

2506/102  
2507/102  
AIRCRAFT ELECTRICAL TECHNOLOGY  
June/July 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;*

*Non-programmable scientific calculator;*

*Drawing instruments.*

*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.*

**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: AIR CRAFT ELECTRICAL INSTALLATION TECHNOLOGY

Answer **THREE** questions from this section.

1. (a) (i) Define arc flash with respect to aircraft electrical safety hazards.  
(ii) Describe **three** causes of arc flash in aircrafts. (7 marks)
- (b) Explain the following aircraft power sources, citing their use in each case.  
(i) auxiliary power units (APUs);  
(ii) ram air turbine (RAT). (6 marks)
- (c) With the aid of schematic circuit diagrams, explain the operation of a three-phase brushless AC generator used in aircrafts. (7 marks)
2. (a) Distinguish between BNC and TNC cable connectors citing **one** merit for each. (4 marks)
- (b) Stat **three** IEE regulations on joints and terminations of electric wiring cables. (3 marks)
- (c) With the aid of diagrams, outline the procedure of making a scarf joint. (6 marks)
- (d) (i) Define bonding with respect to aircraft electrical installation.  
(ii) Describe **three** types of bonding used in aircraft wiring. (7 marks)
3. (a) (i) Define current rating with respect to fuses.  
(ii) Explain the working principle of a resettable fuse. (5 marks)
- (b) Draw a basic wiring diagram of a three-way lighting circuit. (5 marks)
- (c) (i) Draw a labelled block diagram of a structured cabling system.  
(ii) Describe **four** components of the system in c(i) above. (10 marks)



4. (a) Describe each of the following aircraft anti-collision lights citing where they are located in an aircraft:

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

(6 marks)

(b) Table 1 shows various quantities in illumination. Complete the table.

(6 marks)

Table 1

Quantity	Unit	Symbol
Luminous flux		
	Candela	
		E

(c) Figure 1 shows an arrangement for four lamps. Each lamp radiates 200 lumens in all directions.

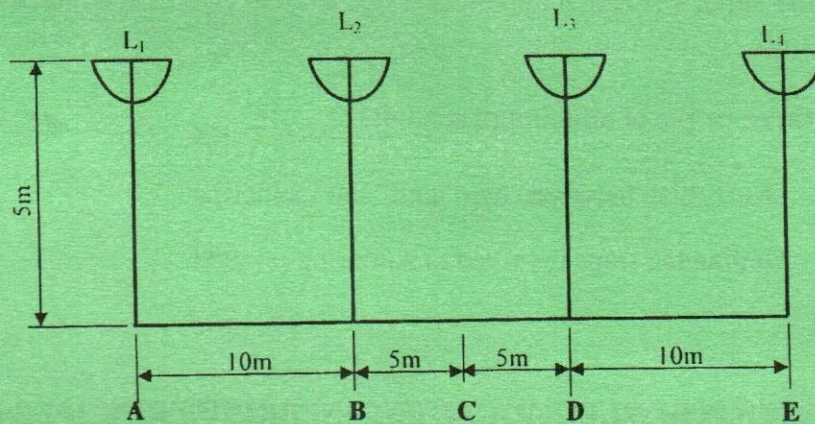


Fig. 1

Determine the illumination at point C, due to:

- (i) lamp L<sub>1</sub>;
- (ii) lamp L<sub>2</sub>;
- (ii) all the four lamps.




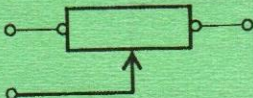
(8 marks)



5. (a) Table 2 shows various aircraft electrical wiring symbols. Complete the table.

(4 marks)

Table 2

Symbol	Representation
	
	
	
	

(b) With the aid of a wiring diagram, describe a radial electrical circuit citing **one** merit.

(6 marks)

(c) State **three** merits of aluminium conduits.

(3 marks)

(d) (i) Distinguish between 'hard' and 'soft' soldering.

(ii) Outline the steps involved in soldering process.

(7 marks)

## SECTION B: ELECTRICAL ENGINEERING PRINCIPLES

*Answer TWO questions from this section.*

6. (a) State **two** merits of moving iron instruments.

(2 marks)

(b) A moving coil instrument has a resistance of  $10\ \Omega$  and gives a full scale deflection when carrying a current of 50 mA.

(i) Draw schematic circuit diagrams to show how it can be adopted to measure:

(I) current up to 100A;

(II) voltage up to 750V.

(ii) Determine the value of resistance required in b(i).

(8 marks)



- (c) Two parallel metal plates each of area  $0.01 \text{ m}^2$  and separated by a layer of mica  $2 \text{ mm}$  thick and a dielectric constant of 6 are connected to a  $100 \text{ V}$  d.c supply. Determine the:
- (i) capacitance;
  - (ii) charge stored;
  - (iii) energy stored;
  - (iv) field strength in the dielectric;
  - (v) electric flux density.

(10 marks)

7. (a) Define the following with respect to a.c circuits:

- (i) peak value;
- (ii) root mean square (r.m.s) value.

(2 marks)

- (b) A  $50 \text{ Hz}$  a.c circuit has maximum voltage and current values of  $400 \text{ V}$  and  $20 \text{ A}$  respectively. The quantities are sinusoidal. At time  $t = 0$ , the values of voltage and current are  $283 \text{ V}$  and  $10 \text{ A}$  respectively, both increasing positively. Determine the:

- (i) expression of voltage at time  $t$ ;
- (ii) expression for current at time  $t$ ;
- (iii) power consumed in the circuit.

(10 marks)

- (c) A coil of inductance  $0.15 \text{ H}$  and resistance  $10 \Omega$  is wired in series with a  $60 \mu\text{F}$  capacitor to a  $240 \text{ V}$ ,  $50 \text{ Hz}$  supply. Determine the:

- (i) inductive reactance;
- (ii) capacitive reactance;
- (iii) total impedance.

(8 marks)



8. (a) With the aid of a labelled diagram, describe the construction of a single-phase core type transformer. (6 marks)
- (b) (i) State the **two** types of instrument transformers.
- (ii) Describe each of the following transformer losses:
- (I) core/iron losses;
- (II) copper losses. (6 marks)
- (c) (i) The losses of a 30 KVA, 2000/200 volts transformer are:
- Iron losses = 360 W
- Copper losses = 480 W
- Determine its efficiency at unity power factor for:
- (I) full-load;
- (II) half-load.
- (ii) State **two** applications of single-phase transformers. (8 marks)

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