

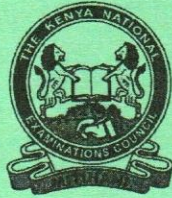
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AIRFRAME STRUCTURES, AIRFIELD  
SAFETY AND PROCEDURES

June/July 2017

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING  
(AIRFRAMES AND ENGINES OPTION)  
(AVIONICS OPTION)

MODULE I

AIRFRAME STRUCTURES, AIRFIELD SAFETY AND PROCEDURES

3 hours

### INSTRUCTIONS TO CANDIDATES

*You should have the following for this examination:*

*answer booklet;*

*drawing instruments;*

*non-programmable scientific calculator.*

*This paper consists of **THREE** sections.*

*Answer **THREE** questions in section A, **ONE** question in section B and **ONE** question in section C.*

*All questions carry equal marks.*

*Maximum marks for each part of the question are as indicated.*

*Candidates should answer the questions in English.*

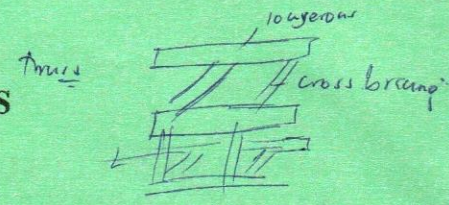
**This paper consists of 5 printed pages.**

**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**



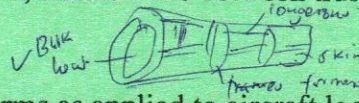
# SECTION A: AIRFRAME STRUCTURES

Answer **THREE** questions from this section.



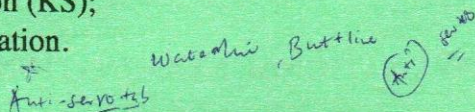
1.

(a) With the aid of labelled sketches, differentiate between truss type and semi-monocoque fuselage construction. (4 marks)



(b) Define each of the following terms as applied to aircraft location numbering system:

- (i) buttock line or butline (BL);  $\rightarrow$  located left or right of the longitudinal axis
- (ii) water line (WL);  $\rightarrow$  vertical locations are made in reference with this
- (iii) aileron station (AS);
- (iv) flap station (KS);
- (v) nacelle station.



(5 marks)

(c) (i) Outline **three** reasons why an aircraft manufacturer would use a nylon coated cable in aircraft control systems. (3 marks)

(ii) With the aid of labelled sketches, explain the operation of each of the following:

allows each blade to lead or lag, flips up or down, independent of each other

- (I) tensiometer;
- (II) turnbuckle.

- (1) Trim tab - keep movable surfaces in position opposite of cockpit
- (2) Balance tab - assist in moving control surfaces
- (3) servo tab - used on movable large surfaces
- (4) spring tab - Modified servo tab to overcome low speed problem

(8 marks)

2.

(a) (i) Outline **five** functions of aircraft tabs. (5 marks)

- (1) Anti-servo tab - tab moving in the same direction as the pre-flight control.

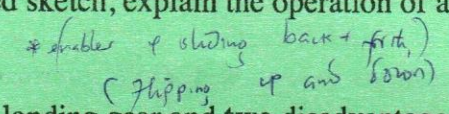
(ii) With the aid of sketches, differentiate between winglets and wing fence. (4 marks)

(4 marks)

(b) (i) Describe **four** requirements for rotor blade preservation and storage. (4 marks)

(4 marks)

(ii) With the aid of a labelled sketch, explain the operation of a fully articulated helicopter rotor system. (7 marks)



(7 marks)

3.

(a) List **two** advantages of tricycle landing gear and **two** disadvantages of a tailwheel landing gear. (4 marks)

(4 marks)

(b) With the aid of a labelled sketch, explain the construction of a nose-wheel landing gear of a light aircraft. (16 marks)

(16 marks)

3+4+2+2+6



4

(a) Highlight the procedure for removing a protruding head rivet. (5 marks)

(b) Describe each of the following types of defects that occur on an aircraft structure:

- (i) burnishing; - polishing of one surface by sliding contact smooth laser surface
- (ii) burr; - small thin metal extending beyond surface
- (iii) corrosion; - loss of metal by chemical or electrochemical action
- (iv) crack; - physical separation to the adjacent sheet metal
- (v) dent; - indentation of metal surface
- (vi) erosion. - loss of metal by mechanical action.

(6 marks)

(c) Explain each of the following types of fuel tanks:

- (i) rigid removable;
- (ii) bladder;
- (iii) integral.

(9 marks)

8.00 + 3.00  
11.00

Polishing, 7 surface  
4 yr. fresh matter  
streaming

### SECTION B: AERODYNAMICS

Answer ONE question from this section.

5. (a) Explain each of the following types of drag, stating how each can be reduced:

- (i) form; → Parasitic drag
- (ii) interference; → drag
- (iii) skin friction; →

(6 marks)

Reduced drag  
Parasitic drag  
drag  
which is light.

(b) With the aid of sketches, show the pressure distribution and the centre of pressure changes with each of the following angles of attack:

- (i) -8°;
- (ii) +4°;
- (iii) +10°.

(9 marks)

(c) Outline five ways of avoiding the effects of wake turbulence.

(5 marks)

100% Parasitic drag  
Not directly associated with lift.

Rigid - clipped onto the A/C structure, riveted and welded together  
Bladder - can be rolled and put into  
a specially prepared structural bag or cavity  
Integral = part of wing/fuselage



6. (a) Given  
 Chord = 2 metres  
 A.O.A = 6°  
 Speed = 100 knots  
 $C_L = 0.06$   
 $C_D = 0.028$   
 $C_m = -0.09$  about the aerodynamic center.

Determine the:

- (i) lift;  
 (ii) drag;  
 (iii) pitching moment.

(8 marks)

- (b) Explain six characteristics of an ideal aerofoil.

(12 marks)

### SECTION C: AIRFIELD AND SAFETY PROCEDURES

Answer *ONE* question from this section.

7. (a) (i) Highlight **five** precautions to be observed before starting an aircraft engine. (5 marks)
- (ii) With the aid of a labelled sketch, show the gas turbine engine intake and exhaust hazard areas. (5 marks)

- (b) (i) State the meaning of the following standard taxiing light signals:

- (I) flashing green;  
 (II) steady red;  
 (III) flashing red;  
 (IV) flashing white;  
 (V) alternate green and red.

(2½ marks)

- (ii) State the ICAO dimensions for registration marks on a fixed wing aircraft in each of the following areas:

- (I) wing;  
 (II) fuselage;  
 (III) fin.

(1½ marks)

① Cleared to taxi  
 ② Stop  
 3  
 ④ Return to start point  
 ⑤



- (c) Differentiate between each of the following giving examples:
- (i) unintentional and intentional error;
  - (ii) active and latent error.
- (4 marks)
- (d) Lack of assertiveness can affect the maintenance proficiency of an aircraft technician. Outline **four** ways to offset this. (2 marks)
8. (a) (i) State **five** types of information contained in the certificate of air navigation. (5 marks)
- (ii) Highlight **seven** functions of the meteorological services for air navigation in support of aviation. (7 marks)
- (b) Explain **four** types of inspections carried out on each of the following:
- (i) propellor;
  - (ii) landing gear.
- (8 marks)

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