

2107/305

**AIRFRAME TECHNOLOGY**

Oct./Nov. 2016

Time: 3 hours



**THE KENYA NATIONAL EXAMINATIONS COUNCIL**

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

**AIRFRAME TECHNOLOGY**

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Answer booklet;*

*Drawing instruments.*

*Answer FIVE of the EIGHT questions in the answer booklet provided.*

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

*Candidates should answer the questions in English.*

**This paper consists of 3 printed pages.**

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

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**Turn over**

1. With the aid of labelled sketches, describe the operation of each of the following aircraft environmental control system components:
  - (a) thermal expansion valve;
  - (b) receiver/dryer. (20 marks)
  
2.
  - (a)
    - (i) With the aid of a labelled cross-sectional sketch of a radial tyre, show the constructional parts. (8 marks)
    - (ii) Outline four reasons why tubeless tyres are preferred for use on aircraft landing gears. (4 marks)
  - (b) Differentiate between castoring and self-centering as applied to aircraft nose wheel landing gear. (4 marks)
  - (c) Outline four advantages of multi-wheeled units other than reduction of wheel loading. (4 marks)
  
3. With the aid of labelled sketches, describe the construction and principle of operation of a typical constant pressure (variable volume) pump used on aircraft hydraulic system. (20 marks)
  
4.
  - (a) Highlight five advantages of lift spoilers compared to the ailerons when used to give lateral control on an aircraft. (5 marks)
  - (b) With the aid of a labelled block diagram, show the layout of the essential components of a simple power operated aircraft flight control system. (6 marks)
  - (c) With the aid of sketches, explain each of the following aerodynamic balance methods used on aircraft flight control systems:
    - (i) set back hingeline;
    - (ii) horn balance;
    - (iii) interval balance. (9 marks)
  
5.
  - (a) List six main requirements of an ideal fuel for either a gas turbine engine or piston engine powered aircraft. (3 marks)
  - (b) Explain the aircraft fuel storage systems stating where each system is applicable. (10 marks)
  - (c) With the aid of a labelled sketch, illustrate the layout of a single engine light aircraft fuel system. (7 marks)

6. (a) With the aid of labelled sketches, describe the principle of operation of each of the following smoke and fire detectors used on aircraft:
- (i) ionization;
  - (ii) differential expansion detectors.
- (14 marks)
- (b) Explain the three types of fire systems in general aircraft use. (6 marks)
7. (a) Outline two functions of each of the following helicopter rotors in flight:
- (i) main;
  - (ii) tail.
- (4 marks)
- (b) Explain each of the following conditions affecting the helicopter rotor operations in flight:
- (i) dissymmetry of lift;
  - (ii) coriolis effect;
  - (iii) translational lift;
  - (iv) gyroscopic precession.
- (8 marks)
- (c) With the aid of a labelled sketch, describe the drive and control mechanism of the main rotor of a helicopter in flight. (8 marks)
8. (a) Describe three ice and rain removal methods used on modern aircraft windshields. (6 marks)
- (b) Differentiate between de-icing and anti-icing systems and give the areas where each is applicable on an aircraft in flight. (6 marks)
- (c) Explain two functions of each of the following:
- (i) ice detection system;
  - (ii) ice protection system.
- (8 marks)

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