T780(E)(N22)T
NOVEMBER 2012

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

22 November (X-Paper)
09:00 – 12:00

This question paper consists of 7 pages and a 1-page 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 Make a sketch of a sine wave and show the following:

1.1.1 A peak value
1.1.2 A peak-to-peak value
1.1.3 An amplitude
1.1.4 A cycle

1.2 Read the following sentence and state the law represented by the sentence.

The EMF induced in an electric circuit always reacts in such a direction that the current it drives opposes the change in magnetic flux which produced the EMF.

1.3 State Fleming's right hand rule.

1.4 State THREE characteristics of the lines of force.

1.5 State the law for magnetism.

1.6 State FOUR disadvantages of a lead-acid cell.

1.7 Name THREE main components of an electric cell.

1.8 A battery with a total internal resistance of 3 Ω is connected to a load resistor of 47 Ω. The current flow through the circuit is 0.2 A.

Calculate the EMF of the battery.
QUESTION 2

2.1 Refer to FIGURE 1 below and calculate the following:

2.1.1 The resistance across the parallel section

2.1.2 The voltage across resistor R4

2.1.3 The total resistance of the circuit

2.1.4 The power by the resistors in the parallel section

2.2 Briefly describe how each ONE of the following factors influence the resistance of a conductive material:

2.2.1 The higher temperature of the conductive material

2.2.2 The bigger cross-sectional area of the conductive material

2.2.3 The increased length of the conductive material

2.3 A copper conductor is 65 m long and has a cross-sectional area of 6 mm². The resistivity of copper is $1.728 \times 10^{-6}$ Ω m.

Determine the resistance of the conductor.

2.4 Sketch the IEC symbols of the following components:

2.4.1 An NPN transistor

2.4.2 A pre-set inductor

2.4.3 A rheostat
QUESTION 3

3.1 What is the value for the resistor's colour codes: GREEN; BLUE; RED and SILVER? (4)

3.2 Make a neat, labelled sketch to show a charging curve for a capacitor. (3)

3.3 A conductor has a resistance of 78 ohms at 0 °C. The temperature coefficient of resistance of the conductor is 0.004 ohms per °C. Calculate the resistance of the conductor at 60 °C. (3)

3.4 Make a neat, labelled sketch to illustrate how a voltmeter is connected to a load resistor. (2)

3.5 Explain what is meant by frequency of a waveform. (2)

3.6 Three capacitors with values 1.8 µF, 4.7 µF and 5.6 µF are connected in parallel.

Calculate the following:

3.6.1 The total capacitance of the circuit diagram (3)

3.6.2 The charge across the circuit with an applied voltage of 24 V (3)

3.7 Complete the following sentences by filling in the missing word(s). Write only the word(s) next to the question number (3.7.1 – 3.7.5) in the ANSWER BOOK.

3.7.1 Transformers make use of the principle of ...

3.7.2 The ... coil is connected to an electrical energy source.

3.7.3 An ideal transformer is the one with ...

3.7.4 When the magnetic field changes, the energy from the primary coil is transferred to the secondary coil and the energy appears as a/an ...

3.7.5 An alternating current produces a/an ... in the core of the transformer.
QUESTION 4

4.1 Choose the correct word(s) from those given in brackets. Write only the word(s) next to the question number (4.1.1 – 4.1.9) in the ANSWER BOOK.

4.1.1 The ability of a conductor to conduct electricity is determined by the number of (protons/electrons) in the valence shell. (1)

4.1.2 The process of generating holes is called (donor/acceptor) doping. (1)

4.1.3 Semiconductor material formed when two silicon atoms covalently bond is referred to as (intrinsic/extrinsic). (1)

4.1.4 The potential barrier for silicon diode is (0.2 V / 0.6 V). (1)

4.1.5 Forward bias occurs when the external voltage source is connected in such a way that its positive terminal is connected to the (P-type/N-type) material. (1)

4.1.6 A diode has a (low resistance/high resistance) when forward biased. (1)

4.1.7 In a diode, electrons always flow (against/with) the direction of arrow and the conventional current flows (against/with) it. (2)

4.1.8 In a transistor, the (emitter/base) provides the junctions for proper interaction. (1)

4.1.9 A transistor has got (TWO/THREE) junctions. (1)

4.2 Describe self-induction. (4)

4.3 State the conditions under which an NPN transistor will conduct. (3)

4.4 State THREE advantages of using a transistor as a switch. (3)

4.5 What is meant by an amplifier device or circuit? (2)
4.6 Refer to the diagram below and answer the question that follows:

![DIAGRAM OF A CIRCUIT WITH TRANSFORMERS AND DIODES]

**FIGURE 2**

What will happen when B is positive with respect to A?

(3) [25]

TOTAL: 100
INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

\[ P = V \times I \]

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

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

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

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

\[ Q = C \times V \]

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

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

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

\[ R_i = R_o (1 + \alpha_f) \]

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