higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T620**(E)**(N23)T

NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

23 November 2016 (X-Paper)
09:00–12:00

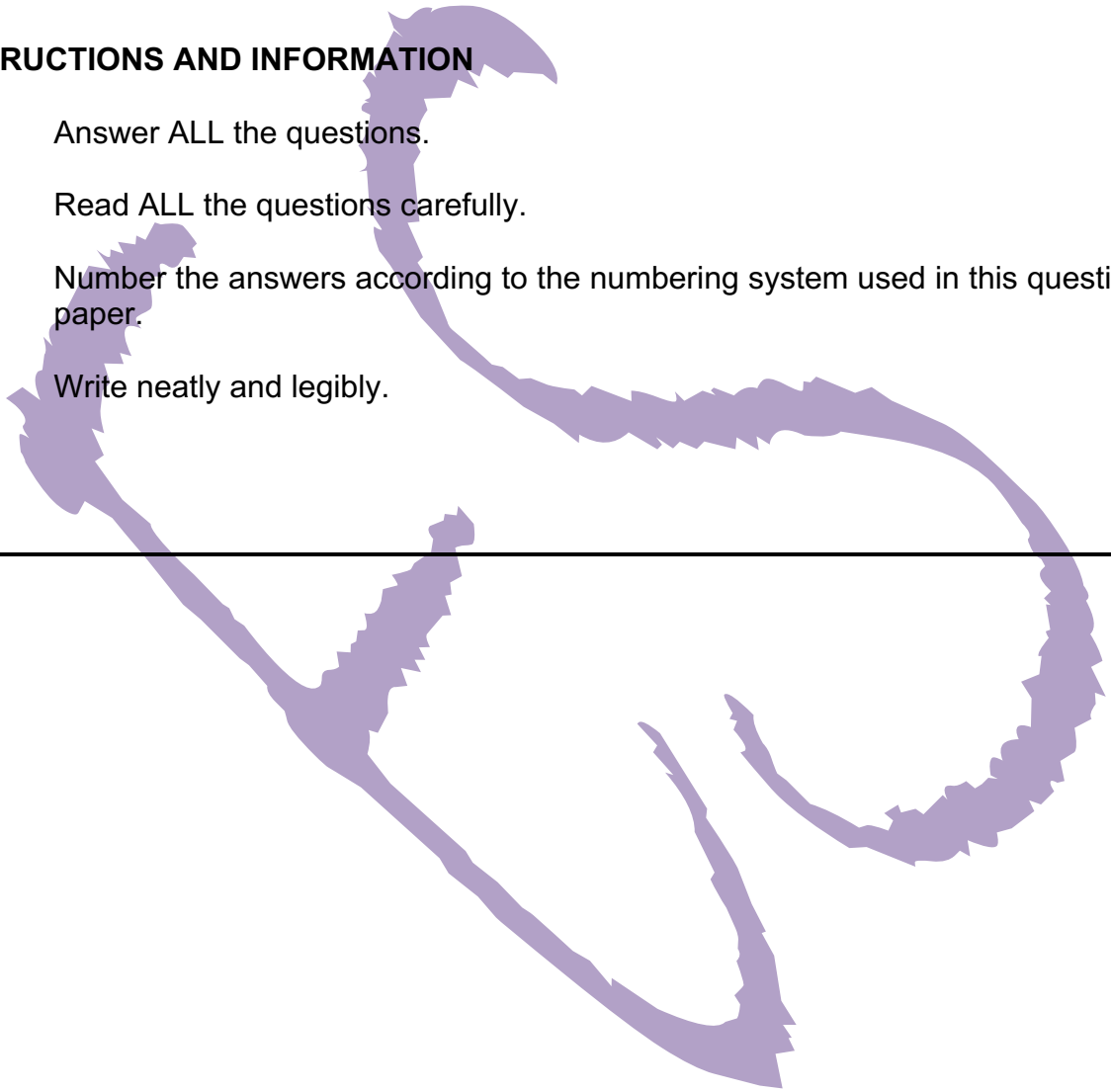
This question paper consists of 6 pages and 1 formula sheet.

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 Choose an/a item/word from COLUMN B that matches a description in COLUMN A. Write only the letter (A–M) next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1.1	Will polarise easily	A	laminations
1.1.2	Tends to block direct current	B	induction
1.1.3	Positive terminal connected to P-material	C	increases
1.1.4	Separates the plates of a capacitor	D	primary cell
1.1.5	Makes the core of a transformer	E	negative ion
1.1.6	Measures specific gravity	F	hydrometer
1.1.7	A conductor induces a voltage when the current changes	G	positive ion
1.1.8	The voltage when cells are connect series	H	reverse biased
1.1.9	A neutral atom that has gained electrons	I	decreases
1.1.10	Possesses an ability to oppose any change in the existing current	J	inductor
		K	forward biased
		L	dielectric
		M	capacitor

(10 × 1) (10)

1.2 State TWO disadvantages of secondary cells. (2)

1.3 Give THREE types of wave forms. (3)

1.4 Calculate the secondary current of a transformer when the primary current is 36 mA. The input voltage to the transformer is 110 V and the turns ratio is 3 : 1. (4)

1.5 Name the instrument that is used to measure specific gravity in a battery. (1)

[20]

QUESTION 2

2.1 A battery consists of FOUR cells. Each cell has got an EMF of 1,5 V and an internal resistance of 0,1 Ω. A 3,6 ohm resistor, is connected across the battery.

2.1.1 Sketch the circuit diagram. (2)

Calculate the following:

2.1.2 The total EMF of the battery (2)

2.1.3 The internal resistance of the battery (2)

2.1.4 The total current flow through the circuit (4)

2.2 Sketch the IEC symbol of the following components:

2.2.1 An electrolytic capacitor

2.2.2 A variable resistor

2.2.3 An inductor

2.2.4 A P-N-P transistor

2.2.5 A diode

(5 × 1) (5)

2.3 Give the units in which the following are measured:

2.3.1 Inductance

2.3.2 Frequency

2.3.3 Temperature coefficient of resistance

2.3.4 A charge

2.3.5 Power

(5 × 1) (5)
[20]

QUESTION 3

3.1 Draw a labelled sketch of TWO bar magnets with their opposite sides brought next to each other, and show the magnetic lines of force and their direction around the TWO bar magnets. (5)

3.2 An 800 m long copper conductor with a diameter of 3 mm has a resistivity of 0,017 $\mu\Omega$ m.

Calculate:

3.2.1 The cross-sectional area of the conductor. (5)

3.2.2 The resistance of the conductor. (3)

3.3 THREE capacitors with values of 1,4 μF, 2,8 μF and 5,6 μF are connected in series. This combination is then connected across an applied voltage of 240 volts.

3.3.1 Calculate the total capacitance of the circuit diagram. (4)

3.3.2 Calculate the charge across the circuit. (3)

[20]

QUESTION 4

4.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (4.1.1–4.1.10) in the ANSWER BOOK.

4.1.1 The secondary winding of transformer is connected to an electrical energy source.

4.1.2 Transformers operate on the principle of self induction.

4.1.3 Secondary cells polarises when used.

4.1.4 The poles of a magnet that are the same will attract each other.

4.1.5 The magnetic lines of force cross each other only at the centre.

4.1.6 The temperature of a conductor will affect its resistance.

4.1.7 A bridge rectifier circuit uses only TWO diodes.

4.1.8 The junction voltage of a germanium diode is 0,3 V.

4.1.9 The anode of a diode is formed from a P-type semi-conductor material.

4.1.10 Hydrogen forms around the positive electrode of a primary cell.

(10 × 1) (10)

4.2 State THREE common faults that occur on transformers. (3)

4.3 Name FOUR advantages of digital multimeters. (4)

4.4 State Flemming's Right hand rule. (3)
[20]

QUESTION 5

5.1 Complete the following sentences by filling the missing word(s). Write only the word(s) next to the question number (5.1.1–5.1.5) in the ANSWER BOOK.

5.1.1 The junction voltage of a silicon diode is ... volts.

5.1.2 A transistor has got ... terminals.

5.1.3 Holes are ... charge carriers.

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

5.1.5 In the elementary common emitter amplifier the output signal is ... than the input signal.

(5 × 1) (5)

5.2 Give TWO faults that can occur in diodes. (2)

5.3 Name the THREE elements of a transistor. (3)

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

5.5 Draw a half-wave rectifier circuit and a load resistor(RL). Show polarity at the load terminals. (4)

5.6 Sketch the input and output wave forms for the circuit in QUESTION 5.5 above. (4)
[20]

TOTAL: 100

INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

$$P = V \times I$$

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

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

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

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

$$Q = C \times V$$

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

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

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

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

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