

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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