

2107/306

AIRCRAFT PROPULSION

Oct./Nov. 2016

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 4 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) With the aid of a sketch, describe the operational difference between multi-lobe and corrugated type nozzle noise suppressors. (6 marks)
- (b) With the aid of a labelled sketch, describe the operation of centrifugal breather and vent. (9 marks)
- (c) Describe the **two** types of oil coolers used in gas turbine engines. (5 marks)
2. (a) Outline **three** disadvantages of a float carburettor used on aeropiston engines. (3 marks)
- (b) With the aid of a simple waste gate system, explain the operation of aeropiston turbocharger. (17 marks)
3. (a) Describe the construction design of afterburner jet pipes. (8 marks)
- (b) With the aid of a labelled sketch of a diffuser and jet pipe, describe the afterburner system method of thrust augmentation. (12 marks)
4. Discuss the principle of operation of each of the following aero gas turbine engine compressors:
 - (a) centrifugal flow; (10 marks)
 - (b) axial flow. (10 marks)
5. (a) Differentiate between the “tractor” and “pusher” propellers on an aircraft and state **one** advantage of the tractor over the pusher. (3 marks)
- (b) Explain the operation of each of the following types of aircraft propellers:
 - (i) reverse pitch;
 - (ii) feathering;
 - (iii) coarse and fine pitch. (9 marks)
- (c) (i) Describe each of the following types of imbalances on an aircraft propeller and state how each can be checked:
 - (I) static;
 - (II) dynamic.

(ii) State **one** reason for carrying out each of the following on an aircraft propeller blade:

(I) painting the tip;

(II) spraying with a fluid;

(III) rubber booting.

(8 marks)

6. (a) Describe each of the following different types of aircraft gas turbine engine lubrication systems:

(i) pressure relief valve;

(ii) full flow;

(iii) total loss.

(6 marks)

(b) Explain each of the following characteristics of lubrication oils:

(i) flash point;

(ii) cloud point;

(iii) specific gravity.

(6 marks)

(c) Outline **two** functions of each of the following components of aircraft engine lubrication system:

(i) oil lump;

(ii) magnetic chip detector;

(iii) fuel cooled oil cooler;

(iv) by-pass valve.

(8 marks)

7. (a) Outline **four** factors that would warrant varying the fuel flow to the engine burner.

(4 marks)

(b) With the aid of sketches, explain the operation of kinetic valve used on gas turbine engine fuel system.

(8 marks)

(c) With the aid of a sketch, explain the construction and operation of a multiplunger fuel pump.

(8 marks)

8. (a) Differentiate between each of the following aeropiston maintenance tasks:
- (i) timing and tuning;
 - (ii) lapping and honning;
 - (iii) spark gap setting and tappet gap. (6 marks)
- (b) Sketch each of the following aeropiston engines according to cylinder arrangement:
- (i) 'V';
 - (ii) horizontally opposed;
 - (iii) double row radial. (6 marks)
- (c) (i) Define the term "firing order" as applied on aeropiston engine and state how it is achieved. (4 marks)
- (ii) Calculate and record the best firing order on the following double row radial engines:
- (I) 14 cylinders;
 - (II) 18 cylinders. (4 marks)

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