

2107/306

AIR CRAFT PROPULSION

Oct./Nov. 2017

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES AND ENGINES OPTION)

AIRCRAFT PROPULSION

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.

Maximum marks for each part of a question are as shown.

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) Outline **five** requirements of a propeller unit. (5 marks)
- (b) With the aid of sketches, compare centrifugal turning moment (CTM) and aerodynamic turning moment (ATM) as applied to the operation of aircraft propellers. (10 marks)
- (c) With the aid of a labelled schematic diagram of a synchronizer system, show the parts. (5 marks)
2. (a) Highlight **six** requirements of an engine combustion system. (3 marks)
- (b) With the aid of a labelled sketch, explain the difference between impulse and reaction turbine. (11 marks)
- (c) Describe each of the following types of fuel nozzles used in gas turbine:
- (i) vaporizing;
 - (ii) atomizing;
 - (iii) simplex. (6 marks)
3. (a) Describe the construction and operation of the electric stator motor as used in gas turbine engines. (8 marks)
- (b) Discuss **three** types of gas turbine engine starting malfunctions. (12 marks)
4. With the aid of labelled sketches, describe each of the following types of intakes:
- (a) subsonic; (6 marks)
 - (b) supersonic; (5 marks)
 - (c) variable geometry. (9 marks)
5. (a) Differentiate between the operation of a centrifugal and axial flow compressors as used in aircraft engines. (2 marks)
- (b) Outline the principal advantages of the centrifugal flow compressor over the axial flow compressor. (5 marks)
- (c) With the aid of sketches and velocity/pressure graph, explain the operation of an aircraft centrifugal flow compressor. (13 marks)

6. (a) Explain the objectives of air sealing, internal and external cooling on gas turbine engines. (5 marks)
- (b) Describe the **three** types of by-pass engine bleed air and state where each is used. (6 marks)
- (c) With the aid of a sketch, describe how external and internal cooling and ventilation is achieved during ground running on an aircraft engine. (9 marks)
7. (a) Define each of the following terms as applied to a four-stroke aeropiston engine:
- (i) work;
- (ii) compression ratio;
- (iii) valve overlap. (6 marks)
- (b) Explain each of the following types of efficiencies of a four stroke aeropiston engine:
- (i) thermal;
- (ii) mechanical;
- (iv) propulsive;
- (v) volumetric. (6 marks)
- (c) With the aid of a labelled sketch, show the relationship of Brake Mean Effective pressure (BMEP) and Brake Horse-power (BHP). (8 marks)
8. (a) Differentiate between the operation of a ramjet and a rocket engine. (4 marks)
- (b) With the aid of sketches, explain the operation of a pulse jet. (8 marks)
- (c) With the aid of a graph, show the ideal gas turbine process. (8 marks)

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