Electrical Technician (Power Option) Level 6
ENG/OS/PO/CC/03/6
Apply Electrical Principles
3 Hours
March/April 2023

THE KENYA NATIONAL EXAMINATIONS COUNCIL

WRITTEN ASSESSMENT

3 HOURS

INSTRUCTIONS TO CANDIDATE

*This paper consists of **TWO** sections **A** and **B**.*

*Answer **ALL** questions in section **A** and any **THREE** in section **B** in the answer booklet provided.*

You are required to have a non-programmable calculator.

Marks for each question are indicated in brackets.

*Answer the questions in **English**.*

This paper consists of four (4) printed pages

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

SECTION A: (40 MARKS)

*Answer **all** questions in this section*

1. State the SI units of: [2 Marks]
   a) Charge;
   b) Force.
2. List **two** types of electrical indicating instruments. [2 Marks]

3. A current of 10A flows through a heating element of an electric kettle for two minutes, find the quantity of electricity consumed. [2 Marks]

4. State Kirchhoff's laws. [2Marks]
5. Determine the power dissipated by the coil of a d.c motor of resistance 15 Ω when a current of 1 A passes through it. [2 Marks]

6. A current of 1.2 A flows for 12 hours through a 1 KΩ resistor. Calculate the energy consumed by the resistor. [3 Marks]
7. State **four** types of solar panels. [4 Marks]
8. Figure 1 shows the connection of an Anderson bridge for measuring the inductance L and resistance R of the coil. Find R and L, if balance is obtained when, $R_4 = R_2 = 1$ kΩ, $R_3 = 500Ω$, r = 100Ω and C = 0.5 μF. [4Marks]
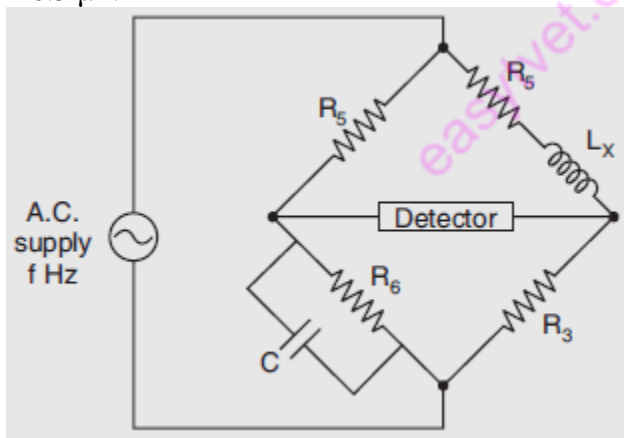

   Figure 1.
9. Two brass plates are arranged horizontally, one 2 cm above the other and the lower plate is earthed. The plates are charged to a difference of potential of 6,000 volts. A drop of oil with an electric charge of 1.6×10^{-19} C is in equilibrium between the plates so that it neither rises nor falls. Determine the mass of the drop. [4Marks]
10. With the aid of a diagram, differentiate between star and delta transformer connections. [2 Marks]
11. With reference to delta-connected system, state the relationships between the following:
    i. line and phase currents;
    ii. line and phase voltages. . [2 Marks]
12. List the **three** wattmeter methods used for the measurements of power in a three-phase system. [3 Marks]
13. List **two** factors to consider while selecting an electrical protective device. [2 Marks]

14. State **two** reasons for balancing single-phase loads across a three-phase supply.   [2 Marks]
15. Define the following terms with reference to earthing in an electrical installation:
     i.   Current rating of a fuse;
     ii.   Rated minimum fusing current.   [4 Marks]

SECTION B: (60 MARKS)

*Answer **three** questions from this section.*

16. (a) (i)Explain **three** methods of correcting of low power factor.   [6 marks]

       (ii)State **two** advantages of each of the methods mentioned in a(i)   [6marks]

    (b) A 240 V supply feeds three 2 kW loads with power factors of 1, 0.7 and 0.3. Calculate the

       current at each power factor.   [8 marks]

17. (a) List **three** importance for earthing.   [3marks]

    (b) Identify **three** methods that can be used to achieve earthing of an installation.   [6 marks]
    (c) Outline **three** earthing tests that should be carried out in a completed electrical installation.

                                                                              [4 marks]

    (d) Explain the operation of a current transformer.   [3 marks]

    (e) List **four** parts of lightning protection system.   [4Marks]

18. (a) An impedance $Z_1 = (8 − j5)$ Ω is in parallel with an impedance $Z_2 = (3 + j7)$ Ω. If 100 V

        are impressed on the parallel combination, find the branch currents I_1, I_2 and the resultant

        current.

    (i)Draw the corresponding phasor diagram showing each current and the voltage

       drop across each parameter.

    (ii) Calculate also the equivalent resistance, reactance and

       impedance of the whole circuit.   [10 marks]

     (b) Point charges in air are located as follows: $+ 5 × 10^{−8}$ C at (0, 0) meters, $+ 4 × 10^{−8}$ C at (3,

        0) meters and $− 6 × 10^{−8}$ C at (0, 4) meters. Determine electric field intensity at (3, 4)

        meters.

                                                                              [5Marks]

19. (a) 250 kg of ice at $– 20^{o}$C is placed in a bunker to cool some vegetables. 12 hours later the ice

        has melted into water at 5^{0}C. Determine the average rate of cooling in kJ/hr and Ton of

        refrigeration (TR) provided by the ice.   [10 marks]

(b) A refrigeration system produces 20 kg/hr of ice at 0°C from water at 12.5°C. Find the refrigeration effect per hour and TR. If it consumes 2 kW of energy to produce the ice, find the Coefficient of performance (COP). Take latent heat of solidification of water at 0°C as 335 kJ/kg and specific heat of water 4.19 kJ/kg °C. [10 marks]

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