2	Differentiate between an all-hard blade and the flexible hacksaw blade.	1
3.7.3	State where each of the blades listed above would be used.	1
3.7.4	Describe how hacksaw blades are categorised in terms of tooth pitch.	2
3.7.5	Determine the number of teeth per inch of hacksaw blades which would be suitable for cutting various metal products found on an aircraft.	3
3.7.6	Describe common hack sawing procedures with particular regard to: a. Strokes per minute b. Blade selection c. Fitting a blade in the frame d. Blade tension in the frame e. Securing the work f. Number of teeth in contact with the material g. Starting and finishing the cut	2
3.8	**Taps, Dies and Die Nuts** ***Study Ref. 1 & 2***	
3.8.1	State the three common tap types that make up a set and where each would be used in aircraft engineering.	1
3.8.2	Describe the procedure for correctly tapping the thread in a blind and open hole including: a. Tap selection b. Hole sizing c. Hand tapping d. Use of solid and T-handles	2
3.8.3	Describe the characteristics of adjustable round split and hexagonal dies, and where each would most likely be used.	1
3.8.4	Describe the thread cutting process using a die, including the preparation of the metal stock.	2
3.8.5	Describe the die-stock and the correct installation and adjustment of a die.	2
3.8.6	Specify the purpose and correct use of a die nut.	2
3.9	**Torque Wrenches** ***Study Ref. 1 & 2***	
3.9.1	Determine how torque is derived and annotated.	3
3.9.2	Explain why torque loading of aircraft hardware is critically important.	3

3.9.3	Apply standard torque values and tables.	3
3.9.4	Outline the construction, characteristics, principles of operation and uses of the following types of torque wrench: a. Deflecting beam b. Torsion bar c. Toggle (including micrometer type)	1
3.9.5	With respect to torque wrenches, state the relationship between the following: a. Applied force b. Lever length c. Required torque d. Indicated torque	2
3.9.6	Solve problems relating to the relationships listed above.	3
3.9.7	Evaluate the effects and use of the following torque wrench accessories and, where applicable, re-calculate adjusted torque values: a. Extension bars b. Handle extensions c. Torque multipliers	3
3.9.8	Explain the correct use of a torque wrench.	3
3.9.9	Define the following terms: a. Break torque b. Brag torque	1
3.9.10	Explain how each of the terms listed above is determined and applied in aircraft maintenance.	2
3.9.11	Evaluate the effects of dry and lubricated threaded assemblies when setting torque values.	3
3.9.12	Detail torque wrench testing and calibration procedures and periodicities, including the following: a. use of torque wrench testing fixtures b. actions to be taken if a torque wrench is found to be significantly out of calibration	3
3.9.13	Detail the following: a. correct torque wrench handling and storage procedures b. actions to be taken if a torque wrench is dropped	3
3.9.14	Describe the procedure for aligning the split pinhole on a nut that is being torqued to a particular value.	2
3.10	**General Purpose Power Tools** ***Study Ref. 3 & 6***	
3.10.1	Specify the operation and application of the following tools. a. Drilling machines (Pneumatic, electric and bench) b. Machine grinder c. Lathe d. Milling machines e. Shapers f. Scrapers g. Band saws h. Nibbler i. Riveting gun	1

	j. Electric and pneumatic power hacksaw k. Soldering iron l. Sanders m. Routers n. Heat guns	
3.10.2	In relation to the tools listed above, state the following: a. Special characteristics b. Precautions c. Conditions relating to their use.	1
3.11	**Bench Grinders** ***Study Ref. 6***	
3.11.1	Describe the construction and operation of a bench grinder including the following: a. Grinding techniques b. Tool rest clearance c. Operating precautions	2
3.12	**Grinding Wheels** ***Study Ref.6***	
3.12.1	With regard to grinding wheels, describe: a. Silicon carbide and aluminium oxide abrasives b. Wheel selection to suit material types c. Abrasive size d. Vitrified, silicate, resinoid, rubber and shellac bonds e. Voids f. Grinding wheel dressing g. Grinding wheel installation h. Wheel defects	2
3.13	**Sheet Metal Tools** ***Study Ref. 3 & 6***	
3.13.1	Describe the characteristics, operating principles and precautions relating to the following sheet metal working tools and give examples of when each may be used: a. Dollies b. Bench plate and the various types of stake c. V-Blocks d. Hardwood form blocks e. Sandbag f. Shrinking block g. Cleco fastener h. Squaring shears i. Scroll shears j. Throatless shears k. Rotary punch l. Ketts saw m. Reciprocating saw n. Power drills (various applications) o. Bar folder p. Cornice brake q. Slip roller	1
3.14	**Lubrication and Cooling of Metal Cutting Tools**	
3.14.1	Identify the types of lubricant and cooling medium used for common metal cutting operations.	2

4	**Workshop Practice**	
4.1	**Basic Principles of Sheet Metal Repair** ***Study Ref. 3 & 5***	
4.1.1	Outline the basic sheet metal principles and practices when used in the repair of structural damage, with emphasis on the following tasks: a. Sizing up the job b. Patch design c. Type, size and number of rivets needed d. Repair material selection e. Inspection of surrounding area f. Clean-out of damage g. Creation of paper transfers h. Patch preparation i. Stop drilling j. Use of relief holes in bends k. Creation of lightening holes	2
4.2	**Maintaining Original Strength** ***Study Ref. 3, 5 & 6***	
4.2.1	Define the term “original strength” with regard to: a. Cross-sectional area b. Bending loads c. Crack propagation d. Splicing e. Material reinforcements f. Substitution of materials g. Heat-treatment of repair materials h. Rivet size selection i. Calculation of bearing strength and shear strength	2
4.3	**Maintaining Original Contour** ***Study Ref. 3, 5 &, 6***	
4.3.1	Define the term “original contour” and	1
4.3.2	Specify how original contour is maintained while carrying structural repairs.	2
4.4	**Keeping Weight to a Minimum** ***Study Ref. 3, 5 & 6***	
4.4.1	With regard to design and implementation of structural repairs, describe: a. Principles to be observed b. How weight is kept to a minimum	2
4.4.2	Assess and calculate the weight of a completed repair and	2
4.2.3	Determine the effects of a completed repair on surrounding structure.	2
4.5	**Inspection of Damage** ***Study Ref. 3, 5 & 6***	
4.5.1	Describe the symptoms of structural damage resulting from: a. Heavy landing b. Lightning strike c. Impact with objects or service vehicles d. Excursion off a runway e. Over stressing f. Turbulence	2

4.6	**Defect Definitions** ***Study Ref. 5 & 6***	
4.6.1	Define the following terms and give a practical example of each. a. Brinelling b. Burnishing c. Burr d. Chattering e. Corrosion f. Crack g. Cut h. Dent i. Erosion j. Galling k. Gouge l. Inclusion m. Nick n. Pitting o. Scratch p. Score q. Stain r. Upsetting	1
4.7	**Damage Classification** ***Study Ref. 3 & 6***	
4.7.1	Describe, with examples, the following classifications of damage: a. Negligible damage b. Damage repairable by patching c. Damage repairable by insertion d. Damage necessitating replacement of parts	2
4.8	**Stresses in Structural Members** ***Study Ref. 6***	
4.8.1	Identify the stresses in an aircraft structure resulting from flight and ground loads.	2
4.9	**Metal Forming Operations** ***Study Ref. 6***	
4.9.1	Describe the following sheet metal forming operations: a. Bumping b. Crimping c. Stretching d. Shrinking e. Folding f. Bending g. Shearing h. Forming	2
4.9.2	In relation to the sheet metal forming operations listed above, describe examples of: a. Where each is used b. How each is carried out c. Tools used d. Precautions to be observed	2
4.10	**Straight Line Bends** ***Study Ref. 6***	
4.10.1	Explain criteria which must be considered when designing and constructing a straight-line bend, including: a. Material thickness, alloy composition and temper b. Material thickness in regard to bend radius c. Material grain considerations when planning a bend	3

	d. Bend radius (maximum, minimum and neutral) e. Bend allowance f. Setback g. Brake or sight lines h. Marking of sheet metals (includes method of marking and instruments normally used)	
4.10.2	Define bend allowance, including: a. Its importance b. How it is calculated using given formulae for 90 degree and other than 90 degree bends	2
4.10.3	Describe the four factors governing bend allowance.	2
4.10.4	Describe the technique for estimating bend allowance.	2
4.10.5	Calculate the sheet metal size/area required to fabricate a component from given dimensions and taking into account relevant bend allowances.	3
4.10.6	Explain the following sheet metal bending terms: a. Leg b. Thickness c. Flange d. Mold line e. Mold point f. Setback g. Neutral axis h. Bend tangent line i. Bend radius j. Bend allowance k. Bend line l. Flat m. Base measurement n. Closed angle o. Open angle p. “K” number	1
4.10.7	Calculate setback using given formulae.	3
4.10.8	Explain the making and use of a pattern in sheet metal layouts.	3
4.10.9	Describe the purpose and construction of lightening holes on sheet metal components.	2
4.10.10	Describe the hand forming tools, equipment, procedures and techniques in relation to the following: a. Straight line bends b. Formed or extruded angles c. Flanged angles d. Forming by stretching e. Curved flanged parts f. Bumping g. Joggling h. Working with stainless steel i. Working with magnesium	2
4.10.11	Describe special techniques and practices associated with operating bending machines especially when associated with making bends of minimum radius in light alloys.	2

4.11	**Sheet Metal Rivet Layout** ***Study Ref. 6***	
4.11.1	Explain rivet layout in terms of the following criteria: a. Number of rivets required b. The size and style of rivet to use c. Material, temper condition and strength d. Size of the rivet holes e. Distance of the rivet holes and rivets from the edge of the patch f. Spacing of the rivets throughout the repair and the factors which affect spacing g. Special patch design and rivet spacing requirements for metal stressed skin repairs in both pressurised and unpressurised hulls h. Maximum and minimum allowable overlap when riveting a splice	3
4.12	**Rivet Description** ***Study Ref.6***	
4.12.1	Explain the following rivet characteristics and riveting criteria: a. Rivet size (diameter) b. Types of rivet head c. Total rivet length (countersunk and other types) d. Grip length e. Dimensions of a correctly bucked head f. Shop head allowance g. Edge distance calculation h. Rivet material selection i. Rivet heat-treatment requirements and desirable properties achieved through heat treatment or freezing. (includes ice box rivets) j. Rivet pitch k. Rivet spacing requirements l. Transverse pitch m. Laying out a rivet pattern n. Riveting through tubular components o. Substitution of rivets p. Riveting techniques in confined areas	3
4.12.2	Apply rivet characteristics and riveting criteria to practical riveting exercises.	3
4.13	**Riveting Equipment** ***Study Ref. 3 & 6***	
4.13.1	Identify the types, construction, precautions and use of the following riveting equipment: a. Hole duplicators b. Rivet cutters c. Bucking bars d. Hand rivet and draw sets e. Countersinks f. Dimpling dies g. Pneumatic rivet guns h. Squeeze riveters	2
4.13.2	Describe how rivet sets are categorised and selected for riveting the various head shapes and sizes.	2
4.14	**Rivet Installation and Removal Techniques** ***Study Ref. 3 & 6***	
4.14.1	Specify the following procedures and techniques relating to riveting: a. Rivet hole size determination b. Determining factors such as material thickness and rivet specifications associated with flush machine countersinking	2

	c. Limits of surface protrusion or submersion for countersunk rivets d. Dimpling requirements with respect to material work hardening e. Drilling the hole f. Countersinking and dimpling g. Factors which determine the use of machine countersinking h. Thermo-dimpling i. Bucking j. Hand driving k. Pneumatic driving l. Squeeze riveting m. Microshaving and how a microshaved rivet is identified after completion of the process n. Rivet removal procedures o. Selecting the correct drill size for removal of the various types of rivet, including special rivets	
4.15	**Rivet Defect Identification** ***Study Ref. 3 & 6***	
4.15.1	In regard to riveted joints, explain the following conditions and criteria: a. Inspection requirements and techniques b. Shank joggling c. Shear failure d. Bearing failure e. Head failure	3
4.16	**Special Rivets - Self Plugging (friction-lock)** ***Study Ref. 1, 2 & 6***	
4.16.1	Describe the uses and selection of rivet: a. Types (e.g. tucker pop, cherry, chobert, avdel and semi-pierced) b. Rivet guns and tools	2
4.16.2	Describe the procedures or techniques relating to rivet: a. installation b. removal c. inspection techniques	2
4.17	**Special Rivets - Self Plugging (mechanical Lock)** ***Study Ref. 1, 2 & 6***	
4.17.1	Compare the physical differences between friction lock and mechanical lock rivets.	2
4.17.2	Describe the strength relationship between structural rivets, e.g. hi-shear (pin) rivets and equivalent diameter bolts.	2
4.17.3	Describe the design characteristics, dimensional classification, installation techniques, and uses of the following rivets and special fasteners: a. Huck lokrivet b. Olympic loks c. Cherrymax (self-plugging) d. Cherry lock rivets e. Bulbed cherrylock blind rivets f. Pull-through rivets g. Rivnuts h. Dill lock-screws and lock-rivets i. Deutsch rivets j. Hi-shear rivets k. Lock bolts l. Hi-loks m. Hi-lites n. Cherrybucks	2

	o. Taper-lok p. Hi-tigue q. Jo-bolts	
4.18	**Specific Types of Metal Repairs** ***Study Ref. 3 & 6***	
4.18.1	Describe basic techniques and special features relating to the following repair types: a. Flush patch for a stressed skin b. Stringer repair c. Leading edge repair d. Trailing edge repair e. Smooth skin repair f. Elongated octagonal patch g. Round patch h. Panel repair i. Former or bulkhead repair j. Longeron repair k. Spar repair l. Rib and web repair m. Splicing and overlapping (e.g. single-lap)	2
4.18.2	Specify the design criteria for the repair of tubular structure with respect to the following: a. Angles b. Dimensions of tubular weld repairs c. Patching d. Inner and outer sleeves e. Splicing	2
4.18.3	Describe non-welded repair techniques for tubular structural members.	2
4.19	**Structural Sealing** ***Study Ref. 8***	
4.19.1	Describe common methods and applications for structural sealing including: a. Rubber sealing of joints, seams, doors and access panels. b. Cables, tubing and mechanical linkages passing through structure. c. Wires and tubes passing through pressure bulkheads.	2
4.19.2	Outline the following characteristics relating to the use of sealants, rubbers and associated materials: a. Sealant repair processes b. Sealing compounds c. Sealing materials d. Application processes e. Bonding agents f. Natural rubber products g. Synthetic rubbers h. Characteristics of rubbers i. Handling and storage precautions for rubber j. Vulcanising k. Inspection of rubbers and sealants l. Common defects found in rubbers and sealants	1

5	**Aircraft Standard Hardware**	
5.1	**Identification of Aircraft Hardware.** ***Study Ref. 6 & 8***	
5.1.1	Identify the following common classification systems for aircraft hardware and where each would normally be found: a. AN b. NAS c. MS	1
5.2	**Rivets** ***Study Ref. 6***	
5.2.1	By means of head marking and alpha code (A, AD, B, D etc); distinguish rivets made from the following aircraft materials: a. 1100 b. 2117T c. 2017T d. 2017T-HD e. 2024T f. 5056H	3
5.2.2	Determine which of the common rivets require heat-treatment before use.	3
5.2.3	Identify the type of material rivets would be made of when riveting metals commonly used on aircraft, such as: a. Aluminium alloys b. Magnesium c. Titanium d. Mild steel e. Nickel alloy steels f. Carbon steels g. Stainless steels	1
5.2.4	Describe the physical characteristics, common uses and AN identification code for the following types of solid shank rivet: a. Countersunk head 78 degrees b. Countersunk head 100 degrees c. Round head d. Flat head e. Brazier head f. Universal head	2
5.2.5	Describe the process for heat-treating rivets and why some rivets are stored in an icebox.	2
5.2.6.	Explain which rivet types may be substituted for others.	3
5.2.7	Explain, with examples, the AN identification marking system for solid shank rivets.	3
5.3	**Classification of Threads** ***Study Ref. 1, 2 & 6***	
5.3.1	Describe the following criteria pertaining to threads: a. Screw thread nomenclature and common thread angles b. Single and multi-start c. Maintenance and lubrication	2
5.3.2	Specify the thread form, advantages, disadvantages and common aviation applications of the following types of thread: a. NC b. NF	1

	c. UNC d. UNF e. Metric f. BSW g. BSP h. BA. i. Special thread types such as square, buttress, acme etc	
5.3.3	Describe the use of thread charts.	2
5.3.4	Specify how aviation threads are designated in terms of their dimensions, tolerances and class of fit.	2
5.3.5	Specify how screw threads are measured.	2
5.4	**Bolts, Studs and Dowels** ***Study Ref. 1, 2 & 6***	
5.4.1	Explain how a standard aircraft bolt is identified in terms of a. Length b. Grip length c. Diameter	3
5.4.2	Describe the AN codification system (and how it is broken down) for standard aircraft bolts and the common head styles for AN bolts.	2
5.4.3	Describe the UNF markings on a bolt in terms of diameter and TPI.	2
5.4.4	Describe the SAE and metric classification system for aircraft bolts.	2
5.4.5	Specify how the manufacturing thread tolerance of an aircraft bolt is classified and give examples of the classes of fit associated with common types of bolt.	2
5.4.6	Describe the material head marking system for the following standard aircraft bolts: a. Corrosion resistant steel b. Standard steel c. Close tolerance including NAS close tolerance d. Aluminium alloy e. Low strength material f. Magnetically inspected g. Special purpose	2
5.4.7	State how the following special purpose bolts are identified and where each may be used: a. Internal wrenching bolts b. Clevis bolts c. Drilled head bolts d. Undrilled shank e. Drilled shank f. Eye bolt	2
5.4.8	Describe the types of stud and dowel used on aircraft or aircraft components and how stud and dowel threads may vary when inserted into different metals.	2
5.5	**Nuts** ***Study Ref. 1, 2 & 6***	
5.5.1	Describe the AN classification (and how it is broken down), applications and precautions relating to the following nuts: a. Castle b. Shear castle c. Plain	2

	d. Lock (check) e. Slotted engine f. Wing g. Machine screw h. Self locking i. Low temperature self-locking j. Metal self locking k. Shear self locking l. Anchor m. Tinnerman n. Boots self locking o. Stainless steel self locking p. Elastic stop q. Sheet steel r. Internal and external wrenching s. Pal	
5.5.2	Explain how the self-locking feature of fibre, nylon and steel locknuts is achieved.	3
5.6	**Washers** ***Study Ref. 1, 2 & 6***	
5.6.1	Describe the identification, features, applications and special requirements of the following washers: a. Plain washers b. Lockwashers (spring washers) c. Shakeproof lockwashers d. Tab washers and locking plates e. Special washers f. Large area washers g. High strength washers h. High strength countersunk washers	2
5.7	**Installation of Nuts, Bolts, Studs and Dowels** ***Study Ref. 1, 2 & 6***	
5.7.1	Explain the following practices and precautions associated with the installation of nuts, washers, bolts, studs and dowels: a. Bolt hole preparation b. Clearances c. Oversize or elongated holes d. Close tolerance installations e. Fits f. Material selection and compatibility g. Purpose and use of washers under the bolt head or the nut h. Precautions associated with the use of spring washers on light alloys or soft materials i. Use of steel bolts/nuts on magnesium and the associated precautions j. Correct bolt head placement k. Grip length selection l. Torque loading of nuts and bolts m. Safetying of nuts and bolts using split (safety) pins n. Installation and locking of clevis bolts in control cable assemblies o. How fibre and steel locknuts are checked for serviceability and effective locking p. Precautions and environmental limitations associated with the use of self-locking nuts q. Selection of acceptable fastener alternatives r. Special materials and installation requirements associated with fasteners used on powerplant exhaust systems s. Removal, insertion and locking techniques for studs and dowels	3
5.7.2	Explain standard practices and techniques relating to lockwiring (safety wiring) fasteners	3

	and componentry, including: a. identification of components commonly lockwired b. Use of lockwire pliers c. Correct direction for RH and LH threads d. Lockwire angles, wire turns and tension e. Use of tabs f. Locking of multiple fasteners g. Bending of lockwire ends h. Types of lockwire and where each may be used i. Lockwire holes in fasteners j. Repair of lockwire holes k. Inspection and certification of locked components l. Identification of locking defects	
5.8	**Screws** ***Study Ref. 1, 2 & 6***	
5.8.1	Describe the following types of screw: a. Machine b. Structural c. Self tapping d. Wood	2
5.8.2	Outline the physical characteristics, applications, identification and precautions for the following screw types: a. Fillister-head machine b. Flat-head machine c. Round-head machine d. Truss-head machine e. Fillister-head structural f. Flat head structural g. Washer-head h. Round, CSK oval, truss and 100 degree CSK self tapping i. Drive j. Wood	2
5.9	**Pins, Keys and Circlips** ***Study Ref. 1, 2 & 6***	
5.9.1	Outline the features, applications, classification, precautions and installation practices relating to the following types of pins: a. Roll b. Clevis c. Cotter d. Taper e. Safety (split pins)	2
5.9.2	Outline the construction, uses, installation, precautions and defects associated with the following types of key and keyway: a. Plain b. Tapered c. Woodruff d. Round e. Splines	2
5.9.3	Describe the types, uses, installation and removal of circlips and quick release fasteners.	2
5.10	**Repair of Damaged Internal Threads** ***Study Ref. 1, 2 & 6***	
5.10.1	Describe the principles, applications, installation, removal, classification, tooling, precautions and trade practices associated with the use of heli-coils.	2

5.10.2	Describe the techniques and practices associated with the replacement of threaded bushings and inserts.	2
5.10.3	Describe the characteristics, principles, advantages, limitations, installation and removal procedures relating to acres fastener sleeves.	2
5.11	**Panel Fasteners** ***Study Ref. 1, 2 & 6***	
5.11.1	Outline the characteristics, construction, principles of operation, advantages, limitations, classification, installation and removal procedures relating to the following special panel fasteners: a. Turnlock b. Dzus c. Camloc d. Airlock	2
5.12	**Control Cables, Rods and Fasteners** ***Study Ref. 1, 2 & 6***	
5.12.1	Outline the construction, applications, installation procedures and precautions relating to the following classifications of cable: a. Nonflexible b. Flexible c. Extra-flexible d. Lockclad	2
5.12.2	Describe how aircraft control cables are classified in terms of wires in a strand and number of strands in a cable, including standard wire gauge (SWG).	2
5.12.3	With respect to aircraft control cables, state the: a. Various materials which aircraft control cables may be manufactured from b. Advantages and disadvantages of each type c. Control systems in which each type would normally be used	1
5.12.4	Describe the construction, applications and uses of the following cable fittings: a. Double shank ball-end b. Single shank ball end c. Rod terminal d. Threaded cable terminal e. Fork end cable terminal f. Eye end cable terminal g. Spring connectors	1
5.12.5	Describe cable swaging, splicing and testing procedures and precautions.	2
5.12.6	Compare the advantages and disadvantages of cable over push-pull control systems.	1
5.12.7	Describe the installation of nicopress sleeves and the associated tooling used.	2
5.12.8	Explain the characteristics, assembly procedures, identification and precautions associated with cable turnbuckle assemblies.	3
5.12.9	Explain safety inspection requirements relating to both American and British style turnbuckles.	3
5.12.10	Explain the left-hand threaded end of a turnbuckle barrel.	3
5.12.11	Explain the following turnbuckle locking methods and where each would most likely be used:	3

	a. Locking clip b. Double wrap c. Double wrap spiral d. Single wrap e. Single wrap spiral	
5.12.12	Explain how cables are visually and physically inspected for corrosion or broken strands.	3
5.12.13	In relation to push-pull tube assemblies, describe the : a. Construction b. Assembly c. Locking d. Installation, including the correct installation of clevis pins	2
5.12.14	Describe the construction, operation, use and inspection of flexible control systems such as Bowden and Teleflex.	2
5.13	**Springs** ***Study Ref. 6***	
5.13.1	State the types, materials, applications, limitations, inspection and testing of springs.	1
5.14	**Bearings** ***Study Ref.6***	
5.14.1	Outline the characteristics, construction, applications, loads and installation and removal requirements of the following types of aircraft bearing: a. Plain b. Ball c. Roller d. Needle e. Taper f. Self aligning g. Air	2
5.14.2	Describe testing, cleaning and inspection of bearings including the use of sonic cleaners.	2
5.14.3	Specify the lubrication requirements for bearings: a. At installation b. In service	2
5.14.4	Identify the factors that determine the types of lubricant used in a bearing.	2
5.14.5	Describe the following defects found in bearings and state their likely causes: a. Brinelling b. Burnishing c. Galling d. Spalling e. Abrasion f. Burning g. Burring h. Chaffing i. Chipping j. Corrosion k. Fretting l. Gouging m. Grooving n. Cutting o. Inclusions p. Peening q. Pitting	2

	r. Scoring	
5.14.6	Describe bearing pre-load and how it is established.	2
5.14.7	Explain storage and handling requirements for bearings, including the spinning of dry bearings with compressed air.	3
5.15	**Transmissions** ***Study Ref. 1***	
5.15.1	Outline the characteristics, applications, installations, inspection requirements and defects associated with the following types of gears: a. Spur b. Helical c. Bevel d. Hypoid e. Worm f. Planetary g. Differential h. Sector i. Rack and pinion	1
5.15.2	Describe and calculate gear ratios relating to reduction and multiplication systems.	2
5.15.3	Identify driven, driver and idler gear systems.	1
5.15.4	Explain gear patterns and the calculation and setting of backlash.	3
5.15.5	Describe gear lubrication systems and gear failure detection devices.	2
5.15.6	Describe gear inspection and common failure characteristics.	2
5.15.7	Specify the types, typical uses, installation, maintenance and defects relating to: a. Belts b. Pulleys c. Chains d. Sprockets	2
5.15.8	Describe the operation, installation and inspection of screw jacks, levers and push-pull rod systems.	2
5.16	**Seals and Gaskets** ***Study Ref. 1 & 2***	
5.16.1	Describe the characteristics, uses and precautions associated with the following seals and packings: a. U-ring b. O-ring c. V-ring (chevron) d. U-cup e. V-ring male and female	2
5.16.2	Specify the use and installation of backup rings	2
5.16.3	Describe the identification of o-rings.	2
5.16.4	Describe the characteristics, uses and precautions associated with the following gaskets: a. Solid copper washer b. Copper asbestos (or equivalent crushable gaskets) c. Cork gaskets	2

	d. Rubber sheeting e. Felt wipers	
5.17	**Sealing Compounds** ***Study Ref. 1 & 2***	
5.17.1	Describe the characteristics, uses, mixing ratio calculations and precautions associated with the following sealing compounds: a. One-part sealant b. Two-part sealant	2
5.17.2	Describe base sealing compound, accelerator and sealant curing.	1
5.18	**Rigid Fluid lines** ***Study Ref. 1, 2 & 6***	
5.18.1	State the common materials used in the construction of rigid aircraft fluid lines.	1
5.18.2	Specify the advantages and disadvantages of each type of rigid fluid line.	2
5.18.3	Identify the type of tubing that would be used for low, medium and high-pressure systems.	2
5.18.4	Identify the causes of failure in each of the types of rigid fluid lines.	2
5.18.5	State how broken or damaged rigid fluid lines may be repaired/rejoined in service.	2
5.18.6	Specify the various heat-treatment requirements for rigid fluid lines.	2
5.18.7	Identify the types of aluminium alloy used in rigid fluid lines by reference to their colour bands.	2
5.18.8	Using the magnet test and nitric acid test, identify the following rigid tubing materials: a. Carbon steel b. 18-8 stainless steel c. Monel d. Nickel steel	2
5.18.9	Describe the fabrication of rubber hose joints for rigid pipes, with particular respect to: a. Pipe segment gap. b. Hose length. c. Pipe beads. d. Clamping techniques. e. Bonding. f. Hose removal and installation techniques.	2
5.19	**Fabricating and Installing Rigid Tubing** ***Study Ref. 1, 2 & 6***	
5.19.1	Describe the processes, tooling used and precautions to be observed for each of the following: a. Tube cutting b. Tube bending c. Connection by single and double flare (one or two piece) connectors d. Flaring of pipes e. Flareless fittings f. Beading g. Rigid tube installation and tightening techniques, routing, supporting and securing h. Repairing of rigid tubing i. Testing of rigid pipes	2

5.19.2	State the various types of AN fittings and pipe fittings.	1
5.19.3	Discuss the interchangeability of various types of AN and pipe fittings.	1
5.19.4	With respect to MS (Military Standard) flareless fittings, describe the: a. Identification b. Uses c. Installation practices	2
5.19.5	State the standard unions for the following types of pipes: a. Hydraulic b. Fuel c. Oil d. Pneumatic e. Air system	1
5.19.6	Explain how flare thickness reduction due to “wiping” is eliminated during assembly of a rigid hydraulic pipe.	3
5.20	**Flexible fluid lines** ***Study Ref. 1, 2 & 6***	
5.20.1	Describe the characteristics, applications, comparative advantages and precautions associated with the following flexible fluid line materials: a. Synthetic - neoprene, Buna-N and butyl b. Rubber hose c. Teflon hose	2
5.20.2	Identify hose material and its fluid compatibility or incompatibility.	3
5.20.3	State the size designation of flexible fluid lines.	1
5.20.4	Describe the fabrication of flexible fluid lines for the following pressures: a. Low b. Medium c. High	2
5.20.5	Explain the following procedures for a flexible line and associated end fittings: a. Correct routing and installation b. How lengthwise stripes are used to indicate twist	3
5.20.6	Specify the use and installation of swaged and reusable fittings.	2
5.20.7	Describe the use of protective sleeves and wrappings for flexible hose assemblies.	2
5.20.8	Explain the procedures for inspecting and testing aircraft pipes and hose assemblies, including the storage and refitting of a previously installed hose assembly.	3
5.20.9	Determine: a. What is meant by cold flow in a hose assembly b. What may cause this defect	3
5.21	**Clamps** ***Study Ref. 6***	
5.21.1	Specify the classification, characteristics, uses and precautions associated with the following aircraft clamps: a. Hose clamps including Jubilee clips b. Self locking hose clamps c. Cushioned clamps or “P” clips d. Plain clamps	2

5.22	**Standard Fluid Line Markings** ***Study Ref. 1, 2 & 6***	
5.22.1	Detail the colour and marking codes for the following fluid lines: a. Fuel b. Water injection c. Electrical conduit d. Compressed gas e. Instrument air f. Pneumatic g. Coolant h. Hydraulic i. Lubrication j. Breathing oxygen k. De icing l. Fire protection m. Air-conditioning	3

6	**Aircraft Cleaning**	
6.1	**Cleaning Operations** ***Study Ref. 1 & 2***	
6.1.1	Specify the following terms, procedures, precautions and products associated with the cleaning of aircraft and their components: a. General cleaning requirements as a means of corrosion protection b. Exterior cleaning c. Interior cleaning d. Types of cleaning operations including the common cleaning classifications such as wet wash, dry wash and polish e. Non-flammable aircraft cabin cleaning agents and solvents f. Cleaning and protection of faying surfaces g. Flammable and combustible agents h. Fire prevention precautions i. Fire protection recommendations j. Powerplant cleaning k. Dry-cleaning solvent l. Aliphatic naphtha, white spirit, and Stoddards solvent m. Aromatic naphtha including benzene, toluene and xytene n. Safety solvent o. MEK p. Kerosene q. Cleaning compounds for oxygen systems r. Water emulsion cleaners s. Solvent emulsion cleaners t. Soaps and detergents u. Nonionic detergent cleaners v. Mild abrasive materials w. Use of aluminium/steel wool x. Abrasive paper y. Crocus cloth, Scotch-Bright or similar proprietary materials z. Phosphoric-citrus acid aa. Baking soda	2
6.1.2	Specify common cleaning procedures, products and precautions relating to: a. Windows, windshields and transparent plastics, including pre-clean flushing b. GRP, FRP or modern plastic materials c. Exterior metal structure d. Wood and fabric structure e. The use of caustic cleaning products on aluminium alloy structures f. Oil and grease removal from tyres g. Cleaning of airframe or propeller deicer boots h. Exhaust tracks i. Engine cowlings, cooling fins and other powerplant assemblies j. Gas turbine engine compressors k. Aluminium alloy or steel propeller blade cleaning, corrosion removal and crack detection/prevention l. Wheel wells m. Brakes n. Gaseous systems including oxygen bottles, masks and componentry o. Removal of corrosion off anodised components and approved re-treatment methods p. Flushing air, vacuum and fluid system lines q. Oil and fuel tanks r. Interior upholstery and furnishings including special requirements for flame retardant materials s. Cockpits t. Galleys u. Waste and effluent systems	2

	v. Air-conditioning systems w. Sand, prunus, water, vapour, bead and shot blasting x. Nickel cadmium and lead acid battery cases y. Cleaning up and treating mercury spills z. Cleaning and corrosion removal from control cables aa. Component cleaning and “blow through” with compressed air particularly after sand or bead blasting	
6.1.3	Specify the operational or safety effects that could occur where any of the components or systems identified above remains in an unclean condition.	2
6.1.4	Explain the dangers and limitations associated with the use of chemical cleaners on aircraft and aircraft components.	3
6.1.5	Describe pre-wash protection and post-wash maintenance procedures normally required on aircraft to prevent: a. Corrosion b. Loss of system/component lubrication c. Mechanical/electrical malfunctions	2

7	**Aircraft Painting and Finishing**	
7.1	**Identification of Paint Finishes** ***Study Ref. 3 & 4***	
7.1.1	Identify the various types of paint finish commonly used on aircraft.	1
7.2	**Paint Finishing Materials** ***Study Ref. 3 & 4***	
7.2.1	Describe the characteristics, uses and precautions relating to the following aircraft finishing materials: a. Acetone b. Alcohol c. Benzene d. Thinners e. Acrylic nitro-cellulose lacquer thinner f. Cellulose nitrate dope and lacquer thinner g. Volatile mineral spirits h. Toluene i. Turpentine j. Dope k. Nitro-cellulose lacquer l. Acrylic nitro-cellulose lacquer m. Paint drier n. Linseed oil o. Zinc chromate primer p. Standard wash primer q. Acrylic cellulose nitrate modified primer r. Enamel s. Varnish t. Oil stain u. Paint v. Paint remover w. Epoxy coating remover x. Fluorescent paint remover y. Masking material	1
7.3	**Paint Finishing Processes** ***Study Ref. 3 & 4***	
7.3.1	State the application of the following painting processes: a. Synthetic enamels b. Acrylic lacquer c. Polyurethane d. Acrylic urethanes e. Special finishes and finishing products	1
7.3.2	Detail special precautions and handling requirements for these processes.	2
7.3.3	For given applications, state the advantages and disadvantages of each process.	2
7.3.4	Specify the physical conditions required for application of the various paint processes.	2
7.4	**Primers and Priming** ***Study Ref. 3 & 4***	
7.4.1	Specify the various priming processes in aircraft use detailing special precautions and handling requirements.	2
7.4.2	State the advantages of particular primers for given applications	2

7.5	**Painting Equipment and Safety** ***Study Ref. 3 & 4***	
7.5.1	Describe the following finishing equipment, facilities and safety procedures: a. Paint room design and operation. b. Air supply (including the three main requirements and approximate air pressures). c. Spray guns. d. Respirators and safety equipment. e. Viscosity measuring cup. f. Mixing equipment. g. Health and safety requirements.	1
7.5.2	Describe the spray gun and its operation with regard to: a. Application techniques for various coatings. b. Adjusting the spray pattern. c. Applying the finish. d. Sequence for painting an aeroplane. e. Common finishing problems. f. Clean-up.	1
7.6	**Maintenance of Painted Surfaces** ***Study Ref. 3 & 4***	
7.6.1	Describe the following: a. Paint touch-up b. Restoration of paint finishes c. Paint system compatibility	2
7.7	**Paint Stripping and Surface Preparation** ***Study Ref. 3 & 4***	
7.7.1	Specify correct methods and techniques to be used for the removal of: a. Old corrosion protection systems b. Corrosion	2
7.7.2	Describe methods of degreasing and cleaning surfaces prior to surface treatment.	2
7.7.3	Describe the methods of surface pre-treatment associated with common painting processes.	2
7.7.4	Detail the special safety precautions and requirements associated with the use of MEK (methyl ethyl ketone) as a paint stripper and metal cleaner.	3
7.7.5	Identify common paint strippers	1
7.7.6	With respect to paint strippers, detail application and removal precautions, especially in relation to other aircraft structure or structural components and susceptible materials.	3
7.7.7	Describe special processes relating to the painting of radomes and composite plastic materials	1
7.8	**Preparation of Paint** ***Study Ref. 3 & 4***	
7.8.1	Describe the following processes associated with the preparation of paint: a. Stirring b. Thinning c. Colour tinting and mixing d. Straining	2

7.9	**Decals, Marking and Placards** ***Study Ref. 3 & 4***	
7.9.1	Specify procedures and techniques for the proper application of the following items found in general use on and in aircraft: a. Decals b. Marking c. Placards	2
7.10	**Paint Defects** ***Study Ref. 3 & 4***	
7.10.1	Describe the following paint defects and identify their causes: a. Poor adhesion b. Spray dust c. Sags and runs d. Spray mottle e. Blushing	2

8	**Gases and Compounds**	
8.1	**Gaseous Oxygen Storage and Supply Systems** ***Study Ref. 3 & 4***	
8.1.1	Explain the identification of high and low-pressure oxygen bottles.	3
8.1.2	Explain how breathing oxygen bottles are positively identified through colour coding and stencilled lettering.	3
8.1.3	Detail oxygen system decontamination procedures.	3
8.1.4	Describe the maintenance and servicing requirements for oxygen trolleys.	2
8.1.5	Detail the oxygen replenishment procedures and precautions.	3
8.1.6	Detail safety precautions when handling oxygen cylinders and dispensing equipment, including the dangers associated with the presence of petroleum products such as oil and grease.	3
8.2	**Aviation Gasses - Other than Oxygen** ***Various references in study material appropriate to where each gas is used.***	
8.2.1	Detail the uses, storage, identification, characteristics and safety precautions associated with the following gaseous compounds: a. Nitrogen b. Carbon dioxide c. Freon d. Helium e. Compressed air	3
8.2.2	Specify the type of gas commonly used in: a. Gas operated safety equipment on aircraft b. Aircraft wheels c. Air-conditioning systems d. Shock struts e. Accumulators f. Inert gas welding systems	2
8.2.3	Detail precautions associated with the use of compressed air for cleaning aircraft and aircraft components.	3
8.2.4	Evaluate the dangers associated with cleaning personal clothing and exposed body parts with a compressed air gun.	3

9	Aircraft Ground Handling	
9.1	**Ground Operations** ***Study Ref. 1 & 2***	
9.1.1	Specify the following aviation ground operations, safety precautions and the relevant equipment used: a. Marshalling and marshalling signals. b. Refuelling/defuelling procedures and precautions c. System replenishments d. Long and short term storage e. Picketing f. Taxiing g. Airfield tower communications including commonly used abbreviations, transmitting technique, transmission of letters, numbers, time and standard words and phrases, distress and urgency procedures h. Taxi lanes and vehicular movements i. Airfield and airport markings j. Ground running and run-up areas k. Safety zones around aircraft l. Approaching and leaving aircraft m. Control locks n. Undercarriage locks o. Aircraft levelling procedures p. Hoisting q. Attendance at a crash scene r. Hearing protection s. Aircraft tie-down t. Ramp operations	2
9.1.2	Specify aircraft towing operations in respect of the following: a. Towing arms b. Weak links c. Locking devices d. Weight limits e. Turning angle limits f. Control of aircraft brakes g. Lookouts h. Tugs and tractors	2
9.1.3	Specify the aircraft jacking operations in respect of the following: a. Principles of aircraft jacking b. Safety precautions c. Weight and balance limits d. Jack types e. Jacking points f. Jacking techniques g. Maintaining structural integrity while jacking (fitment of structural panels, positioning of flight control surfaces, undercarriage precautions etc)	2
9.1.4	Describe ground de-ice and anti-ice procedures in respect of the following: a. Removal of frost, ice and snow b. Temperatures c. Time limits d. Materials e. Application techniques	2

9.2	**General Aeronautical Practices and Processes** ***Various references in textbooks, maintenance manuals and aircraft operating instructions.***	
9.2.1	Describe the following: a. Aircraft tool control systems b. Foreign object damage control c. Environmental protection and the effects of environmental conditions on aircraft handling and operation d. Aircraft jacks and levelling equipment e. Protection from high intensity radiated field (HIRF) f. Electrical, hydraulic and pneumatic ground supplies g. Identification and operation of ground use fire extinguishers h. Fire fighting techniques i. Requirements for the use of personal safety equipment such as gloves, masks, goggles, shields, respirators, overalls and special suits j. Guarding of machinery k. Spontaneous combustion of accumulated oily rags l. Workshop cleanliness m. Working in adverse conditions such as; confined spaces, hot, cold, wet and windy conditions	2