

2506/102

2507/102

AIRCRAFT ELECTRICAL TECHNOLOGY

Oct./Nov. 2018

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 7 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 any **THREE** questions from this section.

1. (a) Highlight **three** requirements for safety in an aircraft working environment. (3 marks)
- (b) Table 1 shows various electrical components found in an aircraft. Complete the table. (6 marks)

Table 1

S/No.	Item Description	Symbol diagram
1	Socket outlet	
2	Buzzer	
3	Antenna	

- (c) (i) Draw a complete married joint. (4 marks)
- (ii) List **three** types of cable terminations found in aircrafts. (3 marks)
- (d) Describe **two** requirements of the IEEE Regulations and Code of Practice for the installation of conduits. (4 marks)
2. (a) List **three** handworking tools found in aircraft electrical installations. (3 marks)
- (b) Describe **two** materials used for insulation of cables in aircraft electrical installations. (4 marks)
- (c) (i) State **three** applications of the power supplies in an aircraft. (3 marks)
- (ii) Draw a schematic wiring diagram of an alarm that can be operated from two remote switching positions alternately. (4 marks)
- (d) With the aid of a diagram, describe the operation of the current operated Earth Leakage Circuit Breaker (ELCB). (6 marks)

3. (a) State **two** IEEE regulations with respect to earthing requirements in electrical installation. (2 marks)
- (b) Figure 1 shows a schematic installation layout diagram of lighting and power circuit. The power circuit is connected in radial. Draw a wiring diagram of the installation. (7 marks)

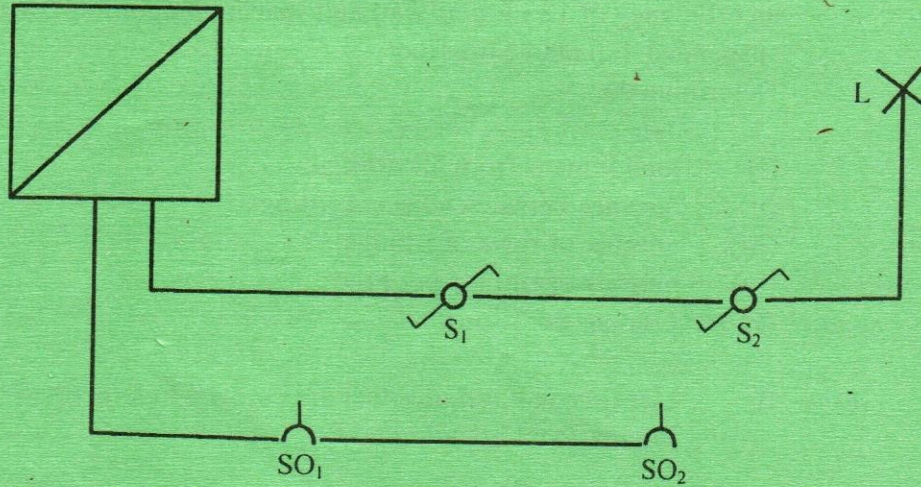


Fig. 1

- (c) With the aid of a diagram, describe the operation of a TWO-way call and alarm circuit with calling facilities incorporated. (7 marks)
- (d) Table 2 shows electrical installation accessories. Complete the table. (4 marks)

Table 2

S/No.	Item Description	Pictorial Diagram
1	4-Way through box	
2	Through box	
3	Junction box	
4	T-Inspection box	

4. (a) Define the following with respect to illumination:

- (i) Utilization factor;
- (ii) Space/Height Ratio;
- (iii) Luminous exitance (M) of a surface.

(3 marks)

(b) An office measuring 20 m by 15 m is illuminated by 70 Lx. Utilization and maintenance factors are 0.5 and 0.8 respectively. Incandescent fittings with an efficiency of 12 Lumen/Watt and spacing/height ratio of 1.2 are to be suspended 4 m above the floor.

Determine the:

- (i) total lumens from all fittings;
- (ii) distance between adjacent fittings;
- (iii) number of rows of fittings;
- (iv) number of fittings per row;
- (v) Lumens per fitting.

(10 marks)

(c) (i) List **three** importance that are enjoyed in structured cabling from the International Standard bodies.

(3 marks)

(ii) Describe backbone cabling as applied to structured cabling in aircraft installations.

(4 marks)

5. (a) List **three** types of lightning signals used in an aircraft environment.

(3 marks)

(b) Describe the following components with respect to horizontal cabling:

- (i) cable pathway;
- (ii) connecting hardware;
- (iii) miscellaneous support facilities.

(6 marks)

(c) Table 3 shows parameters of the various cables used in structured cabling. Complete the table.

(9 marks)

Table 3

S/No.	Cable Type	Max. Distance	Noise Immunity	Data Rate
1	Coaxial			
2	Optical fibre			
3	Twisted pair			

(d) State the functions of each of the following in a structured cabling topology:

- (i) Entrance facility;
- (ii) Equipment Room (ER).

(2 marks)

SECTION B: ELECTRICAL ENGINEERING PRINCIPLES

Answer any TWO questions from this section.

6. (a) Define the following as used in electromagnetic circuits:

- (i) flux Density;
- (ii) Intensity of Magnetisation. *strength*

(2 marks)

(b) A mild steel ring 200 mm² in cross-sectional area and 0.2 m in mean diameter is wound with 450 turns of wire. The steel has a relative permeability of 600. A current of 2A flows in the coil. Determine the:

- (i) magnetising force;
- (ii) flux density produced;
- (iii) total flux.

(6 marks)

(c) With the aid of a diagram, explain leakage flux as applied to electromagnetism.

(8 marks)

(d) Table 4 shows the comparison between magnetic circuit and electric circuit parameters. Complete the table.

(4 marks)

Table 4

S/No.	Magnetic Circuit	Electric Circuit
1	Flux = mmf - Relucance	
2		Resistance $R = \rho l$ A
3	Reluctivity	
4	Permeability	

7. (a) State Faraday's Law of Electrolysis. (2 marks)
- (b) Two parallel metal plates each of area 0.01m^2 are each separated by a layer of mica 2 mm thick of relative permittivity 6. The metal plates are connected to 100 V dc supply.
- (i) Sketch the network;
- (ii) Determine the:
- I. Capacitance of the network;
 - II. Charge stored;
 - III. Energy stored;
 - IV. Electric flux density. (10 marks)
- (c) (i) Define the following as applied to ac generation:
- I. frequency;
 - II. root mean square value;
 - III. average value. (3 marks)
- (ii) State two merits of using moving coil instruments. (2 marks)
- (d) Show how a moving coil instrument can be used as an ammeter. (3 marks)
8. (a) State the following with respect to dc circuits:
- (i) Superposition Theorem;
 - (ii) Ohm's Law. (3 marks)

- (b) Figure 2 shows a network with two sources of power. Determine the following currents:

- (i) I_1 ;
- (ii) I_2 ;
- (iii) I .

(12 marks)

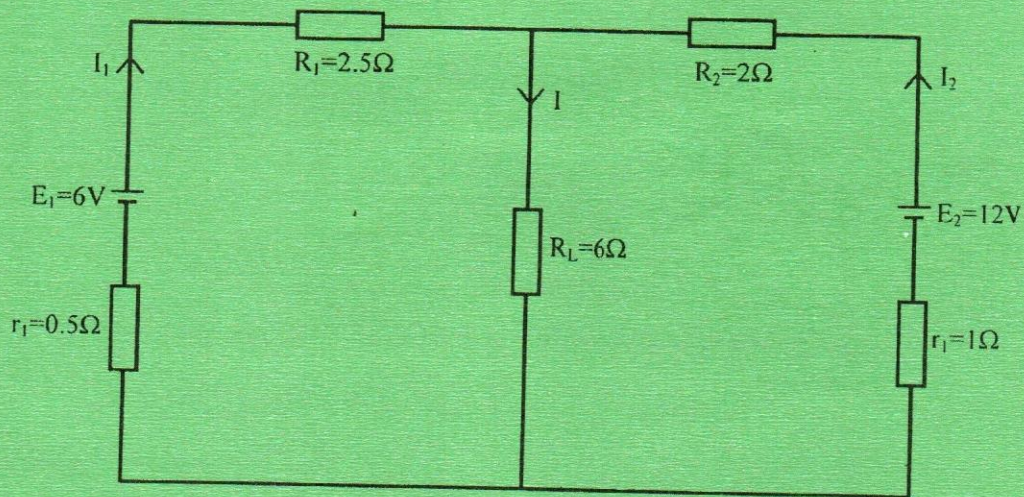


Fig. 2

- (c) (i) Draw the open circuit test diagram of a single phase transformer.
(ii) State the purpose of test in (i).

(5 marks)

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