

2107/306

AIRCRAFT PROPULSION

Oct./Nov. 2009

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

Answer booklet

Mathematical tables/Non-programmable calculator

Drawing instruments

Answer any FIVE of the EIGHT questions in this paper.

ALL questions carry equal marks.

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

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) Differentiate between the following types of engine maintenance:
- (i) unscheduled and intercheck;
 - (ii) non destructive and modular.
- (4 marks)
- (b) Explain each of the following types of on condition monitoring techniques:
- (i) magnetic chip detector;
 - (ii) internal viewing;
 - (iii) remote indicators.
- (6 marks)
- (c) Describe the procedure of carrying out each of the following inspections on aircraft engine parts:
- (i) magnetic oil particle (magnaflux);
 - (ii) dye penetrant.
- (10 marks)
2. (a) Explain the term combustion as applied on aircraft engines. (2 marks)
- (b) With the aid of a sketch explain the apportionment of airflow through an aircraft engine flame tube. (6 marks)
- (c) (i) Explain the function of each of the following engine fuel devices:
- low pressure cock;
 - high pressure cock;
 - throttle.
- (ii) With the aid of a labelled sketch explain the construction and operation of an aircraft engine duplex burner. (12 marks)
3. (a) Outline **two** functions of each of the following aircraft engine parts:
- (i) nozzle guide vanes;
 - (ii) inlet guide vanes;
 - (iii) turbines.
- (6 marks)
- (b) Explain the operation of each of the following types of aircraft engine turbines:
- (i) impulse;
 - (ii) free;
 - (iii) reaction.
- (6 marks)
- (c) With the aid of labelled sketches show **four** methods of attaching turbine blades to the turbine discs of an aircraft engine. (8 marks)
4. (a) Differentiate between the terms geometrical pitch and zero thrust pitch as applied on aircraft propellers. (4 marks)
- (b) Explain each of the **four** pitch change positions of an aircraft engine propeller. (4 marks)

- (c) Explain one method of carrying out each of the following tasks on an aircraft engine propeller blade:
- (i) anti-icing;
 - (ii) de-icing;
 - (iii) synchronizing;
 - (iv) feathering.
- (12 marks)

5. (a) Outline four design considerations for the construction of aeropiston engine cylinder.
- (4 marks)

- (b) With the aid of a labelled sketch:
- (i) outline the procedure of installing piston rings on an aeropiston assembly;
 - (ii) explain the construction and operation of an aeropiston valve operating mechanism.
- (16 marks)

6. (a) Differentiate between the following oil lubricating systems in aeropiston engines:
- (i) a dry-sump and a wet-sump;
 - (ii) a pressure and A splash.
- (8 marks)

- (b) In aeropiston engines, explain:
- (i) the main disadvantages of a wet-sump over a dry-sump engine oil lubricating systems;
 - (ii) the main advantages of a pressure over splash engine oil lubricating systems.
- (6 marks)

- (c) With the aid of a schematic flow chart show the layout of a turbo jet full flow type engine oil lubrication system.
- (6 marks)

With the aid of pressure volume diagram explain the cycles of operation of the following types of aircraft engines:

- (a) Aeropiston;
- (10 marks)

- (b) Turbo jet.
- (10 marks)

8. (a) Outline **six** precautions to be observed before starting a high bypass gas turbine engine. (6 marks)
- (b) Explain **three** sources of pneumatic air for starting aircraft engines. (6 marks)
- (c) With the aid of a labelled sketch explain the principle of operation of an engine electrical starter motor and state the magnitude the output depends on. (8 marks)