

2506/102
 2507/102
**AIRCRAFT ELECTRICAL
 TECHNOLOGY**
 Oct./Nov. 2022
 Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
DIPLOMA IN AERONAUTICAL ENGINEERING
(AIRFRAMES AND ENGINES OPTION)
(AVIONICS OPTION)
AIRCRAFT ELECTRICAL TECHNOLOGY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Drawing instruments;

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** 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**.*

Take permittivity of free space: $\epsilon_0 = 8.854 \times 10^{-12} \text{ F/m}$ and

Permeability of free space: $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$.

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 THREE questions from this section.

1. (a) Distinguish between 'windshear' and 'microburst' with reference to aircraft safety hazards. (2 marks)
- (b) Describe each of the following types of first aid kit:
 (i) class A;
 (ii) class B. (4 marks)
- (c) With aid of a block diagram, describe the integrated drive generator (IDG) used in aircrafts. (7 marks)
- (d) (i) An aircraft alternator is required to produce an output of 115V at 400 Hz. It uses a 4 - pole rotor. Determine its shaft speed.
 (ii) A 4 - pole 60 Hz induction motor runs at a speed of 1700 rpm. Determine the:
 (I) percentage slip;
 (II) synchronous speed of the motor. (7 marks)
2. (a) State **three** functions of auxiliary power unit (APU) in aircrafts. (3 marks)
- (b) Draw and label wiring diagram of a two-way switch control of a lamp. (4 marks)
- (c) With aid of a diagram, outline the procedure of making a tee cable joint. (6 marks)
- (d) A lighting panel consists of 10 mercury vapour lamps rated at 400 W. The panel is supplied with a 230 V source at power factor of 0.8 lagging. Determine the:
 (i) total power of the panel;
 (ii) full load current;
 (iii) fuse rating. (7 marks)
3. (a) State **three** demerits of threaded Neil-concelman (TNC) connectors. (3 marks)



- (b) Figure 1 shows cross-section of an armoured cable.

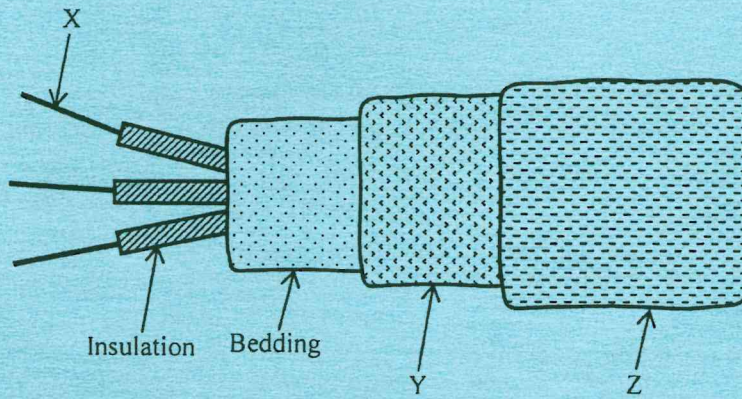


Fig. 1

- (i) identify parts labelled X, Y and Z;
 (ii) describe each of the parts of the cable.

(8 marks)

- (c) With aid of a labelled schematic diagram, describe the operation of differential current protection unit used in aircrafts. (7 marks)

- (d) Distinguish between crimping and splicing with respect to aircraft cabling. (2 marks)

4. (a) State **three** disadvantages of radial over ring power circuits. (3 marks)

- (b) Describe each of the following aircraft configuration warnings:

- (i) take-off;
 (ii) landing.

(6 marks)

- (c) (i) Distinguish between horizontal and backbone cabling.

- (ii) With aid of labelled diagrams, describe each of the following physical network topologies with reference to structured cabling:

- (I) bus topology;
 (II) mesh topology.

(8 marks)

- (d) State **three** types of cables used in structured cabling. (3 marks)



5. (a) Table 1 shows types of aircraft's lights, their colour and location. Complete the table. (4 marks)

Table 1

Light	Colour	Location
Taxi	White	-
Beacon	-	Fuselage
Landing	-	Wing
Strobe	White	-

- (b) An aircraft office floor area measuring 10 m by 10 m is illuminated to 200 lux using twin 32 W lamps fixtures. The spacing to mounting height ratio of the fixtures is 1.25. Each lamp has an efficiency of 80 lumen per watt. The lamps' maintenance factor (MF) is 0.65 and utilization factor (UF) is 0.7. Determine the:
- total wattage of each fixture;
 - lumen per fixture;
 - number of fixtures;
 - minimum spacing between each fixture if the ceiling to desk height is 2 m.
- (8 marks)

89

- (c) Figure 2 shows two lamps suspended above a surface. Each lamp emits 350 cd. At point P, determine the:

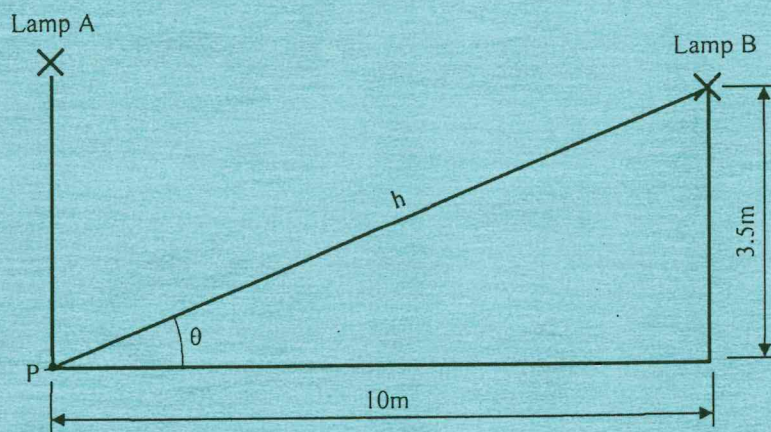


Fig. 2

- illumination due to lamp A;
- illumination due to lamp B;
- total illuminance.

(8 marks)



SECTION B: ELECTRICAL ENGINEERING PRINCIPLES

Answer TWO questions from this section.

6. (a) Table 2 shows some derived units. Complete the table by filling in the corresponding quantity measured and SI base unit. (4 marks)

Table 2

Unit name	Quantity measured	SI base units
newton	force	-
siemens	-	$kg^{-1}m^{-2}s^3A^2$
volt	potential difference	-
henry	-	$kg\ m^2\ s^{-2}\ A^{-2}$

- (b) Figure 3 shows 4 identical cells each having an emf of 5 V and internal resistance of $0.5\ \Omega$ connected in parallel.

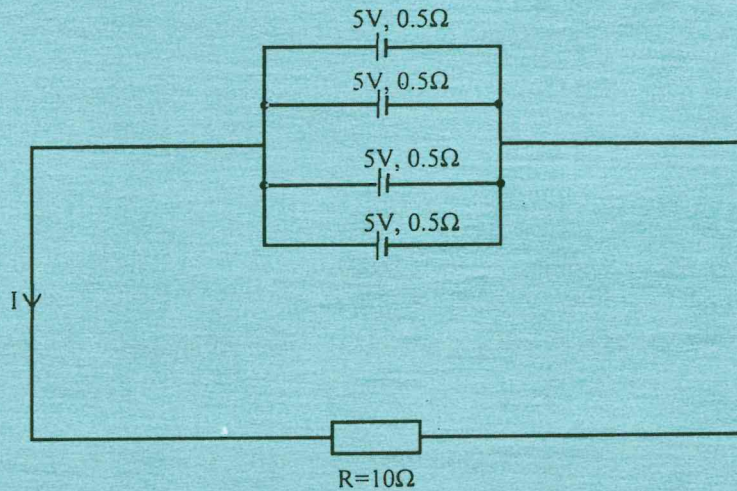


Fig. 3

Determine the:

- (i) equivalent e.m.f;
 - (ii) equivalent internal resistance;
 - (iii) total current;
 - (iv) current from each cell.
- (7 marks)
- (c) (i) With aid of a labelled diagram, describe the construction of a permanent magnet moving coil instrument (PMMC).
- (ii) State **two** merits of the instrument in (c) (i).

(9 marks)



7. (a) State Kirchhoff's voltage law. (1 mark)
- (b) Figure 4 shows a resistive network.

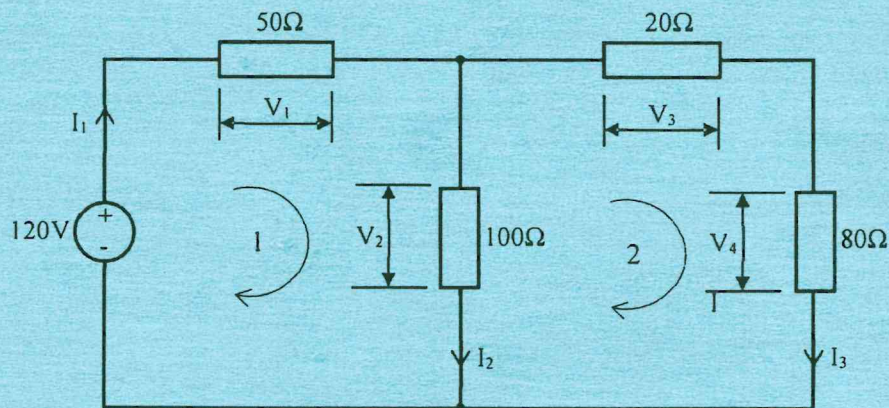


Fig. 4

Determine the:

- (i) current I_2 ;
 (ii) current I_1 ;
 (iii) voltage V_1 ;
 (iv) voltage V_4 .

(10 marks)

- (c) (i) Define hysteresis with respect to magnetism.
 (ii) Distinguish between retentivity and coercivity with respect to hysteresis loop. (3 marks)
- (d) A coil of 300 turns is wound uniformly on a ring of non-magnetic material. The ring has a mean circumference of 40 cm and a uniform cross-section area of 4 cm^2 . The current in the coil is 5 A. Determine the:
- (i) magnetic field strength;
 (ii) magnetic flux density;
 (iii) total magnetic flux in the ring.

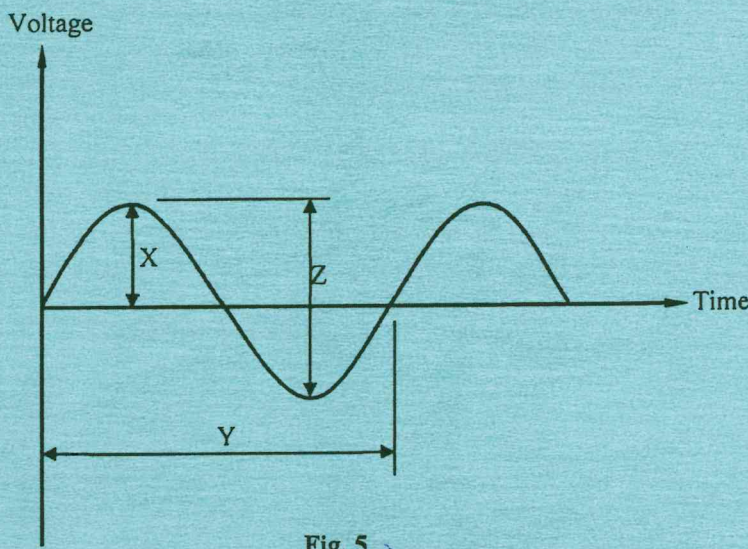
(6 marks)



8. (a) (i) Define 'permittivity' with reference to electrostatics.
- (ii) Two parallel plates each of surface area $8 \times 10^{-4} \text{ m}^2$ having a potential difference of 200 V between them are placed 0.8 mm apart in air. Determine the:
- (I) electric field strength between the plates, E;
 - (II) flux density D;
 - (III) charge, Q;
 - (IV) capacitance, C.

(9 marks)

- (b) Figure 5 shows an a.c. wave form. Identify the parts labelled X, Y and Z. (3 marks)



- (c) A 240 V/12 V ideal transformer has 500 turns on the primary winding. It supplies 150 W load. Determine the:
- (i) load current;
 - (ii) transformer turns ratio;
 - (iii) current in the primary winding;
 - (iv) transformer secondary turns.

(8 marks)

THIS IS THE LAST PRINTED PAGE.

