DEPARTMENT OF EDUCATION
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
ELECTRICAL TRADE THEORY N1
TIME: 3 HOURS
MARKS: 100

Answer ALL the questions.

INSTRUCTIONS

1. Questions relating to the wiring of premises must be in accordance with the SABS Code of Practice.
2. Candidates will be penalised for untidy and illegible work.
3. Read the questions carefully and answer only what has been asked.
4. Questions may be answered in any order, but subsections of questions must NOT be separated.
5. Rule off across the paper on completion of each answer.

1 mark = 1%

A formula sheet is attached to the question paper.

QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question number.

1.1 Good housekeeping means an increase in production and better working conditions.
1.2 The toolrest of a grinding wheel must not be more than 3 mm from the wheel.
1.3 Energy is the amount of work done in a specific time.
1.4 The formula used to calculate electrical current is \( V = I + R \).
1.5 Keepers are used on the poles of a magnet when it is stored for long periods of time.

1.6 Pulsating direct current can be increased or decreased with the aid of transformers.

1.7 The magnetic field around a conductor can be indicated with pieces of paper.

1.8 Secondary cells have a long life span.

1.9 The segments of a commutator are spaced with mica.

1.10 RMS value is maximum value \( \times 0.637 \).

1.11 A coil attracts the moving iron in an attraction type instrument.

1.12 The value of a resistor is accurate when a voltmeter and an ammeter are used to determine the resistance value.

1.13 Potential transformers are used when measuring high voltages.

1.14 Current transformers are used when measuring high currents.

1.15 An earth continuity conductor is used to receive radio signals.

1.16 A circuit breaker is used to disconnect the current in normal circumstances.

1.17 The sensitivity of an earth leakage relay should not be higher than 30 mA.

1.18 A calibrated earth leakage tester can be used to determine the sensitivity of an earth leakage relay.

1.19 The symbol for a Zener diode is a cross.

1.20 The value of the red band on a resistor is two. [20]

QUESTION 2

2.1 What is meant by the term good housekeeping? (3)

2.2 Why is good housekeeping important and desirable? (4)

2.3 List FIVE of the main causes of fire. (5) [12]
QUESTION 3

3.1 Define Joule’s law with respect to electricity in terms of the quantities involved and also give the symbols used for these quantities. (6)

3.2 Three resistors with values of 6 ohms, 4 ohms and 2 ohms respectively are connected in series across a 24-volt supply.

Draw a neat, fully labelled diagram of the circuit and calculate the following: (5)

3.2.1 The total resistance of the circuit (2)
3.2.2 The total current flowing through the circuit (2)
3.2.3 The voltage drop across each resistor (6)
3.2.4 The energy consumed by the circuit in 3 hours [25]

QUESTION 4

4.1 Describe how the direction of flux around a conductor, relative to the current, can be determined by means of the right-hand rule. (6)

4.2 A single-phase transformer has a supply voltage of 220 V and a primary current of 10 A. The number of windings on the primary coil is 250 turns and on the secondary it is 50 turns.

Calculate the following:

4.2.1 The turns ratio (2)
4.2.2 The secondary voltage (3)
4.2.3 The secondary current (3)

QUESTION 5

5.1 What are the FOUR major components of a measuring instrument? (4)

5.2 Name TWO methods that can be used to extend the range of a moving coil instrument. (2)

5.3 Define Faraday’s first law of electromagnetic induction. (4)

[10]
QUESTION 6

6.1 Name TWO conductors generally used in practice. (2)

6.2 State THREE properties of a good insulating material. (3)

6.3 Can carbon be used to wire domestic installations? (2)

6.4 What is the purpose of the bending spring? (2)

QUESTION 7

7.1 When must a certificate of compliance be obtained for an installation? (2)

7.2 Which instrument should be used to test the insulation resistance between conductors and what must be the reading? (2)

7.3 Three capacitors of 6 μF, 8 μF and 12 μF are connected in parallel. Determine the total capacitance of this circuit. (2)

7.4 Write the resistance value and tolerance for a resistor with the following colour bands:

yellow; violet; yellow; gold (4)

TOTAL: 100
ELECTRICAL TRADE THEORY N1

FORMULA SHEET

RESISTORS

\[ R = \frac{V}{I} \]

\[ R_T = R_1 + R_2 + R_3 + \ldots \]

\[ \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots \]

POWER

\[ P = V \times I \]

\[ P = I^2 \times R \]

\[ P = \frac{V^2}{R} \]

ENERGY

\[ W = P \times t \]

\[ W = VI \times t \]

\[ W = I^2 R \times t \]

\[ W = \frac{V^2}{R} \times t \]

CAPACITORS

\[ C_T = C_1 + C_2 + C_3 + \ldots \]

\[ \frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots \]

FREQUENCY

\[ f = np \]

\[ f = \frac{1}{T} \]
ELECTRICAL TRADE THEORY N1

FORMULA SHEET

\[ I = \frac{V}{R} \]

\[ I = \frac{E}{R + r} \]

\[ P = V \times I \]

\[ R_t = R_1 + R_2 + \ldots + R_n \]

\[ \frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_n} \]

\[ C_t = C_1 + C_2 + \ldots + C_n \]

\[ \frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots + \frac{1}{C_n} \]

\[ Q = C \times V \]

\[ L_t = L_1 + L_2 + \ldots + L_n \]

\[ \frac{1}{L_t} = \frac{1}{L_1} + \frac{1}{L_2} + \ldots + \frac{1}{L_n} \]

\[ \frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_p} \]

\[ R_t = R_o (1 + \alpha t) \]

\[ R = \frac{\rho l}{A} \]