3.8 AVIATION TECHNOLOGY (450)

The 2013 KCSE examination for Aviation Technology consisted of two papers namely Paper 1 (Theory) and Paper 2 (Practical). The theory was worth 60% while practical was worth 40% of the final mark .The format and weighting of the two papers was the same as that of 2012.

Candidates General Performance

The table below shows candidates' overall performance for the last six years:

Table 15: Candidates' Overall Performance in Aviation Technology for the years 2008, 2009, 2010, 2011, 2012 and 2013

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2008	1		60	34.78	5.84
	2		40	26.56	2.94
	Overall	**63**	**100**	**61.33**	**7.79**
2009	1		60	34.84	6.17
	2		40	26.24	3.97
	Overall	**68**	**100**	**61.07**	**9.09**
2010	1		60	37.76	6.62
	2		40	27.21	2.94
	Overall	**52**	**100**	**63.52**	**11.1**
2011	1		60	35.49	6.51
	2		40	26.16	3.04
	Overall	**70**	**100**	**61.26**	**9.05**
2012	1		60	34.82	6.63
	2		40	25.08	4.13
	Overall	**118**	**100**	**59.90**	**9.87**
2013	1		60	33.39	8.24
	2		40	24.94	3.57
	Overall	**158**	**100**	**58.33**	**10.76**

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

(i) The candidature increased from **118** in 2012 to **158** in 2013.

(ii) The mean dropped slightly from 59.90 in 2012 to 58.33 in 2013.

(iii) However the standard deviation improved from 9.87 in 2012 to 10.76 in 2013

3.8.1 Aviation Technology Paper 1 (450/1)

The questions which were reported to have been poorly responded to have been analyzed with a view to pointing out candidates' weaknesses and propose suggestions on some remedial measures that would be taken in order to improve the performance in future. The questions for discussions include 4, 5, 6, 7, 8, 11 and 14 (b).

Question 4

Differentiate between the following:

(a) airport and airfield; (2 marks)
(b) runway and taxiway. (2 marks)

Weakness

Most candidates were unable to differentiate between airports and airfields and runway and taxiway..

Advices to teachers

Teachers need to organize for trips to take students to airports and airfields for them to be able to differentiate between them.

Expected responses

(a) An **airport** is a vast aviation area exclusively for commercial use for freight while an **airfield** is a relatively small area for private aviation base.

(b) **Runway** is a surface provided in an airport for aircrafts to land on or take off from while a **taxiway** is used exclusively for aircraft ground manoeuvres.

Question 5

(a) State **four** causes of flow change from laminar to turbulent on an aircraft wing. (2 marks)
(b) Use a labelled sketch to show how a lift is generated on an aerofoil. (4 marks)

Weakness

Most candidates were not able to state the causes of flow change from laminar to turbulent on an aircraft wing.

Advice to Teachers

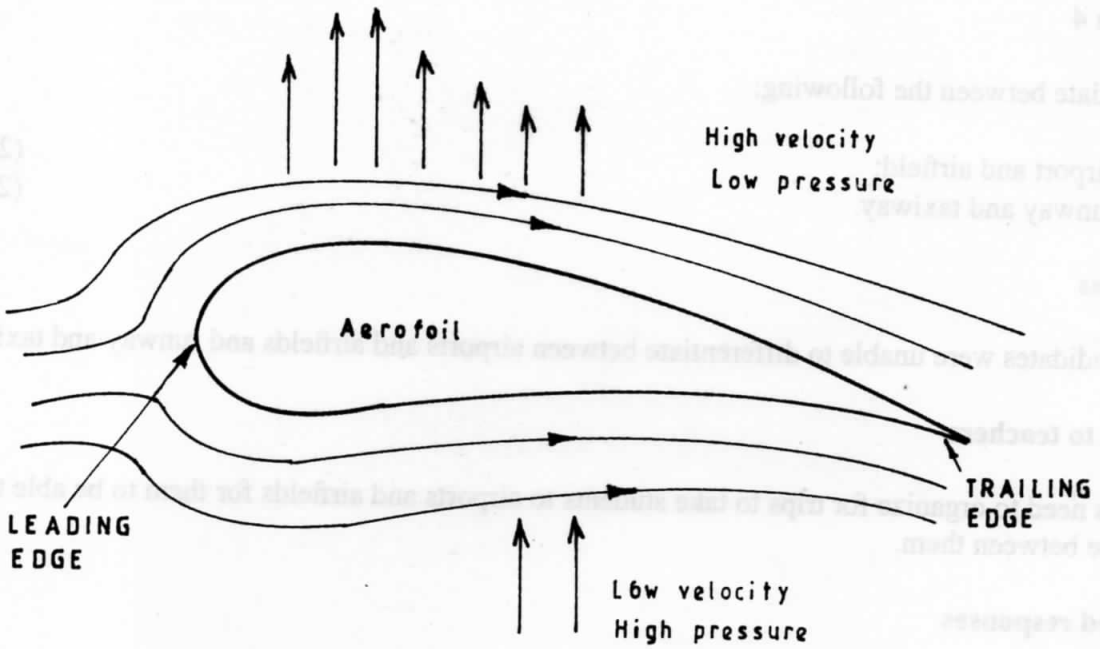
They should teach exhaustively on the theory of flight.

Expected response

(a) Causes of flow change from lamina to turbulent.

- Roughness of the surface.
- Abrupt changes in direction - 90% bends
- Shape - curvature determines how far separation occurs from leading edge.
- Speed of the aircraft.

(b)



Sketch = 1
Labelling, 6×1/2 = 3
= 4 marks

Question 6

Explain each of the following terms as applied to aircraft structure:

(a) fairing; (1 mark)
(b) monocoque; (1 mark)
(c) rigging position; (1 mark)
(d) winglet. (1 mark)

Weakness

Most candidates could not answer the question as expected.

Advice to Teachers

They should teach by making use of models for the students to understand better.

Expected response

(a) Fairing - Additional structures provided to any structure to reduce its drag.

(b) Monocoque - is a type of fuselage structure in which all the load is taken by the skin.

(c) Rigging position is positioning of the aircraft when the longitudinal and lateral axis of the aircraft are in horizontal plane for the purpose of coordinating the control surfaces.

(d) Winglet is a small nearly vertical wing like surface usually of aerofoil section, attached to the wing tip. It is usually located rearward above the wing tip and is effective in reducing induced drag.

Question 7

Use a labelled sketch to show the forces acting on an aircraft propeller blade during generation of thrust. (6 marks)

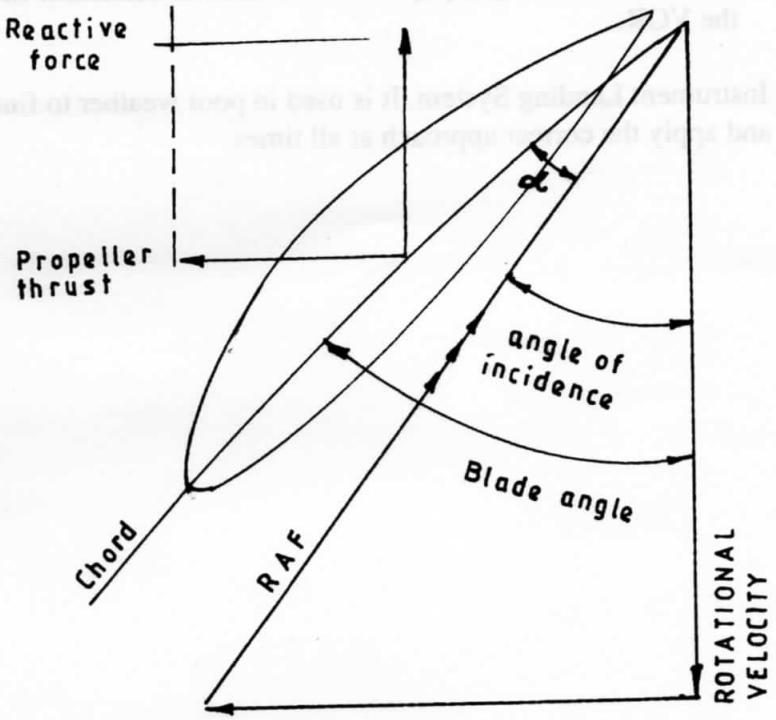
Weakness

Most candidates could not draw and show the forces acting on an aircraft propeller blade.

Advice to teachers

Teachers are advised to make use of sketches and videos to explain the working principles of aircraft propellers.

Expected response



Question 8

(a) Explain **two** methods of preventing failure in an aircraft hydraulic system. (2 marks)

(b) State the meaning and the function of each of the following aircraft flight systems:

(i) RMI ($1\frac{1}{2}$ marks)
(ii) DME ($1\frac{1}{2}$ marks)
(iii) ILS ($1\frac{1}{2}$ marks)

Weakness

Most candidates gave wrong answers

Comment

Teachers should source for resource persons to teach more in the areas where they find difficulties.

Expected response

(a) **Methods of preventing failure in an aircraft hydraulic system.**

- Monitor the condition of all the system components for any impeding failure.
- Monitor the fluid by checking contamination, level, aeration e.t.c.

(b) **Meaning of;**

(i) RMI - Radial Magnetic indicator. It helps the pilot to find the direction to the airport or for navigation.

(ii) DME - Distance Measuring Equipment. It is used to determine the distance to the VOR.

(iii) ILS - Instrument Landing System. It is used in poor weather to find the runway and apply the correct approach at all times.

(3 x 1 = 3 marks)

Question 11

Figure 2 shows the three orthographic views of an aircraft engine bracket drawn in first angle projection.

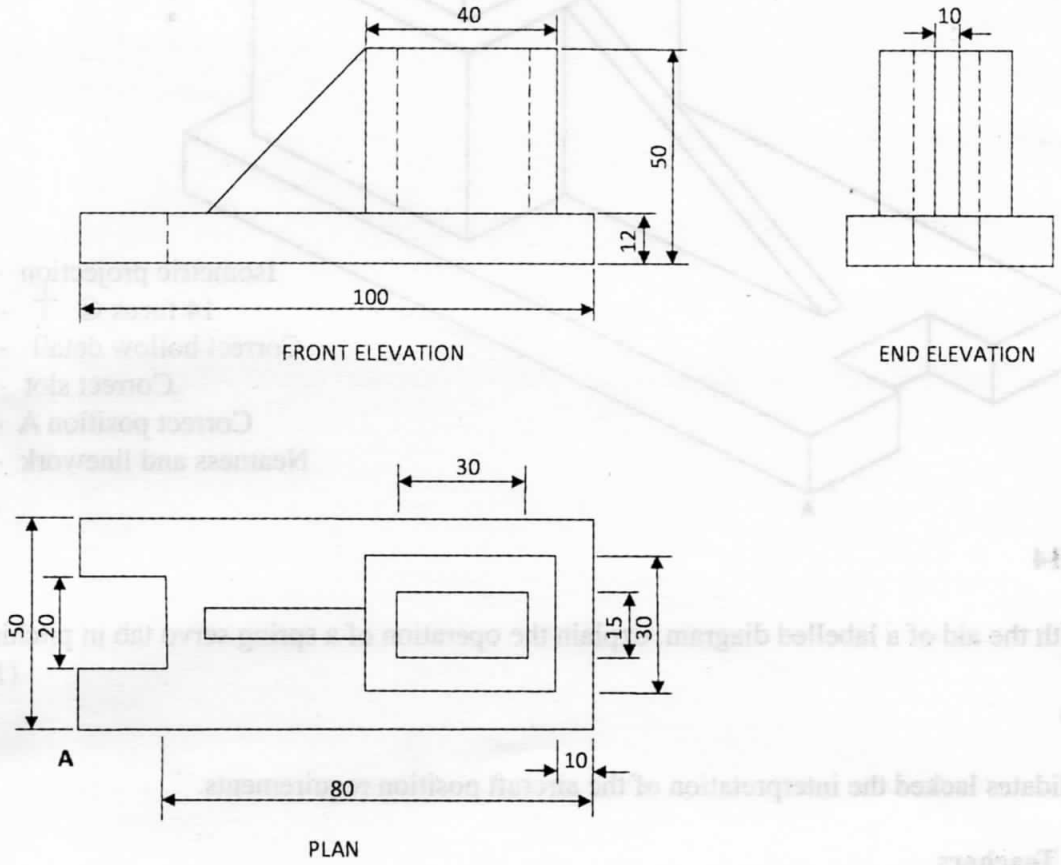


Figure 2

On the isometric grid paper provided on page 10, draw the isometric view of the bracket taking A as the lowest point.

(14 marks)

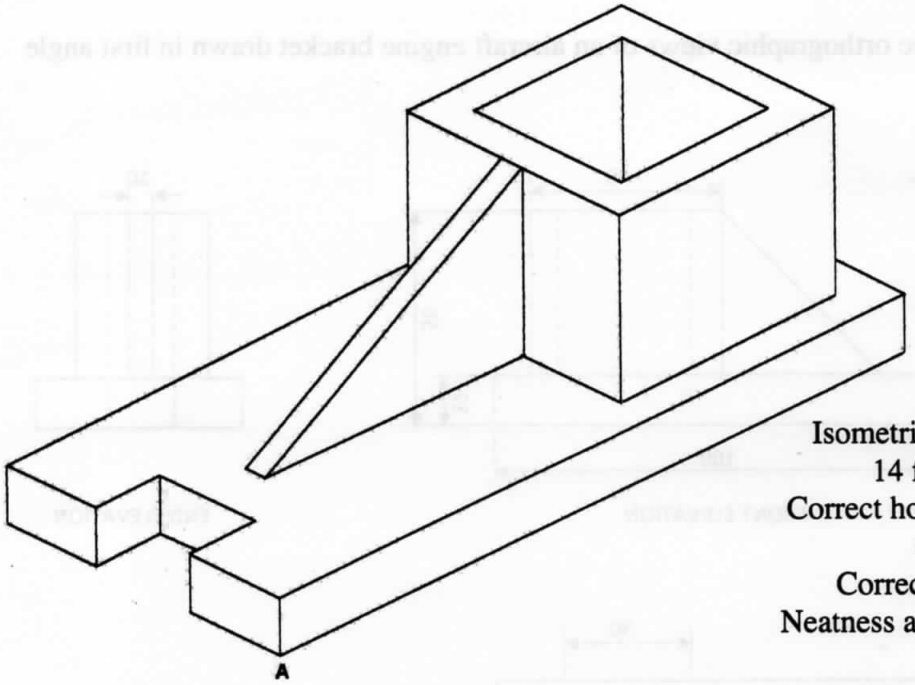
Weakness

Most candidates had no idea about the question

Advice to Teachers

They should give students more take away assignments in drawing for them to acquire the skills in drawing.

Expected response



Isometric projection - 1 mark
14 faces @ $\frac{1}{2}$ - 7 marks
Correct hollow detail - 2 marks
Correct slot - 2 marks
Correct position A - 1 mark
Neatness and linework - 1 mark
14 marks

Question 14

(b) With the aid of a labelled diagram, explain the operation of a spring servo tab in pitching mode. (10 marks)

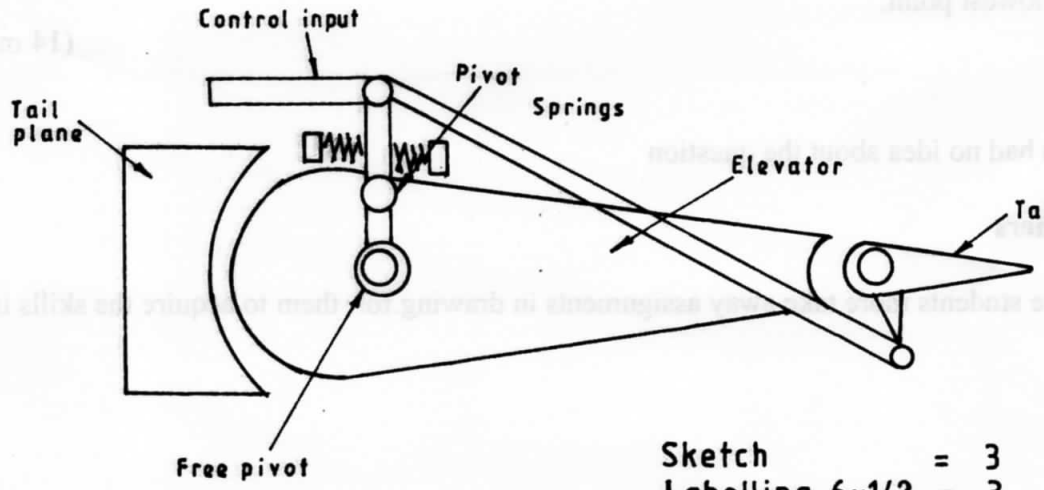
Weakness

Most candidates lacked the interpretation of the aircraft position requirements.

Advice to Teachers

Teachers involve a lot demonstration when teaching the topic of controls tabs in flight operations.

Expected response



Sketch = 3
Labelling 6×1/2 = 3
= 6 marks

(b) **Servo-tabs**

(i) These tabs are connected directly to the cockpit controls and the tab can be made to apply the hinge moment required to move the control surface. The pilot's control input deflects the tab and the moment produced about the hinge line of the control surface causes this surface to "float" to its position of equilibrium.

(ii) The floating control will then produce the required moment about the CG of the aircraft. The stick forces involved are only those arising from the hinge moments acting on the tab, which are much less than those on the main control surface.

(iii) Movement of the input rod deflects the tab against spring tension. The input force is transmitted through the spring to the control surface, which moves as a result of the combined effect of input force and aerodynamic assistance provided by the tab.

(iv) The amount of servo-action depends on the rate (strength) of the spring employed. It can be seen that an infinitely strong spring produces no assistance from the tab whereas an infinitely weak spring causes the tab to behave as a servo-tab.

(v) The spring tabs may be pre-loaded to prevent them from coming into operation until the stick (or rudder) force exceeds a predetermined value. This is done to keep the spring tab out of action at low speeds, thus avoiding excessive lightening and lack of feel.
When loads are excessive at increase of speed the spring is compressed to return the aircraft.

(vi) On sensing any load differences, the spring returns the aircraft automatically.

3.8.2 Aviation Technolofy Paper 2 (450/2)

This practical paper comprised 10 equally weighted exercises which were compulsory. The various practical skills tested in this paper included the following:

- Sketching in good proportion an exploded view of a hydraulic system paper filter.
- Making an overlap patch as shown in the figure provided.
- Measuring and recording details on parts of a connecting rod
- Using a manila paper to make and label aircraft wing plan forms to suit the given regimes.
- Demonstrating the procedure of carrying out a dye penetrant test.
- Carrying out the breaking, cutting, burning and bending test on materials provided.
- Studying a given instrument and identifying its principle of operation, the aircraft system used and its starting requirement.
- Stripping one end of an electricity cable, identifying its type and stating its application.
- Identifying given aircraft components and stating their application and maintenance requirements.

Weaknesses

Although the overall performance in this paper was good, some weaknesses were noted in most of the questions as discussed below.

In **station 1** some candidates could not draw the exploded view of the filter as expected.

In **station 2** most candidates were not able rivet and deburr as expected.

In **Station 3** some candidates lacked the skills in using appropriate tools in taking measurements.

In **station 4** some candidates were unable to interpret the results.

In **station 5,** candidates in some centers seemed not to be aware of what they were to do

In **station 6** some candidates failed to carry out the exercise and just guessed the answer.

In **station 7** some centres lacked the standard instruments thus lack of practice by students.

In **station 8,** candidates in a few centers had no idea about the electrical and electronic system.

In **station 9** some candidates were not able to use the gauges while some could not identify parts of a piston engine.

ADVICE TO TEACHERS

Teachers should ensure that all the practical aspects in the syllabus are adequately covered without assuming the support topics. The list of tools and equipment at the back of the syllabus should be used as a check list to ascertain that students are familiar with tools and equipment they are expected to handle during the examination.

Students are expected to know aviation tools parts, materials etc by the correct names.
The correct handling of tools, parts, materials etc. should also be emphasized during training.

Teachers should be proactive and involve students in carrying out various experiments, inspecting and evaluating various aircraft components and also in setting and adjusting various parts of an aircraft.

Schools offering the subject are advised to source for aircraft instruments from grounded aircrafts in some airstrips and airports within their locality for learning purposes.