higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T730(E)(M28)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

28 March 2013 (X-Paper)
09:00–12:00

This question paper consists of 6 pages and 1 formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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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 Choose the correct word(s) from those given in brackets. Write only the word(s) next to the question number (1.1.–1.1.10) in the ANSWER BOOK.

1.1.1 An ability of a conductor to induce a voltage in itself when the current changes are known as (mutual induction/self-induction).

1.1.2 A simple chemical cell has got (TWO/FOUR) electrodes.

1.1.3 Germanium has got (FOUR/THREE) valence electrons.

1.1.4 An ammeter is connected in (series/parallel) in a circuit.

1.1.5 An N-type semi-conductor material has a (deficiency/excess) of electrons.

1.1.6 A horse-shoe magnet has (TWO/FOUR) poles.

1.1.7 A diode will pass current in (both/one) direction(s).

1.1.8 A process of gaining or losing electrons is known as (donating/ ionisation).

1.1.9 A good capacitor has a (low/high) resistance.

1.1.10 The number of electrons in an atom is always (more/equal) than/to the protons. (10×1) (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 Like poles ... each other.

1.2.2 Frequency is the number of ... which passes a given point in one second.

1.2.3 The magnetic lines of force flow from ... outside a bar magnet.

1.2.4 An instrument used to measure extremely small currents is a ...

1.2.5 Specific gravity is measured with a ...

1.2.6 The movement of electrons in one direction along a conductor is known as ...

1.2.7 A neutral atom that gains electrons, becomes a ... ion.

1.2.8 The junction voltage of a silicon diode is ...

1.2.9 A transistor is made out of ... elements.

1.2.10 A diode will conduct when it is ... biased.

(10 × 1) (10)
[20]

QUESTION 2

2.1 Sketch the IEC symbols for the following components:

2.1.1 A PNP transistor

2.1.2 A diode

2.1.3 A variable resistor

2.1.4 An electrolytic capacitor

2.1.5 An air-core transformer

(5 × 1) (5)

2.2 Name THREE types of wave forms. (3)

2.3 Give THREE advantages of lead-acid cells. (3)

2.4 Give THREE factors which affect the resistance of a material. (3)

2.5 Explain the difference between a *conductor* and an *insulator* in terms of atomic theory. (2)

2.6 Define the left-hand rule for magnetism. (3)

2.7 Explain what is meant by polarisation of cells. (1)
[20]

QUESTION 3

3.1 THREE resistors with values 1,2 Ω; 3,2 Ω; and 4,8 Ω respectively are connected in series across a 36 V supply.

Calculate the following:

3.1.1 The total resistance of the circuit (3)

3.1.2 The total current flow in the circuit (3)

3.1.3 The voltage drop across the 1,2 Ω resistor (3)

3.1.4 The power used by the 3,2 Ω resistor (3)

3.1.5 Give the colour code for the 4,8 Ω resistor with a tolerance of 5%. (4)

3.2 Calculate the secondary voltage of a transformer with an input voltage of 220 V and a turns ratio of 11 : 1. (4)
[20]

QUESTION 4

4.1 A copper conductor is 66 m long and has a diameter of 4 mm. The resistivity of copper is 0,017 micro-ohm metre.

Calculate:

4.1.1 The cross-sectional area of the conductor (4)

4.1.2 The resistance of the conductor (3)

4.2 Two capacitors with values of 6 μF and 8 μF are connected in parallel.

Calculate:

4.2.1 The total capacitance of the circuit. (3)

4.2.2 The charge across the circuit with an applied voltage of 12 volts. (3)

4.3 Calculate the resistance of the copper conductor at 22 °C.The resistance of the copper conductor is 56 Ω at 0°C. The temperature coefficient of resistance of copper is 0,0043 Ω per °C (3)

4.4 State TWO common faults that occur on transformers. (2)

4.5 Give TWO types of core material used in the construction of an inductor. (2)
[20]

QUESTION 5

5.1	What is a junction barrier of a diode?	(1)
5.2	State FOUR advantages of digital multimeters.	(4)
5.3	Make a neat sketch to illustrate how a voltmeter is connected to a load.	(2)
5.4	What is *covalent bonding*?	(2)
5.5	What are *valence electrons*?	(2)
5.6	State TWO uses of transistors.	(2)
5.7	Give TWO faults that can occur in diodes.	(2)
5.8	Make a neat, labelled sketch of a full-wave rectifier circuit. Use TWO diodes (D1 and D2), a centre-tap transformer and a load resistor (RL). Show the polarity at the load terminals.	(5)
		[20]

TOTAL: 100

INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

$$P = V \times I$$

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

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

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

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

$$Q = C \times V$$

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

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

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

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

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