CIVIL AVIATION DEPARTMENT
Republic of Maldives

MALDIVIAN
CIVIL AVIATION REGULATIONS

MCAR-66
Aircraft Maintenance Licensing

Amendment 2 25 May 2009

I. LIST OF AMENDMENTS

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Amendment 2	2-5	25-05-09	25-05-09	CAD		

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SECTION 1 – REGULATIONS

SUBPART A

AIRCRAFT MAINTENANCE LICENCE AEROPLANES AND HELICOPTERS

MCAR-66.1 Scope

(a) This section establishes the requirements for the issue of an aircraft maintenance licence and conditions of its validity and use, for aeroplanes and helicopters of the following categories:

— Category A

— Category B1

— Category B2

— Category C

(b) Categories A and B1 are subdivided into subcategories relative to combinations of aeroplanes, helicopters, turbine and piston engines. The subcategories are:

— A1 and B1.1 Aeroplanes Turbine

— A2 and B1.2 Aeroplanes Piston

— A3 and B1.3 Helicopters Turbine

— A4 and B1.4 Helicopters Piston

MCAR-66.3 Effectivity

This MCAR-66 becomes effective on 15 July 2007.

MCAR-66.10 Application

An application for an aircraft maintenance licence or amendment to such licence shall be made on CAD form 19 and in a manner established by CAD and submitted thereto.

MCAR-66.15 Eligibility

An applicant for an aircraft maintenance licence shall be at least 18 years of age.

MCAR-66.20 Privileges

(a) Subject to compliance with paragraph (b), the following privileges shall apply:

1. A category A aircraft maintenance licence permits the holder to issue certificates of release to service following minor scheduled line maintenance and simple defect rectification within the limits of tasks specifically endorsed on the authorisation. The

certification privileges shall be restricted to work that the licence holder has personally performed in a MCAR-145 organisation.

2. A category B1 aircraft maintenance licence shall permit the holder to issue certificates of release to service following maintenance, including aircraft structure, power plant and mechanical and electrical systems. Replacement of avionic line replaceable units, requiring simple tests to prove their serviceability, shall also be included in the privileges. Category B1 shall automatically include the appropriate A subcategory.

3. A category B2 aircraft maintenance licence shall permit the holder to issue certificates of release to service following maintenance on avionic and electrical systems.

4. A category C aircraft maintenance licence shall permit the holder to issue certificates of release to service following base maintenance on aircraft. The privileges apply to the aircraft in its entirety in a MCAR-145 organisation.

(b) The holder of an aircraft maintenance licence may not exercise certification privileges unless:

1. in compliance with the applicable requirements of MCAR-M and/or MCAR-145.

2. in the preceding two-year period he/she has, either had six months of maintenance experience in accordance with the privileges granted by the aircraft maintenance licence or, met the provision for the issue of the appropriate privileges.

3. he/she is able to read, write and communicate to an understandable level in the language(s) in which the technical documentation and procedures necessary to support the issue of the certificate of release are written.

MCAR-66.25 Basic knowledge requirements

(a) An applicant for an aircraft maintenance licence or the addition of a category or subcategory to such an aircraft maintenance licence shall demonstrate, by examination, a level of knowledge in the appropriate subject modules in accordance with Appendix I to this MCAR.

The basic knowledge examinations shall be conducted by a training organisation appropriately approved under MCAR-147 or by CAD.

(b) Full or partial credit against the basic knowledge requirements and associated examination shall be given for any other technical qualification considered by CAD to be equivalent to the knowledge standard of this MCAR.

MCAR-66.30 Experience requirements

(a) An applicant for an aircraft maintenance licence shall have acquired:

1. for category A and subcategories B1.2 and B1.4:

(i) three years of practical maintenance experience on operating aircraft, if the

applicant has no previous relevant technical training; or

(ii) two years of practical maintenance experience on operating aircraft and completion of training considered relevant by CAD as a skilled worker, in a technical trade; or

(iii) one year of practical maintenance experience on operating aircraft and completion of a MCAR-147 approved basic training course.

2. for category B2 and subcategories B1.1 and B1.3:

(i) five years of practical maintenance experience on operating aircraft if the applicant has no previous relevant technical training; or

(ii) three years of practical maintenance experience on operating aircraft and completion of training considered relevant by CAD as a skilled worker, in a technical trade; or

(iii) two years of practical maintenance experience on operating aircraft and completion of a MCAR -147 approved basic training course.

3. for category C with respect to large aircraft:

(i) three years of experience exercising category B1.1, B1.3 or B2 privileges on large aircraft or as MCAR-145 B1.1, B1.3 or B2 support staff, or, a combination of both; or

(ii) five years of experience exercising category B1.2 or B1.4 privileges on large aircraft or as MCAR-145 B1.2 or B1.4 support staff, or a combination of both; or

4. for category C with respect to non large aircraft:

three years of experience exercising category B1 or B2 privileges on non large aircraft or as MCAR-145 B1 or B2 support staff, or a combination of both; or

5. for category C obtained through the academic route:

an applicant holding an academic degree in a technical discipline, from a university or other higher educational institution recognised by CAD, three years of experience working in a civil aircraft maintenance environment on a representative selection of tasks directly associated with aircraft maintenance including six months of observation of base maintenance tasks.

(b) An applicant for an extension to an aircraft maintenance licence shall have a minimum civil aircraft maintenance experience requirement appropriate to the additional category or subcategory of licence applied for as defined in Appendix IV to this MCAR.

(c) For category A, B1 and B2 the experience must be practical which means being involved with a representative cross section of maintenance tasks on aircraft.

(d) For all applicants, at least one year of the required experience must be recent maintenance experience on aircraft of the category/subcategory for which the initial aircraft maintenance licence is sought. For subsequent category/subcategory additions to an existing aircraft maintenance licence, the additional recent maintenance experience required may be less than one year, but must be at least three months. The required experience must be dependent upon the difference between the licence category/subcategory held and applied for. Such additional experience must be typical of the new licence category/subcategory sought.

(e) Notwithstanding paragraph (a), aircraft maintenance experience gained outside a civil aircraft maintenance environment shall be accepted when such maintenance is equivalent to that required by this MCAR as established by CAD. Additional experience of civil aircraft maintenance shall, however, be required to ensure understanding of the civil aircraft maintenance environment.

MCAR-66.40 Continued validity of the aircraft maintenance licence

(a) The aircraft maintenance licence becomes invalid five years after its last issue or amendment, unless the holder submits his/her aircraft maintenance licence to CAD, in order to verify that the information contained in the licence is the same as that contained in CAD records.

(b) Any certification privileges based upon an aircraft maintenance licence becomes invalid as soon as the aircraft maintenance licence is invalid.

(c) The aircraft maintenance licence is only valid when issued and/or amended by CAD and when the holder has signed the document.

MCAR-66.45 Type/task training and ratings

(a) The holder of a category A aircraft maintenance licence may only exercise certification privileges on a specific aircraft type following the satisfactory completion of the relevant category A aircraft task training carried out by an appropriately approved MCAR-145 or MCAR-147 organisation. The training shall include practical hands on training and theoretical training as appropriate for each task authorised. Satisfactory completion of training shall be demonstrated by an examination and/or by workplace assessment carried out by an appropriately approved MCAR-145 or MCAR-147 organisation.

(b) Except as otherwise specified in paragraph (g), the holder of a category B1, B2 or C aircraft maintenance licence shall only exercise certification privileges on a specific aircraft type when the aircraft maintenance licence is endorsed with the appropriate aircraft type rating.

(c) Except as otherwise specified in paragraph (h), ratings shall be granted following satisfactory completion of the relevant category B1, B2 or C aircraft type training approved by CAD or conducted by an appropriately approved MCAR-147 maintenance training organisation.

(d) Category B1 and B2 approved type training shall include theoretical and practical elements and consist of the appropriate course in relation to the 66.20(a) privileges. Theoretical and practical training shall comply with Appendix III to this Part.

(e) Category C approved type training shall comply with Appendix III to this MCAR. In the case of a category C person qualified by holding an academic degree as specified in 66.30(a), (5), the first relevant aircraft type theoretical training shall be at the category B1 or B2 level. Practical training is not required.

(f) Completion of approved aircraft type training, as required by paragraphs (b) to (e), shall be demonstrated by an examination. The examination shall comply with Appendix III to this MCAR. The examinations in respect of category B1 or B2 or C aircraft type ratings shall be conducted by training organisations appropriately approved under MCAR-147, CAD, or the training organisation conducting the approved type training course.

(g) Notwithstanding paragraph (b), for aircraft other than large aircraft, the holder of a category B1 or B2 aircraft maintenance licence may also exercise certification privileges, when the aircraft maintenance licence is endorsed with the appropriate group ratings, or manufacturer group ratings, unless CAD has determined that the complexity of the aircraft in question requires a type rating.

1. Manufacturer group ratings may be granted after complying with the type rating requirements of two aircraft types representative of the group from the same manufacturer.

2. Full group ratings may be granted after complying with the type rating requirements of three aircraft types representative of the group from different manufacturers. However, no full group rating may be granted to B1 multiple turbine engine aeroplanes, where only manufacturer group rating applies.

3. The groups shall consist of the following:

(i) for category B1 or C:

— helicopter piston engine

— helicopter turbine engine

— aeroplane single piston engine — metal structure

— aeroplane multiple piston engines — metal structure

— aeroplane single piston engine — wooden structure

— aeroplane multiple piston engines — wooden structure

— aeroplane single piston engine — composite structure

— aeroplane multiple piston engines — composite structure

— aeroplane turbine — single engine

— aeroplane turbine — multiple engine

(ii) for category B2 or C:

— aeroplane

— helicopter

(h) Notwithstanding paragraph (c), ratings on aircraft other than large aircraft may also be granted, subject to satisfactory completion of the relevant category B1, B2 or C aircraft type examination and demonstration of practical experience on the aircraft type, unless CAD has determined that the aircraft is complex, where paragraph 3 approved type training is required.

In the case of a category C ratings on aircraft other than large aircraft, for a person qualified by holding an academic degree as specified in 66.30 (a), (5), the first relevant aircraft type examination shall be at the category B1 or B2 level.

1. Category B1, B2 and C approved type examinations must consist of a mechanical examination for category B1 and an avionics examination for category B2 and both mechanical and avionics examination for category C.

2. The examination shall comply with Appendix III to this MCAR. The examination shall be conducted by training organisations appropriately approved under MCAR-147, or by CAD.

3. Aircraft type practical experience shall include a representative cross section of maintenance activities relevant to the category.

MCAR-66.55 Evidence of qualification

Personnel exercising certification privileges must produce their licence, as evidence of qualification, if requested by an authorised person, within 24 hours.

MCAR-66.70 Conversion Provisions

(a) The holder of a valid Maldivian aircraft maintenance licence issued by CAD prior to the date of entry into force of this MCAR shall be issued an aircraft maintenance licence without further examinations subject to conditions specified by CAD.

(b) A person undergoing a qualification process approved by CAD, prior to the date of entry into force of this MCAR may continue to be qualified. The holder of qualification gained following such qualification process shall be issued an aircraft maintenance licence without further examination subject to the conditions specified by CAD.

(c) Where neccessary, the aircraft maintenance licence shall contain technical limitations in relation to the scope of the pre-existing qualification.

SUBPART B

AIRCRAFT OTHER THAN AEROPLANES AND HELICOPTERS

MCAR-66.100 General

This subpart is reserved.

SUBPART C

COMPONENTS

MCAR-66.200 General

This subpart is reserved.

For the Civil Aviation Department
Mahmood Razee
EXECUTIVE DIRECTOR

Appendix I

Basic Knowledge Requirements

1. KNOWLEDGE LEVELS — CATEGORY A, B1, B2 AND C AIRCRAFT MAINTENANCE LICENCE

Basic knowledge for categories A, B1 and B2 are indicated by the allocation of knowledge levels indicators (1, 2 or 3) against each applicable subject. Category C applicants must meet either the category B1 or the category B2 basic knowledge levels.

The knowledge level indicators are defined as follows:

LEVEL 1

A familiarisation with the principal elements of the subject.

Objectives: The applicant should be familiar with the basic elements of the subject.

The applicant should be able to give a simple description of the whole subject, using common words and examples.

The applicant should be able to use typical terms.

LEVEL 2

A general knowledge of the theoretical and practical aspects of the subject

An ability to apply that knowledge.

Objectives: The applicant should be able to understand the theoretical fundamentals of the subject.

The applicant should be able to give a general description of the subject using, as appropriate, typical examples.

The applicant should be able to use mathematical formulae in conjunction with physical laws describing the subject.

The applicant should be able to read and understand sketches, drawings and schematics describing the subject.

The applicant should be able to apply his 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 know the theory of the subject and interrelationships with other subjects.

The applicant should be able to give a detailed description of the subject using theoretical fundamentals and specific examples.

The applicant should understand and be able to use mathematical formulae related to the subject.

The applicant should be able to read, understand and prepare sketches, simple drawings and schematics describing the subject.

The applicant should be able to apply his knowledge in a practical manner using manufacturer's instructions.

The applicant should be able to interpret results from various sources and measurements and apply corrective action where appropriate.

2. MODULARISATION

Qualification on basic subjects for each MCAR-66 aircraft maintenance licence category or subcategory should be in accordance with the following matrix. Applicable subjects are indicated by an 'X':

Subject modules	A or B1 aeroplane with:		A or B1 helicopter with:		B2
	Turbine engine(s)	Piston engine(s)	Turbine engine(s)	Piston engine(s)	Avionics
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X
4	X	X	X	X	X
5	X	X	X	X	X
6	X	X	X	X	X
7	X	X	X	X	X
8	X	X	X	X	X
9	X	X	X	X	X
10	X	X	X	X	X
11	X	X			
12			X	X	
13					X
14					X
15	X		X		
16		X		X	
17	X	X			

MODULE 1. MATHEMATICS

	Level		
	A	B1	B2
1.1 Arithmetic Arithmetical terms and signs, methods of multiplication and division, fractions and decimals, factors and multiples, weights, measures and conversion factors, ratio and proportion, averages and percentages, areas and volumes, squares, cubes, square and cube roots.	1	2	2
1.2 Algebra			
(a) Evaluating simple algebraic expressions, addition, subtraction, multiplication and division, use of brackets, simple algebraic fractions;	1	2	2
(b) Linear equations and their solutions; Indices and powers, negative and fractional indices; Binary and other applicable numbering systems; Simultaneous equations and second degree equations with one unknown; logarithms;	—	1	1
1.3 Geometry			
(a) Simple geometrical constructions;	—	1	1
(b) Graphical representation; nature and uses of graphs, graphs of equations/functions;	2	2	2
(c) Simple trigonometry; trigonometrical relationships, use of tables and rectangular and polar coordinates.	—	2	2

MODULE 2. PHYSICS

	Level		
	A	B1	B2
2.1 Matter Nature of matter: the chemical elements, structure of atoms, molecules; Chemical compounds. States: solid, liquid and gaseous; Changes between states.	1	1	1

2.2 Mechanics			
2.2.1 *Statics*	1	2	1
Forces, moments and couples, representation as vectors; Centre of gravity. Elements of theory of stress, strain and elasticity: tension, compression, shear and torsion; Nature and properties of solid, fluid and gas; Pressure and buoyancy in liquids (barometers).			
2.2.2 *Kinetics*	1	2	1
Linear movement: uniform motion in a straight line, motion under constant acceleration (motion under gravity); Rotational movement: uniform circular motion (centrifugal/centripetal forces); Periodic motion: pendular movement; Simple theory of vibration, harmonics and resonance; Velocity ratio, mechanical advantage and efficiency.			
2.2.3 *Dynamics*			
(a)	1	2	1
Mass Force, inertia, work, power, energy (potential, kinetic and total energy), heat, efficiency;			
(b)	1	2	2
Momentum, conservation of momentum; Impulse; Gyroscopic principles; Friction: nature and effects, coefficient of friction (rolling resistance).			
2.2.4 *Fluid dynamics*			
(a)	2	2	2
Specific gravity and density;			
(b)	1	2	1
Viscosity, fluid resistance, effects of streamlining; effects of compressibility on fluids; Static, dynamic and total pressure: Bernoulli's Theorem, venturi.			
2.3 Thermodynamics			
(a)	2	2	2

Temperature: thermometers and temperature scales: Celsius, Fahrenheit and Kelvin; Heat definition. (b) Heat capacity, specific heat; Heat transfer: convection, radiation and conduction; Volumetric expansion; First and second law of thermodynamics; Gases: ideal gases laws; specific heat at constant volume and constant pressure, work done by expanding gas; Isothermal, adiabatic expansion and compression, engine cycles, constant volume and constant pressure, refrigerators and heat pumps; Latent heats of fusion and evaporation, thermal energy, heat of combustion.	—	2	2
2.4 Optics (Light) Nature of light; speed of light; Laws of reflection and refraction: reflection at plane surfaces, reflection by spherical mirrors, refraction, lenses; Fibre optics.	—	2	2
2.5 Wave Motion and Sound Wave motion: mechanical waves, sinusoidal wave motion, interference phenomena, standing waves; Sound: speed of sound, production of sound, intensity, pitch and quality, Doppler effect.	—	2	2

MODULE 3. ELECTRICAL FUNDAMENTALS

	Level		
	A	B1	B2
3.1 Electron Theory Structure and distribution of electrical charges within: atoms, molecules, ions, compounds; Molecular structure of conductors, semiconductors and insulators.	1	1	1
3.2 Static Electricity and Conduction Static electricity and distribution of electrostatic charges; Electrostatic laws of attraction and repulsion; Units of charge, Coulomb's Law; Conduction of electricity in solids, liquids, gases and a vacuum.	1	2	2

3.3 Electrical Terminology	1	2	2
The following terms, their units and factors affecting them: potential difference, electromotive force, voltage, current, resistance, conductance, charge, conventional current flow, electron flow.			
3.4 Generation of Electricity	1	1	1
Production of electricity by the following methods: light, heat, friction, pressure, chemical action, magnetism and motion.			
3.5 DC Sources of Electricity	1	2	2
Construction and basic chemical action of: primary cells, secondary cells, lead acid cells, nickel cadmium cells, other alkaline cells; Cells connected in series and parallel; Internal resistance and its effect on a battery; Construction, materials and operation of thermocouples; Operation of photo-cells.			
3.6 DC Circuits	—	2	2
Ohms Law, Kirchoff's Voltage and Current Laws; Calculations using the above laws to find resistance, voltage and current; Significance of the internal resistance of a supply.			
3.7 Resistance/Resistor			
(a)	—	2	2
Resistance and affecting factors; Specific resistance; Resistor colour code, values and tolerances, preferred values, wattage ratings; Resistors in series and parallel; Calculation of total resistance using series, parallel and series parallel combinations; Operation and use of potentiometers and rheostats; Operation of Wheatstone Bridge.			
(b)	—	1	1
Positive and negative temperature coefficient conductance;			

Fixed resistors, stability, tolerance and limitations, methods of construction; Variable resistors, thermistors, voltage dependent resistors; Construction of potentiometers and rheostats; Construction of Wheatstone Bridge;			
3.8 Power	—	2	2
Power, work and energy (kinetic and potential); Dissipation of power by a resistor; Power formula; Calculations involving power, work and energy.			
3.9 Capacitance/Capacitor	—	2	2
Operation and function of a capacitor; Factors affecting capacitance area of plates, distance between plates, number of plates, dielectric and dielectric constant, working voltage, voltage rating; Capacitor types, construction and function; Capacitor colour coding; Calculations of capacitance and voltage in series and parallel circuits; Exponential charge and discharge of a capacitor, time constants; Testing of capacitors.			
3.10 Magnetism			
(a)	—	2	2
Theory of magnetism; Properties of a magnet; Action of a magnet suspended in the Earth's magnetic field; Magnetisation and demagnetisation; Magnetic shielding; Various types of magnetic material; Electromagnets construction and principles of operation; Hand clasp rules to determine: magnetic field around current carrying conductor.			
(b)	—	2	2
Magnetomotive force, field strength, magnetic flux density, permeability, hysteresis loop, retentivity, coercive force reluctance, saturation point, eddy currents; Precautions for care and storage of magnets.			
3.11 Inductance/Inductor	—	2	2

Faraday's Law; Action of inducing a voltage in a conductor moving in a magnetic field; Induction principles; Effects of the following on the magnitude of an induced voltage: magnetic field strength, rate of change of flux, number of conductor turns; Mutual induction; The effect the rate of change of primary current and mutual inductance has on induced voltage; Factors affecting mutual inductance: number of turns in coil, physical size of coil, permeability of coil, position of coils with respect to each other; Lenz's Law and polarity determining rules; Back emf, self induction; Saturation point; Principle uses of inductors;			
3.12 DC Motor/Generator Theory Basic motor and generator theory; Construction and purpose of components in DC generator; Operation of, and factors affecting output and direction of current flow in DC generators; Operation of, and factors affecting output power, torque, speed and direction of rotation of DC motors; Series wound, shunt wound and compound motors; Starter Generator construction.	—	2	2
3.13 AC Theory Sinusoidal waveform: phase, period, frequency, cycle; Instantaneous, average, root mean square, peak, peak to peak current values and calculations of these values, in relation to voltage, current and power Triangular/Square waves; Single/3 phase principles.	1	2	2
3.14 Resistive (R), Capacitive (C) and Inductive (L) Circuits Phase relationship of voltage and current in L, C and R circuits, parallel, series and series parallel; Power dissipation in L, C and R circuits; Impedance, phase angle, power factor and current calculations; True power, apparent power and reactive power calculations.	—	2	2
3.15 Transformers Transformer construction principles and operation; Transformer losses and methods for overcoming them;	—	2	2

Transformer action under load and no-load conditions; Power transfer, efficiency, polarity markings; Calculation of line and phase voltages and currents; Calculation of power in a three phase system; Primary and Secondary current, voltage, turns ratio, power, efficiency; Auto transformers.			
3.16 Filters	—	1	1
Operation, application and uses of the following filters: low pass, high pass, band pass, band stop.			
3.17 AC Generators	—	2	2
Rotation of loop in a magnetic field and waveform produced; Operation and construction of revolving armature and revolving field type AC generators; Single phase, two phase and three phase alternators; Three phase star and delta connections advantages and uses; Permanent Magnet Generators.			
3.18 AC Motors	—	2	2
Construction, principles of operation and characteristics of: AC synchronous and induction motors both single and polyphase; Methods of speed control and direction of rotation; Methods of producing a rotating field: capacitor, inductor, shaded or split pole.			

MODULE 4. ELECTRONIC FUNDAMENTALS

	Level		
	A	B1	B2
4.1 Semiconductors			
4.1.1 Diodes			
(a)	—	2	2
Diode symbols; Diode characteristics and properties; Diodes in series and parallel; Main characteristics and use of silicon controlled rectifiers (thyristors), light emitting diode, photo conductive diode, varistor, rectifier diodes; Functional testing of diodes.			

(b) Materials, electron configuration, electrical properties; P and N type materials: effects of impurities on conduction, majority and minority characters; PN junction in a semiconductor, development of a potential across a PN junction in unbiased, forward biased and reverse biased conditions; Diode parameters: peak inverse voltage, maximum forward current, temperature, frequency, leakage current, power dissipation; Operation and function of diodes in the following circuits: clippers, clampers, full and half wave rectifiers, bridge rectifiers, voltage doublers and triplers; Detailed operation and characteristics of the following devices: silicon controlled rectifier (thyristor), light emitting diode, Shottky diode, photo conductive diode, varactor diode, varistor, rectifier diodes, Zener diode.	—	—	2
4.1.2 Transistors			
(a) Transistor symbols; Component description and orientation; Transistor characteristics and properties.	—	1	2
(b) Construction and operation of PNP and NPN transistors; Base, collector and emitter configurations; Testing of transistors. Basic appreciation of other transistor types and their uses. Application of transistors: classes of amplifier (A, B, C); Simple circuits including: bias, decoupling, feedback and stabilisation; Multistage circuit principles: cascades, push-pull, oscillators, multivibrators, flip-flop circuits.	—	—	2
4.1.3 Integrated Circuits			
(a) Description and operation of logic circuits and linear circuits/operational amplifiers.	—	1	—
(b) Description and operation of logic circuits and linear circuits; Introduction to operation and function of an operational amplifier used as: integrator, differentiator, voltage follower, comparator;	—	—	2

Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive(IR), direct; Advantages and disadvantages of positive and negative feedback.			
4.2 Printed Circuit Boards Description and use of printed circuit boards.	—	1	2
4.3 Servomechanisms			
(a) Understanding of the following terms: Open and closed loop systems, feedback, follow up, analogue transducers; Principles of operation and use of the following synchro system components/features: resolvers, differential, control and torque, transformers, inductance and capacitance transmitters.	—	1	—
(b) Understanding of the following terms: Open and closed loop, follow up, servomechanism, analogue, transducer, null, damping, feedback, deadband; Construction operation and use of the following synchro system components: resolvers, differential, control and torque, E and I transformers, inductance transmitters, capacitance transmitters, synchronous transmitters; Servomechanism defects, reversal of synchro leads, hunting.	—	—	2

MODULE 5. DIGITAL TECHNIQUES ELECTRONIC INSTRUMENT SYSTEMS

	Level			
	A	B1.1 B1.3	B1.2 B1.4	B2
5.1 Electronic Instrument Systems Typical systems arrangements and cockpit layout of electronic instrument systems.	1	2	2	3
5.2 Numbering Systems Numbering systems: binary, octal and hexadecimal; Demonstration of conversions between the decimal and binary, octal and hexadecimal systems and vice versa.	—	1	—	2
5.3 Data Conversion	—	1	—	2

Analogue Data, Digital Data; Operation and application of analogue to digital, and digital to analogue converters, inputs and outputs, limitations of various types.				
5.4 Data Buses	—	2	—	2
Operation of data buses in aircraft systems, including knowledge of ARINC and other specifications.				
5.5 Logic Circuits				
(a)	—	2	—	2
Identification of common logic gate symbols, tables and equivalent circuits; Applications used for aircraft systems, schematic diagrams.				
(b)	—	—	—	2
Interpretation of logic diagrams.				
5.6 Basic Computer Structure				
(a)	1	2	—	—
Computer terminology (including bit, byte, software, hardware, CPU, IC, and various memory devices such as RAM, ROM, PROM); Computer technology (as applied in aircraft systems).				
(b)	—	—	—	2
Computer related terminology; Operation, layout and interface of the major components in a micro computer including their associated bus systems; Information contained in single and multiaddress instruction words; Memory associated terms; Operation of typical memory devices; Operation, advantages and disadvantages of the various data storage systems.				
5.7 Microprocessors	—	—	—	2
Functions performed and overall operation of a microprocessor; Basic operation of each of the following microprocessor elements: control and processing unit, clock, register, arithmetic logic unit.				
5.8 Integrated Circuits	—	—	—	2

Operation and use of encoders and decoders; Function of encoder types; Uses of medium, large and very large scale integration.				
5.9 Multiplexing	—	—	—	2
Operation, application and identification in logic diagrams of multiplexers and demultiplexers.				
5.10 Fibre Optics	—	1	1	2
Advantages and disadvantages of fibre optic data transmission over electrical wire propagation; Fibre optic data bus; Fibre optic related terms; Terminations; Couplers, control terminals, remote terminals; Application of fibre optics in aircraft systems.				
5.11 Electronic Displays	—	2	—	2
Principles of operation of common types of displays used in modern aircraft, including Cathode Ray Tubes, Light Emitting Diodes and Liquid Crystal Display.				
5.12 Electrostatic Sensitive Devices	1	2	2	2
Special handling of components sensitive to electrostatic discharges; Awareness of risks and possible damage, component and personnel anti-static protection devices.				
5.13 Software Management Control	—	2	1	2
Awareness of restrictions, airworthiness requirements and possible catastrophic effects of unapproved changes to software programmes.				
5.14 Electromagnetic Environment	—	2	2	2
Influence of the following phenomena on maintenance practices for electronic system: EMC-Electromagnetic Compatibility EMI-Electromagnetic Interference HIRF-High Intensity Radiated Field Lightning/lightning protection				
5.15 Typical Electronic/Digital Aircraft Systems	—	2	2	2

General arrangement of typical electronic/digital aircraft systems and associated BITE (Built In Test Equipment) testing such as: ACARS-ARINC Communication and Addressing and Reporting System ECAM-Electronic Centralised Aircraft Monitoring EFIS-Electronic Flight Instrument System EICAS-Engine Indication and Crew Alerting System FBW-Fly by Wire FMS-Flight Management System GPS-Global Positioning System IRS-Inertial Reference System TCAS-Traffic Alert Collision Avoidance System				

MODULE 6. MATERIALS AND HARDWARE

	Level		
	A	B1	B2
6.1 Aircraft Materials — Ferrous			
(a)	1	2	1
Characteristics, properties and identification of common alloy steels used in aircraft; Heat treatment and application of alloy steels;			
(b)	—	1	1
Testing of ferrous materials for hardness, tensile strength, fatigue strength and impact resistance.			
6.2 Aircraft Materials — Non-Ferrous			
(a)	1	2	1
Characteristics, properties and identification of common non-ferrous materials used in aircraft; Heat treatment and application of non-ferrous materials;			
(b)	—	1	1
Testing of non-ferrous material for hardness, tensile strength, fatigue strength and impact resistance.			
6.3 Aircraft Materials — Composite and Non-Metallic			

6.3.1 Composite and non-metallic other than wood and fabric			
(a)	1	2	2
Characteristics, properties and identification of common composite and non-metallic materials, other than wood, used in aircraft; Sealant and bonding agents.			
(b)	1	2	—
The detection of defects/deterioration in composite and non-metallic material. Repair of composite and non-metallic material.			
6.3.2 Wooden structures	1	2	—
Construction methods of wooden airframe structures; Characteristics, properties and types of wood and glue used in aeroplanes; Preservation and maintenance of wooden structure; Types of defects in wood material and wooden structures; The detection of defects in wooden structure; Repair of wooden structure.			
6.3.3 Fabric covering	1	2	—
Characteristics, properties and types of fabrics used in aeroplanes; Inspections methods for fabric; Types of defects in fabric; Repair of fabric covering.			
6.4 Corrosion			
(a)	1	1	1
Chemical fundamentals; Formation by, galvanic action process, microbiological, stress;			
(b)	2	3	2
Types of corrosion and their identification; Causes of corrosion; Material types, susceptibility to corrosion.			
6.5 Fasteners			
6.5.1 Screw threads	2	2	2
Screw nomenclature;			

Thread forms, dimensions and tolerances for standard threads used in aircraft; Measuring screw threads;			
6.5.2 Bolts, studs and screws	2	2	2
Bolt types: specification, identification and marking of aircraft bolts, international standards; Nuts: self locking, anchor, standard types; Machine screws: aircraft specifications; Studs: types and uses, insertion and removal; Self tapping screws, dowels.			
6.5.3 Locking devices	2	2	2
Tab and spring washers, locking plates, split pins, pal-nuts, wire locking, quick release fasteners, keys, circlips, cotter pins.			
6.5.4 Aircraft rivets	1	2	1
Types of solid and blind rivets: specifications and identification, heat treatment.			
6.6 Pipes and Unions			
(a)	2	2	2
Identification of, and types of rigid and flexible pipes and their connectors used in aircraft;			
(b)	2	2	1
Standard unions for aircraft hydraulic, fuel, oil, pneumatic and air system pipes.			
6.7 Springs	—	2	1
Types of springs, materials, characteristics and applications.			
6.8 Bearings	1	2	2
Purpose of bearings, loads, material, construction; Types of bearings and their application.			
6.9 Transmissions	1	2	2
Gear types and their application;			

Gear ratios, reduction and multiplication gear systems, driven and driving gears, idler gears, mesh patterns; Belts and pulleys, chains and sprockets.			
6.10 Control Cables	1	2	1
Types of cables; End fittings, turnbuckles and compensation devices; Pulleys and cable system components; Bowden cables; Aircraft flexible control systems.			
6.11 Electrical Cables and Connectors	1	2	2
Cable types, construction and characteristics; High tension and co-axial cables; Crimping; Connector types, pins, plugs, sockets, insulators, current and voltage rating, coupling, identification codes.			

MODULE 7. MAINTENANCE PRACTICES

	Level		
	A	B1	B2
7.1 Safety Precautions-Aircraft and Workshop	3	3	3
Aspects of safe working practices including precautions to take when working with electricity, gases especially oxygen, oils and chemicals. Also, instruction in the remedial action to be taken in the event of a fire or another accident with one or more of these hazards including knowledge on extinguishing agents.			
7.2 Workshop Practices	3	3	3
Care of tools, control of tools, use of workshop materials; Dimensions, allowances and tolerances, standards of workmanship; Calibration of tools and equipment, calibration standards.			
7.3 Tools	3	3	3
Common hand tool types; Common power tool types; Operation and use of precision measuring tools; Lubrication equipment and methods. Operation, function and use of electrical general test equipment;			
7.4 Avionic General Test Equipment	—	2	3

Operation, function and use of avionic general test equipment.			
7.5 Engineering Drawings, Diagrams and Standards Drawing types and diagrams, their symbols, dimensions, tolerances and projections; Identifying title block information; Microfilm, microfiche and computerised presentations; Specification 100 of the Air Transport Association (ATA) of America; Aeronautical and other applicable standards including ISO, AN, MS, NAS and MIL; Wiring diagrams and schematic diagrams.	1	2	2
7.6 Fits and Clearances Drill sizes for bolt holes, classes of fits; Common system of fits and clearances; Schedule of fits and clearances for aircraft and engines; Limits for bow, twist and wear; Standard methods for checking shafts, bearings and other parts.	1	2	1
7.7 Electrical Cables and Connectors Continuity, insulation and bonding techniques and testing; Use of crimp tools: hand and hydraulic operated; Testing of crimp joints; Connector pin removal and insertion; Co-axial cables: testing and installation precautions; Wiring protection techniques: Cable looming and loom support, cable clamps, protective sleeving techniques including heat shrink wrapping, shielding.	1	2	2
7.8 Riveting Riveted joints, rivet spacing and pitch; Tools used for riveting and dimpling; Inspection of riveted joints.	1	2	—
7.9 Pipes and Hoses Bending and belling/flaring aircraft pipes; Inspection and testing of aircraft pipes and hoses; Installation and clamping of pipes.	1	2	—
7.10 Springs Inspection and testing of springs.	1	2	—
7.11 Bearings	1	2	—

Testing, cleaning and inspection of bearings; Lubrication requirements of bearings; Defects in bearings and their causes.			
7.12 Transmissions	1	2	—
Inspection of gears, backlash; Inspection of belts and pulleys, chains and sprockets; Inspection of screw jacks, lever devices, push-pull rod systems.			
7.13 Control Cables	1	2	—
Swaging of end fittings; Inspection and testing of control cables; Bowden cables; aircraft flexible control systems.			
7.14 Material handling			
7.14.1 Sheet Metal	—	2	—
Marking out and calculation of bend allowance; Sheet metal working, including bending and forming; Inspection of sheet metal work.			
7.14.2 Composite and non-metallic	—	2	—
Bonding practices; Environmental conditions Inspection methods			
7.15 Welding, Brazing, Soldering and Bonding			
(a)	—	2	2
Soldering methods; inspection of soldered joints.			
(b)	—	2	—
Welding and brazing methods; Inspection of welded and brazed joints; Bonding methods and inspection of bonded joints.			
7.16 Aircraft Weight and Balance			
(a)	—	2	2

Centre of Gravity/Balance limits calculation: use of relevant documents;			
(b)	—	2	—
Preparation of aircraft for weighing; Aircraft weighing;			
7.17 Aircraft Handling and Storage	2	2	2
Aircraft taxiing/towing and associated safety precautions; Aircraft jacking, chocking, securing and associated safety precautions; Aircraft storage methods; Refuelling/defuelling procedures; De-icing/anti-icing procedures; Electrical, hydraulic and pneumatic ground supplies. Effects of environmental conditions on aircraft handling and operation.			
7.18 Disassembly, Inspection, Repair and Assembly Techniques			
(a)	2	3	2
Types of defects and visual inspection techniques. Corrosion removal, assessment and reprotection.			
(b)	—	2	—
General repair methods, Structural Repair Manual; Ageing, fatigue and corrosion control programmes;			
(c)	—	2	1
Non destructive inspection techniques including, penetrant, radiographic, eddy current, ultrasonic and boroscope methods.			
(d)	2	2	2
Disassembly and re-assembly techniques.			
(e)	—	2	2
Trouble shooting techniques			
7.19 Abnormal Events			
(a)	2	2	2
Inspections following lightning strikes and HIRF penetration.			

(b) Inspections following abnormal events such as heavy landings and flight through turbulence.	2	2	—
7.20 Maintenance Procedures Maintenance planning; Modification procedures; Stores procedures; Certification/release procedures; Interface with aircraft operation; Maintenance Inspection/Quality Control/Quality Assurance; Additional maintenance procedures. Control of life limited components	1	2	2

MODULE 8. BASIC AERODYNAMICS

	Level		
	A	B1	B2
8.1 Physics of the Atmosphere International Standard Atmosphere (ISA), application to aerodynamics.	1	2	2
8.2 Aerodynamics Airflow around a body; Boundary layer, laminar and turbulent flow, free stream flow, relative airflow, upwash and downwash, vortices, stagnation; The terms: camber, chord, mean aerodynamic chord, profile (parasite) drag, induced drag, centre of pressure, angle of attack, wash in and wash out, fineness ratio, wing shape and aspect ratio; Thrust, Weight, Aerodynamic Resultant; Generation of Lift and Drag: Angle of Attack, Lift coefficient, Drag coefficient, polar curve, stall; Aerofoil contamination including ice, snow, frost.	1	2	2
8.3 Theory of Flight Relationship between lift, weight, thrust and drag; Glide ratio; Steady state flights, performance; Theory of the turn; Influence of load factor: stall, flight envelope and structural limitations; Lift augmentation.	1	2	2

8.4 Flight Stability and Dynamics Longitudinal, lateral and directional stability (active and passive).	1	2	2

MODULE 9. HUMAN FACTORS

	Level		
	A	B1	B2
9.1 General The need to take human factors into account; Incidents attributable to human factors/human error; 'Murphy's' law.	1	2	2
9.2 Human Performance and Limitations Vision; Hearing; Information processing; Attention and perception; Memory; Claustrophobia and physical access.	1	2	2
9.3 Social Psychology Responsibility: individual and group; Motivation and de-motivation; Peer pressure; 'Culture' issues; Team working; Management, supervision and leadership.	1	1	1
9.4 Factors Affecting Performance Fitness/health; Stress: domestic and work related; Time pressure and deadlines; Workload: overload and underload; Sleep and fatigue, shiftwork; Alcohol, medication, drug abuse.	2	2	2
9.5 Physical Environment Noise and fumes; Illumination; Climate and temperature;	1	1	1

Motion and vibration; Working environment.			
9.6 Tasks Physical work; Repetitive tasks; Visual inspection; Complex systems.	1	1	1
9.7 Communication Within and between teams; Work logging and recording; Keeping up to date, currency; Dissemination of information.	2	2	2
9.8 Human Error Error models and theories; Types of error in maintenance tasks; Implications of errors (i.e accidents) Avoiding and managing errors.	1	2	2
9.9 Hazards in the Workplace Recognising and avoiding hazards; Dealing with emergencies.	1	2	2

MODULE 10. AVIATION LEGISLATION

	Level		
	A	B1	B2
10.1 Regulatory Framework Role of International Civil Aviation Organisation; Role of CAD and general understanding of civil aviation regulations; Relationship between MCAR-145, MCAR-66, MCAR-147, MCAR-21 and MCAR- M; Relationship with other Aviation Authorities.	1	1	1
10.2 MCAR-66 — Aircraft Maintenance Licensing Detailed understanding of MCAR-66.	2	2	2
10.3 MCAR-145 — Approved Maintenance Organisations Detailed understanding of MCAR-145.	2	2	2

10.4 Operation of Aircraft	1	1	1
Air Operators Certificates; Operators Responsibilities; Documents to be Carried; Aircraft Placarding (Markings);			
10.5 Aircraft Certification			
(a) General	—	1	1
Certification rules; Type Certification; Supplemental Type Certification; MCAR-21 Design/Production Organisation Approvals.			
(b) Documents	—	2	2
Certificate of Airworthiness; Certificate of Registration; Noise Certificate; Weight Schedule; Radio Station Licence and Approval.			
10.6 MCAR-M	2	2	2
Detailed understanding of MCAR-M.			
10.7 Other Applicable Requirements			
(a)	1	2	2
Maintenance Programmes, Maintenance checks and inspections; Master Minimum Equipment Lists, Minimum Equipment List, Dispatch Deviation Lists; Mandatory Aircraft Equipment Airworthiness Directives; Service Bulletins, manufacturers service information; Modifications and repairs; Maintenance documentation: maintenance manuals, structural repair manual, illustrated parts catalogue, etc.;			
(b)	—	1	1
Continuing airworthiness; Test flights; ETOPS, maintenance and dispatch requirements;			

All Weather Operations, Category 2/3 operations and minimum equipment requirements.			

MODULE 11A. TURBINE AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS

	Level		
	A1	B1.1	B2
11.1 Theory of Flight			
11.1.1 Aeroplane Aerodynamics and Flight Controls Operation and effect of: — roll control: ailerons and spoilers; — pitch control: elevators, stabilators, variable incidence stabilisers and canards; — yaw control, rudder limiters; Control using elevons, ruddervators; High lift devices, slots, slats, flaps, flaperons; Drag inducing devices, spoilers, lift dumpers, speed brakes; Effects of wing fences, saw tooth leading edges; Boundary layer control using, vortex generators, stall wedges or leading edge devices; Operation and effect of trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels;	1	2	—
11.1.2 High Speed Flight Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number, compressibility buffet, shock wave, aerodynamic heating, area rule; Factors affecting airflow in engine intakes of high speed aircraft; Effects of sweepback on critical Mach number.	1	2	—
11.2 Airframe Structures — General Concepts			
(a) Airworthiness requirements for structural strength; Structural classification, primary, secondary and tertiary; Fail safe, safe life, damage tolerance concepts; Zonal and station identification systems; Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue; Drains and ventilation provisions; System installation provisions; Lightning strike protection provision. Aircraft bonding	2	2	—

(b)	1	2	—
Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, anti-corrosive protection, wing, empennage and engine attachments; Structure assembly techniques: riveting, bolting, bonding; Methods of surface protection, such as chromating, anodising, painting; Surface cleaning. Airframe symmetry: methods of alignment and symmetry checks.			
11.3 Airframe Structures — Aeroplanes			
11.3.1 Fuselage (ATA 52/53/56)	1	2	—
Construction and pressurisation sealing; Wing, stabiliser, pylon and undercarriage attachments; Seat installation and cargo loading system; Doors and emergency exits: construction, mechanisms, operation and safety devices; Windows and windscreen construction and mechanisms.			
11.3.2 Wings (ATA 57)	1	2	—
Construction; Fuel storage; Landing gear, pylon, control surface and high lift/drag attachments.			
11.3.3 Stabilisers (ATA 55)	1	2	—
Construction; Control surface attachment.			
11.3.4 Flight Control Surfaces (ATA 55/57)	1	2	—
Construction and attachment; Balancing — mass and aerodynamic.			
11.3.5 Nacelles/Pylons (ATA 54)	1	2	—
Construction; Firewalls; Engine mounts.			
11.4 Air Conditioning and Cabin Pressurisation (ATA21)			

11.4.1 Air supply	1	2	—
Sources of air supply including engine bleed, APU and ground cart;			
11.4.2 Air Conditioning	1	3	—
Air conditioning systems; Air cycle and vapour cycle machines; Distribution systems; Flow, temperature and humidity control system.			
11.4.3 Pressurisation	1	3	—
Pressurisation systems; Control and indication including control and safety valves; Cabin pressure controllers.			
11.4.4 Safety and warning devices	1	3	—
Protection and warning devices.			
11.5 Instruments/Avionic Systems			
11.5.1 Instrument Systems (ATA 31)	1	2	—
Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator; Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems; Other aircraft system indication.			
11.5.2 Avionic Systems	1	1	—
Fundamentals of system lay-outs and operation of; Auto Flight (ATA 22); Communications (ATA 23); Navigation Systems (ATA 34).			
11.6 Electrical Power (ATA 24)	1	3	—
Batteries Installation and Operation; DC power generation; AC power generation; Emergency power generation; Voltage regulation;			

Power distribution; Inverters, transformers, rectifiers; Circuit protection. External/Ground power;			
11.7 Equipment and Furnishings (ATA 25)			
(a)	2	2	—
Emergency equipment requirements; Seats, harnesses and belts.			
(b)	1	1	—
Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation; Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Airstairs.			
11.8 Fire Protection (ATA 26)	1	3	—
(a)			
Fire and smoke detection and warning systems; Fire extinguishing systems; System tests.			
(b)			
Portable fire extinguisher	1	1	—
11.9 Flight Controls (ATA 27)	1	3	—
Primary controls: aileron, elevator, rudder, spoiler; Trim control; Active load control; High lift devices; Lift dump, speed brakes; System operation: manual, hydraulic, pneumatic, electrical, fly-by-wire; Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks systems; Balancing and rigging; Stall protection/warning system.			
11.10 Fuel Systems (ATA 28)	1	3	—

System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Refuelling and defuelling; Longitudinal balance fuel systems.			
11.11 Hydraulic Power (ATA 29)	1	3	—
System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.			
11.12 Ice and Rain Protection (ATA 30)	1	3	—
Ice formation, classification and detection; Anti-icing systems: electrical, hot air and chemical; De-icing systems: electrical, hot air, pneumatic and chemical; Rain repellant; Probe and drain heating. Wiper systems			
11.13 Landing Gear (ATA 32)	2	3	—
Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and autobraking; Tyres; Steering.			
11.14 Lights (ATA 33)	2	3	—
External: navigation, anti-collision, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.			
11.15 Oxygen (ATA 35)	1	3	—
System lay-out: cockpit, cabin; Sources, storage, charging and distribution;			

Supply regulation; Indications and warnings;			
11.16 Pneumatic/Vacuum (ATA 36)	1	3	—
System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure control; Distribution; Indications and warnings; Interfaces with other systems.			
11.17 Water/Waste (ATA 38)	2	3	—
Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing; Corrosion aspects.			
11.18 On Board Maintenance Systems (ATA 45)	1	2	—
Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).			

MODULE 11B. PISTON AEROPLANE AERODYNAMICS, STRUCTURES AND SYSTEMS

Note: The scope of this Module should reflect the technology of aeroplanes pertinent to the A2 and B1.2 subcategory.

	Level		
	A2	B1.2	B2
11.1 Theory of Flight			
11.1.1 Aeroplane Aerodynamics and Flight Controls	1	2	—
Operation and effect of: — roll control: ailerons and spoilers; — pitch control: elevators, stabilators, variable incidence stabilisers and canards; — yaw control, rudder limiters;			

Control using elevons, ruddervators; High lift devices, slots, slats, flaps, flaperons; Drag inducing devices, spoilers, lift dumpers, speed brakes; Effects of wing fences, saw tooth leading edges; Boundary layer control using, vortex generators, stall wedges or leading edge devices; Operation and effect of trim tabs, balance and antibalance (leading) tabs, servo tabs, spring tabs, mass balance, control surface bias, aerodynamic balance panels;			
11.1.2 High Speed Flight — N/A	—	—	—
11.2 Airframe Structures — General Concepts			
(a)	2	2	—
Airworthiness requirements for structural strength; Structural classification, primary, secondary and tertiary; Fail safe, safe life, damage tolerance concepts; Zonal and station identification systems; Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue; Drains and ventilation provisions; System installation provisions; Lightning strike protection provision. Aircraft bonding			
(b)	1	2	—
Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning, anti-corrosive protection, wing, empennage and engine attachments; Structure assembly techniques: riveting, bolting, bonding; Methods of surface protection, such as chromating, anodising, painting; Surface cleaning; Airframe symmetry: methods of alignment and symmetry checks.			
11.3 Airframe Structures — Aeroplanes			
11.3.1 Fuselage (ATA 52/53/56)	1	2	—
Construction and pressurisation sealing; Wing, tail-plane pylon and undercarriage attachments; Seat installation; Doors and emergency exits: construction and operation; Window and windscreen attachment.			
11.3.2 Wings (ATA 57)	1	2	—

Construction; Fuel storage; Landing gear, pylon, control surface and high lift/drag attachments.			
11.3.3 Stabilisers (ATA 55) Construction; Control surface attachment.	1	2	—
11.3.4 Flight Control Surfaces (ATA 55/57) Construction and attachment; Balancing — mass and aerodynamic.	1	2	—
11.3.5 Nacelles/Pylons (ATA 54)			
(a) Nacelles/Pylons: — Construction; — Firewalls; — Engine mounts.	1	2	—
11.4 Air Conditioning and Cabin Pressurisation (ATA21) Pressurisation and air conditioning systems; Cabin pressure controllers, protection and warning devices.	1	3	—
11.5 Instruments/Avionic Systems			
11.5.1 Instrument Systems (ATA 31) Pitot static: altimeter, air speed indicator, vertical speed indicator; Gyroscopic: artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator; Compasses: direct reading, remote reading; Angle of attack indication, stall warning systems. Other aircraft system indication.	1	2	—
11.5.2 Avionic Systems Fundamentals of system lay-outs and operation of: — Auto Flight (ATA 22); — Communications (ATA 23); — Navigation Systems (ATA 34).	1	1	—

11.6 Electrical Power (ATA 24)	1	3	—
Batteries Installation and Operation; DC power generation; Voltage regulation; Power distribution; Circuit protection; Inverters, transformers.			
11.7 Equipment and Furnishings (ATA 25)			
(a)	2	2	—
Emergency equipment requirements; Seats, harnesses and belts.			
(b)	1	1	—
Cabin lay-out; Equipment lay-out; Cabin Furnishing Installation (level 2); Cabin entertainment equipment; Galley installation; Cargo handling and retention equipment; Airstairs.			
11.8 Fire Protection (ATA 26)			
(a)	1	3	—
Fire extinguishing systems; Fire and smoke detection and warning systems; System tests.			
(b)	1	3	—
Portable fire extinguisher.			
11.9 Flight Controls (ATA 27)	1	3	—
Primary controls: aileron, elevator, rudder; Trim tabs; High lift devices; System operation: manual; Gust locks; Balancing and rigging; Stall warning system.			
11.10 Fuel Systems (ATA 28)	1	3	—

System lay-out; Fuel tanks; Supply systems; Cross-feed and transfer; Indications and warnings; Refuelling and defuelling.			
11.11 Hydraulic Power (ATA 29)	1	3	—
System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical; Pressure Control; Power distribution; Indication and warning systems.			
11.12 Ice and Rain Protection (ATA 30)	1	3	—
Ice formation, classification and detection; De-icing systems: electrical, hot air, pneumatic and chemical; Probe and drain heating; Wiper systems.			
11.13 Landing Gear (ATA 32)	2	3	—
Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, brakes, antiskid and autobraking; Tyres; Steering.			
11.14 Lights (ATA 33)	2	2	—
External: navigation, anti collision, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.			
11.15 Oxygen (ATA 35)	1	3	—
System lay-out: cockpit, cabin; Sources, storage, charging and distribution; Supply regulation; Indications and warnings;			

11.16 Pneumatic/Vacuum (ATA 36) System lay-out; Sources: engine/APU, compressors, reservoirs, ground supply; Pressure control; Distribution; Indications and warnings; Interfaces with other systems.	1	3	—
11.17 Water/Waste (ATA 38) Water system lay-out, supply, distribution, servicing and draining; Toilet system lay-out, flushing and servicing; Corrosion aspects.	2	3	—

MODULE 12. HELICOPTER AERODYNAMICS, STRUCTURES AND SYSTEMS

	Level		
	A3 A4	B1.3 B1.4	B2
12.1 Theory of Flight — Rotary Wing Aerodynamics Terminology; Effects of gyroscopic precession; Torque reaction and directional control; Dissymmetry of lift, Blade tip stall; Translating tendency and its correction; Coriolis effect and compensation; Vortex ring state, power settling, overpitching; Auto-rotation; Ground effect.	1	2	—
12.2 Flight Control Systems Cyclic control; Collective control; Swashplate; Yaw control: Anti-Torque Control, Tail rotor, bleed air; Main Rotor Head: Design and Operation features; Blade Dampers: Function and construction; Rotor Blades: Main and tail rotor blade construction and attachment; Trim control, fixed and adjustable stabilisers; System operation: manual, hydraulic, electrical and fly-by- wire; Artificial feel; Balancing and Rigging.	2	3	—
12.3 Blade Tracking and Vibration Analysis	1	3	—

Rotor alignment; Main and tail rotor tracking; Static and dynamic balancing; Vibration types, vibration reduction methods; Ground resonance.			
12.4 Transmissions	1	3	—
Gear boxes, main and tail rotors; Clutches, free wheel units and rotor brake.			
12.5 Airframe Structures			
(a)	2	2	—
Airworthiness requirements for structural strength; Structural classification, primary, secondary and tertiary; Fail safe, safe life, damage tolerance concepts; Zonal and station identification systems; Stress, strain, bending, compression, shear, torsion, tension, hoop stress, fatigue; Drains and ventilation provisions; System installation provisions; Lightning strike protection provision.			
(b)	1	2	—
Construction methods of: stressed skin fuselage, formers, stringers, longerons, bulkheads, frames, doublers, struts, ties, beams, floor structures, reinforcement, methods of skinning and anti-corrosive protection. Pylon, stabiliser and undercarriage attachments; Seat installation; Doors: construction, mechanisms, operation and safety devices; Windows and windscreen construction; Fuel storage; Firewalls; Engine mounts; Structure assembly techniques: riveting, bolting, bonding; Methods of surface protection, such as chromating, anodising, painting; Surface cleaning. Airframe symmetry: methods of alignment and symmetry checks.			
12.6 Air Conditioning (ATA 21)			
12.6.1 Air supply	1	2	—

Sources of air supply including engine bleed and ground cart;			
12.6.2 Air Conditioning	1	3	—
Air conditioning systems; Distribution systems; Flow and temperature control systems; Protection and warning devices.			
12.7 Instruments/Avionic Systems			
12.7.1 Instrument Systems (ATA 31)	1	2	—
Pitot static:altimeter, air speed indicator, vertical speed indicator; Gyroscopic:artificial horizon, attitude director, direction indicator, horizontal situation indicator, turn and slip indicator, turn coordinator; Compasses: direct reading, remote reading; . Vibration indicating systems — HUMS; Other aircraft system indication			
12.7.2 Avionic Systems	1	1	—
Fundamentals of system layouts and operation of: Auto Flight (ATA 22); Communications (ATA 23); Navigation Systems (ATA 34).			
12.8 Electrical Power (ATA 24)	1	3	—
Batteries Installation and Operation; DC power generation, AC power generation; Emergency power generation; Voltage regulation, Circuit protection. Power distribution; Inverters, transformers, rectifiers; External/Ground power.			
12.9 Equipment and Furnishings (ATA 25)			
(a)	2	2	—
Emergency equipment requirements; Seats, harnesses and belts; Lifting systems.			
(b)	1	1	—
Emergency flotation systems; Cabin lay-out, cargo retention; Equipment lay-out;			

Cabin Furnishing Installation.			
12.10 Fire Protection (ATA 26)	1	3	—
Fire and smoke detection and warning systems; Fire extinguishing systems; System tests.			
12.11 Fuel Systems (ATA 28)	1	3	—
System lay-out; Fuel tanks; Supply systems; Dumping, venting and draining; Cross-feed and transfer; Indications and warnings; Refuelling and defuelling.			
12.12 Hydraulic Power (ATA 29)	1	3	—
System lay-out; Hydraulic fluids; Hydraulic reservoirs and accumulators; Pressure generation: electric, mechanical, pneumatic; Emergency pressure generation; Pressure Control; Power distribution; Indication and warning systems; Interface with other systems.			
12.13 Ice and Rain Protection (ATA 30)	1	3	—
Ice formation, classification and detection; Anti-icing and de-icing systems: electrical, hot air and chemical; Rain repellant and removal; Probe and drain heating.			
12.14 Landing Gear (ATA 32)	2	3	—
Construction, shock absorbing; Extension and retraction systems: normal and emergency; Indications and warning; Wheels, tyres, brakes; Steering Skids, floats.			
12.15 Lights (ATA 33)	2	3	—
External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo;			

Emergency.			
12.16 Pneumatic/Vacuum (ATA 36) System lay-out; Sources: engine, compressors, reservoirs, ground supply.; Pressure control; Distribution; Indications and warnings; Interfaces with other systems.	1	3	—

MODULE 13. AIRCRAFT AERODYNAMICS, STRUCTURES AND SYSTEMS

	Level		
	A	B1	B2
13.1 Theory of Flight			
(a) Aeroplane Aerodynamics and Flight Controls Operation and effect of: — roll control: ailerons and spoilers; — pitch control: elevators, stabilators, variable incidence stabilisers and canards; — yaw control, rudder limiters; Control using elevons, ruddervators; High lift devices: slots, slats, flaps; Drag inducing devices: spoilers, lift dumpers, speed brakes; Operation and effect of trim tabs, servo tabs, control surface bias.	—	—	1
(b) High Speed Flight Speed of sound, subsonic flight, transonic flight, supersonic flight, Mach number, critical Mach number.	—	—	1
(c) Rotary Wing Aerodynamics Terminology; Operation and effect of cyclic, collective and anti-torque controls.	—	—	1
13.2 Structures — General Concepts			
(a) Fundamentals of structural systems.	—	—	1
(b) Zonal and station identification systems; Electrical bonding; Lightning strike protection provision.	—	—	2
13.3 Autoflight (ATA 22)	—	—	3

Fundamentals of automatic flight control including working principles and current terminology; Command signal processing; Modes of operation: roll, pitch and yaw channels; Yaw dampers; Stability Augmentation System in helicopters; Automatic trim control; Autopilot navigation aids interface; Autothrottle systems. Automatic Landing Systems: principles and categories, modes of operation, approach, glideslope, land, go-around, system monitors and failure conditions.			
13.4 Communication/Navigation (ATA 23/34)	—	—	3
Fundamentals of radio wave propagation, antennas, transmission lines, communication, receiver and transmitter; Working principles of following systems: — Very High Frequency (VHF) communication; — High Frequency (HF) communication; — Audio; — Emergency Locator Transmitters; — Cockpit Voice Recorder; — Very High Frequency omnidirectional range (VOR); — Automatic Direction Finding (ADF); — Instrument Landing System (ILS); — Microwave Landing System (MLS); — Flight Director systems; Distance Measuring Equipment (DME); — Very Low Frequency and hyperbolic navigation (VLF/ Omega); — Doppler navigation; — Area navigation, RNAV systems; — Flight Management Systems; — Global Positioning System (GPS), Global Navigation Satellite Systems (GNSS); — Inertial Navigation System; — Air Traffic Control transponder, secondary surveillance radar; — Traffic Alert and Collision Avoidance System (TCAS); — Weather avoidance radar; — Radio altimeter; — ARINC communication and reporting;			
13.5 Electrical Power (ATA 24)	—	—	3
Batteries Installation and Operation; DC power generation; AC power generation; Emergency power generation; Voltage regulation; Power distribution; Inverters, transformers, rectifiers;			

Circuit protection; External/Ground power			
13.6 Equipment and Furnishings (ATA 25)	—	—	3
Electronic emergency equipment requirements; Cabin entertainment equipment.			
Flight Controls (ATA 27)			
(a)	—	—	1
Primary controls: aileron, elevator, rudder, spoiler; Trim control; Active load control; High lift devices; Lift dump, speed brakes; System operation: manual, hydraulic, pneumatic; Artificial feel, Yaw damper, Mach trim, rudder limiter, gust locks. Stall protection systems.			
(b)	—	—	2
System operation: electrical, fly by wire.			
13.8 Instrument Systems (ATA 31)	—	—	2
Classification; Atmosphere; Terminology; Pressure measuring devices and systems; Pitot static systems; Altimeters; Vertical speed indicators; Airspeed indicators; Machmeters; Altitude reporting/alerting systems; Air data computers; Instrument pneumatic systems; Direct reading pressure and temperature gauges; Temperature indicating systems; Fuel quantity indicating systems; Gyroscopic principles; Artificial horizons; Slip indicators; Directional gyros; Ground Proximity Warning Systems; Compass systems; Flight Data Recording systems; Electronic Flight Instrument Systems; Instrument warning systems including master warning systems and centralised warning panels;			

Stall warning systems and angle of attack indicating systems; Vibration measurement and indication.			
13.9 Lights (ATA 33) External: navigation, landing, taxiing, ice; Internal: cabin, cockpit, cargo; Emergency.	—	—	3
13.10 On board Maintenance Systems (ATA 45) Central maintenance computers; Data loading system; Electronic library system; Printing; Structure monitoring (damage tolerance monitoring).	—	—	2

MODULE 14 PROPULSION

	Level		
	A	B1	B2
14.1 Turbine Engines			
(a) Constructional arrangement and operation of turbojet, turbofan, turboshaft and turbopropeller engines;	—	—	1
(b) Electronic Engine control and fuel metering systems (FADEC).	—	—	2
14.2 Engine Indicating Systems Exhaust gas temperature/Interstage turbine temperature systems; Engine speed; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature; Fuel pressure, temperature and flow; Manifold pressure; Engine torque; Propeller speed.	—	—	2

MODULE 15. GAS TURBINE ENGINE

	Level		
	A	B1	B2
15.1 Fundamentals Potential energy, kinetic energy, Newton's laws of motion, Brayton cycle; The relationship between force, work, power, energy, velocity, acceleration; Constructional arrangement and operation of turbojet, turbofan, turboshaft, turboprop.	1	2	—
15.2 Engine Performance Gross thrust, net thrust, choked nozzle thrust, thrust distribution, resultant thrust, thrust horsepower, equivalent shaft horsepower, specific fuel consumption; Engine efficiencies; By-pass ratio and engine pressure ratio; Pressure, temperature and velocity of the gas flow; Engine ratings, static thrust, influence of speed, altitude and hot climate, flat rating, limitations.	—	2	—
15.3 Inlet Compressor inlet ducts Effects of various inlet configurations; Ice protection.	2	2	—
15.4 Compressors Axial and centrifugal types; Constructional features and operating principles and applications; Fan balancing; Operation: Causes and effects of compressor stall and surge; Methods of air flow control: bleed valves, variable inlet guide vanes, variable stator vanes, rotating stator blades; Compressor ratio.	1	2	—
15.5 Combustion Section Constructional features and principles of operation.	1	2	—
15.6 Turbine Section Operation and characteristics of different turbine blade types; Blade to disk attachment; Nozzle guide vanes;	2	2	—

Causes and effects of turbine blade stress and creep.			
15.7 Exhaust Constructional features and principles of operation; Convergent, divergent and variable area nozzles; Engine noise reduction; Thrust reversers.	1	2	—
15.8 Bearings and Seals Constructional features and principles of operation.	—	2	—
15.9 Lubricants and Fuels Properties and specifications; Fuel additives; Safety precautions.	1	2	—
15.10 Lubrication Systems System operation/lay-out and components.	1	2	—
15.11 Fuel Systems Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.	1	2	—
15.12 Air Systems Operation of engine air distribution and anti-ice control systems, including internal cooling, sealing and external air services.	1	2	—
15.13 Starting and Ignition Systems Operation of engine start systems and components; Ignition systems and components; Maintenance safety requirements.	1	2	—
15.14 Engine Indication Systems Exhaust Gas Temperature/Interstage Turbine Temperature; Engine Thrust Indication: Engine Pressure Ratio, engine turbine discharge pressure or jet pipe pressure systems; Oil pressure and temperature; Fuel pressure and flow; Engine speed; Vibration measurement and indication;	1	2	—

Torque; Power.			
15.15 Power Augmentation Systems Operation and applications; Water injection, water methanol; Afterburner systems.	—	1	—
15.16 Turbo-prop Engines Gas coupled/free turbine and gear coupled turbines; Reduction gears; Integrated engine and propeller controls; Overspeed safety devices.	1	2	—
15.17 Turbo-shaft engines Arrangements, drive systems, reduction gearing, couplings, control systems.	1	2	—
15.18 Auxiliary Power Units (APUs) Purpose, operation, protective systems.	1	2	—
15.19 Powerplant Installation Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.	1	2	—
15.20 Fire Protection Systems Operation of detection and extinguishing systems.	1	2	—
15.21 Engine Monitoring and Ground Operation Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Trend (including oil analysis, vibration and boroscope) monitoring; Inspection of engine and components to criteria, tolerances and data specified by engine manufacturer; Compressor washing/cleaning; Foreign Object Damage.	1	3	—
15.22 Engine Storage and Preservation Preservation and depreservation for the engine and accessories / systems.	—	2	—

MODULE 16. PISTON ENGINE

	Level		
	A	B1	B2
16.1 Fundamentals	1	2	—
Mechanical, thermal and volumetric efficiencies; Operating principles — 2 stroke, 4 stroke, Otto and Diesel; Piston displacement and compression ratio; Engine configuration and firing order.			
16.2 Engine Performance	1	2	—
Power calculation and measurement; Factors affecting engine power; Mixtures/leaning, pre-ignition.			
16.3 Engine Construction	1	2	—
Crank case, crank shaft, cam shafts, sumps; Accessory gearbox; Cylinder and piston assemblies; Connecting rods, inlet and exhaust manifolds; Valve mechanisms; Propeller reduction gearboxes.			
16.4 Engine Fuel Systems			
16.4.1 Carburettors	1	2	—
Types, construction and principles of operation; Icing and heating.			
16.4.2 Fuel injection systems	1	2	—
Types, construction and principles of operation.			
16.4.3 Electronic engine control	1	2	—
Operation of engine control and fuel metering systems including electronic engine control (FADEC); Systems lay-out and components.			
16.5 Starting and Ignition Systems	1	2	—
Starting systems, pre-heat systems; Magneto types, construction and principles of operation; Ignition harnesses, spark plugs; Low and high tension systems.			

16.6 Induction, Exhaust and Cooling Systems Construction and operation of: induction systems including alternate air systems; Exhaust systems, engine cooling systems — air and liquid.	1	2	—
16.7 Supercharging/Turbocharging Principles and purpose of supercharging and its effects on engine parameters; Construction and operation of supercharging/turbocharging systems; System terminology; Control systems; System protection	1	2	—
16.8 Lubricants and Fuels Properties and specifications; Fuel additives; Safety precautions.	1	2	—
16.9 Lubrication Systems System operation/lay-out and components.	1	2	—
16.10 Engine Indication Systems Engine speed; Cylinder head temperature; Coolant temperature; Oil pressure and temperature; Exhaust Gas Temperature; Fuel pressure and flow; Manifold pressure.	1	2	—
16.11 Powerplant Installation Configuration of firewalls, cowlings, acoustic panels, engine mounts, anti-vibration mounts, hoses, pipes, feeders, connectors, wiring looms, control cables and rods, lifting points and drains.	1	2	—
16.12 Engine Monitoring and Ground Operation Procedures for starting and ground run-up; Interpretation of engine power output and parameters; Inspection of engine and components: criteria, tolerances, and data specified by engine manufacturer.	1	3	—
16.13 Engine Storage and Preservation Preservation and depreservation for the engine and accessories /	—	2	—

systems.			

MODULE 17. PROPELLER

	Level		
	A	B1	B2
17.1 Fundamentals Blade element theory; High/low blade angle, reverse angle, angle of attack, rotational speed; Propeller slip; Aerodynamic, centrifugal, and thrust forces; Torque; Relative airflow on blade angle of attack; Vibration and resonance.	1	2	—
17.2 Propeller Construction Construction methods and materials used in wooden, composite and metal propellers; Blade station, blade face, blade shank, blade back and hub assembly; Fixed pitch, controllable pitch, constant speeding propeller; Propeller/spinner installation.	1	2	—
17.3 Propeller Pitch Control Speed control and pitch change methods, mechanical and electrical/electronic; Feathering and reverse pitch; Overspeed protection.	1	2	—
17.4 Propeller Synchronising Synchronising and synchrophasing equipment.	—	2	—
17.5 Propeller Ice Protection Fluid and electrical de-icing equipment.	1	2	—
17.6 Propeller Maintenance Static and dynamic balancing; Blade tracking; Assessment of blade damage, erosion, corrosion, impact damage, delamination; Propeller treatment/repair schemes; Propeller engine running.	1	3	—

17.7 Propeller Storage and Preservation Propeller preservation and depreservation	1	2	—

Appendix II

Basic Examination Standard

1. Standardisation Basis for Examinations

1.1. All basic examinations must be carried out using the multi-choice question format and essay questions as specified below.

1.2. Each multi-choice question must have three alternative answers of which only one must be the correct answer and the candidate must be allowed a time per module which is based upon a nominal average of 75 seconds per question.

1.3. Each essay question requires the preparation of a written answer and the candidate must be allowed 20 minutes to answer each such question.

1.4. Suitable essay questions must be drafted and evaluated using the knowledge syllabus in MCAR-66 Appendix I Modules 7, 9 and 10.

1.5. Each question will have a model answer drafted for it, which will also include any known alternative answers that may be relevant for other subdivisions.

1.6. The model answer will also be broken down into a list of the important points known as Key Points.

1.7. The pass mark for each MCAR-66 module and sub-module multi-choice part of the examination is 75 %.

1.8. The pass mark for each essay question is 75 % in that the candidates answer must contain 75 % of the required key points addressed by the question and no significant error related to any required key point.

1.9. If either the multi-choice part only or the essay part only is failed, then it is only necessary to retake the multi-choice or essay part, as appropriate.

1.10. Penalty marking systems must not be used to determine whether a candidate has passed.

1.11. All MCAR-66 modules that make up a complete MCAR-66 aircraft maintenance licence category or subcategory must be passed within a 5 year time period of passing the first module except in the case specified in paragraph 1.12. A failed module may not be retaken for at least 90 days following the date of the failed module examination, except in the case of a MCAR-147 approved maintenance training organisation which conducts a course of retraining tailored to the failed subjects in the particular module when the failed module may be retaken after 30 days.

1.12. The 5 year time period specified in paragraph 1.11 does not apply to those modules which are common to more than one MCAR-66 aircraft maintenance licence category or subcategory and which were previously passed as part of another such category or subcategory examination.

2. Question Numbers for the MCAR-66 Appendix I Modules

2.1. Subject Module 1 Mathematics:
Category A-16 multi-choice and 0 essay questions. Time allowed 20 minutes.
Category B1-30 multi-choice and 0 essay questions. Time allowed 40 minutes.
Category B2-30 multi-choice and 0 essay questions. Time allowed 40 minutes.

2.2. Subject Module 2 Physics:
Category A-30 multi-choice and 0 essay questions. Time allowed 40 minutes.
Category B1-50 multi-choice and 0 essay questions. Time allowed 65 minutes.
Category B2-50 multi-choice and 0 essay questions. Time allowed 65 minutes.

2.3. Subject Module 3 Electrical Fundamentals:
Category A- 0 multi-choice and 0 essay questions. Time allowed 25 minutes.
Category B1-50 multi-choice and 0 essay questions. Time allowed 65 minutes.
Category B2-50 multi-choice and 0 essay questions. Time allowed 65 minutes.

2.4. Subject Module 4 Electronic Fundamentals:
Category A-None.
Category B1-20 multi-choice and 0 essay questions. Time allowed 25 minutes.
Category B2-40 multi-choice and 0 essay questions. Time allowed 50 minutes.

2.5. Subject Module 5 Digital Techniques/Electronic Instrument Systems:
Category A-16 multi-choice and 0 essay questions. Time allowed 20 minutes.
Category B1.1 & B1.3-40 multi-choice and 0 essay questions. Time allowed 50 minutes.
Category B1.2 & B1.4-20 multi-choice and 0 essay questions. Time allowed 25 minutes.
Category B2-70 multi-choice and 0 essay questions. Time allowed 90 minutes.

2.6. Subject Module 6 Materials and Hardware:
Category A-50 multi-choice and 0 essay questions. Time allowed 65 minutes.
Category B1-70 multi-choice and 0 essay questions. Time allowed 90 minutes.
Category B2-60 multi-choice and 0 essay questions. Time allowed 75 minutes.

2.7. Subject Module 7 Maintenance Practices:
Category A-70 multi-choice and 2 essay questions. Time allowed 90 minutes plus 40 minutes.
Category B1-80 multi-choice and 2 essay questions. Time allowed 100 minutes plus 40 minutes.
Category B2-60 multi-choice and 2 essay questions. Time allowed 75 minutes plus 40 minutes.

2.8. Subject Module 8 Basic Aerodynamics:
Category A-20 multi-choice and 0 essay questions. Time allowed 25 minutes.
Category B1-20 multi-choice and 0 essay questions. Time allowed 25 minutes.
Category B2-20 multi-choice and 0 essay questions. Time allowed 25 minutes.

2.9. Subject Module 9 Human factors:
Category A-20 multi-choice and 1 essay question. Time allowed 25 minutes plus 20 minutes.
Category B1-20 multi-choice and 1 essay question. Time allowed 25 minutes plus 20 minutes.
Category B2-20 multi-choice and 1 essay question. Time allowed 25 minutes plus 20 minutes.

2.10. Subject Module 10 Aviation Legislation:
Category A-30 multi-choice and 1 essay question. Time allowed 40 minutes plus 20 minutes.
Category B1-40 multi-choice and 1 essay question. Time allowed 50 minutes plus 20 minutes.
Category B2-40 multi-choice and 1 essay question. Time allowed 50 minutes plus 20 minutes.

2.11. Subject Module 11a Turbine Aeroplane Aerodynamics, Structures and Systems:
Category A-100 multi-choice and 0 essay questions. Time allowed 125 minutes.
Category B1-130 multi-choice and 0 essay questions. Time allowed 165 minutes.
Category B2-None.

2.12. Subject Module 11b Piston Aeroplane Aerodynamics, Structures and Systems:
Category A-70 multi-choice and 0 essay questions. Time allowed 90 minutes.
Category B1-100 multi-choice and 0 essay questions. Time allowed 125 minutes.
Category B2-None.

2.13. Subject Module 12 Helicopter Aerodynamics, Structures and Systems:
Category A-90 multi-choice and 0 essay questions. Time allowed 115 minutes.
Category B1-115 multi-choice and 0 essay questions. Time allowed 145 minutes.
Category B2-None.

2.14. Subject Module 13 Aircraft Aerodynamics, Structures and Systems:
Category A-None.
Category B1-None.
Category B2-130 multi-choice and 0 essay questions. Time allowed 165 minutes.

2.15. Subject Module 14 Propulsion:
Category A-None.
Category B1-None.
Category B2-25 multi-choice and 0 essay questions. Time allowed 30 minutes.

2.16. Subject Module 15 Gas Turbine Engine:
Category A-60 multi-choice and 0 essay questions. Time allowed 75 minutes.
Category B1-90 multi-choice and 0 essay questions. Time allowed 115 minutes.
Category B2-None.

2.17. Subject Module 16 Piston Engine:
Category A-0 multi-choice and 0 essay questions. Time allowed 65 minutes.
Category B1-0 multi-choice and 0 essay questions. Time allowed 90 minutes.
Category B2-None.

2.18. Subject Module 17 Propeller:
Category A-0 multi-choice and 0 essay questions. Time allowed 25 minutes.
Category B1-30 multi-choice and 0 essay questions. Time allowed 40 minutes.
Category B2-None.

Appendix III

Type training and Examination Standard

1. Type training levels

The three levels listed below define the objectives that a particular level of training is intended to achieve.

Level 1 General Familiarisation

1. A brief overview of the airframe, systems and powerplants as outlined in the Systems description Section of the Aircraft Maintenance Manual.

2. Course objectives: Upon completion of the course, the student will be able to identify safety precautions related to the airframe, its systems and powerplant

3. Identify maintenance practices important to the airframe, its systems and powerplant

4. Define the general layout of the aircraft's major systems

5. Define the general layout and characteristics of the powerplant

6. Identify special tooling and test equipment used with the aircraft

Level 2 Ramp and transit

Basic system overview of controls, indicators, principal components including their location and purpose, servicing and minor troubleshooting.

Course objectives: In addition to the information contained in the Level 1 General Familiarisation course, at the completion of this Level 2 Ramp and Transit training, the student will be able to:

1. Recall the safety precautions to be observed when working on or near the aircraft, power plant and systems.

2. Demonstrate knowledge of the main ramp and transit (through-flight) activities of the following:

   (a) Doors, windows and hatches.
   (b) Electrical power supplies.
   (c) Fuel.
   (d) Auxiliary power unit.
   (e) Powerplant.
   (f) Fire protection.
   (g) Environmental Control Systems.
   (h) Hydraulic power.
   (i) Landing gear.
   (j) Flight controls.
   (k) Water/waste.

(l) Oxygen.
(m) Flight and service interphone.
(n) Avionics.
(o) Cabin equipment/furnishings.

3. Describe systems and aircraft handling particularly access, power availability and sources.

4. Identify the locations of the principal components.

5. Explain the normal functioning of each major system, including terminology and nomenclature.

6. Perform the procedures for ramp and transit servicing associated with the aircraft for the following systems: Fuel, Power Plants, Hydraulics, Landing Gear, Water/Waste, Oxygen.

7. Demonstrate proficiency in use of crew reports and on-board reporting systems (minor troubleshooting) and determine aircraft airworthiness per the MEL/CDL.

8. Identify and use appropriate documentation.

9. Locate those procedures for replacement of components for ramp and transit activities identified in objective 2.

Level 3 Line and Base Maintenance Training

Detailed description, operation, component location, removal/installation and bite and troubleshooting procedures to maintenance manual level.

Course objectives: In addition to the information contained in Level 1 and Level 2 training, at the completion of Level III Line and Base Maintenance training, the student will be able to:

(a) Perform system, engine, component and functional checks as specified in the maintenance manual.

(b) Correlate information for the purpose of making decisions in respect of fault diagnosis and rectification to maintenance manual level.

(c) Describe procedures for replacement of components unique to aircraft type.

2. Type training standard

Type training must include a theoretical and practical element.

2.1. Theoretical element

As a minimum the elements in the Syllabus below that are specific to the aircraft type must be covered. Additional elements introduced due to technological changes shall also be included.

Training levels are those levels defined in paragraph 1 above.

After the first type course for category C certifying staff all subsequent courses need only be to level 1.

Introduction Module Title	
General Aircraft(dimensions/weights MTOW etc)	
Time limits/maintenance checks	
Levelling and weighing	
Towing and taxiing	
Parking/mooring Servicing	
Standard practices-only type particular	
B2 module-safety items/mechanical interface	
B1 module-safety items/avionics interface	

	Aeroplanes turbine		Aeroplanes piston		Helicopters turbine		Helicopters piston		Avionics
	B1	C	B1	C	B1	C	B1	C	B2
Blade tracking and vibration analysis	-	-	-	-	3	1	3	1	-
Transmissions	-	-	-	-	3	1	3	1	-
Airframe structure	-	-	-	-	3	1	3	1	1
Main rotor	-	-	-	-	3	1	3	1	-
Tail rotor/rotor drive	-	-	-	-	3	1	3	1	-
Rotor flight control	-	-	-	-	3	1	3	1	-
Airframe Structure	3	1	3	1	-	-	-	-	1
Fuselage Doors	3	1	3	1	-	-	-	-	-
Fuselage	3	1	3	1	-	-	-	-	-
Fuselage Windows	3	1	3	1	-	-	-	-	-
Wings	3	1	3	1	-	-	-	-	-
Stabilisers	3	1	3	1	-	-	-	-	-
Flight Control Surfaces	3	1	3	1	-	-	-	-	-
Nacelles/Pylons	3	1	3	1	-	-	-	-	-
Zonal & Station Identification Systems	1	1	1	1	1	1	1	1	1
Air Supply	3	1	3	1	3	1	3	1	1
Air Conditioning	3	1	3	1	3	1	3	1	1
Pressurisation	3	1	-	-	-	-	-	-	1
Safety & Warning Devices	3	1	-	-	-	-	-	-	1
Instrument Systems	3	1	3	1	3	1	3	1	3
Avionics Systems	2	1	2	1	2	1	2	1	3
Electrical Power	3	1	3	1	3	1	3	1	3
Equipment & Furnishings	3	1	3	1	3	1	3	1	-
Electronic Emergency Equip. Requir. & Cabin Entertainment Equipment	-	1	-	-	-	-	-	-	3
Fire Protection	3	1	3	1	3	1	3	1	1
Flight Controls	3	1	3	1	3	1	3	1	2
Sys. Operation: Electrical/Fly-by-Wire	3	1	-	-	-	-	-	-	3
Fuel Systems	3	1	3	1	3	1	3	1	1
Hydraulic Power	3	1	3	1	3	1	3	1	1
Ice & Rain Protection	3	1	3	1	3	1	3	1	1
Landing Gear	3	1	3	1	3	1	3	1	1

Lights	3	1	3	1	3	1	3	1	3
Oxygen	3	1	3	1	-	-	-	-	1
Pneumatic/Vacuum	3	1	3	1	3	1	3	1	1
Water/Waste	3	1	3	1	-	-	-	-	1
On-board Maintenance Systems	3	1	3	1	-	-	-	-	3
Turbine Engines:									
Constructional arrangement and operation	-	-	-	-	-	-	-	-	1
Engine Performance	3	1	-	-	3	1	-	-	1
Inlet	3	1	-	-	3	1	-	-	-
Compressors	3	1	-	-	3	1	-	-	-
Combustion Section	3	1	-	-	3	1	-	-	-
Turbine Section	3	1	-	-	3	1	-	-	-
Exhaust	3	1	-	-	3	1	-	-	-
Bearing and Seals	3	1	-	-	3	1	-	-	-
Lubricant and Fuels	3	1	-	-	3	1	-	-	-
Lubrication Systems	3	1	-	-	3	1	-	-	-
Fuel Systems	3	1	-	-	3	1	-	-	1
Engine controls	3	1	-	-	3	1	-	-	1
FADEC	2	1	-	-	2	1	-	-	3
Air Systems	3	1	-	-	3	1	-	-	-
Starting Ignition Systems	3	1	-	-	3	1	-	-	-
Engine Indicating System	3	1	-	-	3	1	-	-	3
Power Augmentation Systems	3	1	-	-	-	-	-	-	-
Turbo-prop Engines	3	1	-	-	-	-	-	-	-
Turbo-shaft Engines	-	-	-	-	3	1	-	-	-
Auxiliary Power Units (APUs)	3	1	-	-	-	-	-	-	1
Powerplant Installation	3	1	-	-	3	1	-	-	-
Fire Protection Systems	3	1	-	-	3	1	-	-	1
Engine Monitoring and Ground Operation	3	1	-	-	3	1	-	-	-
Engine Storage and Preservation	3	1	-	-	3	1	-	-	-
Piston Engines:									
Engine Performance	-	-	3	1	-	-	3	1	1
Engine Construction	-	-	3	1	-	-	3	1	1
Engine Fuel Systems	-	-	3	1	-	-	3	1	1
Carburettors	-	-	3	1	-	-	3	1	-
Fuel injection systems	-	-	3	1	-	-	3	1	-
Engine controls	3	1	-	-	3	1	-	-	1
FADEC	-	-	2	1	-	-	2	1	3
Starting and Ignition Systems	-	-	3	1	-	-	3	1	-
Induction, Exhaust and Cooling Systems	-	-	3	1	-	-	3	1	-
Supercharging/ Turbocharging	-	-	3	1	-	-	3	1	-
Lubricants and Fuels	-	-	3	1	-	-	3	1	-
Lubrication Systems	-	-	3	1	-	-	3	1	-
Engine Indication Systems	-	-	3	1	-	-	3	1	3
Powerplant Installation	-	-	3	1	-	-	3	1	-
Engine Monitoring and Ground Operation	-	-	3	1	-	-	3	1	-
Engine Storage and Preservation	-	-	3	1	-	-	3	1	-
Propellers:									
Propeller — General	3	1	3	1	-	-	-	-	1
Propeller Construction	3	1	3	1	-	-	-	-	-
Propeller Pitch Control	3	1	3	1	-	-	-	-	-

Propeller Synchronising	3	1	3	1	-	-	-	-	-
Propeller Electronic control	2	1	2	1	-	-	-	-	3
Propeller Ice Protection	3	1	3	1	-	-	-	-	-
Propeller Maintenance	3	1	3	1	-	-	-	-	-

2.2. Practical element

The practical training element must consist of the performance of representative maintenance tasks and their assessment, in order to meet the following objectives:

(a) Ensure safe performance of maintenance, inspections and routine work according to the maintenance manual and other relevant instructions and tasks as appropriate for the type of aircraft, for example troubleshooting, repairs, adjustments, replacements, rigging and functional checks such as engine run, etc, if required.

(b) Correctly use all technical literature and documentation for the aircraft.

(c) Correctly use specialist/special tooling and test equipment, perform removal and replacement of components and modules unique to type, including any on-wing maintenance activity.

3. Type training examination standard

Where aircraft type training is required, the examination must be written and comply with the following:

1. Format of the examination is of the multiple-choice type. Each multiple-choice question must have three alternative answers of which only one must be the correct answer. The time for answering is based upon a nominal average of 120 seconds per level 3 question and 75 seconds per level 1 or 2 question.

2. The examination must be of the closed book type. No reference material is permitted. An exception will be made for the case of examining a B1 or B2 candidate's ability to interpret technical documents.

3. The number of questions must be at least one question per hour of instruction subject to a minimum of two questions per Syllabus subject. The CAD will assess number and level of questions on a sampling basis when approving the course.

4. The examination pass mark is 75 %.

5. Penalty marking is not to be used to determine whether a candidate has passed.

6. End of module phase examinations cannot be used as part of the final examination unless they contain the correct number and level of questions required.

4. Type examination standard

Where type training is not required, the examination must be oral, written or practical assessment based, or a combination thereof.

Oral examination questions must be open.

Written examination questions must be essay type or multiple-choice questions.

Practical assessment must determine a person's competence to perform a task.

Examination subjects must be on a sample of subjects drawn from paragraph 2 type training/examination syllabus, at the indicated level.

The examination must ensure that the following objectives are met:

(a) Properly discuss with confidence the aircraft and its systems.

(b) Ensure safe performance of maintenance, inspections and routine work according to the maintenance manual and other relevant instructions and tasks as appropriate for the type of aircraft, for example troubleshooting, repairs, adjustments, replacements, rigging and functional checks such as engine run, etc, if required.

(c) Correctly use all technical literature and documentation for the aircraft.

(d) Correctly use specialist/special tooling and test equipment, perform removal and replacement of components and modules unique to type, including any on-wing maintenance activity.

A written report must be made by the examiner to explain why the candidate has passed or failed.

Appendix IV

Experience requirements for extending a MCAR-66 Aircraft Maintenance Licence

The table below shows the experience requirements for adding a new category or subcategory to an existing MCAR-66 licence.

The experience must be practical maintenance experience on operating aircraft in the subcategory relevant to the application.

The experience requirement will be reduced by 50 % if the applicant has completed an approved MCAR-147 course relevant to the subcategory.

To: / From:	A1	A2	A3	A4	B1.1	B1.2	B1.3	B1.4	B2
A1		6 Months	6 Months	6 Months	2 Years	6 Months	2 Years	1 Year	2 Years
A2	6 Months		6 Months	6 Months	2 Years	6 Months	2 Years	1 Year	2 Years
A3	6 Months	6 Months		6 Months	2 Years	1 Year	2 Years	6 Months	2 Years
A4	6 Months	6 Months	6 Months		2 Years	1 Year	2 Years	6 Months	2 Years
B1.1	None	6 Months	6 Months	6 Months		6 Months	6 Months	6 Months	1 Year
B1.2	6 Months	None	6 Months	6 Months	2 Years		2 Years	6 Months	2 Years
B1.3	6 Months	6 Months	None	6 Months	6 Months	6 Months		6 Months	1 Year
B1.4	6 Months	6 Months	6 Months	None	2 Years	6 Months	2 Years		2 Years
B2	6 Months	6 Months	6 Months	6 Months	1 Year	1 Year	1 Year	1 Year	

SECTION 2 - ACCEPTABLE MEANS OF COMPLIANCE

This section contains Acceptable Means of Compliance (AMC) to MCAR-66 Section 1 – Regulations. Acceptable Means of Compliance (AMC) illustrate a means, or several alternative means, but not necessarily the only possible means by which a requirement can be met.

A numbering system has been used in which the Acceptable Means of Compliance uses the same number as the paragraph in MCAR-66 Section 1 to which it refers. The number is preceded by the letters AMC to distinguish the material from the MCAR-66 Section 1 itself.

AMC 66.10 Application

1. Maintenance experience should be written up in a manner that the reader has a reasonable understanding of where, when and what maintenance constitutes the experience. A task by task account is not necessary but at the same time a bland statement "X years maintenance experience completed" is not acceptable. A log book of maintenance experience is desirable and CAD may require such log books to be kept. It is acceptable to cross refer in the MCAR Form 19 to other documents containing information on maintenance.

2. Applicants claiming the maximum reduction in 66.30(a) total experience based upon having successfully completed 147.200 approved basic training, should include the MCAR-147 certificate of recognition for approved basic training.

3. Applicants claiming reduction in MCAR 66.30(a) total experience based upon having successfully completed technical training in an organisation or institute recognised by CAD as a competent organisation or institute, should include the relevant certificate of successful completion of training.

AMC 66.20(a) Privileges

The following definition of line and base maintenance should apply:

Line maintenance is any maintenance that is carried out before flight to ensure that the aircraft is fit for the intended flight. It may include:

- trouble shooting;

- defect rectification;

- component replacement with use of external test equipment if required. Component replacement may include components such as engines and propellers;

- scheduled maintenance and/or checks including visual inspections that will detect obvious unsatisfactory conditions/discrepancies but do not require extensive in depth inspection. It may also include internal structure, systems and power plant items which are visible through quick opening access panels/doors;

- minor repairs and modifications which do not require extensive disassembly and can

- be accomplished by simple means;

- for temporary or occasional cases (airworthiness directives, hereinafter AD; service bulletins, hereinafter SB) the quality manager may accept base maintenance tasks to be performed by a line maintenance organisation provided all requirements are fulfilled. CAD will prescribe the conditions under which these tasks may be performed.

Maintenance tasks falling outside these criteria are considered to be *base maintenance*.

Note: Aircraft maintained in accordance with "progressive" type programmes need to be individually assessed in relation to this paragraph. In principle, the decision to allow some "progressive" checks to be carried out is determined by the assessment that all tasks within the particular check can be carried out safely to the required standards at the designated line maintenance station

AMC 66.20(b)2 Privileges.

The 6 months maintenance experience in 2 years should be understood as consisting of two elements, duration and nature of the experience. The minimum to meet the requirements for these elements may vary depending on the size and complexity of the aircraft and type of operation and maintenance.

1. Duration:

Within an approved maintenance organization:

- 6 months continuous employment within the same organisation; or
- 6 months split up into different blocks, employed within the same or in different organisations.

The 6 months period can be replaced by 100 days of maintenance experience in accordance with the privileges, whether they have been performed within an approved organisation or as independent certifying staff according to MCAR-M.801(b)2 or as a combination here of.

When certifying staff maintains and releases aircraft in accordance with MCAR-M.801(b)2, in certain circumstances this number of days may even be reduced by 50% when agreed in advance by the CAD. These circumstances consider the cases where the holder of a MCAR-66 licence happens to be the owner of an aircraft and carries out maintenance on his own aircraft, or where a licence holder maintains an aircraft operated for low utilization, that does not allow the licence holder to accumulate the required experience. This reduction should not be combined with the 20% reduction permitted when carrying out technical support, or maintenance planning, continuing airworthiness management or engineering activities. To avoid a too long period without experience, the working days should be spread over the intended 6 months period.

2. Nature of the experience:

Depending on the category of the aircraft maintenance licence, the following activities are considered relevant for maintenance experience:

- Servicing;

- Inspection;
- Operational and functional testing;
- Trouble-shooting;
- Repairing;
- Modifying;
- Changing component;
- Supervising these activities;
- Releasing aircraft to service.

For category A certifying staff, the experience should include exercising the privileges, by means of performing tasks related to the authorization on at least one aircraft type for each licence subcategory. This means tasks as mentioned in AMC 145.30(g), including servicing, component changes and simple defect rectifications.

For category B1 and B2, for every aircraft included in the authorization the experience should be on that particular aircraft or on a similar aircraft within the same licence subcategory. Two aircraft can be considered as similar when they have similar technology, construction and comparable systems, which means equally equipped with the following (as applicable to the licence category):

(a) Propulsion systems (piston or turboprop or turbofan or turboshaft or jet-engine or push propellers); and

(b) Flight control systems (only mechanical controls or hydro-mechanically powered controls or electro-mechanically powered controls); and

(c) Avionic systems (analog systems or digital systems); and

(d) Structure (manufactured of metal or composite or wood).

As an alternative to the above:

- In the case of B1 licence endorsed with group ratings (either manufacturer group or full group) as defined in MCAR-66.45(g) the holder may show experience on at least one aircraft type per group and per aircraft structure (metal, composite, wood).

- In the case of a B2 licence endorsed with group ratings (either manufacturer group or full group) as defined in MCAR-66.45(g) the holder may show experience on at least one aircraft type per group.

For category C, the experience should cover at least one of the aircraft types endorsed on the authorization.

For a combination of categories, the experience should include some activities of the nature shown in paragraph 2 in each category.

A maximum of 20% of the experience duration required may be replaced by the following relevant activities on an aircraft type of similar technology, construction and with comparable systems:

- Aircraft maintenance related training as an instructor/assessor or as a student;
- Maintenance technical support/engineering;

- Maintenance management/planning.

The experience should be documented in an individual log book or in any other recording system (which may be an automated one) containing the following data:

(a) Date;

(b) Aircraft type;

(c) Aircraft identification i.e. registration;

(d) ATA chapter (optional);

(e) Operation performed i.e. 100 FH check, MLG wheel change, engine oil check and complement, SB embodiment, troubleshooting, structural repair, STC embodiment…;

(f) Type of maintenance i.e. base, line;

(g) Type of activity i.e. perform, supervise, release;

(h) Category used A, B1, B2 or C.

Remark: this experience requirement does not apply to:

- Certifying staff issuing a certificate of release of aircraft as per MCAR-M.607(b);
- Pilot-owner certifying tasks according to MCAR-M.803; and
- Certifying staff according to MCAR-145.30(j) and Appendix IV of MCAR-145.

AMC 66.25 Basic knowledge requirements

3. For an applicant being a person qualified by holding an academic degree in an aeronautical, mechanical or electronic discipline from a recognised university or other higher educational institute the need for any examination will depend upon the course taken in relation to Appendix I to MCAR-66.

4. Knowledge gained and examinations passed during previous experiences, for example, in military aviation and civilian apprenticeships will be credited where CAD is satisfied that such knowledge and examinations are equivalent to that required by Appendix I to MCAR-66.

AMC 66.30(a) Experience requirements

1. For a category C applicant holding an academic degree the representative selection of tasks should include the observation of hangar maintenance, maintenance planning, quality assurance, record-keeping, approved spare parts control and engineering development.

2. While an applicant to a MCAR-66 category C licence may be qualified by having 3 years experience as category B1 or B2 certifying staff only in line maintenance, it is however recommended that any applicant to a category C holding a B1 or B2 licence demonstrate at least 12 months experience as a B1 or B2 base maintenance support staff.

3. A skilled worker is a person who has successfully completed a course of training

acceptable to CAD, involving the manufacture, repair, overhaul or inspection of mechanical, electrical or electronic equipment. The training would include the use of tools and measuring devices.

AMC 66.30(d) Experience requirements

To be considered as recent experience, at least 50% of the required 12 month experience should be gained within the 12 month period prior to the date of application for the MCAR-66 aircraft maintenance licence. The remainder of the experience should have been gained within the 7 year period prior to application.

AMC 66.30(e) Experience requirements

1. For category A the additional experience of civil aircraft maintenance should be a minimum of 6 months. For category B1 or B2 the additional experience of civil aircraft maintenance should be a minimum of 12 months.

2. Aircraft maintenance experience gained outside a civil aircraft maintenance environment can include aircraft maintenance experience gained in armed forces, coast guards, police etc. or in aircraft manufacturing.

AMC 66.45(a) Type/task training and ratings

1. For category A certifying staff specific training on each aircraft type will be required reflecting the authorised task(s) as indicated under MCAR-66.20(a) 1.

2. Appropriately approved MCAR-145 or MCAR-147 organisation means compliance with the applicable paragraphs of AMC 66.45

AMC 66.45(d) Type/task training and ratings

1. The training should give adequate detailed theoretical knowledge of the aircraft, its main parts, systems, equipment, interior and applicable components, including training in the systems in use for technical manuals and maintenance procedures.

   The course should also take into account the following:

   (i) in service experience on the aircraft type;

   (j) feedback from in-service difficulties/occurrence reporting etc;

   (k) significant airworthiness directives and/or service bulletins;

   (l) known human factors issues associated with the particular aircraft type.

2. Theoretical training should be supported by training aids such as aircraft system components. Ground simulator time, engine ground running and computer based training (CBT) etc may also be utilised.

3. Theoretical and practical training should also take into account the critical aspects of Fuel Tank Safety (FTS) airworthiness limitation items (ALI) including Critical Design Configuration Control Limitations (CDCCL).

4. Knowledge is also recommended of relevant inspections and limitations as applicable to the effects of environmental factors such as cold and hot climates, wind, moisture, etc.

5. The practical training must comprise a period of 4 months for applicants with no recent recorded previous practical experience of aircraft of comparable construction and systems, including the engines, but this can be reduced to a minimum of two weeks for applicant with such previous experience.

6. A programme of structured on-job-training (OJT) may be prepared to satisfy the practical training requirement.

   Where the practical training element is conducted by or under the responsibility of the training organisation under a MCAR-147 approval or a direct type course approval, it should be considered as part of the approved course and as such, its acceptance by CAD should be supported by a detailed syllabus showing its content and duration. The individual practical training records should be designed in a manner that they demonstrate compliance with the detailed practical training syllabus. Such records may take the form of an individual training logbook. The logbook should be designed such that tasks may be countersigned by the MCAR-147 school or other course provider.

   Where the practical training element is conducted by a maintenance organisation approved under MCAR-145, under its own responsibility, its acceptance by CAD should be supported by a detailed syllabus showing its content and duration. The individual practical training records should be designed in a manner that they demonstrate compliance with the detailed practical training syllabus. Alternatively, the practical training element may consist of a structured OJT programme. In this case the maintenance organisation approved under MCAR-145 should provide applicants for a type rating a logbook indicating a list of tasks to be performed under supervision. The logbook should be designed such that tasks may be countersigned by the supervisor. The list of tasks should be accepted either directly for each individual – depending on the individuals previous experience, or indirectly through the acceptance of a procedure giving delegation to the maintenance organisation.

   In all cases the practical element should include an acceptable cross section of maintenance tasks, which, in the case of a structured OJT, can be tailored to accommodate the operating profile of the MCAR-145 organisation whilst also supplementing the theoretical course elements. The means by which the practical element is supervised and the control of the standard should be acceptable to CAD. The duration of the practical type training element should take into account significant differences between types and be acceptable to CAD. These differences will require considerably more practical training for certifying staff who are not familiar with the new techniques and technologies. Some examples of differences may include, but are not limited to, the following elements: Fly by wire, glass cockpit avionics, significant structural differences, etc.

7. Before grant of the aircraft type, the applicant should be able to:

   (a) demonstrate by knowledge examination a detailed understanding of applicable systems, their operation and maintenance;

   (b) ensure safe performance of maintenance, inspections and routine work according to the maintenance manual and other relevant instructions and tasks, as appropriate, for

the type of aircraft, for example trouble shooting, repairs, adjustments, replacements, rigging and functional checks such as engine run, etc, if required;

(c) correctly use all technical literature and documentation for the aircraft;

(d) correctly use specialist/special tooling and test equipment, perform removal and replacement of components and modules unique to type, including any on-wing maintenance activity.

8. The practical assessment should also ensure safe performance of maintenance, inspections and routine work according to the maintenance manual and other relevant instructions and tasks as appropriate for the type of aircraft, for example trouble shooting, repairs, adjustments (rigging), replacements and functional / operational checks etc including engine operation (ground running) if required.

AMC 66.45(e) Type/task training and ratings

Category C certifying staff may not carry out the duties of category B1 or B2, or equivalent within base maintenance, unless they hold the relevant B1 or B2 category and have passed type training corresponding to the relevant B1 or B2 category

AMC 66.45(g) Type/task training and ratings

1. "Aircraft types representative of a group" means that:

   - for the B1 category the aircraft type should include typical systems and engines relevant to the group (e.g. retractable undercarriage, pressurisation, variable pitch propeller, etc. for the single piston engine metal subgroup) and,

   - for the B2 category the aircraft type should include complex avionics systems such as radio coupled autopilot, EFIS (Electronic flight instrument system), flight guidance systems, etc .

2. A "multiple engines" group automatically includes the corresponding "single engine" group.

AMC 66.45(h) Type/task training and ratings

1. Type experience should cover an acceptable cross section of tasks from Appendix II. For the first aircraft type of each manufacturer group, at least 50% of the Appendix II tasks, as applicable to the concerned aircraft type and licence category, should be performed. For the second aircraft type of each manufacturer group, this should be reduced to 30%. For subsequent aircraft types of each manufacturer group, this should be reduced to 20%.

2. Type experience should be demonstrated by the submission of records or logbook showing the Appendix II tasks performed by the applicant as specified by CAD.

AMC 66.70 Conversion provisions

Technical limitations will be deleted, as appropriate, when the person satisfactorily sits the relevant conversion examination and gains relevant experience.

Licences issued under MAR-66 will be valid until the expiry date specified on the licence.

Upon meeting all the requirements for the renewal of the licence, a MCAR-66 licence will be issued to the MAR-66 licence holder.

APPENDIX II

Aircraft Type Practical Experience List of Tasks

Time limits/Maintenance checks

100 hour check (general aviation aircraft).
"B" or "C" check (transport category aircraft).
Review records for compliance with airworthiness directives.
Review records for compliance with component life limits.
Procedure for Inspection following heavy landing.
Procedure for Inspection following lightning strike.

Dimensions/Areas

Locate component(s) by station number.
Perform symmetry check.

Lifting and Shoring

Assist in :

Jack aircraft nose or tail wheel.
Jack complete aircraft.
Sling or trestle major component.

Levelling/Weighing

Level aircraft.
Weigh aircraft.
Prepare weight and balance amendment.
Check aircraft against equipment list.

Towing and Taxiing

Tow aircraft.
Be part of aircraft towing team

Parking and mooring

Tie down aircraft.
Park, secure and cover aircraft.
Position aircraft in dock.
Secure rotor blades.

Placards and Markings

Check aircraft for correct placards.
Check aircraft for correct markings.

Servicing

Refuel aircraft.
Defuel aircraft.
Check tire pressures.
Check oil level.
Check hydraulic fluid level.
Check accumulator pressure.
Charge pneumatic system.
Grease aircraft.
Connect ground power.
Service toilet/water system
Perform pre-flight/daily check

Vibration and Noise Analysis

Analyse helicopter vibration problem.
Analyse noise spectrum

Air Conditioning

Replace combustion heater.
Replace outflow valve.
Replace vapour cycle unit.
Replace air cycle unit.
Replace cabin blower.
Replace heat exchanger.
Replace pressurisation controller.
Clean outflow valves.
Check operation of air conditioning/heating system
Check operation of pressurization system
Troubleshoot faulty system

Auto flight

Install servos.
Rig bridle cables
Replace controller.
Replace amplifier.
Check operation of auto-pilot.

Check operation of auto-throttle.
Check operation of yaw damper.
Check and adjust servo clutch.
Perform autopilot gain adjustments.
Perform mach trim functional check.
Troubleshoot faulty system.
Check autoland system
Check flight management systems
Check stability augmentation system

Communications

Replace VHF com unit.
Replace HF com unit.
Replace existing antenna.
Replace static discharge wicks.
Check operation of radios.
Perform antenna VSWR check.
Perform Selcal operational check.
Perform operational check of passenger address system.
Functionally check audio integrating system.
Repair co-axial cable.
Troubleshoot faulty system.

Electrical Power

Charge lead/acid battery.
Charge ni-cad battery.
Check battery capacity.
Deep-cycle ni-cad battery.
Replace generator/alternator.
Replace switches.
Replace circuit breakers.
Adjust voltage regulator.
Amend electrical load analysis report.
Repair/replace electrical feeder cable.
Troubleshoot faulty system

Equipment/Furnishings

Replace carpets
Replace crew seats
Replace passenger seats
Check inertia reels
Check seats/belts for security.
Check emergency equipment.
Check ELT for compliance with regulations.
Repair toilet waste container.
Repair upholstery.
Change cabin configuration.

Fire protection

Check fire bottle contents.
Check operation of warning system.
Check cabin fire extinguisher contents.
Check lavatory smoke detector system.
Install new fire bottle.
Replace fire bottle squib.
Troubleshoot faulty system.
Inspect engine fire wire detection systems

Flight Controls

Replace horizontal stabiliser.
Replace elevator.
Replace aileron.
Replace rudder.
Replace trim tabs.
Install control cable and fittings.
Replace flaps.
Replace powered flying control unit
Replace flat actuator
Adjust trim tab.
Adjust control cable tension.
Check control range and sense of movement.
Check for correct assembly and locking.
Troubleshoot faulty system.

Fuel

Replace booster pump.
Replace fuel selector.
Replace fuel tank cells.
Check filters.
Flow check system.
Check calibration of fuel quantity gauges.
Check operation feed/selectors
Troubleshoot faulty system.

Hydraulics

Replace engine driven pump.
Replace standby pump.
Replace accumulator.
Check operation of shut off valve.
Check filters.
Check indicating systems.
Perform functional checks.
Troubleshoot faulty system.

Ice and rain protection

Replace pump.
Replace timer.
Install wiper motor.
Check operation of systems.
Troubleshoot faulty system.

Indicating/recording systems

Replace flight data recorder.
Replace cockpit voice recorder.
Replace clock.
Replace master caution unit.
Replace FDR.
Perform FDR data retrieval.
Troubleshoot faulty system.
Implement ESDS procedures
Inspect for HIRF requirements

Landing Gear

Build up wheel.
Replace main wheel.
Replace nose wheel.
Replace shimmy damper.
Rig nose wheel steering.
Replace shock strut seals.
Replace brake unit.
Replace brake control valve.
Bleed brakes.
Test anti skid unit.
Test gear retraction.
Change bungees.
Adjust micro switches.
Charge struts.
Troubleshoot faulty system.
Test outbrake system

Lights

Repair/replace rotating beacon.
Repair/replace landing lights.
Repair/replace navigation lights.
Repair/replace interior lights.
Repair/replace emergency lighting system.
Perform emergency lighting system checks.
Troubleshoot faulty system

Navigation

Calibrate magnetic direction indicator.
Replace airspeed indicator
Replace altimeter.
Replace air data computer.
Replace VOR unit.
Replace ADI.
Replace HSI.
Check pitot static system for leaks.
Check operation of directional gyro.
Functional check weather radar.
Functional check doppler.
Functional check TCAS.
Functional check DME
Functional check ATC Transponder
Functional check flight director system.
Functional check inertial nav system.
Complete quadrantal error correction of ADF system.
Update flight management system database.
Troubleshoot faulty system
Check marker systems
Compass replacement direct/indirect
Check Satcom
Check GPS
Test AVM

Oxygen

Inspect on board oxygen equipment.
Purge and recharge oxygen system.
Replace regulator.
Replace oxygen generator.
Test crew oxygen system.
Perform auto oxygen system deployment check.
Troubleshoot faulty system.

Pneumatic systems

Replace filter.
Replace compressor.
Recharge dessicator.
Adjust regulator.
Check for leaks.
Troubleshoot faulty system.

Vacuum systems

Replace vacuum pump.

Check/replace filters.
Adjust regulator.
Troubleshoot faulty system.

Water/Waste

Replace water pump.
Replace tap.
Replace toilet pump.
Troubleshoot faulty system.

Central Maintenance System

Retrieve data from CMU.
Replace CMU.
Perform Bite check.
Troubleshoot faulty system.

Airborne Auxiliary power

Install APU.
Inspect hot section.
Troubleshoot faulty system.

Structures

Sheet metal repair.
Fibre glass repair.
Wooden repair.
Fabric repair.
Recover fabric control surface.
Treat corrosion.
Apply protective treatment.

Doors

Rig/adjust locking mechanism.
Adjust air stair system
Check operation of emergency exits.
Test door warning system.
Troubleshoot faulty system.

Windows

Replace windshield.
Replace window.
Repair transparency.

Wings

Skin repair.
Recover fabric wing.
Replace tip.
Replace rib.
Check incidence/rig.

Propeller

Assemble prop after transportation.
Replace propeller.
Replace governor.
Adjust governor.
Perform static functional checks.
Check operation during ground run.
Check track.
Check setting of micro switches.
Dress out blade damage.
Dynamically balance prop.
Troubleshoot faulty system.

Main Rotors

Install rotor assembly.
Replace blades.
Replace damper assembly.
Check track.
Check static balance.
Check dynamic balance.
Troubleshoot.

Rotor Drive

Replace mast.
Replace drive coupling.
Replace clutch/freewheel unit
Replace drive belt.
Install main gearbox.
Overhaul main gearbox.
Check gearbox chip detectors.

Tail Rotors

Install rotor assembly.
Replace blades.
Troubleshoot.

Tail Rotor Drive

Replace bevel gearbox.
Replace universal joints.
Overhaul bevel gearbox.
Check chip detectors.

Rotorcraft flight controls

Install swash plate.
Install mixing box.
Adjust pitch links.
Rig collective system.
Rig cyclic system.
Rig anti-torque system.
Check controls for assembly and locking
Check controls for operation and sense.
Troubleshoot faulty system.

Power Plant

Build up ECU.
Replace engine.
Repair cooling baffles.
Repair cowling. Adjust cowl flaps.
Repair faulty wiring.
Troubleshoot.

Piston Engines

Remove/install reduction gear.
Check crankshaft run-out.
Check tappet clearance.
Extract broken stud.
Install helicoil.
Perform ground run.
Establish/check reference RPM.
Troubleshoot.

Turbine Engines

Replace module.
Hot section inspection.
Engine ground run.
Establish reference power.
Trend monitoring/gas path analysis.
Troubleshoot.

Fuel and control, piston

Replace engine driven pump.
Adjust AMC.
Adjust ABC.
Install carburetor/injector.
Adjust carburetor/injector.
Clean injector nozzles.
Replace primer line.
Check carburetor float setting.
Troubleshoot faulty system

Fuel and control, turbine

Replace FCU.
Replace engine driven pump.
Clean/test fuel nozzles.
Clean/replace filters
Adjust FCU.
Troubleshoot faulty system.

Ignition systems, piston

Change magneto.
Change ignition vibrator.
Change plugs.
Test plugs.
Check H.T. leads.
Install new leads.
Check timing.
Check system bonding.
Troubleshoot faulty system.

Ignition systems, turbine

Check glow plugs/igniters.
Check H.T. leads.
Check ignition unit.
Replace ignition unit.
Troubleshoot faulty system.

Engine Controls

Rig thrust lever. Rig RPM control.
Rig mixture HP cock lever.
Rig power lever.
Check control sync (multi-eng).
Check controls for correct assembly and locking.
Check controls for range and sense of operation.
Adjust pedestal micro-switches.
Troubleshoot faulty system.

Engine Indicating

Replace engine instruments(s).
Replace oil temperature bulb.
Replace thermocouples.
Check calibration.
Troubleshoot faulty system.

Exhaust, piston

Replace exhaust gasket.
Inspect welded repair.
Pressure check cabin heater muff.
Troubleshoot faulty system.

Exhaust, turbine

Change jet pipe.
Change shroud assembly.
Install trimmers.

Oil

Change oil.
Check filter(s).
Adjust pressure relief valve.
Replace oil tank.
Replace oil pump.
Replace oil cooler.
Replace firewall shut off valve.
Perform oil dilution.
Troubleshoot faulty system.

Starting
Replace starter
Replace start relay.
Replace start control valve.
Check cranking speed.
Troubleshoot faulty system.

Turbines, piston engines

Replace PRT.
Replace turbo-blower.
Replace heat shields.
Replace waste gate.
Adjust density controller.

Engine water injection
Replace water/methanol pump.
Flow check water/methanol system.
Adjust water/methanol control unit.
Check fluid for quality.
Troubleshoot faulty system

Accessory gear boxes

Replace gearbox.
Replace drive shaft.
Check chip detector.

SECTION 3 – GUIDANCE MATERIAL

This section contains Guidance Material (GM) to MCAR-66 Section 1 – Regulations. "Guidance Material" helps to illustrate the meaning of a requirement.

GM 66.20(a) Privileges

1. The following titles shown against each category designator below are intended to provide a readily understandable indication of the job function:

   Category A: Line maintenance certifying mechanic.

   Category B1: Maintenance certifying technician - mechanical.

   Category B2: Maintenance certifying technician - avionic.

   Category C: Base maintenance certifying engineer.

2. Individual aircraft maintenance licence holders need not be restricted to a single category. Provided that each qualification requirement is satisfied, any combination of categories may be granted.

GM 66.20(a) Privileges

1. Tasks permitted by 66.20 (a) 1. to be certified under the category A certification authorisation as part of minor scheduled maintenance or simple defect rectification are as specified in MCAR 145 and agreed by CAD. MCAR 145 contains a typical example list of such tasks.

2. For the purposes of category A minor scheduled line maintenance means any minor check up to but not including the A check where functional tests can be carried out by the aircrew to ensure system serviceability. In the case of an aircraft type not controlled by a maintenance programme based upon the A/B/C/D check principle, minor scheduled line maintenance means any minor check up to and including the weekly check or equivalent.

3. The category B1 licence also permits the certification of work involving avionic systems, providing the serviceability of the system can be established by a simple self-test facility, other on-board test systems/equipment or by simple ramp test equipment. Defect rectification involving test equipment which requires an element of decision making in its application - other than a simple go/no-go decision - cannot be certified. The category B2 will need to be qualified as category A in order to carry out simple mechanical tasks and be able to make certifications for such work.

4. The category C certification authorisation permits certification of scheduled base maintenance by the issue of a single certificate of release to service for the complete aircraft after the completion of all such maintenance. The basis for this certification is that the maintenance has been carried out by competent mechanics and both category B1 and B2 staff have signed for the maintenance under their respective specialisation. The principal function of the category C certifying staff is to ensure that all required maintenance has been called up and signed off by the category B1 and B2 staff before issue of the certificate of release to service. Category C personnel who also hold category

B1 or B2 qualifications may perform both roles in base maintenance.

GM 66.20(b)3. Privileges

1. Holders of a MCAR-66 aircraft maintenance licence may not exercise certification privileges unless they have a general knowledge of the language used within the maintenance environment including knowledge of common aeronautical terms in the language. The level of knowledge should be such that the licence holder is able to:

   - read and understand the instructions and technical manuals in use within the organisation;

   - make written technical entries and any maintenance documentation entries, which can be understood by those with whom they are normally required to communicate;

   - read and understand the maintenance organisation procedures;

   - communicate at such a level as to prevent any misunderstanding when exercising certification privileges.

2. In all cases, the level of understanding should be compatible with the level of certification privileges exercised.

GM 66.25(a) Basic knowledge requirements

The levels of knowledge are directly related to the complexity of certifications appropriate to the particular MCAR 66.1 category, which means that category A must demonstrate a limited but adequate level of knowledge, whereas category B1 and B2 must demonstrate a complete level of knowledge in the appropriate subject modules.

Category C certifying staff must meet the relevant level of knowledge for B1 or B2.

GM 66.30(a) Basic knowledge requirements

Maintenance experience on operating aircraft means the experience of being involved in maintenance tasks on aircraft which are being operated by airlines, air taxi organisations, etc. The point being to gain sufficient experience in the environment of commercial maintenance as opposed to only the training school environment. Such experience may be combined with approved training so that periods of training can be intermixed with periods of experience rather like the apprenticeship.

GM 66.40 Continued validity of the aircraft maintenance licence

Validity of the MCAR-66 aircraft maintenance licence is not affected by recency of maintenance experience whereas the validity of the MCAR 66.20 privileges is affected by maintenance experience as specified in MCAR 66.20(a)

GM 66.45(d) Type/task training and ratings

1. The required duration of practical training must be accepted on a case by case basis by

CAD prior to the type rating endorsement. It is strongly recommended that the agreement on the practical training duration be reached before the training starts. For applicants from a MCAR-145 organisation, the required duration may be approved through the organisation's MOE procedures.

2. While it is not feasible to establish a formula giving the required training duration in all cases, the following may be used as a guideline:

   (a) For a first type training course with no recent recorded maintenance experience six months practical training is required.

   (b) Some factors that may lead to a reduction in the maximum duration of 6 months practical training required are as follows:

   - experience on aircraft type of a similar technology, construction and systems including engines;
   - recency on type;
   - the quantity of the practical experience. For example experience gained will depend upon the environment e.g. line maintenance environment with one aircraft per week would permit limited experience compared with the constant base maintenance check environment;
   - the quality of the practical experience. The type of tasks carried out. These tasks should reflect, at a minimum, those tasks specified by the practical training needs matrix developed by the organisation approved under MCAR-147.

3. The minimum two weeks practical training is normally required for all type training courses. This includes the addition of similar type ratings on a MCAR-66 licence (differences courses). There may be cases where the practical differences training required is less than two weeks for example an engineer with a MCAR-66 type license in category B2 on an Airbus A330 with PW 4000 engines who takes a differences course to an Airbus A330 with Rolls Royce Trent engines.

   It should be noted however that while AMC 66.45(d) specifies a practical training duration between 2 weeks and 4 months, in the case of a structured OJT performed at line stations, due to the availability of aircraft its duration may need be subsequently extended in order to fulfill the required list of supervised tasks.

4. Except in those cases where the MCAR-147 organisation determines the practical training required it is the responsibility of the maintenance organisation to determine that the duration of practical training is commensurate with the candidates' recency and experience. However, in either case CAD must satisfy itself that the practical training is of sufficient duration before adding a type rating.

   Limited avionics system training should be included in the category B1 type training as the B1 privileges include the replacement of avionic line replaceable units. Electrical systems should be included in both categories type training.

GM 66.45(f) Type/task training and ratings

The examinations in respect of category B1 or B2 or C aircraft type ratings may be conducted by training organisations appropriately approved under MCAR-147, CAD or an organisation accepted by CAD to conduct such examination.

GM 66.45(d) and (e) Type/task training and ratings

MCAR-66 Appendix III type training levels are based upon ATA 104 (Air Transport Association) corresponding type training levels.

GM 66.70 Conversion provisions

For example a technical limitation could be where a person holds a pre MCAR-66 licence or authorisation limited to the release of the airframe and engine but not the electrical power system. This person would be issued with an MCAR-66 aircraft maintenance licence in the B1 category with a limitation excluding electrical power systems.