higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T670(**E**)(A4)T

APRIL EXAMINATION

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

4 April 2014 (Y-Paper)
13:00–16:00

This question paper consists of 6 pages and 1 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 according to the numbering system used in this question paper.
4. Write neatly and legibly.

QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

1.1.1 A conductor has an abundance of free electrons.

1.1.2 Lead-acid cells can be used repeatedly.

1.1.3 A capacitor tends to block direct current.

1.1.4 The cross-sectional area of a conductor does not influence the resistance of a conductor.

1.1.5 A diode will conduct only when it is reverse biased.

1.1.6 An ammeter is always connected in parallel in a circuit.

1.1.7 The type of material used in the core of a magnet will determine the strength of the electromagnet.

1.1.8 Faraday's law states that when a conductor moves through a magnetic field, voltage/current is induced in the conductor.

1.1.9 A transistor can be used as an amplifier.

1.1.10 Primary cells are more expensive than secondary cells.

(10 x 1) (10)

1.2 Complete the following sentences by filling in the missing word(s). Write only the word(s) next to the question number (1.2.1–1.2.10) in the ANSWER BOOK.

1.2.1 An advantage of a ... multimeter is that it switches off automatically.

1.2.2 The bonds between adjacent atoms in a crystal structure are known as ... bonds.

1.2.3 ... is the voltage measured across the terminals of a cell without being connected to a circuit.

1.2.4 ... are used to step down or step up voltage or current.

1.2.5 The ... of a capacitor is influenced by the distance between the plates of the capacitor.

1.2.6 The ... voltage of a silicon diode is 0,6 V.

1.2.7 ... electrons are the electrons in the outermost shell of an atom.

1.2.8 Capacitance is measured in ...

1.2.9 A transistor consist of ... elements.

1.2.10 When TWO capacitors are connected in ... their total value will decrease.

(10 x 1) (10)
[20]

QUESTION 2

2.1 A battery consists of THREE cells. Each cell has an EMF of 2 V and an internal resistance of 0,2 Ω. The load resistance RL, is 10 Ω.

Calculate the following:

2.1.1 The total EMF of the battery (2)

2.1.2 The internal resistance of the battery (2)

2.1.3 The total current through the circuit (4)

2.2 THREE resistors with values of 4 Ω, 2 Ω and 8 Ω respectively, are connected in parallel to a 10 volt DC(direct-current) power source.

Calculate the following:

2.2.1 The total resistance of the circuit (4)

2.2.2 The voltage drop across the 2-Ω resistor (1)

2.2.3 The power dissipated by R_1 (4)

2.3 Give the colour code for the 2-Ω resistor with 10% tolerance. The resistor has THREE colour bands. (3)
[20]

QUESTION 3

3.1 Calculate the cross-sectional area of a copper conductor that is 100 m long and measures a resistance of 50 ohms.
Take the resistivity of the conductor to be 0,017 $\mu\Omega m^{-1}$ (micro-ohm meter). (4)

3.2 Calculate the resistance of the conductor at 50 °C. The resistance of the conductor at 20 °C is 48 Ω. The temperature coefficient of resistance of the conductor is 0,0058 Ω per °C. (3)

3.3 THREE capacitors with values of 3 μF, 4 μF and 9 μF are connected in parallel.

Calculate the following:

3.3.1 The total capacitance of the circuit (3)

3.3.2 The charge across the circuit with an applied voltage of 20 V (3)

3.4 Name THREE factors that affect the inductance of an inductor. (3)

3.5 Explain the left-hand rule for magnetism. (4)
[20]

QUESTION 4

4.1 A transformer has a turns ratio of 3 : 1 and an output current of 0,8 A.

Calculate the following:

4.1.1 The input current of the transformer (4)

4.1.2 The output voltage if the input voltage is 230 V (4)

4.2 Draw a sine wave and show a peak-to-peak value. (2)

4.3 Give the SI units in which the following are measured:

4.3.1 Potential difference

4.3.2 Frequency

4.3.3 Electromotive force

4.3.4 Inductance

4.3.5 Capacity of the battery

(5 x 1) (5)

4.4 Sketch the IEC symbols for the following components:

4.4.1 A P-N-P transistor

4.4.2 A variable resistor

4.4.3 An inductor

4.4.4 A transformer

4.4.5 A capacitor

(5 x 1) (5)
[20]

QUESTION 5

5.1	State FOUR advantages of a digital meter.	(4)
5.2	What is the junction voltage of a germanium diode?	(1)
5.3	Give TWO faults that can occur in diodes.	(2)
5.4	Draw a fully labelled sketch of a half-wave rectifier circuit.	(5)
5.5	Show the input and output wave forms of the sketch in QUESTION 5.4 above.	(4)
5.6	Explain how a junction barrier of a diode is formed.	(4)
		[20]

TOTAL: 100

INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

$$I = \frac{V}{R}$$

$$I = \frac{E}{R + r}$$

$$P = V \times I$$

$$R_t = R_1 + R_2 + \ldots + R_n$$

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

$$C_t = C_1 + C_2 + \ldots + C_n$$

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

$$Q = C \times V$$

$$L_t = L_1 + L_2 + \ldots + L_n$$

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

$$\frac{V_p}{V_s} = \frac{N_p}{N_s} = \frac{I_s}{I_p}$$

$$R_t = R_o(1 + \alpha_o t)$$

$$R = \frac{\rho l}{A}$$