

2506/102

2507/102

AIRCRAFT ELECTRICAL TECHNOLOGY

Oct./Nov. 2017

Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

**DIPLOMA IN AERONAUTICAL ENGINEERING  
(AIRFRAMES AND ENGINES OPTION)  
(AVIONICS OPTION)**

**MODULE I**

AIRCRAFT ELECTRICAL TECHNOLOGY

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Mathematical tables;*

*Non-programmable scientific calculator;*

*Answer booklet.*

*This paper consists of TWO sections; A and B.*

*Answer Question 1 (compulsory) and TWO other questions from section A.*

*Answer TWO questions from section B.*

*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 6 printed pages.**

**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**

## SECTION A: WORKSHOP TECHNOLOGY (60 marks)

Answer Question 1 (compulsory) and TWO other questions from this section.

1. (a) Outline **three** safety gears worn during aircrafts electrical installations. (3 marks)
- (b) Describe the following aircraft safety hazards:
- (i) use of mobile phones on aircraft take-off;
  - (ii) turbulence due to thunderstorms. (6 marks)
- (c) Explain how to handle the following accidents:
- (i) electrical burns;
  - (ii) shock. (8 marks)
- (d) List **three** types of soldering techniques. (3 marks)
2. (a) List **three** tools used in aircraft electrical maintenance. (3 marks)
- (b) Table 1 shows the state of aviation light signals at two different stages. Complete the table to indicate the action taken by the pilot.

**Table 1**

Signal	Aircraft in flight	Aircraft on the ground
Steady green		
Flashing green		
Steady red		

(6 marks)

- (c) Describe the following Radio Frequency (R.F) connectors:
- (i) N-Series;
  - (ii) C- Series. (4 marks)
- (d) With the aid of a circuit diagram, explain the operation of thermal switch fire detection system used in aircraft's alarms. (7 marks)
3. (a) Define the following terms:
- (i) earth fault loop impedance;
  - (ii) fault current. (2 marks)

- (b) Describe the following wiring systems:
- (i) bus bars;
  - (ii) trunking.
- (6 marks)

- (c) With the aid of a circuit diagram, describe the single pole earth return technique of earthing a three phase installation.
- (6 marks)

- (d) A 4 mm<sup>2</sup> copper wire with a resistance of 0.0046 Ω/m is used to run a 7.5 kW single phase motor which draws 14 A from a 240 V supply. The circuit is a direct on line (D.O.L) connected to 40 A circuit breaker whose rating is 7.5.

Take:

- resistance of the earth wire to be = 0.074 Ω/m;
- cable run is 100m.

Determine the:

- (i) voltage drop along the cable;
  - (ii) short circuit current;
  - (iii) trip current.
- (6 marks)

4. (a) Name two tools used in structured cabling.
- (2 marks)

- (b) Describe the following call and alarm systems:
- (i) ground proximity warning;
  - (ii) traffic collision avoidance system.
- (4 marks)

- (c) With the aid of a diagram, describe each of the following topologies:
- (i) mesh topology;
  - (ii) bus topology.
- (8 marks)

- (d) The circuit diagram below show a type of earth leakage circuit breaker (ELCB).
- (i) Identify parts labelled X,Y.
  - (ii) Explain its operation.
- (6 marks)

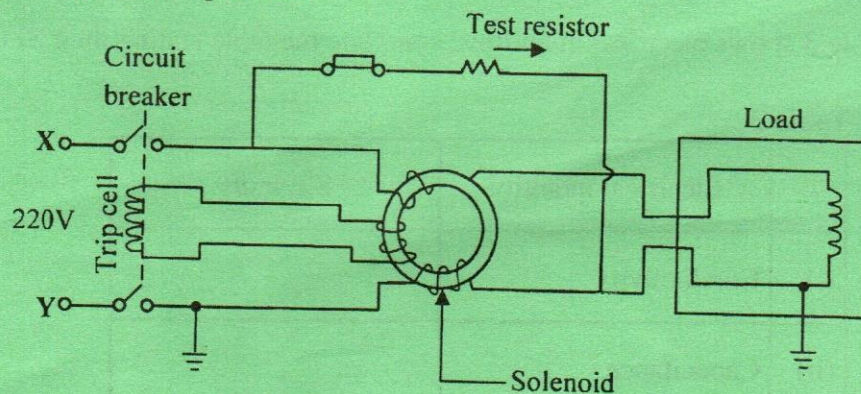


Fig. 1

5. (a) Define the following with respect to Illumination:

- (i) transmittance;
- (ii) reflection ratio.

(2 marks)

(b) Table 2 shows illumination concepts, complete the table.

**Table 2**

Concept	SI units	Symbol
Luminous Flux		
Luminous Intensity		
Illuminance		

(6 marks)

(c) A corridor is lit by 4 lamps spaced 10 m apart and suspended at a height of 5 m above the center line of the floor. Each lamp gives 200 candela power in all directions below the horizontal.

- (i) Sketch the layout of the lamps;
- (ii) Determine the illumination at the centre of the corridor due to:
  - (I) first lamp ( $L_1$ );
  - (II) second lamp ( $L_2$ ).

(8 marks)

(d) Explain the following types of luminaries used in aircraft installations:

- (i) beacon;
- (ii) strobe lights.

(4 marks)

**SECTION B: ELECTRICAL ENGINEERING PRINCIPLES (40 marks)**

*Answer TWO questions from this section.*

6. (a) Table 3 shows electrical quantities, complete the table stating their SI units.

**Table 3**

	Electrical quantity	S.I. units
(i)	Conductivity	
(ii)	Capacitance	
(iii)	Charge	

(3 marks)

- (b) Figure 2 shows a circuit diagram with resistors of different combinations supplied from a potential difference (p.d) of 60V between points A to B.

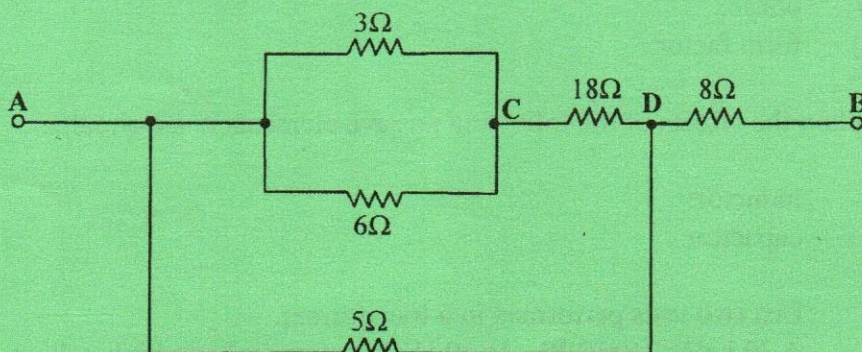


Fig. 2

- (i) Determine the resistance between:
- (I) A and C;
  - (II) ACD;
  - (III) A and D.
- (ii) Determine the effective resistance. (8 marks)

- (c) (i) With the aid of a diagram, explain the principle of operation of Lead Acid Battery.
- (ii) List **two** methods used in battery charging. (9 marks)

7. (a) State Faraday's laws of electromagnetic induction. (2 marks)

- (b) A mild steel ring of 30 cm mean circumference has a cross-sectional area of 6 cm<sup>2</sup> and has a winding of 500 turns on it. The ring is cut through a point so as to provide an air-gap of 1 mm in the magnetic circuit. A current of 4 A in the winding produces a flux density of 1 Tesla in the air gap.

Determine the:

- (i) field strength due to the air gap;
  - (ii) relative permeability;
  - (iii) field strength due to mild steel ring. (9 marks)
- (c) (i) List **three** merits of permanent-magnet moving coil (PMMC) instruments.
- (ii) With the aid of circuit diagram, describe the extension of the range of an Ammeter. (9 marks)

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8. (a) Define the following with respect to a.c theory:

- (i) cycle;
- (ii) phase;
- (iii) form factor.

(3 marks)

(b) Explain the effects of the following passive elements in a.c circuits:

- (i) inductor;
- (ii) capacitor.

(6 marks)

(c) (i) List **two** tests performed in a transformer.

- (ii) A 30 kVA, 2400/120 – V, 50 Hz transformer has a high voltage winding resistance of  $0.1 \Omega$  and a leakage reactance of  $0.22 \Omega$ . The low voltage winding resistance is  $0.035 \Omega$  and reactance is  $0.012 \Omega$ .

Determine the:

- (I) equivalent winding resistance;
  - (II) equivalent reactance;
- for both primary and secondary side.

(11 marks)

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