24.0 AVIATION TECHNOLOGY (450)

The 2010 Aviation Technology examination was composed of a theory and a practical paper. The format and weighting of the two papers was the same as the previous years.

23.1 CANDIDATES GENERAL PERFORMANCE

The table below shows as the candidates' performance in aviation technology for the year 2010. The statistics for 2008 and 2009 have been included in the table for comparison.

Table 30: Candidates' overall performance in aviation technology for the last three years

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
	1		60	34.78	5.84
	2		40	26.56	2.94
2008	**overall**	**63**	**100**	**61.33**	**7.79**
	1		60	34.84	6.17
	2		40	26.24	3.97
2009	**overall**	**68**	**100**	**61.07**	**9.09**
	1		60	37.76	6.62
	2		40	27.21	2.94
2010	**overall**	**52**	**100**	**63.52**	**11.1**

From the table above, the following observations can be made.

24.1.1. The candidature dropped by **16** candidates from **68** to **52.**
24.1.2. The performance in **2010** for both papers 1 and 2 improved compared to that of 2009 with the overall mean being **63.52** and **61.07** respectively.

The following report focus on the questions which were poorly done in both theory and practical papers.

24.2 PAPER 1(450/1)

Question 1

State four safety precautions to be observed when handling high compressed gas cylinders in aviation industry.
Differentiate between illustrated parts catalogue and overhaul manual as applied to aircraft maintenance.

Part A of the question required the candidates to state safety precautions specifically on high compressed gas cylinders.

Weaknesses
Most students failed to state the specific safety requirements when using compressed gases but listed the general safety precautions.

Part B of the question required the candidates to differentiate between illustrated parts catalogue and overhaul manuals.

Most students failed to answer the questions or answered incorrectly. The students were expected to give the difference by giving any of the following reasons:

Expected Responses
(a) SAFETY PRECAUTIONS
- Containers must be positively identified
- Bottles must be tightly clamped

- Bottles must have higher pressure than the system pressure
- Never used oil or grease
- Must be covered when not in use

(b) Parts catalogue shows a sequence of assembly and is used for ordering parts while overhaul manual guides in disassembly and reassembly of components.

Question 5

Sketch the following aircraft control parts and explain the function of each part

a. Torque tube;
b. Bell crank;
c. Quadran

Expected Responses

Candidates were expected to sketch and give the function or application of each in aircraft control system e.g.

- Torque tube changes linear motion to rotary motion
- Bell crank changes direction of motion
- Quadrant changes motion angle

Question 7

Outline three differences between soft soldering and brazing.

Weaknesses

The students got mixed up between soft soldier and brazing. They were expected to outline the differences as follows:-

Expected Responses

- Soft soldier is used on copper, brass and coated iron
- jobs while brazing is mostly for mechanical joints in conjunction with mechanical seams while brazing is metal joining process where the bonding material is a non-ferrous metal or alloy
- Soft soldier mostly is used for electrical connections, sealing, minor repair
- Soft solder requires low temperature while brazing requires higher temperatures
- Soft soldier utilizes soldering wire while brazing uses brazing wire
- Soft soldier requires tinning while brazing utilizes brazing flux

Question 8

Explain why each of the following materials is used in an aircraft

a) Titanium
b) Carbon graphite
c) Thycol

Weaknesses

All students give a reason as to why titanium is used. They were expected to state carbon graphite is used for dry lubrication and Thycol is a sealant.

Expected Responses

MATERIALS

(a) Carbon graphite is the only dry lubricant available.
(b) Titanium retains mechanical properties even at high temperatures. It is also light and strong.
(c) Thycol is a sealant which can withstand any solvent.

Question 9

With aid of sketches, explain two methods of generating thrust in aircraft.

The students embarked on drawing both aero piston and jet engine operations system instead of explaining thrust generation methods as follows

- Method 1 to draw sketch showing
  - *A propeller accelerates a large volume of air by a small amount*
- *Method 2 to draw sketch showing*
  - *A jet engine accelerates a small volume amount of air by a large*

Expected Responses
GENERATING THRUST

(i) Accelaration of large mass of air creates a reaction which pushes/pulls aircraft forward.
(ii) Acceleration of small mass at high velocity creates reaction which pushes aircraft forward.

Question 12
(a). Explain Two functions of the compressor section of the turbo jet
(b) With the aid of labelled sketches, describe the construction and operation of the two types of gas turbine engine compressors.

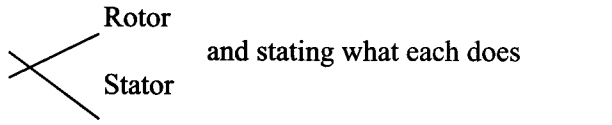
Students explained very well the functions of the compressor, described operation of axial and centrifugal flow but failed to show the constructional differences-

The students were expected to make sketches and label:-
Centrifugal flow
- Impeller
- diffuser and
- manifold

Axial
- Inlet guide vanes ,
- stator vanes
- rotor blades in a casing .

Expected Responses
(a) COMPRESSOR SECTION
Supplies sufficient quantity of air to satisfy the requirements of combustion burners.
Supplies bleed-air for various purposes in the engine and aircraft.

(b) TYPES OF COMPRESSORS
(i) Centrifugal and Axial flow
CONSTRUCTION



(ii) OPERATION
Axial – correct statement about its operation
Centrifugal – correct statement about its operation
SKETCHES

Question 14
a) Classify the four aircraft flow regimes
b) With the aid of labelled sketches, explain the behaviour of airflow on increasing the speed of an aircraft from mach number 0.6 to 1.2

Student classified the regimes well but failed to show and explain the development of shockwave.

Candidate also needed to show and explain behaviour of the flow over an airfoil at mach:-

- 0.6, all the flow over the aerofoil is subsonic,
- 0.8 the flow in front of incipient shockwave is supersonic while aft is subsonic
- a fully developed shockwave is formed with flow ahead being supersonic and behind being subsonic.
- At mach 1.2 all flow is supersonic, shockwave is at the tail but there is still a small region of subsonic flow immediately in front of the leading edge at what is called the stagnation point where flow is brought to rest and immediately behind the trailing. Bow wave approaches from front.

Expected Responses

(a) FLOW REGIMES

Subsonic	-speed of aircraft is below speed of sound
Transonic	-when flow of air at part of aircraft is above the speed of sound but a/c is below the speed of sound 0.75 – 1.2
Supersonic	-When speed of a/c is above the speed of sound but a flow at the tail is below the speed of sound 1.2 – 5.0
Hypersonic	- when entire aircraft and airflow are above the speed of sound (above 5.0)

(b) AIRCRAFT BEHAVIOUR ON INCREASING SPEED

(a) Subsonic speed
No shock wave. Breakaway at transition point.

(b) At critical mack number –first shock wave develops
(c) At speed of sound – shock waves become stronger and moving back
(d) At transonic speeds – blow wave appears from front, orginal wave at the tail.

Question 15

a) State the function of each of the following devices
   (i) Vortex generator;
   (ii) Slats;
   (iii) Spoilers.
b) Outline three effects of lowering aircraft wing trailing edge.
c) With aid of sketches, explain the operation of each of the following aircraft flaps:
   (i) Double slotted;
   (ii) Split;
   (iii) Zap.

Student answered part (a) and (b) very well but failed to answer part (c) adequately. The students were expected to sketch and explain what happens when;-

i. Double slotted flap is operated the slots delay formation of the boundary by setting favourable pressure gradient and so maintain a suitable boundary layer for a greater distance over the sharply deflected surface of the flap,
ii. split flap when extended, it leaves the top surface normal whilst increasing the angle of attack of the lower hinged portion and thus causes increase in lift but a larger increase in drag,
iii. Zap type leading edge moves aft along the lower surface of the wings as the flap angle is increased, so the trailing edge of the flap remains approximately under the trailing edge of the wing.

Expected Responses

(a) **Vortex generators**:
generates vortices to held down the boundary layer at high speed to delay aircraft stall.

Slats:
When deployed they form slots that increase the velocity of air to hold down the boundary layer at large angle attack to delay stall during landing and taking off.

Spoilers:
When the spoilers are raised deliberately, they break the boundary layer for quick rate of descent during pressurization failure or combat.

(b) EFFECTS OF LOWERING FLAPS

- Increases coefficient of lift by changing the shape of the wing.
- Increase the surface area thus increasing the magnitude of lift.
- Creates pitching down attitude to lower down the nose for better gliding angle.
- Increases drag to bring down the aircraft to a halt without excessive use of brakes.
- Slows down the aircraft in flight to act as speed brakes

(c) (i) DOUBLE SLOTTED
This is the type of flap when lowered increases the camber to increase the coefficient of lift and surface area of the wing and also creates slots to provide spill air to hold down the boundary layer to delay stalling.

24.3 PAPER 2 (450/2)

Question 1
Figure 1 shows an isometric view of assembled aircraft horse shoe hydraulic brake unit. On the drawing paper provided:

a) Sketch in good proportion **seven** breakdown parts of the assembly
b) Label **four** parts

The question required the candidates to sketch in good proportion any seven parts of the horse shoe assembly and label any four parts ie bolts, springs, linings, drum, piston, studs, seals, etc.
Most students drew the basic hydraulic brake system and labelled.

***Question* 3**

a) Identify the instruments labelled A to E and state the use of each.
b) State the principle of operation of the instruments labelled C,D and E
c)
   (i) List two errors associated with the instrument labelled F
   (ii) State two maintenance tasks required for instrument labelled F

The question required students to:-

a) identify the aircraft instruments provided, stating the use in part (a)
b) state the principles of instrument in (b)
c) list errors associated with aircraft compass labelled F in part(c)(i) and maintenance tasks required for same instrument in part (c)(ii)

The students answered well part (a) and (b) but failed to state the errors associated with aircraft compass in:
(c)(i) which includes hysteresis, parallax error, sticking pointer etc and

(ii) maintenance tasks which includes instrument calibration, compass swing etc

Question 8
Carry out the following tasks using the materials and tools provided:

a) Identify the type and size of the spanner labelled P.
   Type---------- size----------
b) (i)Use spanner P to tighten the four nuts on the plate provided.
   (ii)Torque the nuts to 20NM using the torque wrench provided
   (iii) Wires lock the nuts using the wire twister

Let the examiner check your work

The question required the students to identify the type and size of spanner provided, torque load and wire lock the bolts.

Most students could not torque load the bolts to required value and others failed to perform wire locking using a wire twister.

Question 9

a) Connect the components provided as shown in the circuit in Figure 3.Let the examiner check your work.

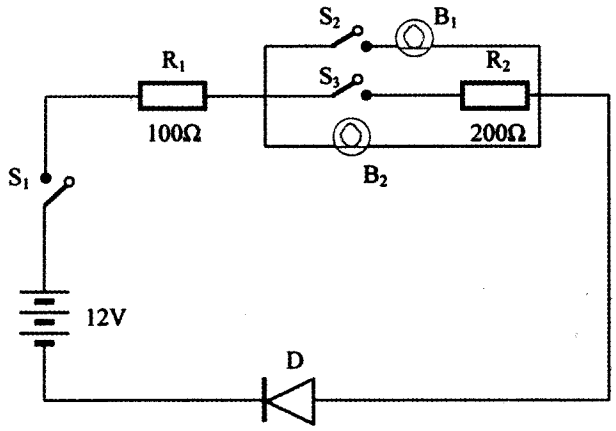


Figure 3

b)(i) Select switch S1, to ON position and state what happens.
(ii) Select switch S2, to ON position and state what happens.
(iii)Select switch S3, to ON position and state what happens.

c)(i) State the reasons behind the observations in (b)(i),(ii) and (iii) above.
(ii) State two applications of the circuit in an aircraft.

The question required the students to:

a) Connect the components to make the circuit provided.
b) Select switch S1, S2 and S3 to ON position and state what happens in each case respectively.
c) Give reasons behind observations made and in each case in (b).
d) Give two applications of the system

Some students were unable to interpret the circuit and could not get any results and thus unable to answer subsequent questions. Others could not finish part (b) and (c) though they connected the circuit well.

24.4 GENERAL COMMENTS

Students could have done the exams very well if schools:

a) Equipped the workshops with all prerequisite equipment, tools and materials
b) Avoid buying or borrowing tools, equipment materials for exam purpose.
c) Availed practical equipment, tools and materials at least for 20 students for every session.
d) Encouraged teachers to cover the syllabus adequately
e) Encouraged students to attend and do Practical sessions in all areas covered.
f) Facilitated field visits to various airlines and other stake holders in aviation industry
g) Had equal level of syllabus coverage.