2506/207
THEORY OF FLIGHT
June/July 2020
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;
Drawing instruments;
Mathematical tables/Non-programmable scientific calculator.
*This paper consists of **EIGHT** questions.*
*Answer **FIVE** questions in the answer booklet provided.*
All questions carry equal marks.
Maximum marks for each part of a 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.

1. Discuss each of the following intersections between lateral and directional static stability:

   (a) spiral instability; (10 marks)
   (b) oscillatory instability. (10 marks)

2. (a) Table 1 relates to particulars of an aircraft. Plot the graph and estimate each of the following speeds in level flight: 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95 and 100 kts.

(16 marks)

Table 1

Speed of level flight	45	50	55	60	65	70	75	80	85	90	95	100	kt
Power available from propeller	135	170	205	225	240	250	255	255	250	240	230	220	KW
Power required for level flight	250	115	93	90	100	120	150	180	215	255	300	350	KW

   (b) Differentiate between slats and flaps as methods of augmenting lift. (4 marks)

3. With the aid of labelled sketches, describe the causes and recovery procedure of an aircraft from an incipient spin. (20 marks)

4. With the aid of labelled sketches, describe each of the following aircraft manoeuvres:

   (a) climbing turn;
   (b) descending turn. (20 marks)

5. (a) Explain the influence of ground effect on the aircraft during each of the following:

   (i) landing; (2 marks)
   (ii) take-off; (3 marks)
   (iii) selection of trailing edge flaps. (3 marks)

   (b) Explain **four** effects of heavy rain on aircraft performance. (4 marks)

   (c) With the aid of a labelled sketch, explain the forces acting on a helicopter in forward flight. (8 marks)

6. (a) Explain **six** factors that determine the stalling speed of an aircraft. (15 marks)

   (b) With the aid of sketch, show **four** design features that effect stall behaviour on an aircraft with reference to helicopters. (5 marks)

Attitude

7. (a) Explain the function of each of the following rotocraft components:

(i) transmission system;
(ii) clutch;
(iii) freewheeling coupling. (12 marks)

(b) Describe the operation of collective pitch control. (8 marks)

8. (a) An aircraft has a mass of 1,500 kg. It is turning on a horizontal circle of radius 100 m at an airspeed of 80 knots Calculate the:

(i) centripetal force exerted by the air on the aircraft; (4 marks)
(ii) correct angle of bank. (3 marks)

(b) With the aid of a labelled sketch, explain the forces acting on an aircraft in a steady dive. (13 marks)

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