

2107/306

AIRCRAFT PROPULSION

June/July 2019

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES AND ENGINES OPTION)

AIRCRAFT PROPULSION

3 hours

INSTRUCTIONS TO CANDIDATES

The candidate should have the following for this examination:

Answer booklet;

Non-programmable scientific calculator;

Drawing instruments.

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. Explain each of the following non-destructive testing techniques:
 - (a) visual;
 - (i) surface;
 - (ii) internal. (4 marks)
 - (b) fluorescent penetrant inspection. (16 marks)

2. (a) In relation to the aero gas turbine engine, outline:
 - (i) **four** factors that affect turbine efficiency;
 - (ii) **three** factors that increase torque in a single stage turbine assembly. (7 marks)

(b) Explain **three** effects of stress on turbine blades. (3 marks)

(c) With the aid of a labelled sketch, explain the operation of the propeller fluid de-icing system. (10 marks)

3. (a) Explain the operation of the clamshell door thrust reversal method. (5 marks)

(b) Discuss each of the following maintenance aspects of the aero-piston engine:

 - (i) disassembly;
 - (ii) cleaning;
 - (iii) inspection. (15 marks)

4. Highlight the key safety precautions to be observed during maintenance of each the following jet engine systems:
 - (a) ignition; (9 marks)
 - (b) lubrication; (7 marks)
 - (c) axial flow compressor. (4 marks)

5. Highlight the turbo propeller engine ground run procedures. (20 marks)

6. (a) With the reference to the aero piston engine, give the meaning and formulae of each of the following as applied to horse power:
 - (i) indicated;
 - (ii) brake;
 - (iii) friction. (6 marks)

- (b) Define each of the following terms:
- (i) detonation;
 - (ii) back firing;
 - (iii) hydraulic lock. (6 marks)
- (c) Highlight **four** causes of each of the following in a gas turbine engine:
- (i) turbine over temperature;
 - (ii) high oil consumption. (8 marks)
7. (a) Discuss the function, construction and operation of a gas turbine accessory gear drive. (12 marks)
- (b) With the aid of a labelled sketch, show the horizontally opposed aero-piston valve train. (8 marks)
8. (a) With the aid of labelled line graphs, explain how each of the following factors affect thrust:
- (i) speed;
 - (ii) air temperature;
 - (iii) altitude;
 - (iv) air pressure (16 marks)
- (b) Discuss torque indication system as applied to a turbo propeller aircraft engine. (4 marks)

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