

2506/304

GAS TURBINE ENGINES

June/July 2018

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES & ENGINES OPTION)

MODULE III

GAS TURBINE ENGINES

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Drawing instruments;

Mathematical tables/Non-programmable Scientific calculator.

This paper consists of EIGHT questions.

Answer FIVE of the EIGHT 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) In relation to aircraft propulsion, explain the effect of adding heat energy at constant:
- (i) volume;
 - (ii) pressure.
- (4 marks)
- (b) Explain each of the following forms of energy:
- (i) heat;
 - (ii) fuel;
 - (iii) kinetic;
 - (iv) potential.
- (4 marks)
- (c) With the aid of a labelled pressure/volume diagram, explain the gas turbine engine combustion cycle. (12 marks)
2. (a) Using a labelled sketch, show the pressure notation through a single spool gas turbine engine. (9 marks)
- (b) With the aid of a labelled sketch, explain 'choked nozzle' as applied to gas turbine engine. (9 marks)
- (c) Outline **one** advantage and **one** disadvantage of the pitot type air intake. (2 marks)
3. (a) With the aid of labelled sketches, describe the **three** types of gas turbine engine combustion chambers. (15 marks)
- (b) Highlight **five** selection criteria for gas turbine engine combustion chambers. (5 marks)
4. (a) In relation to the gas engine, outline:
- (i) **four** reasons that affect turbine efficiency;
 - (ii) **three** factors that increase torque in a single stage turbine assembly.
- (7 marks)
- (b) With the aid of a time-elongation graph, show the comparison of turbine blade creep life for each of the following:
- (i) single crystal blades;
 - (ii) directionally solidified blades;
 - (iii) equalised blades.
- (7 marks)
- (c) Explain the effects of centrifugal stress in turbine blades. (6 marks)

5. (a) Outline **five** aircraft fuel system requirements. (5 marks)
- (b) Explain the type, function and operation of each of the following gas turbine engine fuel system components:
- (i) LP cock;
 - (ii) plunger type fuel pump;
 - (iii) fuel cooled, oil cooled and fuel heater;
 - (iv) kinetic valve;
 - (v) throttle valve.
- (15 marks)
6. With the aid of a labelled diagram, show the basic pressure fuel flow control system. (20 marks)
7. (a) Outline **five** requirements of a thrust reversal system. (5 marks)
- (b) Explain the operation of each of the following thrust reversal methods:
- (i) clamshell door;
 - (ii) retractable ejector system;
 - (iii) cold stream reverser/hot stream spoiler system.
- (15 marks)
8. With reference to gas turbine engine, highlight the:
- (a) **nine** reasons for failing to reach self sustaining speed; (9 marks)
- (b) inspection to be carried out after Suspected Foreign Object (FOD) ingestion. (11 marks)

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