2506/102
2507/102
AIRCRAFT ELECTRICAL
TECHNOLOGY
June/July 2020
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: $\varepsilon_0 = 8.854 \times 10^{-12}$ **F/m and**
   Permeability of free space: $\mu_0 = 4\pi \times 10^{-7}$ **H/m.**

This paper consists of 6 printed pages.

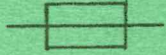**Candidates should check the question paper to ascertain that all
the pages are printed as indicated and that no questions are missing.**

Turn over

1.   (a)   (i)   Distinguish between 'wind shear' and 'microburst' with respect to aircraft safety.
      (ii)   Explain why passengers are advised to switch off their mobile phones during an aircraft take-off or landing.

(5 marks)

   (b)   State the use of each of the following electrical installation tools:

      (i)   wire strippers;
      (ii)   linesman pliers;
      (iii)   fish tape.

(3 marks)

   (c)   Highlight **three** merits of polyimide (PI) tape as used in aircraft electrical insulation.

(3 marks)

   (d)   With aid of a block diagram, describe the integrated drive generator (IDG) used in aircrafts.

(9 marks)

2.   (a)   (i)   Table 1 shows aircraft electrical symbols. Complete the table by stating what each symbol represents.

(3 marks)

Table 1

Symbol	Meaning

      (ii)   Describe each of the following electrical drawings:

         (I)   wiring diagrams;
         (II)   schematic diagrams.

(4 marks)

   (b)   Describe each of the following RF connectors:

      (i)   C - type;
      (ii)   N - type.

(4 marks)

(c)   With aid of a diagram, outline the steps to be followed when making a telegraph joint.

(6 marks)

(d)   An aircraft landing lights circuit, consists of two series lamps of 4 Ω resistance each. The supply voltage is 28 V d.c. Determine the total current in the circuit.   (3 marks)

3.   (a)   State **two** types of each of the following materials used in aircraft electrical installation:

(i)   insulators;
(ii)   conductors.

(4 marks)

(b)   Describe **three** methods of determining an open fuse.   (6 marks)

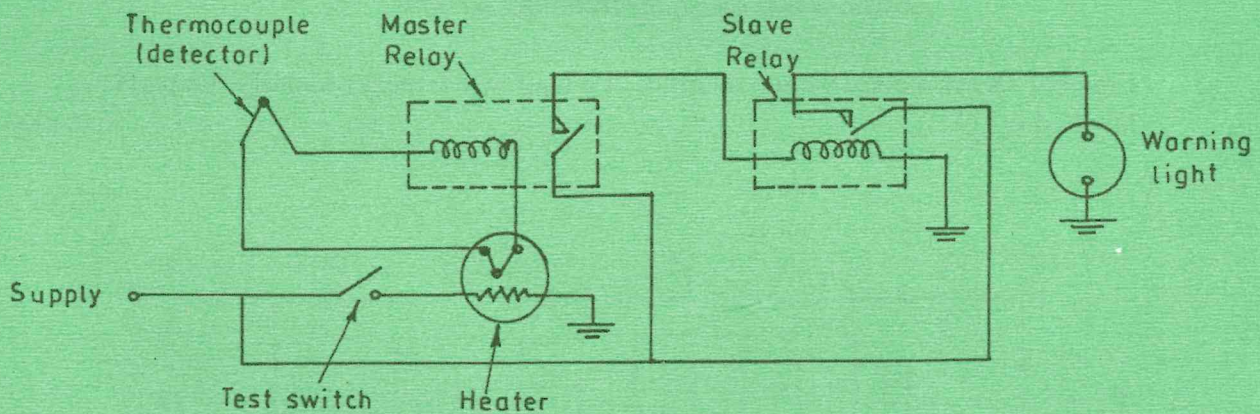(c)   Figure 1 shows a fire detection circuit of an aircraft. Explain its operation.   (4 marks)

Fig. 1

(d)   Draw a wiring diagram of a lighting circuit to control a lamp from three positions using an intermediate switch and two-way switches.   (6 marks)

4.   (a)   State **two** factors considered when selecting cable sizes for aircraft electrical installation.   (2 marks)

(b)   Explain **four** causes of wiring degradation in aging aircrafts.   (8 marks)

(c)   With the aid of block diagrams, describe each of the following types of wiring circuits:

(i)   radial;
(ii)   ring.

(10 marks)

5. (a) State **four** locations of anti-collision lights in an aircraft. (4 marks)

   (b) With the aid of a diagram, describe the operating principle of a strobe light. (8 marks)

   (c) A room 6 m x 4 m is illuminated by a single lamp of 100 CP in all directions suspended 3 m above the centre of the floor. Determine the illumination:

   (i) directly below the lamp;
   (ii) at the corner of the room. (8 marks)

SECTION B: ELECTRICAL ENGINEERING PRINCIPLES
*Answer **TWO** questions from this section.*

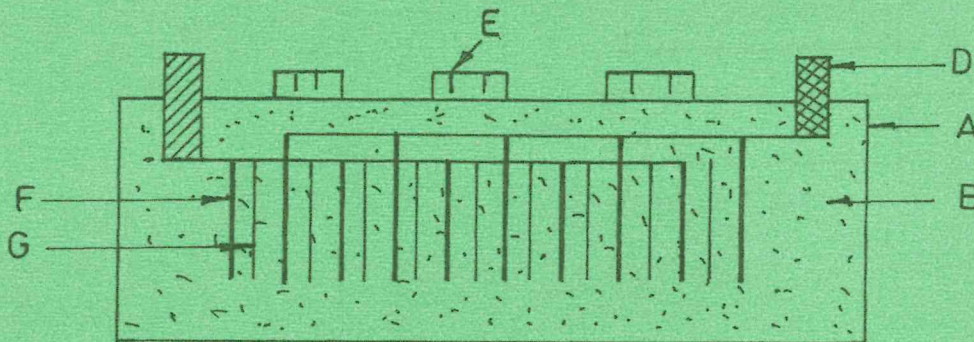6. (a) Figure 2 shows a construction diagram of a lead-acid battery. Identify the parts labelled A - G. (6 marks)

Fig.2

   (b) Table 2 shows features of electrical measuring instruments. Complete the table. (5 marks)

Table 2

Feature	Type of instrument	
	Moving coil	Moving iron
Quantity measured	DC current and voltage	-
Scale	-	Non linear
Method of control	Hairspring	-
Method of damping	-	-

(c)   Figure 3 shows an unbalanced bridge circuit. The internal resistance of the galvanometer G is 4 Ω while that of the battery is 2 Ω. Determine the branch currents I_1, I_2 and I_3.   (9 marks)
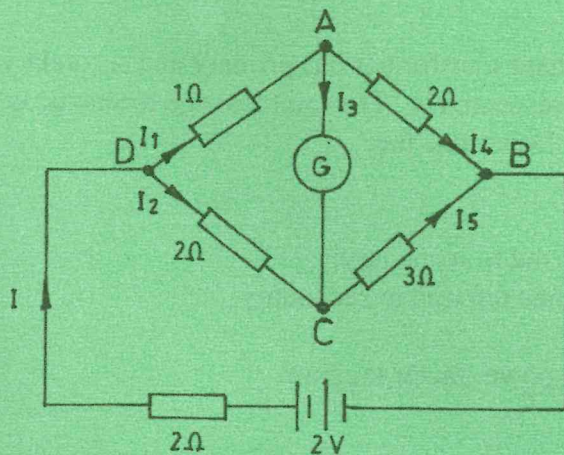

Fig.3

7.   (a)   With the aid of a labelled diagram, describe the construction of a coaxial cable.
(6 marks)

(b)   An aircraft battery is used to start an engine. The starter draws a current of 1000 A for 30 seconds and the battery voltage remains at 12 V during this period. Determine the:

(i)   electrical power supplied by the battery;
(ii)   energy consumed by the starter.
(4 marks)

(c)   Two parallel metal plates each of area $100 \, cm^2$ and separated by a layer of mica 5 mm thick and of dielectric constant 5 are connected to a 50 V d.c supply. Determine the:

(i)   capacitance of the arrangement;
(ii)   charge stored;
(iii)   energy stored;
(iv)   electric field strength in the dielectric;
(v)   electric flux density.

(10 marks)

8.   (a)   Describe each of the following transformer losses:

          (i)   iron losses;
          (ii)   copper losses.

                                                                     (4 marks)

    (b)   A 40 KVA, 6600/250 V single phase transformer has primary and secondary winding resistances of 10 Ω and 0.02 Ω respectively. The total leakage reactance is 35 Ω as referred to the primary winding. Determine the:

          (i)   transformation ratio;
          (ii)   equivalent resistance referred to secondary;
          (iii)   equivalent leakage reactance referred to secondary;
          (iv)   secondary current;
          (v)   full load regulation at 0.8 power factor lagging.

                                                           (11 marks)

                                                           (5 marks)

    (c)   Draw a labelled B - H curve of a soft magnetic material.

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