INSTRUCTION TO CANDIDATES

1. This paper consists of

2. You should have the following for this examination:

   Answer booklet;

   Mathematical tables/ Electronic calculator.

3. Answer THREE questions in SECTION A any TWO questions in SECTION B
SECTION A: AIRCRAFT ELECTRICAL INSTALLATION TECHNOLOGY
Answer any THREE questions from this section.

1. (a) List two types of secondary batteries commonly used in aircrafts and associated support equipment; differentiate the types named. (4 marks)
(b) State three functions of the aircraft battery (3 marks)
(c) Describe four electrical circuit protection devices used in electrical and electronic systems (4 marks)
(d) Briefly describe two functions of an aircraft generator control unit. (2 marks)
(e) Define the term busbar. (2 marks)
(f) Define the term earthing as used in electrical systems and state its advantages in circuits (4 marks)

2. (a) Define the term battery. (2 marks)
(b) With the aid of sketches, differentiate between open and short circuits as applied in electrical wiring circuits. (4 marks)
(c) Differentiate between busbar and bus ties as the components used in an aircraft power distribution systems. (6 marks)
(d) With the aid of a block diagram, explain the functioning of a typical aircraft’s power distribution system using single engine generator as the source of power. (6 marks)
(e) Differentiate between the following lighting technologies used in illumination.
   (i) Incandescence and (2 marks)
   (ii) Electro-luminescence

3. (a) State any four factors considered when selecting the cable size of a given electrical power installation. (8 marks)
(b) With the aid of labeled diagrams, describe each of the following in electrical installation circuits:
   (i) Radial (6 marks)
   (ii) Ring
(c) Describe each of the following electrical diagrams
   (i) Block diagrams (6 marks)
   (ii) Pictorial diagrams
   (iii) Schematic diagrams

4. (a) (i) Explain each of the following types of aviation hazards:
   (I) Bird strike (6 marks)
   (II) Ageing aircraft
   (ii) State two action taken to prevent each of the hazards named above. (12 marks)
(b) Explain the functions of each of the following aircraft flight instruments:
   (i) Altimeter (4 marks)
   (ii) Vertical speed indicator
(c) Differentiate between screening and armouring as used in electrical cable citing the importance of each. (4 marks)
5. (a) State three steps taken when dealing with safety in relation to hazardous substances in an aircraft environment. (3 marks)

(b) (i) Define a hazardous substance
(ii) State any two “hazardous substances” in an aircraft environment with their associated harm to people. (5 marks)

(c) (i) Compare reducing aircraft noise at the source and wearing hearing protectors
(ii) State any four measures employed in an aircraft to reduce noise levels of loud machines and equipment. (8 marks)

(d) List two risks associated with working in a designated aircraft confined space and two corresponding safety measures to be taken (4 marks)

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

6. (a) State the following laws:
   (i) Ohm’s law
   (ii) Kirchhoff’s voltage law
   (iii) Superposition theorem (6 marks)

(b) Capacitances of 3µF, 6µF and 12µF are connected in series across a 350V supply. Calculate
   (i) The equivalent circuit capacitance.
   (ii) The charge on each capacitor
   (iii) The pd across each capacitor (9 marks)

(c) Explain polarization and local action in a dry cell and state how it is minimized. (5 marks)

7. (a) Define the following terms
   (i) Effective value;
   (ii) Period;
   (iii) Amplitude. (3 marks)

(b) The current in an ac circuit at any time t seconds is given by
   \( I = 120 \sin(100\pi t + 0.36) \) amperes. Find;
   (i) The peak value and phase angle;
   (ii) The value of the current when \( t = 0 \)
   (iii) The value of the current when \( t = 8 \)
   (iv) The time when current first reaches 60A (8 marks)

(c) A coil of 300 turns is wound uniformly on ring of non-magnetic material. The ring has a mean circumference of 40 cm and a uniform cross sectional area of 4cm². If the current in the coil is 5A; calculate,
   (i) The magnetic field strength,
   (ii) The flux density
   (iii) The total magnetic in the ring (6 marks)
(b) With the aid of labeled diagram, explain the operation of a moving coil instrument (3 marks)

8. (a) State any three advantages of thermocouples. (3 marks)
(b) An electric heater consumes 3.6MJ when consumed to a 250V supply for 40 minutes. Find the power rating of the heater and the current taken from the supply. (5 marks)
(c) (i) Calculate the resistance of a 2 km length of aluminum overheated power cable if the cross-sectional area of the cable is 100 mm$^2$. Take the resistivity of aluminum to be $0.3 \times 10^{-6} \Omega m$. (5 marks)
(ii) Ten 1.5V cells each having an internal resistance of 0.2 $\Omega$ are connected in series to a load of 58$\Omega$. Determine
  (I) The current flowing in the circuit
  (II) The pd at the battery terminals
  (III) A coil of copper wire has a resistance of 100 $\Omega$ when its temperature is 0$^o$C. Determine its resistance at 70$^o$C if the temperature coefficient of resistance of copper at 0$^o$C is 0.0043 $\Omega$ (7 marks)