23.0 AVIATION TECIINOLOGY (450)

The 2009 Aviation Technology examination was composed of a theory and a practical paper. The format and weighting of the two papers was the same as in the previous years.

23.1 CANDIDATES GENERAL PERFORMANCE

The table below shows as the candidates' performance in Aviation Technology for the year 2009. The statistics for 2007 and 2008 have been included in the table for comparison.

Table 28: Candidates' Overall Performance in Aviation Technology for the last three years

Year	Paper	Candidature	Max. Score	Mean Score	Standard Deviation
	1		60	31.87	6.27
	2		40	22.17	2.32
2007	**Overall**	**53**	**100**	**54.04**	**7.00**
	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	**68**	40	26.24	3.97
2009	**Overall**		**100**	**61.07**	**9.09**

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

23.1.1 The candidature rose by only **5** candidates from **63** to **68**.

23.1.2 The performance in both papers **1** and **2** was almost identical to that of the previous year with the overall mean score being **61.33** and **61.07** respectively.

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

23.2 PAPER 1 (450/1)

Question 7

(a) Use a labelled sketch of an aircraft in level flight to show the relationship between Centre of gravity and centre of pressure.

(b) In a level flight, explain how:

(i) the centre of gravity and centre of pressure vary;

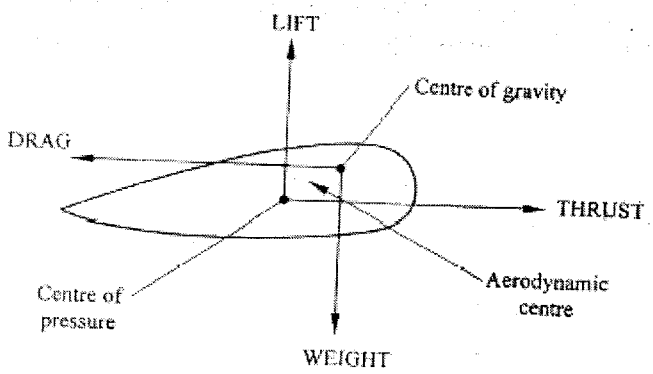
(ii) the variation is corrected.

This question required the candidates to relate the centre of gravity to the centre of pressure and explain how they can be corrected.

Most of the candidates failed to illustrate clearly how the centre of gravity and centre of pressure are related and also explain how they can be corrected.

Expected response

(a) CP and CG



(b) (i) CP changes position with change in angle of attack and CG with reduction in fuel

(ii) Corrected by
- fuel transfer
- using moveable tail plane
- trimming the aircraft

Question 10

Use conventional symbols to illustrate each of the following as used in technical drawing.

(a) first angle projection;

(b) solid cylinder;

(c) machined surface;

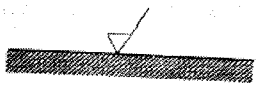
(d) internal screw thread.

The candidates were required to draw various symbols that represent each of the descriptions given. Although the symbols required are quite commonly used in technical drawing, about **80%** of the candidates could not present the correct symbols as expected.

Expected responses

FIRST ANGLE PROJECTION

SOLID CYLINDER



MACHINED SURFACE

INTERNAL SCREW THREAD

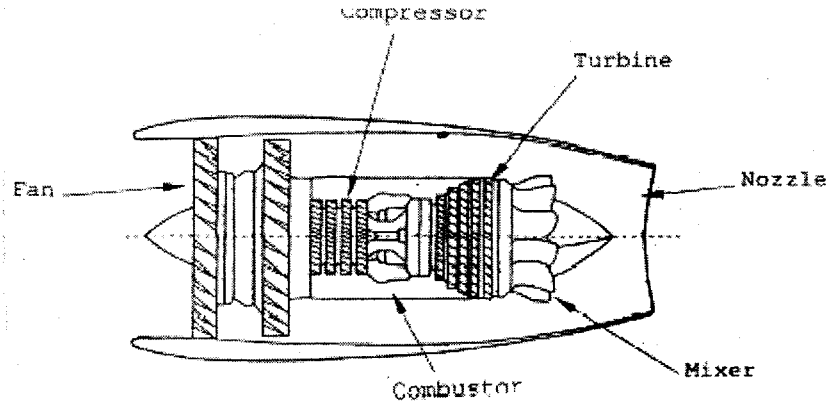
Question 12

With the aid of a labelled sketch, explain the operation of an aero gas turbine engine.

In this question, the candidates were expected to draw a typical aero bypass gas turbine engine and explain how it operates. Most of the candidates failed to read and understand the question correctly and ended up giving the operation of an ordinary jet turbine engine.

Expected responses

AERO BYPASS GAS TURBINE ENGINE



(i) **Fan** – the fan which pulls air into the engine and sucks in large quantities of air. It then, speeds the air up and splits it into two parts. One part continues through the "core" or centre of the engine, where it is acted upon by the other engine components. The second part "bypasses" the core of the engine, instead travelling through a duct that surrounds the core of the back of the engine where it produces much of the force that propels the airplane forward;

(ii) **Compressor** – The compressor squeezes the air that enters it into smaller areas, resulting in an increase in the air pressure. This results in an increase in the energy potential of the air. The squashed air is forced into the combustion chamber;

(iii) **Combustor** – air is mixed with fuel and then ignited. This process results in high temperature, high energy airflow. The fuel burns with the oxygen in the compressed air producing hot expanding gases;

(iv) **Turbine** – The task of a turbine is to convert gas energy into mechanical work to drive the compressor and the accessory gear box;

(v) **Nozzle** – The nozzle is the exhaust duct of the engine. The energy depleted airflow that passed the turbine, in addition to the colder air that bypassed the engine core, produces a force when exiting the nozzle that acts to propel the engine, and therefore the airplane forward;

(vi) **Mixer** – Combines the high temperature air coming from the engine core with the lower temperature air that was bypassed in the fan. These results in a quieter engine than if the mixer was not present.

The operation should have included the function of each of the main parts namely fan, compressor, combustor, turbine, nozzle and mixer.

Question 13

(a) Explain how the rate of aircraft climb can be initiated in flight.
(b) Explain **four** factors that can cause an aircraft to stall in flight.
(c) Outline **five** design features of an aerofoil.

The candidates were required to explain three aspects of the theory of flight with specific reference to rate of limb, causes of stall and aerofoil features. Most of the candidates had very limited knowledge in this topic.

Expected response

(a) **RATE OF CLIMB INITIATED BY:**

(i) Providing more power by advancing the throttle to:
- Overcome the drag as in level flight
- Lift the weight at vertical speed
- Accelerate a/c slowly.

(ii) Increasing the angle of attack by trimming or control stick.

(b) **FACTORS THAT CAN CAUSE A/C TO STALL**

If aircraft wings produce increased air resistance and decreased lift.
If airflow no longer goes around the airfoil nose (leading edge) and separates from upper wing surface.
If plane is under too great angle of attack.
For light aircraft without high-lift devices, the critical angle is usually – 16

(c) **DESIGN FEATURES**

(i) Camber line
(ii) Leading and trailing edges
(iii) Chord line of the airfoil
(iv) Precise distance from leading to trailing edge
(v) Maximum distance between camber and chord line.

Question 14 (c)

(c) Differentiate between the following aircraft electrical devises:

(i) inventor and rectifier;
(ii) fuse and circuit breaker;
(iii) alternator and generator.

This was an electrical question in which the candidates were required to compare three pairs of electrical devices used in an aircraft.

Although the performance in part (a) and (b) was quite good, the responses given by most candidates for part (c) left a lot to be desired. Candidates were expected to describe briefly what each device was and point out the main difference between each of the pairs given.

Expected responses

(c) (i) Inventer is an electromagnet device that converts direct current to alternating current while rectifier is a device that converts alternating current to direct current.

(ii) A fuse is an electric device that disconnect a circuit by blowing when a fault occurs while a circuit breaker disconnects a circuit by triggering off when there is a fault but can be reset after the fault is rectified.

(iii) An alternator is an electric device consisting of rotating coil in a strong magnetic field to generate alternating current while a generator produces direct current by rotating a magnet.

23.3 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 a cross-sectional assembly drawing of an oleo leg given its breakdown parts.
- Fabricating a drill drift.
- Disassembling and assembling various aircraft components.
- Carrying out experiments related to aircraft systems.
- Taking measurements or various electrical circuits.
- Reading and interpreting various manual and safety posters.
- Trouble shooting aircraft instruments.
- Identifying defects in selected parts and materials.

Weaknesses

Although the overall performance in this paper was good, some weaknesses were noted particularly in questions **6**, **8** and **9** as discussed below.

In **station 6** the task involved required the candidates to determine the values of some resistors provided before connecting them in a given circuit. The main weakness portrayed by some candidates was the inability to connect the circuit correctly leading to failure to make the expected observations and deductions.

In **station 8** the candidates were required to take various measurements using precision tools such as outside micrometer and vernier calipers. The main challenge here was the inability to read the tools accurately. Candidates were also expected to determine the accuracy of the measuring tools based on the information inscribed on each tool.

Station 9 tested the candidate's ability to identify various aircraft instruments, understand their principles of operation, read and interprete the information given in each instrument.

Other weaknesses portrayed by the candidates include poor sketching skills, use of wrong names of components and parts, poor skills in metal fabrication lack of mastery of assembly and disassembly procedures.

23.5 ADVICE TO TEACHERS

Teachers should ensure that all the practical aspects in the syllabus are adequately covered. 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 what 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.

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