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AIRCRAFT ELECTRICAL TECHNOLOGY

Oct./Nov. 2019

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:*

*Answer booklet;*

*Drawing instruments;*

*A non-programmable scientific calculator.*

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

*Answer THREE questions from section A and TWO questions from section B 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.*

*(Take  $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$ )*

**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.**


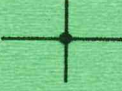




## SECTION A: AIRCRAFT ELECTRICAL INSTALLATION TECHNOLOGY

*Answer **THREE** questions from this section.*

1. (a) List **four** tools used in aircraft electrical installation work. (4 marks)
- (b) Describe each of the following aircraft power distribution systems:
- (i) split;
- (ii) parallel. (4 marks)
- (c) Table 1 shows various aircraft electrical wiring symbols. Complete the table. (4 marks)

Table 1

Symbol	Representation
	
	
	
	

- (d) With the aid of a labelled diagram, describe the working principle of a thermal type circuit breaker. (8 marks)
2. (a) Distinguish between joint and termination with respect to electrical wiring. (2 marks)
- (b) With the aid of diagrams, describe each of the following types of cable terminations:
- (i) pillar terminal;
- (ii) eyelet terminal. (8 marks)
- (c) List **four** safety gears used while carrying out wiring works in aircrafts. (4 marks)
- (d) (i) State **three** types of insulating materials used in aircraft wiring cables.
- (ii) Highlight **three** merits of copper conductors. (6 marks)



3. (a) (i) With the aid of a labelled diagram, describe the construction of a high rupturing capacity fuse (HRC).  
(ii) Explain the operation of HRC fuses.  
(iii) State **three** merits of HRC fuses. (10 marks)
- (b) With the aid of labelled diagrams, describe each of the following types of cables used in structured cabling wiring:  
(i) unshielded twisted pair (UTP);  
(ii) optical fiber cable. (10 marks)

4. (a) Table 2 shows aircraft navigation lights features. Complete the table. (6 marks)

**Table 2**

Colour	Location	Divergence	Wattage
White	Vertical stabilizer	140°	20 W
Red	Left wing tip	110°	20 W
Green	Right wing tip	110°	20 W

- (b) (i) State the inverse square law of illumination.  
(ii) A lamp radiates luminous flux of 1200 lumens in all directions. The lamp is suspended 8 m above a working plane. Determine the:  
I. luminous intensity;  
II. illumination at a point on the plane 6 m away from the foot of the lamp. (7 marks)
- (c) A cabin crew room having a total effective area of 70 m<sup>2</sup>, lit by a number of 40 W incandescent lamps each having 11 lm/W. An illumination of 80 lux is required on the room. Only 60% of the light emitted by the lamps is used for illumination. Determine the number of lamps required. (7 marks)

5. (a) List **four** items contained in a first aid kit. (4 marks)
- (b) With the aid of an electrical wiring diagram, describe a ring circuit. (6 marks)
- (c) Describe each of the following types of conduits systems, citing one area of application of each:  
(i) PVC conduit;  
(ii) flexible metal conduit. (6 marks)



- (d) Figure 1 shows a smoke detector alarm block schematic diagram. Explain its operation. (4 marks)

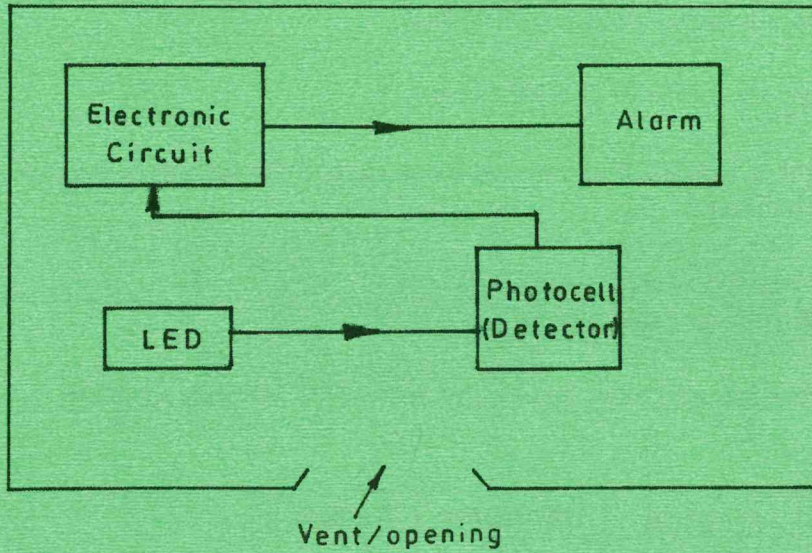


Fig. 1

**SECTION B: ELECTRICAL ENGINEERING PRINCIPLES**

Answer **TWO** questions from this section.

6. (a) Table 3 shows units of various electrical quantities. Complete the table. (4 marks)

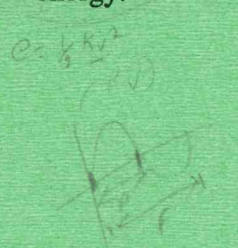
Table 3

Unit	Quantity of measure
Coulomb	Charge
Siemens	
Henry	Inductance
Farad	Capacitance

- (b) An aircraft battery is used to start an engine. The starter draws a current of 1000 A for 30 seconds and the battery voltage remains 12 V for this period. Determine the:

- (i) power;  
 (ii) energy.

(4 marks)





- (c) Figure 2 shows a lead-acid battery charging set up. With the aid of chemical equations, describe the process of charging the battery. (8 marks)

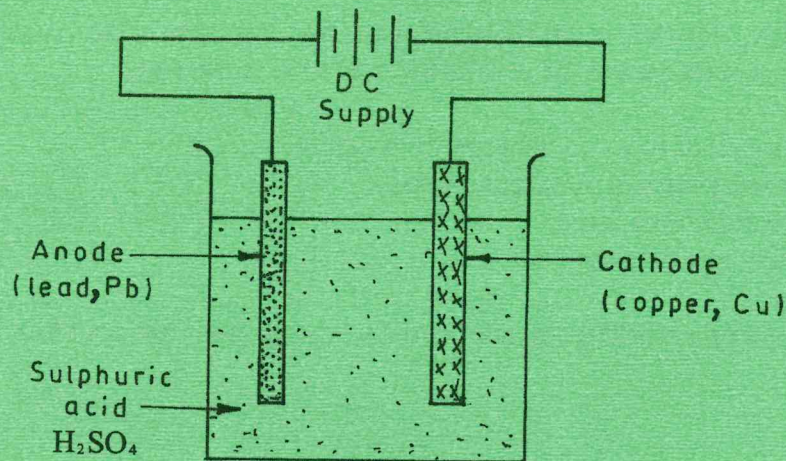


Fig. 2

- (d) A battery of six, 2 V cells is charged through a  $1.2 \Omega$  resistor from a 20 V supply. The terminal voltage per cell is 1.8 V when discharged. Determine the current at the beginning of charging. (4 marks)

7. (a) Define the following with reference to a.c circuits, citing the units in each case:

- (i) frequency;  
 (ii) period. (4 marks)

- (b) An alternating voltage is given by the expression  $V = 75 \sin(200\pi t - 0.25)$  volts. Determine the:

- (i) rms value;  
 (ii) frequency;  
 (iii) phase angle in degree. (8 marks)

- (c) A series circuit of resistance  $60 \Omega$  and inductance  $75 \text{ mH}$  is connected to a 110 V, 60 Hz supply. Determine the:

- (i) inductance reactance;  
 (ii) impedance;  
 (iii) current flowing in the circuit;  
 (iv) power dissipated in the circuit. (8 marks)



8. (a) With the aid of a labelled diagram, describe the construction of a shell type transformer. (6 marks)
- (b) A 750 KVA, 1100/400 V, 50 Hz transformer has 160 turns in the secondary winding. The cross section area of the core is  $100 \text{ cm}^2$ . Determine the:
- (i) number of turns on the primary winding;
  - (ii) primary current, neglecting losses;
  - (iii) electromotive force;
  - (iv) flux density in the core. (8 marks)
- (c) With the aid of a labelled diagram, describe the open-circuit test of a transformer. (6 marks)

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