2506/207
THEORY OF FLIGHT
Oct. / Nov. 2023
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.*
All questions carry equal marks.
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.

Turn over

1. (a) Outline **four** objectives of a manoeuvre envelop V-n diagram. (4 marks)

(b) With the aid of a labelled V-n diagram, discuss aircraft g-limitations. (16 marks)

2. (a) Explain how the trailing edge flaps affect aircraft stalling speed. (4 marks)

(b) With the aid of sketches, explain the construction and function of each of the following types of trailing edge flaps:

(i) plain;
(ii) split;
(iii) slotted;
(iv) fowler.

(16 marks)

3. Discuss each of the following factors that affect aircraft static longitudinal stability.

(a) Position of the center of gravity. (10 marks)

(b) Position of the wing's center of pressure. (3 marks)

(c) Design of the tailplane. (4 marks)

(d) Wing downwash. (3 marks)

4. (a) With the aid of sketches, explain **four** methods used to alleviate wing tip stalling on a swept back wing. (12 marks)

(b) With the aid of labelled sketches, explain the causes of an incipient spin. (8 marks)

5. (a) With the aid of a labelled graph, differentiate between maximum angle of climb (V_X) and maximum rate of climb (V_Y) airspeeds. (10 marks)

(b) A jet aircraft with a wing loading of 2.4 KN/m² and a mass of 4500 kg, has a maximum thrust of 30 kN at sea-level. If the drag coefficient at a speed of 270 knots is 0.04, determine the:

(i) maximum possible rate of climb;
(ii) greatest angle of climb.

(10 marks)

6. (a) Explain how each of the following factors affect aircraft glide performance:

(i) Lift/drag ratio; (7 marks)

(ii) Steady wind; (3 marks)

(iii) Weight. (3 marks)

(b) When there is no wind, a certain aeroplane can glide (engine off) a horizontal distance of 1.5 nautical miles for every 1000 ft of height.
Calculate:

(i) gliding angle;
(ii) horizontal distance travelled per 1000 ft height and head wind of 20 knots.
(iii) gliding angle at 60 knots speed with the horizontal head wind.
(7 marks)

7. (a) With the aid of a turn and slip indicator, explain each of the following aircraft turns:

(i) Slipping;
(ii) Skidding;
(iii) balanced.
(9 marks)

(b) An aircraft with a mass of 1000 kg does a steady turn at 55 knots and an angle of bank of 45°. Calculate the:

(i) acceleration; (5 marks)

(ii) force required to produce the acceleration. (3 marks)

(iii) wing loading on the aircraft during the turn if the wing areas is 14.14 m^2.
(3 marks)

8. Using labelled sketches, explain each of the following as applied to helicopter aerodynamics:

(a) Autorotation; (10 marks)

(b) Coriolis effect. (10 marks)

THIS IS THE LAST PRINTED PAGE