2506/106
2507/106
AIRFRAME STRUCTURES,
AIRFIELD SAFETY AND PROCEDURES
Oct./Nov. 2023
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;
Mathematical tables/ Non-programmable scientific calculator.
*This paper consists of **EIGHT** questions in **THREE** sections; **A**, **B** and **C**.*
*Answer **THREE** questions in section **A**, **ONE** questions in section B and **ONE** question from section **C**.*
All questions carry equal marks.
Maximum marks for each question are as shown.
Candidates should answer the questions in English.

This paper consists of 3 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, explain the construction of each of the following types of helicopter rotor systems:

   (i) fully articulated; (7 marks)

   (ii) semi rigid; (5 marks)

   (iii) rigid. (3 marks)

   (b) Highlight **five** requirements for repairs done on helicopter structures. (5 marks)

2. (a) Explain the **three** classifications of aircraft damage. (6 marks)

   (b) With the aid of labelled sketches, describe flash patch repair. (14 marks)

3. With the aid of a cross-sectional sketch, describe the:

   (a) operation of an aircraft unseperated oleo pneumatic strut. (15 marks)

   (b) Construction and operation of a landing gear shimmy damper. (5 marks)

4. (a) Explain the operation of each of the following cockpit controls:

   (i) control column; (6 marks)

   (ii) rudder control. (4 marks)

   (b) Describe the operation of a power assisted aircraft control system. (10 marks)

SECTION B: AERODYNAMICS

*Answer **ONE** question from this section.*

5. (a) A flat plate of area 0.25 m^2 is placed in a 30.8 m/s airstream at right angles to the direction of the airflow. Calculate the:

   (i) air resistance of the plate;
   (ii) resistance of the flat plate at 61.6 m/s. (6 marks)

(b) Highlight **five** factors that affect aerodynamic lift. (5 marks)

(c) With the aid of sketches, explain the causes of aircraft induced drag. (9 marks)

6. (a) Explain the characteristics of airflow over an aerofoil section. (3 marks)

(b) Calculate the thrust necessary to accelerate an aircraft of 5900 kg mass from rest to a speed of 90 knots in a distance of 750 m. (5 marks)

(c) Explain the effect of each of the following on atmospheric density:

(i) temperature;
(ii) humidity;
(iii) pressure;
(iv) altitude. (12 marks)

SECTION C: AIRFIELD SAFETY AND PROCEDURES

*Answer **ONE** question from this section.*

7. (a) Outline the precautions to be observed when using compressed gases. (8 marks)

(b) Highlight the checks done on fire extinguishers. (6 marks)

(c) With the aid of a labelled sketch, describe the construction and operation of a dry foam fire extinguisher. (6 marks)

8. (a) Explain the requirements for aircraft markings. (5 marks)

(b) With reference to starting a turbo prop engine, outline:

(i) precautions to be observed; (4 marks)

(ii) procedure followed. (11 marks)

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