

2506/304  
GAS TURBINE ENGINES  
Oct./Nov. 2023  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL  
**DIPLOMA IN AERONAUTICAL ENGINEERING**  
**(AIRFRAME AND ENGINES OPTION)**

**MODULE III**

GAS TURBINE ENGINES

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Answer booklet;*

*Drawing instruments.*

*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 shown.*

*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 labeled sketch, describe the principle of operation of each of the following engines:
  - (i) Sir Frank Whittle's aero gas turbine engine; (7 marks)
  - (ii) ram jet engine. (8 marks)
- (b) Differentiate between low and high bypass ratio turbofan engines. (5 marks)
2. (a) Explain each of the following with regard to the gas turbine engine:
  - (i) reaction propulsion; (3 marks)
  - (ii) development of thrust in a reaction propulsion system. (2 marks)
- (b) Describe the function of **seven** major gas turbine engine components. (7 marks)
- (c) With the aid of a pressure-volume diagram, explain the sections of the working cycle of a gas turbine engine. (8 marks)
3. (a) Explain **six** gas turbine engine FADEC inputs. (9 marks)
- (b) Highlight **eight** safety precautions to be observed during maintenance of aero gas turbine engine. (8 marks)
- (c) Figure 1 shows a gas turbine engine component. Identify the component and name the parts labelled A,B,C,D and E. (3 marks)

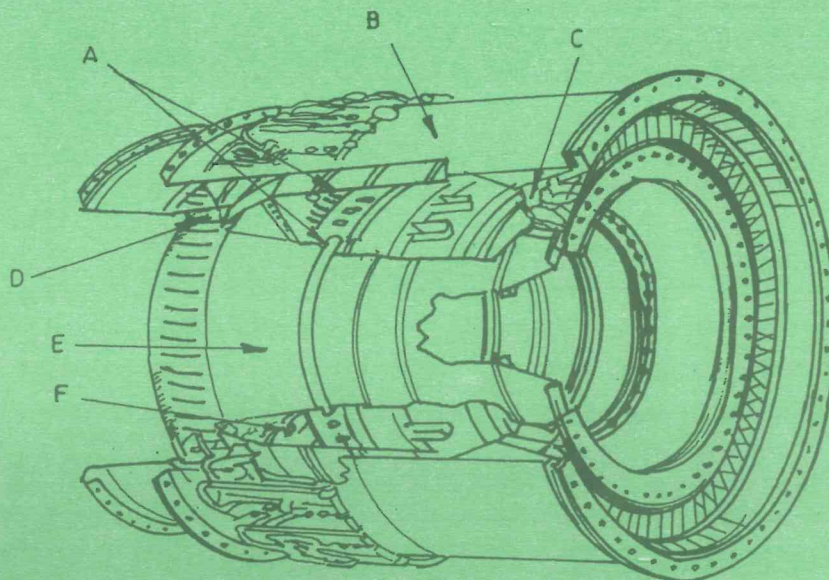


Fig. 1



4. (a) Outline the propeller installation procedure for a turboprop engine. (10 marks)
- (b) Describe the construction of each of the following components of the turboprop engine:
- (i) combustion chamber;
- (ii) accessory gearbox. (10 marks)
5. (a) With the aid of a labelled sketch, explain the principle of operation of a typical aero gas turbine engine centrifugal flow compressor. (10 marks)
- (b) Explain **four** grades of fit classification of ball and cylinder roller bearings. (5 marks)
- (c) Compare the centrifugal and the axial flow compressors used in the aircraft gas turbine. (5 marks)
6. (a) Outline the maintenance procedures for the turbo prop engine exhaust system. (6 marks)
- (b) Explain the function of the main components of a gas turbine engine. (4 marks)
- (c) (i) Describe the construction and operation of the gas turbine engine fuel filter. (6 marks)
- (ii) Explain the aero gas turbine engine fuel pipe pressure test. (4 marks)
7. (a) Describe the aircraft gas turbine engine iso-propyl-nitrate starting system. (4 marks)
- (b) Outline the:
- (i) conditions for the aircraft auxiliary power unit automatic shut down. (5 marks)
- (ii) safety precautions observed while working on aircraft propellers. (7 marks)
- (c) Describe the construction and operation of the aero gas turbine engine cold stream duct. (4 marks)
8. (a) Describe **three** components of the gas turbine engine lubrication system. (3 marks)



- (b) Explain each of the following aircraft gas turbine engine condition monitoring techniques:
- (i) performance monitoring;
  - (ii) spectrometric oil analysis programme;
  - (iii) vibration monitoring;
  - (iv) aircraft integrated data system. (8 marks)
- (c) Explain **four** safety requirements in aero gas turbine engine thrust reversal and noise suppression systems. (6 marks)
- (d) Sketch and label the elements of the single wire thermal switch circuit. (3 marks)

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