2506/207
THEORY OF FLIGHT
Oct./Nov. 2019
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:
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 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) Describe each of the following with reference to aircraft longitudinal stability:

   (i)   static margins;
   (ii)   trim point;
   (iii)   longitudinal dihedral.

   (9 marks)

   (b) Explain **four** factors that affect aircraft longitudinal stability.   (8 marks)

   (c) Explain the **three** degrees of aircraft stability.   (3 marks)

2. With the aid of a sketch, describe the effect of each of the following wing platforms on aircraft performance at low speeds:

   (a)   sweepback;   (10 marks)
   (b)   elliptical;   (4 marks)
   (c)   rectangular.   (6 marks)

3. (a) Outline **three** methods for compensating drift on a helicopter.   (3 marks)

   (b) With the aid of a labelled sketch, explain the function of each helicopter controls.

   (11 marks)

   (c) Discuss **six** methods of overcoming helicopter rotor dissymmetry of lift.   (6 marks)

4. (a) Explain **six** advantages of an aircraft engine assisted approach.   (6 marks)

   (b) With the aid of sketches, explain each of the following aircraft climb manoeuvres:

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

   (10 marks)

   (c) A twin turbojet aircraft that weighs 75,000 kg is climbing with both engines operating. The lift/drag ratio is 15:1. The thrust of each engine is 38,000 Newtons.
   Assume gravity (g) = 10 m/s, calculate the gradient of climb.   (4 marks)

5. (a) Outline the sequence of recovery from a spin.   (5 marks)

   (b) In a level 40° banked turn, calculate the lift developed by an aeroplane of mass 60,000 N.
   (5 marks)

   (c) With reference to lift augmentation, describe slats.   (10 marks)

6.   Discuss each of the following propulsion system with reference to aircraft performance.

     (a)   propeller;   (10 marks)

     (b)   jet.   (10 marks)

7.   With the aid of labelled sketches, describe each of the following on take-off, as applied to propeller driven aircraft:

     (a)   slip stream effect;   (10 marks)

     (b)   gyroscopic effect.   (10 marks)

8.   (a)   Explain the **four** lateral instability modes.   (8 marks)

     (b)   With reference to lateral dynamic stability, describe each of the following:

           (i)   asymmetric thrust;
           (ii)   aerodynamic damping.

                                                                            (12 marks)

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