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**AIRFRAME STRUCTURES AND  
AIRFIELD SAFETY PROCEDURES**

Oct./Nov. 2019

Time: 3 hours



**THE KENYA NATIONAL EXAMINATIONS COUNCIL**

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

**DIPLOMA IN AERONAUTICAL ENGINEERING  
(AVIONICS OPTION)**

**MODULE I**

**AIRFRAME STRUCTURES AND AIRFIELD SAFETY PROCEDURES**

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Answer booklet;*

*Drawing instruments;*

*Mathematical tables/Non-programmable scientific calculator.*

*This paper consists of EIGHT questions in THREE sections; A, B and C.*

*Answer THREE questions from section A, ONE question from section B and ONE question from section C in the answer booklet provided.*

*All questions carry equal marks.*

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

*Candidates should answer the questions in English.*

**This paper consists of 4 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 a labelled sketch, describe each of the following principle structural members of a wing:
- (i) ribs;
  - (ii) spars;
  - (iii) stingers.
- (14 marks)
- (b) With the aid of sketches, show the **six** typical aircraft wing plan forms. (6 marks)
2. (a) (i) Outline **four** reasons of fabric covering on an aircraft. (4 marks)
- (ii) Differentiate between each of the following aircraft fabric terms:
- (I) warp and weave;
  - (II) count and ply;
  - (III) pinked and selvage edge.
- (6 marks)
- (b) Explain each of the following properties of aircraft materials:
- (i) brittleness;
  - (ii) density;
  - (iii) fusibility;
  - (iv) conductivity;
  - (v) thermo-expansion.
- (10 marks)
3. (a) Discuss each of the following classifications of damage:
- (i) negligible;
  - (ii) repairable by patching;
  - (III) repairable by insertion.
- (6 marks)
- (b) Describe the conditions that warrant repair by replacement. (4 marks)
- (c) (i) Outline the factors to consider before performing repair by riveting. (6 marks)



(ii) Using sketches, show each of the following:

(I) total rivet length;

(II) grip length;

(III) amount of rivet length needed for proper snap head.

(4 marks)

4. (a) With the aid of a labelled cross-sectional sketch, describe the construction of rigid removable fuel tank. (14 marks)
- (b) Outline the general safety precautions when working on aircraft fuel tanks. (6 marks)

### SECTION B: AERODYNAMICS

*Answer ONE question from this section.*

5. (a) With the aid of sketches, show the effects of airflow on each of the following shapes:
- (i) flat plate at  $90^\circ$ ;
  - (ii) sphere;
  - (iii) sphere with a fairing;
  - (iv) sphere inside.
- (4 marks)
- (b) Discuss how each of the following is used to control the boundary layer:
- (i) slats and slots;
  - (ii) flap augmentation;
  - (iii) vortex generators;
  - (iv) stall strips;
  - (v) upper surface suction.
- (16 marks)
6. (a) With the aid of a sketch, describe the formation of tip vortices. (6 marks)
- (b) With the aid of a labelled sketch, describe wake turbulence giving **four** ways of minimizing the chances of flying through it. (10 marks)
- (c) Describe skin friction drag. (4 marks)



## SECTION C: AIRFIELD, SAFETY AND PROCEDURES

*Answer ONE question from this section.*

7. (a) Define the term risk management. (1 mark)
- (b) Differentiate between 'hazard' and 'risk'. (2 marks)
- (c) Explain six types of risks. (12 marks)
- (d) With the aid of a labelled chart, show a risk assessment matrix model used to quantify risk. (5 marks)
8. (a) Differentiate between each of the following types of clouds:
- (i) cumulus and stratus;
  - (ii) cirrus and castellanus;
  - (iii) lenticularus and nimbus;
  - (iv) fracto and alto. (8 marks)
- (b) Describe each of the following classification of clouds:
- (i) low;
  - (ii) middle;
  - (iii) high. (12 marks)

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