

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.**

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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