

2506/102

2507/102

AIRCRAFT ELECTRICAL TECHNOLOGY

June/July 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;

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.

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 5 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) (i) Outline **three** aircraft safety hazards.
 (ii) Highlight **three** head gear safety requirements in the work place. (6 marks)
- (b) List **three** hand working tools commonly used in aircraft electrical installation work. (3 marks)
- (c) Figure 1 shows a schematic installation diagram in an aircraft environment. The power circuit is connected in Ring. S2, S3 and S4 control the lamp.

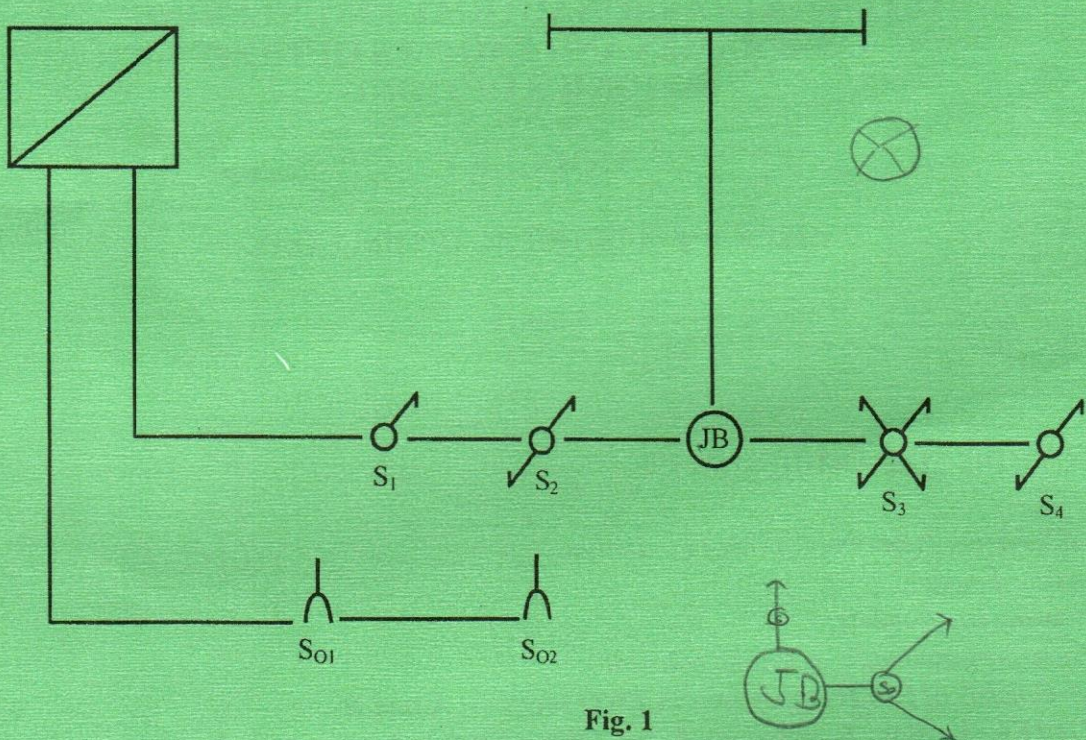
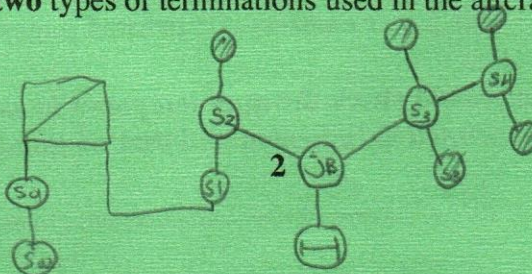


Fig. 1

- (i) State the function of S1;
- (ii) Draw a wiring diagram of the installation in Figure 1. (11 marks)

2. (a) (i) List **two** general purpose cable connectors. (4 marks)
- (ii) Outline **two** types of terminations used in the aircraft.

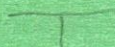


(b) Draw the following:

(i) Interleaving of the sprayed bands of a married joint;



(ii) T-joint.



(6 marks)

(c) (i) Outline **three** parts of a cable.

*→ Conductor
→ Insulate
→ sheath*

(ii) With the aid of a diagram, describe the operation of a pitot tube for pressure measurement in an aircraft.

(10 marks)

3. (a) Explain the following with respect to electrical installation:

(i) bonding;

(ii) earthing.

(6 marks)

(b) With the aid of a diagram, describe the construction and operation of a High Rupture Capacity (HRC) fuse.

(10 marks)

(c) Figure 2 is an installation schematic diagram showing an alarm controlled by two push buttons separately. Draw its wiring diagram.

(4 marks)

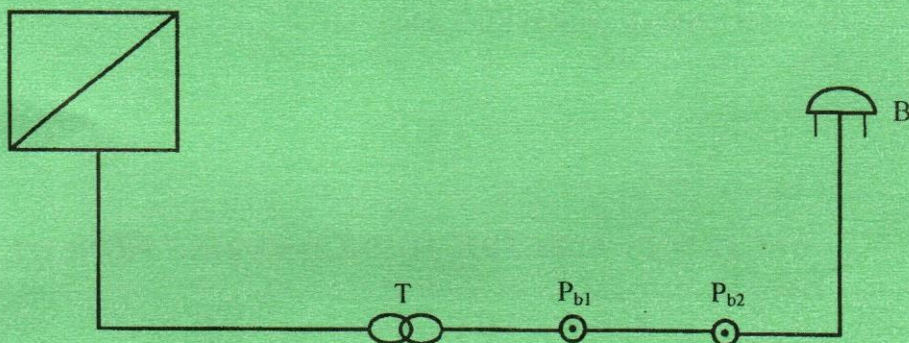


Fig. 2

4. (a) Highlight **three** IEE regulation requirements regarding installation of Residual Current Devices (RCDs) in bathrooms.

(6 marks)

(b) List **three** requirements of the IEE regulations for final sub-circuits of rating not exceeding 15 A.

(3 marks)

- (c) A room measuring 16 m^2 is illuminated by 4 lamps mounted at each corner at a height of 6 m. Each lamp has a luminous intensity of 1000 cd in all directions below the horizontal.



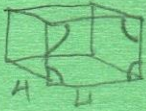
$h = 6 \text{ m}$
 $I = 1000 \text{ cd}$

- (i) Draw the position of the lamps on the layout indicating illumination to the centre of the room.

- (ii) Determine the:

- I. illumination due to one lamp;
- II. total illumination.

(11 marks)



5. (a) List **two** luminaries and **two** lamps for aircraft installation. (4 marks)
- (b) Describe structured cabling system. (4 marks)
- (c) Describe how the following are used in structured cabling, testing and commissioning:
- (i) wire map tester;
 - (ii) induction amplifier/tone generator;
 - (iii) cable - end locator kit. (6 marks)
- (d) Draw and label the cross-sectional view of:
- (i) multimode optical fibre cable;
 - (ii) coaxial cable. (6 marks)

SECTION B: ELECTRICAL ENGINEERING PRINCIPLES

Answer **TWO** questions from this section.

6. (a) With the aid of diagrams, describe algebraically the Kirchoff's Laws. (5 marks)
- (b) (i) Define the following:
- I. electric flux; \mathcal{D}
 - II. permittivity; ϵ_0
 - III. electric field intensity. \mathcal{E}
- (ii) A mild steel ring 200 mm^2 in cross-sectional area and 0.2 m in mean diameter is wound with 450 turns of wire. A current of 2 A flows in the coil. The steel has a relative permeability of 600 . Determine the:
- I. magnetising force; $[F = 4.44 \times 10^{-7} \text{ N f B m A}]$
 - II. total flux. (9 marks)

- (c) Show on graph the following damping methods of indicating instruments:
- (i) underdamped;
 - (ii) overdamped;
 - (iii) critically damped. (6 marks)
7. (a) Define the following with respect to transformers:
- (i) percentage regulation;
 - (ii) efficiency. (2 marks)
- (b) With the aid of a diagram, describe the connection and the operation of the short circuit test of a transformer. (11 marks)
- (c) A single phase transformer having 2000 primary turns is supplied from a 240 V, 50 Hz source. The flux density of the transformer core is 0.5 T and a no - load current of 3 A at 0.2 power factor lagging is detected.
- (i) Draw a no - load phasor diagram showing the flux, no load current, primary voltage and the angle ϕ .
 - (ii) Determine the:
 - I. value of flux;
 - II. cross-sectional area. (7 marks)
8. (a) State the SI units for:
- (i) force;
 - (ii) inductance. (2 marks)
- (b) With the aid of a diagram describe the principle of a.c generation. (8 marks)
- (c) A R-L-C circuit consists of two branches connected in parallel across the supply of 200 V 50 Hz. Branch A has an inductive reactance of 100 Ω and a resistance of 173.2 Ω in series. Branch B has a capacitive reactance of 173.2 Ω and a resistance of 100 Ω in series.
- (i) Draw the circuit network.
 - (ii) Determine the:
 - I. inductive branch impedance;
 - II. inductive branch current;
 - III. capacitive branch impedance;
 - IV. capacitive branch current. (10 marks)

Handwritten notes:

$$Z = \sqrt{R^2 + X^2}$$

$$Z = \frac{1}{\frac{1}{225} + \frac{1}{100}}$$

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