2506/207
THEORY OF FLIGHT
Oct./Nov. 2021
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES AND ENGINES OPTION)

MODULE II

THEORY OF FLIGHT

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
        Answer booklet;
        Mathematical tables/Scientific Non programmable calculator;
        Drawing instruments.
This paper consists of EIGHT questions.
Answer FIVE of the EIGHT questions in the answer booklet provided.
All questions carry equal marks.
Maximum marks for each 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
the pages are printed as indicated and that no questions are missing.

1. (a) (i) Differentiate between longitudinal and lateral stability. (4 marks)

   (ii) With the aid of labelled sketches, describe the types of static stability. (9 marks)

   (b) With reference to control surface flutter:

   (i) Explain the causes; (2 marks)

   (ii) With the aid of a labelled sketch, describe the method elimination. (5 marks)

2. (a) With reference to aircraft instability modes, describe spiral instability. (6 marks)

   (b) Outline the safety precautions to be observed during aircraft control surface rigging. (5 marks)

   (c) With the aid of a labelled sketch, discuss the aircraft positive dynamic directional stability. (9 marks)

3. (a) With reference to aircraft climb performance, complete table 1. (6 marks)

   Table 1

	VARIABLE FACTOR	CHANGE	EFFECT ON ANGLE OF CLIMB	RATE OF CLIMB
(i)	MASS	INCREASE		
(ii)	FLAP SETTING	MAXIMUM		
(iii)	ALTITUDE	INCREASE		
(iv)	TEMPERATURE	INCREASE		
(v)	WIND COMPONENT	HEADWIND		
(vi)	SPEED	INCREASE		

   (b) Discuss the effects of weight on flight performance. (8 marks)

   (c) Describe the degrees of freedom of an aircraft. (6 marks)

4. (a) With the aid of a labelled sketch, describe the forces that act on an aircraft in a turn.

(7 marks)

(b) Discuss fatigue meter with reference to aircraft inspection and maintenance.

(13 marks)

5. With reference to piston engine helicopter flight controls:

(a) complete table 2;   (4 marks)

Table 2

If RPM is	And manifold pressure is	Remedial action
LOW	LOW	
LOW	HIGH	
HIGH	LOW	
HIGH	HIGH	

(b) discuss autorotation.   (16 marks)

6. (a) Discuss each of the following helicopter rotor systems:

(i)   articulated;   (5 marks)

(ii) semi-rigid;   (5 marks)

(iii) rigid.   (4 marks)

(b) Outline **one** advantage and **one** disadvantage of each of the helicopter rotor system in 6 (a).   (6 marks)

7. Explain the effects of each of the following on an aircraft during take-off performance:

(a) mass;   (7 marks)

(b) air density;   (7 marks)

(c) wind.   (6 marks)

8. (a) With the aid of a labelled graph, discuss the total drag curve with reference to aircraft performance.   (9 marks)

(b) Describe the classification of aircraft performance with reference to KCARs regulations.   (11 marks)

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