2506/102
2507/102
AIRCRAFT ELECTRICAL TECHNOLOGY
Oct./Nov. 2021
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 any **THREE** questions in section A and any **TWO** questions in 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, $\varepsilon_0 = 8.85 \times 10^{-12} F/m$;*
        permittivity of free space, $\mu_0 = 4\pi \times 10^{-7} H/m$.

## SECTION A: AIRCRAFT ELECTRICAL INSTALLATION TECHNOLOGY

*Answer **THREE** questions in this section.*

1. (a) (i)   State **two** effects of lightning strike on aircrafts.

    (ii) Explain the need of static dischargers on aircrafts .

    (4 marks)

    (b) Table 1 shows electrical installation tools and their functions. Complete the table.

    (4 marks)

Table 1

Name of tool	Function
-	Cutting and stripping insulation
Nose pliers	-
-	Cutting wires
Wire crimpers	-

    (c) Describe each of the following types of generators used in aircrafts:

    (i)   constant frequency Integrated Drive (IDG);
    (ii) Variable Speed Constant Frequency (VSCF).

    (8 marks)

    (d) (i)   Identify the component represented by each of the following symbol:

    I)

    II)
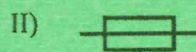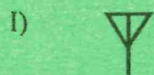
    (ii) Define wild frequency system and state its effect on an aircraft.   (4 marks)

2. (a) (i)   State **three** factors considered when selecting connectors for R.F cables.

    (ii) Describe N-series RF connector.

    (6 marks)

    (b) With the aid of a diagram, describe the process of making a telegraph joint.

    (7 marks)

(c)   Describe each of the following cable termination methods:

   (i)   pillar;
   (ii)   eyelet.

                                                                                      (4 marks)

(d)   List **three** merits of using aluminium cables in aircraft electrical wiring.   (3 marks)

3.   (a)   Outline the steps of soldering a cable joint.   (4 marks)

     (b)   Describe each of the following aircraft control panels:

        (i)   instrument panel;
        (ii)   mode control panel.

                                                                                      (6 marks)

     (c)   State **four** regulation requirements of aircraft equipment specified in the Kenya
             Aviation Act Cap. 394.   (4 marks)

     (d)   (i)   Define busbar;

             (ii)   With aid of a diagram, describe a single bus bar electrical system.

                                                                                      (6 marks)

4.   (a)   (i)   Distinguish between current rating and fusing current with reference to fuses.

             (ii)   With the aid of a diagram, describe the construction of a semi-enclosed fuse.

                                                                                      (8 marks)

     (b)   Describe differential current protection of electrical devices.   (3 marks)

     (c)   State **three** reasons of bonding and earthing in aircrafts.   (3 marks)

     (d)   An aircraft generator supplies 230 V at 0.8 p.f to 10, 400 W mercury vapour lamps.
             Determine the:

        (i)   total load;
        (ii)   full load current;
        (iii) fuse rating.

                                                                                      (6 marks)

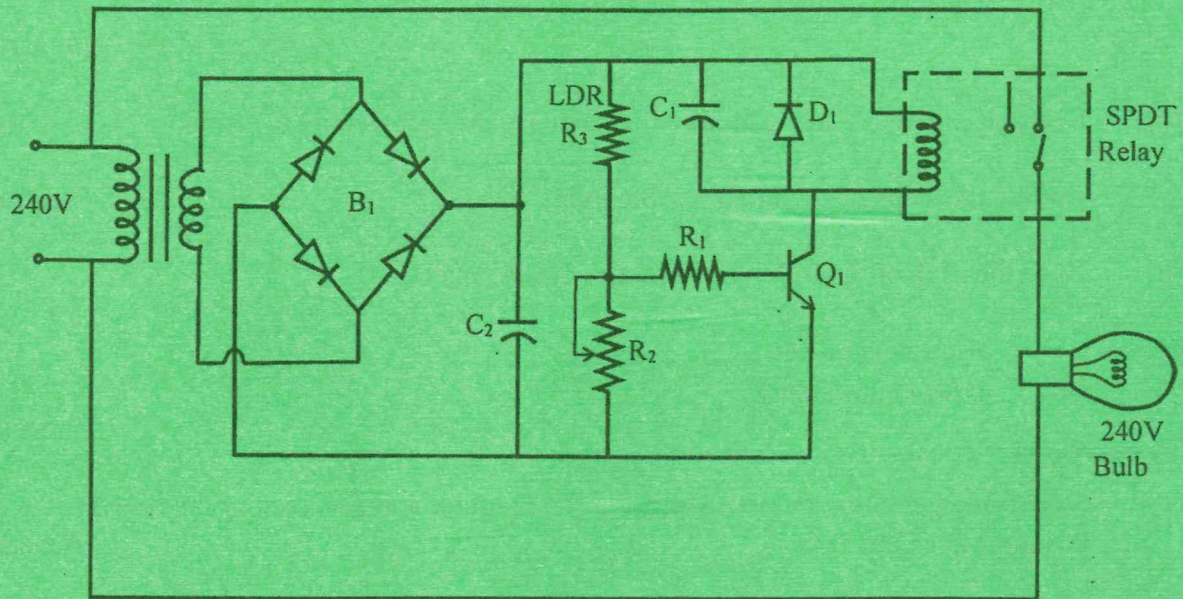5. (a) Figure 1 shows a circuit diagram for controlling a warning light for low flying aircrafts.

Fig. 1

Describe its operation.   (6 marks)

(b) Describe each of the following with respect to structured cabling:

   (i)   horizontal cabling;
   (ii) backbone cabling.

                                                                                     (6 marks)

(c) (i)   State the cosine law of illumination.

   (ii) A room of dimensions 20 m x 10 m x 3 m (L x w x h) is to be illuminated to 250 lux using twin lamps each of 32 watts. Each lamp has an efficiency of 85 lumen per watt. The lamps maintenance and utilization factors are 0.63 and 0.69 respectively. Determine the:

        (I)   total wattage of each lamp;
        (II)   lumen output per lamp;
        (III) number of lamps required.

                                                                                     (8 marks)

SECTION B: ELECTRICAL ENGINEERING PRINCIPLES

*Answer **TWO** questions from this section.*

6.   (a)   Table 2 shows electrical quantities and their units. Complete the table.   (4 marks)

Table 2

Quantity	Unit
-	Henry
Energy	-
-	Siemens
Charge	-

(b)   Figure 2 shows a d.c RLC circuit. Determine the:

(i)   current across the inductor;
(ii)   voltage across the capacitor;
(iii)   energy stored in the capacitor;
(iv)   energy stored in the inductor.

(8 marks)
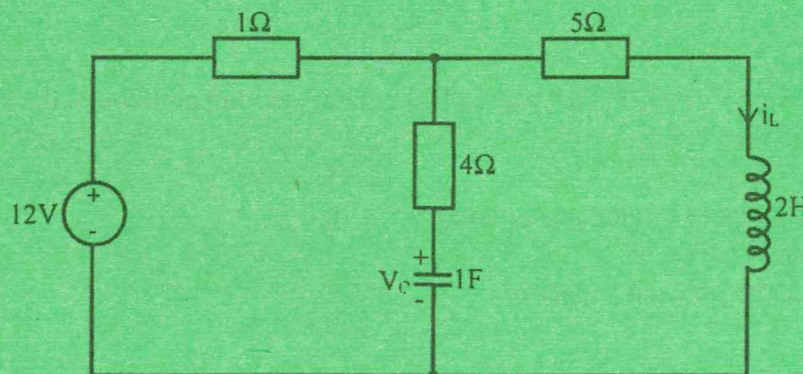

Fig. 2

(c) Figure 3 shows a resistive network. Using Kirchhoff's law, determine currents i_1, i_2 and i_3. (8 marks)
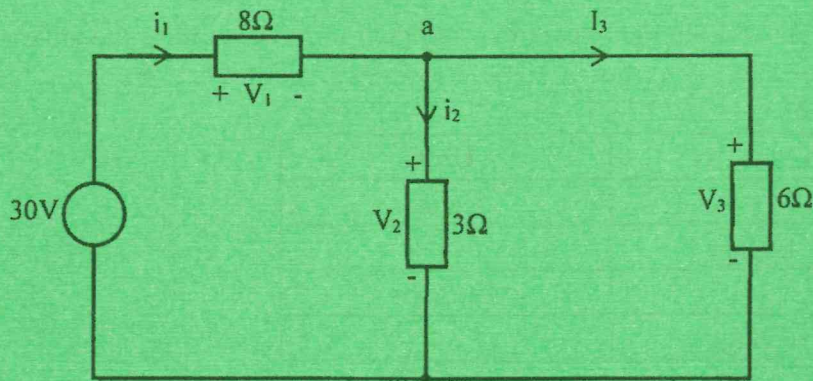

Fig. 3

7. (a) Define each of the following with respect to capacitors:

(i) dielectric;

(ii) permittivity.

(2 marks)

(b) Capacitors of $1\,\mu F$, $3\mu F$, $5\mu F$ and $6\mu F$ are connected in parallel to a d.c supply of 100 V. Determine the:

(i) equivalent circuit capacitance;
(ii) total charge;
(iii) charge on each capacitor.

(8 marks)

(c) (i) State Lenz's law.

(ii) Figure 4 shows a current carrying conductor. Draw its magnetic field pattern.
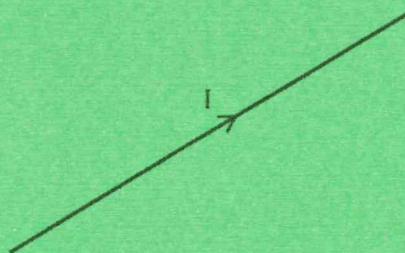
(4 marks)

Fig. 4

(d)   A flux of 25 mWb links with a 1500 turn coil when a current of 3 A passes through the coil Determine the:

(i)   inductance of the coil;
(ii)   energy stored in the coil;
(iii)   e.m.f induced if the current falls to zero in 150 mS.

(6 marks)

8.   (a)   Define each of the following with respect to alternating current:

(i)   period;
(ii)   instantaneous value.

(2 marks)

(b)   The current in an a.c circuit at any time t-seconds is given by the expression:
$$i = 120 \sin(100\pi t + 0.36) \text{A}$$

Determine the:

(i)   peak value;
(ii)   periodic time;
(iii)   frequency;
(iv)   value of the current when t = 0.

(8 marks)

(c)   State **three** applications of transformers in a.c circuits.   (3 marks)

(d)   A 100 kVA, 400 V/200 V, 50 Hz single-phase transformer has 100 secondary turns. Determine the:

(i)   primary current;
(ii)   secondary current.
(iii)   number of primary turns;
(iv)   maximum value of flux.

(7 marks)

THIS IS THE LAST PRINTED PAGE.