T780(E)(M28)T
APRIL 2012

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

28 March (X-Paper)
09:00 – 12:00

This question paper consists of 6 pages and a formula sheet.
DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
INDUSTRIAL ELECTRONICS N1
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Write neatly and legibly.
QUESTION 1

1.1 State THREE advantages of primary cells. (3)

1.2 State TWO advantages of secondary cells. (2)

1.3 A battery consisting of four cells is connected to a resistor with a value of 8.6 Ω. Each cell has an EMF of 3 V and an internal resistance of 0.25 Ω. Calculate the following:

1.3.1 The total EMF of the battery (3)

1.3.2 The internal resistance of the battery (3)

1.3.3 The total circuit current (4)

1.4 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.4.1 – 1.4.10) in the ANSWER BOOK.

1.4.1 Similar poles attract each other. (1)

1.4.2 An EMF is always measured when the circuit is live. (1)

1.4.3 The functioning of a transformer depends on self-induction. (1)

1.4.4 A peak to peak value equals two amplitudes. (1)

1.4.5 According to Ohm's Law, the current is proportional to the voltage in a circuit. (1)

1.4.6 Temperature has no effect on the resistance of a conductor. (1)

1.4.7 A diode has got three conductor elements. (1)

1.4.8 Inductors can also be used as resistance. (1)

1.4.9 Electrons flow from the negative terminal of a cell to the positive terminal of a cell in a circuit. (1)

1.4.10 The magnetic lines of force move from north to south around a magnet. (1) [25]
QUESTION 2

2.1 Consider \( \text{FIGURE 1} \) above, and briefly explain what will happen when:

(a) The bar magnet is moved into the copper wire
(b) The bar magnet is moved out of the copper wire

2.1.2 From the results above, what is your conclusion?

2.2 Two resistors connected in series have the following values:
R1 = 560 ohms; 0.5 W ±5%
R2 = 3.9 kilo-ohms; 1W ±10%

2.2.1 What is the circuit resistance?
2.2.2 What is the maximum current that can pass through resistor R2?
2.2.3 What is the maximum voltage that can be applied across resistor R2?
2.2.4 Give the colour code for the 3.9 kΩ resistor.

2.3 State THREE factors that influence the capacitance of a capacitor.

2.4 State THREE uses of resistor devices.
QUESTION 3

3.1 A circuit consists of three capacitors of 1 μF, 2 μF and 6 μF respectively.

Calculate the following:

3.1.1 The charge across C3 when the voltage drop is 22 V (3)

3.1.2 The total capacitance if the THREE capacitors are connected in series (4)

3.2 Sketch the following wave forms and show both the positive and negative peak-values:

3.2.1 The sine wave (1)

3.2.2 The square wave (1)

3.2.3 The saw tooth wave (1)

3.3 State the laws that are involved in electromagnetic induction. (3)

3.4 Study the data below and calculate the resistance of the conductor.

Data:

The resistivity of the conductor is 0,058 micro-ohm metre
The area of the conductor is 0,2 mm²
The length of the conductor is 10 m (3)

3.5 State TWO faults that could occur on transformers. (2)

3.6 Sketch the EMF symbols of the following components:

3.6.1 An inductor (1)

3.6.2 An iron core transformer (1)

3.6.3 A variable resistor (1)

3.6.4 A capacitor (1)

3.6.5 A diode (1)

3.6.6 A preset resistor (1)

3.6.7 A PNP transistor (1)
QUESTION 4

4.1 State FOUR advantages of digital multimeters. (4)

4.2 State TWO uses of transistors. (2)

4.3 Define the following terms:
   4.3.1 Valance electrons (2)
   4.3.2 Doping (3)

4.4 Explain how a junction barrier is formed. (2)

4.5 Describe an N-type semi-conductor material. (2)

4.6 Sketch a full wave rectifier circuit, using two diodes, a centre-tap transformer and a load resistor. Show the polarity at the load terminals. (5)

4.7 Show the input and output wave forms of the circuit indicated above in QUESTION 4.6. (2)

4.8 Name THREE terminals of a transistor. (3)

TOTAL: 100
INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

\[ P = V \times I \]

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

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

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

\[ Q = C \times V \]

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

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

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

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

\[ R = \frac{p \ell}{A} \]