

2506/207
THEORY OF FLIGHT
June/July 2022
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.

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 the pages are printed as indicated and that no questions are missing.**

1. (a) Differentiate between static and dynamic stabilities. (4 mark)
- (b) With the aid of labelled sketches, differentiate between the operation of each of the following methods of controlling aileron drag:
- (i) frise and differential ailerons;
- (ii) slot/aileron control and spoiler control. (16 marks)
2. (a) With the aid of a labelled sketch, describe the phugoid aircraft instability mode. (9 marks)
- (b) With reference to aircraft longitudinal stability:
- (i) outline the factors that affect the effectiveness of the tailplane; (3 marks)
- (ii) with the aid of labelled sketches, describe the longitudinal dihedral. (8 marks)
3. (a) With the aid of a labelled sketch, show the forces acting on an aircraft during a climb. (5 marks)
- (b) Describe the effects of each of the following on aircraft climb performance:
- (i) altitude; (3 marks)
- (ii) mass; (3 marks)
- (iii) flap setting; (5 marks)
- (iv) wind component. (4 marks)
4. (a) With reference to aircraft manoeuvres:
- (i) differentiate between sideslip and drift; (2 marks)
- (ii) with the aid of sketches, explain the stages in performing an aerobatic spin. (11 marks)
- (b) Outline seven inspection checks carried out on an aircraft wing after flight manoeuvres. (7 marks)
5. (a) With the aid of a labelled sketch, describe the forces that act on a helicopter in forward flight. (9 marks)
- (b) (i) Explain blade flapping as applied to helicopters. (1 mark)
- (ii) With the aid of a labelled sketch, describe the dissymmetry of lift on a helicopter with forward speed of 100 knots and blade tip speed of 400 knots. (10 marks)

6. With the aid of a labelled sketches, describe each of the following with reference to helicopter systems:
- (a) swash plate assembly; (11 marks)
 - (b) anti-torque system. (9 marks)
7. (a) With the aid of a labelled sketch, describe the forces that act on an aircraft during a take-off-run. (9 marks)
- (b) (i) With the aid of a labelled sketch, differentiate between a slat and a leading edge slot; (5 marks)
 - (ii) Describe **four** types of aircraft trailing edge flaps. (6 marks)
8. (a) (i) List the **three** factors that reduce the rate of climb of an aircraft.
- (ii) A four engined aeroplane weighs 150,000 kgs. It has a lift/drag ratio of 1:14 and develops 75,000 Newtons of thrust per engine, in a low angled climb. Calculate the maximum rate of climb. (Take $g = 10 \text{ m/s}^2$). (8 marks)
- (b) With the aid of a labelled graph, explain the effect of wind on the angle and rate of descent with reference to aircraft performance. (12 marks)

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