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 $\mu_0 = 4\pi \times 10^{-7} \, H/m$)

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.

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SECTION A: AIRCRAFT ELECTRICAL INSTALLATION TECHNOLOGY

Answer THREE questions from this section.

1. (a) (i) Outline three aircraft safety hazards. (6 marks)
   (ii) Highlight three head gear safety requirements in the work place.

(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.

![Diagram of electrical installation]

(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 brands of a married joint; (6 marks)

(ii) T-joint.

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

(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; (6 marks)

(ii) earthing.

(b) With the aid of a diagram, describe the construction and operation of a High Rapture 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)

![Wiring Diagram](image)

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)
A room measuring 16 m² 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.

(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)

(a) List two luminaries and two lamps for aircraft installation.

(b) Describe structured cabling system.

(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; \( \Phi \)
   II. permittivity; \( \varepsilon_0 \)
   III. electric field intensity. \( \varepsilon \)

   (ii) A mild steel ring 200 mm² 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; \( F = U H A \times 10^4 \) N kg m A
   II. total flux.

   (9 marks)
7. (a) Define the following with respect to transformers:

(i) percentage regulation; 
(ii) efficiency. 

(b) With the aid of a diagram, describe the connection and the operation of the short circuit test of a transformer. 

(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 $\phi$.

(ii) Determine the:

I. value of flux; 
II. cross-sectional area. 

8. (a) State the SI units for:

(i) force; 
(ii) inductance. 

(b) With the aid of a diagram describe the principle of a.c generation. 

(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 $\Omega$ and a resistance of 173.2 $\Omega$ in series. Branch B has a capacitive reactance of 173.2 $\Omega$ and a resistance of 100 $\Omega$ 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. 

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