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AIRCRAFT ELECTRICAL TECHNOLOGY

Oct./Nov. 2016

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;*

*Non programmable scientific calculator.*

*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.*

*ALL questions carry equal marks.*

*Maximum marks for each part of a question are as indicated.*

*Candidates should answer the questions in English.*

**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 any **THREE** questions in this section.

1. (a) (i) Describe how landscaping and building designs can attract birds in airports.  
(ii) State **one** way of mitigating against the menace in a(i). (6 marks)
- (b) (i) State **four** responsibilities of a First aid personnel.  
(ii) List **three** items found in a First aid kit. (7 marks)
- (c) State **two** uses of each of the following tools in electrical installation works:  
(i) pliers;  
(ii) pocket knife. (4 marks)
- (d) State **three** primary sources of electric power in an aircraft. (3 marks)
2. (a) Sketch the following with respect to cabling:  
(i) T - joint;  
(ii) bolt and nut termination. (4 marks)
- (b) State **one** merit and **one** demerit of each of the following aircraft cable systems:  
(i) armoured cable;  
(ii) PVC cable. (4 marks)
- (c) Figure 1 shows a circuit diagram of an aircraft power supply system. Identify the following sub-systems and state their functions:  
(i) W;  
(ii) X;  
(iii) Y;  
(iv) Z. (12 marks)

disconnect  
decrease mechanical

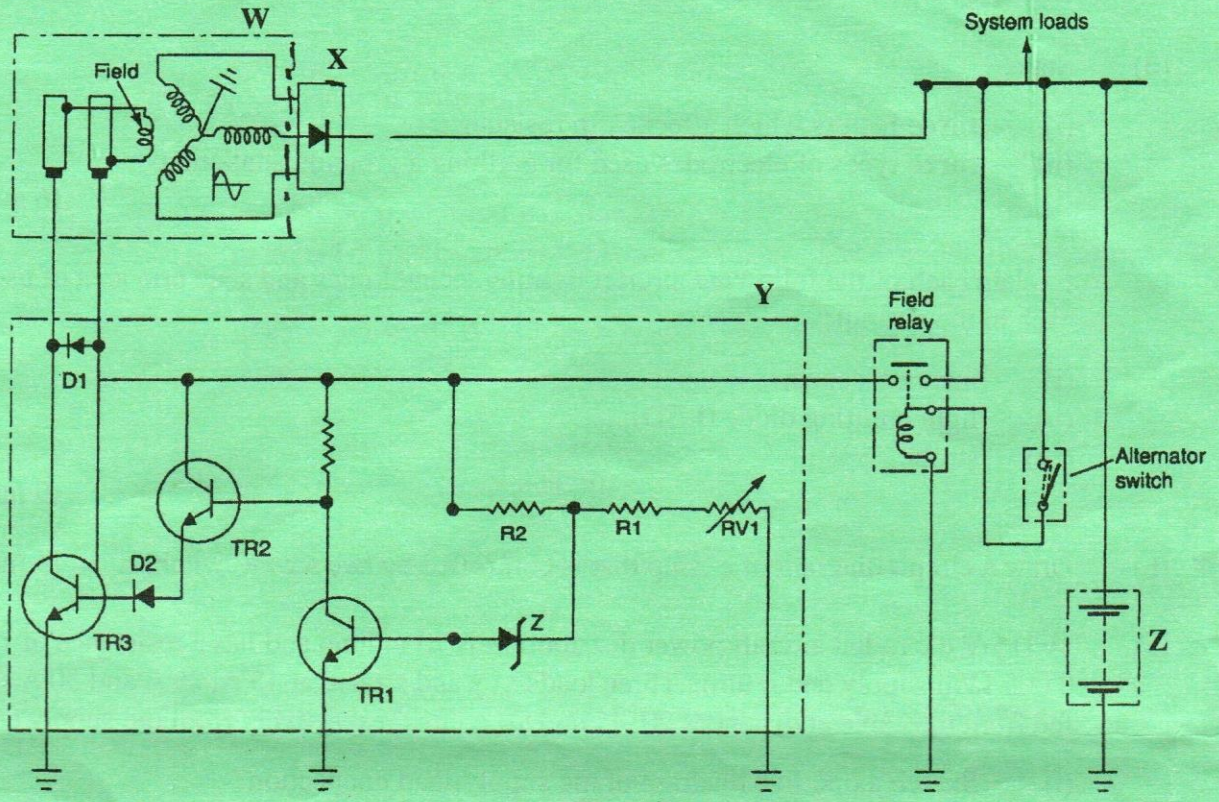


Fig. 1

3. (a) Figure 2 shows a diagram of an aircraft thermal-type circuit breaker. Describe its operation. (5 marks)

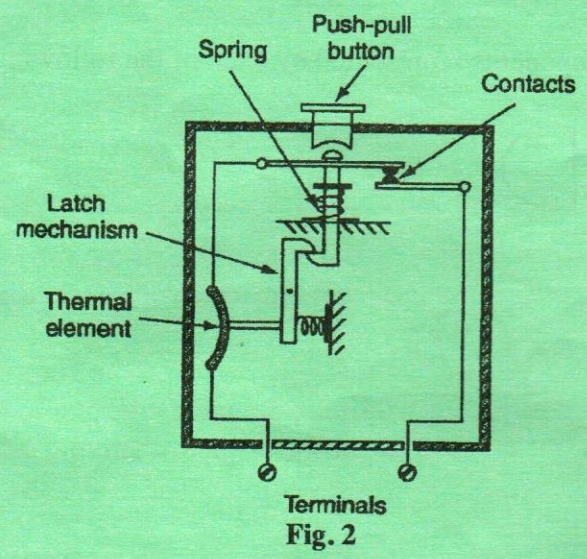


Fig. 2

(b) Draw symbols for each of the following:  
 (i) automatic reset circuit breaker;  
 (ii) fuse;  
 (iii) socket outlet;  
 (iv) consumer control unit (CCU).

(4 marks)

- (c) List **five** parts of an aircraft that need earthing. (5 marks)
- (d) State:
- (i) **three** factors which affect earth resistance;
  - (ii) **three** types of electrodes used for earthing a ground installation.
- (6 marks)

4. (a) Explain each of the following aircraft lighting technologies and state **one** area of use for each in the aircraft:
- (i) incandescence;
  - (ii) light emitting diode (LED);
  - (iii) strobe.
- (9 marks)

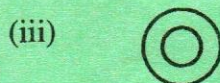
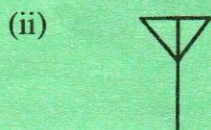
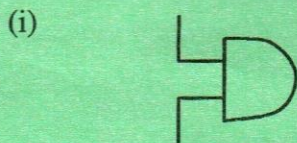
- (b) Draw a circuit diagram of a lamp that is controlled by two - way switches. (4 marks)

- (c) A 115 V d.c radial aircraft power distribution is 70 m long and has a resistance of  $0.005 \Omega/\text{m}$  supply and return. Three loads x, y and z rated at 15 A, 25 A and 50 A are fed from the cable at distances 20, 45 and 70 metres respectively from the supply end.

- (i) Sketch a one-line diagram of the supply-load connection.
- (ii) For all the loads connected, determine the:
  - (I) total current drawn from the supply;
  - (II) voltage at the load z.

(7 marks)

5. (a) Identify the components represented by each of the following symbols for a call system:



(3 marks)

- (b) Draw a circuit diagram for a bell call system in which a pilot can call either his co-pilot or any of his two engineers sitting at different places, by pressing a common push button after adjusting a selector switch installed close to the push button. The bell in each of the called officers should ring only for the period for which the push button remains pressed. (4 marks)

- (c) Define each of the following with respect to illumination:
- (i) luminance;
  - (ii) coefficient of utilization.
- (2 marks)
- (d) (i) A workshop whose dimension is 60 m x 15 m is to be illuminated by lamps mounted 5 metres above the working plane. The average illumination required is 100 lux while the coefficient of utilization is 0.4 and luminous efficiency is 16 lumens per watt. Assuming a space - height ratio of unity and a candle depreciation of 20%, determine the:
- (I) number of lamps required;
  - (II) wattage of each lamp.
- (ii) Sketch the layout of the lamps in d(i).
- (11 marks)

### SECTION B: ELECTRICAL ENGINEERING PRINCIPLES

*Answer any TWO questions from this section.*

6. (a) Define each of the following with respect to electrical quantities:
- (i) potential difference;  $V = IR$
  - (ii) resistance.
- (2 marks)
- (b) (i) Outline the general maintenance procedures of a lead-acid cell battery.
- (6 marks)
- (ii) A cell having an emf of 2 V and an internal resistance of 0.2  $\Omega$  is connected across a 0.8  $\Omega$  load resistor. Determine the current that will flow in the circuit.
- (4 marks)
- (c) With the aid of a labelled diagram, describe the construction and operation of the repulsion type moving iron instrument.
- (8 marks)

7. (a) (i) State Kirchoff's current law. *sum of I arriving at point = sum of I leaving*

(ii) Figure 3 shows a circuit diagram of a resistor network. Determine each of the following currents:

(I)  $I_1$ ;  *$V=IR$*

(II)  $I_3$ .

(7 marks)

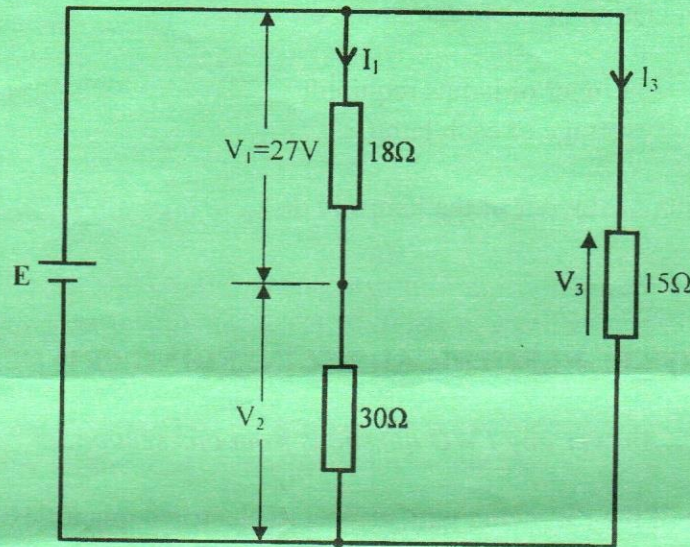


Fig. 3

(b) (i) State Lenz's law of electromagnetism.

(ii) A conductor 8 cm long and carrying a current of 40 A lies perpendicular to a magnetic field of strength 800 AT/m. Determine the:

(I) force acting on the conductor;

(II) mechanical power to move the conductor against this force with a speed of 2 m/s;

(III) emf induced in the conductor.

(7 marks)

(c) (i) Differentiate between relative and absolute permittivity.

(2 marks)

(ii) A positive charge of  $450 \mu\text{C}$  is placed in air. Determine the electric field intensity at a distance of 4 metres from the charge.

(4 marks)

*$9 \times 10^{+9}$*

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

2

- (i) frequency; # of cycles per sec
- (ii) root mean square (rms); sq root of the mean of the squared value of the quantity taken over an interval
- (iii) form factor.

(3 marks)

(b) Figure 4 shows a sinusoidal ac waveform. Determine the:

- (i) peak current;
- (ii) average current;
- (iii) period;
- (iv) frequency. # of cycles per sec

(6 marks)

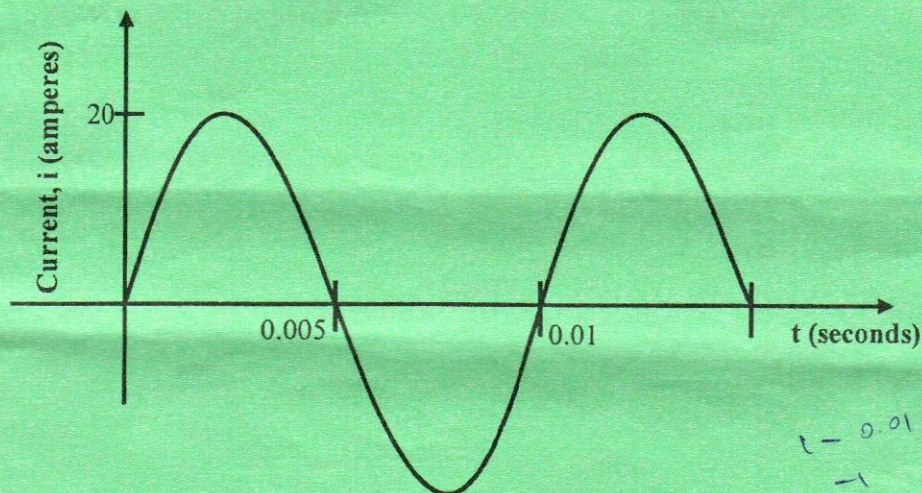


Fig. 4

(c) A single-phase series circuit consists of a  $10\text{-}\Omega$  resistance and  $0.1\text{ H}$  inductance. A voltage of  $220\text{ V}$ ,  $50\text{ Hz}$  is applied across the circuit. Determine the voltage drop across the resistance. (6 marks)

(d) A  $250\text{ kVA}$ ,  $11000/400\text{ V}$ ,  $50\text{ Hz}$  single-phase transformer has  $80$  turns on the secondary. Determine the:

- (i) full-load primary current;
- (ii) number of primary turns.

(5 marks)

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