

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)

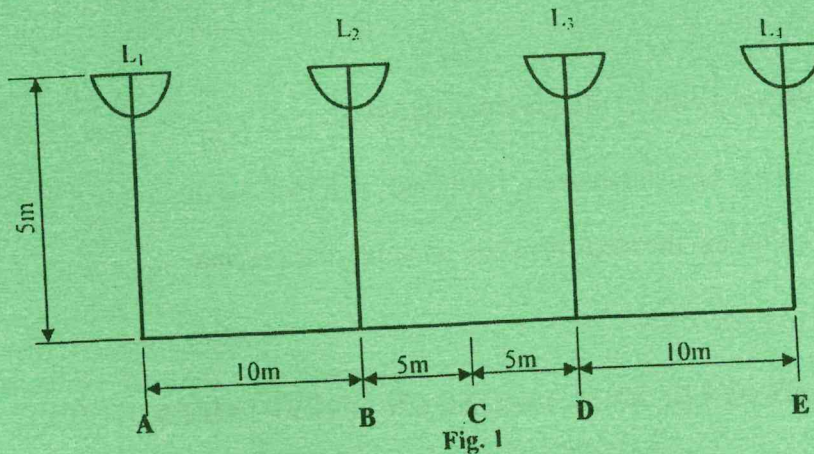
(b) Table 1 shows various quantities in illumination. Complete the table.

(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.





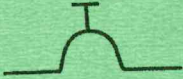
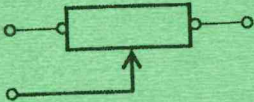
Determine the illumination at point C, due to:

- (i) lamp L_1 ;
- (ii) lamp L_2 ;
- (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 10Ω 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 m^2 and separated by a layer of mica 2 mm thick and a dielectric constant of 6 are connected to a 100 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 Hz a.c circuit has maximum voltage and current values of 400 V and 20 A respectively. The quantities are sinusoidal. At time $t = 0$, the values of voltage and current are 283 V and 10 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 H and resistance 10Ω is wired in series with a $60 \mu\text{F}$ capacitor to a 240 V, 50 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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