higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

AIRCRAFT MAINTENANCE THEORY N2

25 November 2022

This marking guideline consists of 6 pages.

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SECTION A

QUESTION 1

1.1	1.1.1	C		
	1.1.2	A		
	1.1.3	B		
	1.1.4	C		
	1.1.5	C		
			(5 × 1)	(5)
1.2	1.2.1	True		
	1.2.2	True		
	1.2.3	False		
	1.2.4	True		
	1.2.5	True		
			(5 × 1)	(5)
1.3	1.3.1	B		
	1.3.2	A		
	1.3.3	D		
	1.3.4	E		
	1.3.5	F		
			(5 × 1)	(5)
1.4	1.4.1	Accumulators		
	1.4.2	Disc area		
	1.4.3	Angle of incidence		
	1.4.4	Case hardening		
	1.4.5	Compression		
			(5 × 1)	(5)
				[20]

TOTAL SECTION A: 20

SECTION B

QUESTION 2

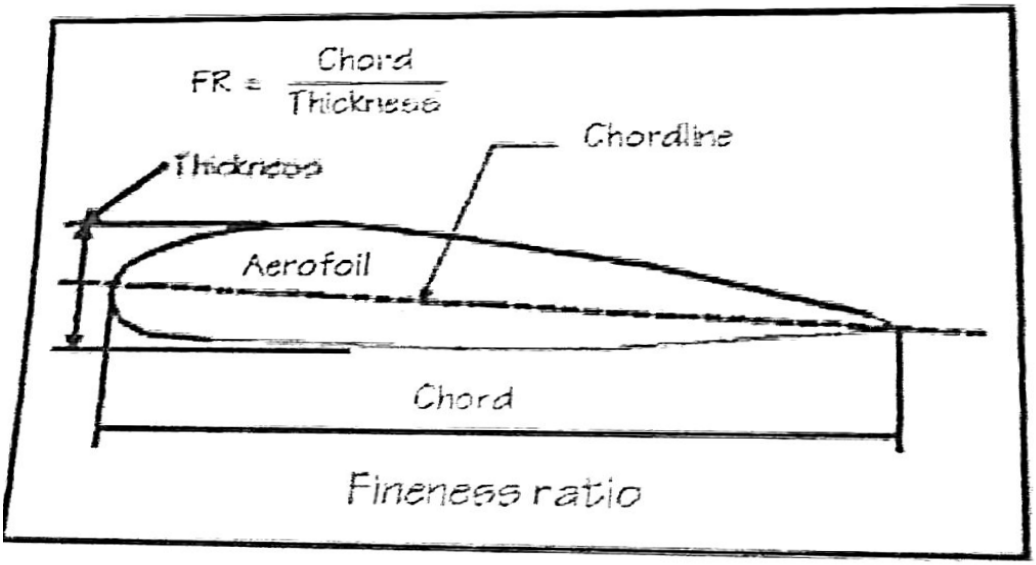
2.1
- Aerofoil shape (Fineness ratio)
- Angle of attack
- Density of the air
- Velocity of the air
- Wing-surface area (5)

2.2
- Well streamlined
- Very strong if its original shape is maintained
- Construction is very light
- Easy to repair
- Can support enormous loads
- Fairly easy to construct (Any 3 × 1) (3)

2.3
- Carburising
- Nitriding or cyaniding (2)

2.4
- The engines are usually mounted with their thrust line parallel to the longitudinal axis.
- Using a plumb bob, make markings on the floor under the engine on the points specified in the instruction manual.
- Using a plumb bob, make markings on the floor under the fuselage on the points specified in the instruction manual.
- Measure the distance between the two lines marked off on the floor. (This check can also be done when doing the symmetry check.)
- Compare the distance to that specified in the instruction/maintenance manual. (5)

2.5



(1 mark for sketch and 4 marks for labelling) (5)
[20]

QUESTION 3

3.1
- A sufficient supply of clean hydraulic fluid
- A method of supplying pressure energy
- A method of controlling pressure
- A method of converting pressure energy into mechanical energy and movement (4)

3.2
- Brakes
- Landing-gear doors
- Landing-gear extension and retraction
- Nose-gear or body-gear steering
- Primary flight controls
- Secondary flight controls
- Engine-thrust reverser
- Lower or upper deck cargo doors (Any 5 × 1) (5)

3.3

3.3.1 An air filter is used to trap tiny solid particles to a size of 10 mm or larger to pass clean air into the system.

3.3.2 A moisture separator is used to remove, as much as possible, water and oil out of the air in the system.

3.3.3 A selector valve controls the direction the air takes to the actuator since the actuator has two ports.

3.3.4 Actuators convert the air-pressure energy to mechanical energy, converting it to mechanical motion or power.

(4 × 2) (8)

3.4
- Anti-icing is the method used to prevent ice formation on critical areas of the aircraft✓ by heating up those areas thermally or electrically.✓
- De-icing is the method used to remove ice from areas of the aircraft after it has formed, normally by means of de-icing boots.✓ (3)

[20]

QUESTION 4

4.1
- Impeller (rotor)
- Diffuser (stator)
- Compressor manifold (3)

4.2
- High-peak efficiencies
- Small front area
- Straight-through airflow allowing ram efficiency
- Increased pressure rises by increasing the number of stages (4)

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4.3
- Freedom from vaporisation icing
- Severe atmospheric conditions
- More uniform delivery of fuel-air mixture to each cylinder
- Improved control of fuel-air ratio
- Reduction of maintenance problems
- Instant acceleration of the engine after idling
- Tendency to stall
- Increased engine efficiency (Any 5 × 1) (5)

4.4 Ground-boosted engines (1)

4.5 Check the complete engine bay and air intake for:

- Loose nuts and washers
- Tools
- Foreign objects
- Throttle and propeller pitch-change lever movement should be smooth and progressive
- Check run area for loose objects
- Fire extinguishers to be manned by competent person
- In case of engine fire during ground run, shut fuel off immediately (fire extinguisher can be operated if fire keeps going)
- Keep clear of rotating propellers (Any 7 × 1) (7)

[20]

QUESTION 5

5.1 The pitch-changing mechanism of a hydromatic propeller is a mechanical-hydraulic system in which hydraulic forces acting on a piston are transformed into mechanical twisting forces acting on the blade.✓ Linear movement of the piston is covered to rotary motion by a cylindrical cam. A bevel gear on the base of the cam mates with bevel-gear segments attached to the butt ends of the blades, thereby turning the blades.✓

The centrifugal force acting on a rotating blade includes a component force that tends to move the blade toward low pitch.✓ A second force, engine oil pressure, is supplied to the outboard side of the propeller piston to assist in moving the blade toward low pitch.✓ Propeller governor oil, taken from the engine oil supply and boosted in pressure by the engine-driven propeller governor, is directed against the inboard side of the propeller piston.✓ It acts as the counter-force which can move the blades toward higher pitch. By metering this high-pressure oil to, or draining it from the inboard side of the propeller piston by means of a constant-speed control unit, the force toward high pitch can balance and control the two forces toward low pitch. In this way, the propeller blade angle is regulated to maintain a select r/m.✓

The basic propeller control forces acting on the Hamilton standard propeller are centrifugal twisting force and high-pressure oil from the governor.✓ The centrifugal force acting on each blade of a rotating propeller includes a component force that results in a twisting moment about the blade centre line which tends, at all times, to move the blade toward low pitch.✓

Governor pump output oil is directed by the governor to either side of the propeller piston. The oil on the side of the piston opposite this high-pressure oil returns to the intake side of the governor pump and is used over again. Engine oil at engine pressure does not enter the propeller directly but is supplied only to the governor. During constant-speed operations, the double-acting governor mechanism sends oil to one side or the other of the piston as needed to keep the speed at a specified setting.✓✓ (10)

5.2
- Collective pitch control
- Throttle control
- Anti-torque pedals or tail-rotor control
- Cyclic pitch control (4)

5.3
- A more even distribution of the fuel-air charge to the cylinders.
- A more complete vaporisation of the fuel due to whirling action of the impeller as well as the heat of compression.
- A rise in temperature which reduces the density of the charge. Excessive rise in temperature may lead to detonation.
- An absorption of power by the supercharger mechanism. (4)

5.4 The function of the collective is to change the pitch angle of the main rotor blades.✓ The change in main rotor blade pitch during hover or flight will cause a change in the angle of attack of the blades. This will allow the helicopter to change altitude due to increase or decrease in lift that is generated.✓ (2)

[20]

TOTAL SECTION B: 80
GRAND TOTAL: 100

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