higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T670(E)(A1)T
AUGUST EXAMINATION

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

1 August 2014 (Y-Paper)
13:00–16:00

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

ENGINEERING

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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.

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QUESTION 1

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

COLUMN A		COLUMN B	
1.1.1	The junction voltage of a Germanium diode	A	silicon
1.1.2	THREE elements of a transistor	B	need maintenance
1.1.3	Will help in finding the poles of the earth	C	series
1.1.4	An advantage of a primary cell	D	0,2 v
1.1.5	An example of a semi-conductor material	E	0,6 v
1.1.6	Mutual induction	F	transformer
1.1.7	The connection of a voltmeter in a circuit	G	parallel
1.1.8	A permanent magnet will always rest with its poles facing this position	H	a transistor
1.1.9	Can be used as an electronic switch	I	relatively cheap
1.1.10	The junction voltage of a silicon diode	J	emitter, base, collector
		K	collector, cathode, base
		L	mica
		M	north-south
		N	east
		O	campus

(10 x 1) (10)

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

1.2.1 Inductance

1.2.2 Electromotive force

1.2.3 Temperature co-efficient of resistance

1.2.4 Potential difference

1.2.5 Frequency

(5 x 1) (5)

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1.3 Sketch the IEC symbols for the following components:

1.3.1 An P-N-P transistor

1.3.2 A polarised capacitor

1.3.3 An Inductor

1.3.4 A pre-set resistor

1.3.5 An air core transformer

(5 x 1) (5)
[20]

QUESTION 2

2.1 FOUR cells connected in series have an EMF of 2,5 volts each and an internal resistance of 0,3 Ω each. A 10 Ω resistor is connected across the cells.

2.1.1 Sketch and label the circuit diagram. (2)

2.1.2 Calculate the total current flow in the circuit. (4)

2.2 The value of a resistor can be known by using its colour bands.

Give the value of a resistor colour coded: Red; Brown; Orange; Silver. (4)

2.3 The strength of an electromagnet is determined by various factors.

State FOUR factors that determines the strength of an electromagnet. (4)

2.4 State TWO advantages of secondary cells. (2)

2.5 Explain the difference between *a permanent magnet* and *an electromagnet.* (4)
[20]

QUESTION 3

3.1 Calculate the resistance of a 6m long conductor with a cross-sectional area of $1,1 \times 10^{-5} m^2$.

The resistivity of the metal is $0,058 \times 10^{-6}$ Ωm. (3)

3.2 A conductor has got a resistance of 18 Ω at 0^0 C.

If the conductor is heated up to 80^0 C, what will be its resistance? Take α as 0,0042 Ω/^{0}C. (4)

3.3 A transformer with 2 000 windings on the secondary side has a secondary voltage of 24 volts and a secondary current of 4 A.

Calculate the primary voltage if the current flow through the primary coil is 500 mA. (4)

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3.4 Three resistors connected in series across a 110 V supply have the following values: R1 = 27 Ω; R2 =30 Ω and R3 =36 Ω. The current flow across the circuit is 1,3 A.

3.4.1 Calculate the total resistance of the circuit.

3.4.2 Calculate the power consumed by the resistor R2.

3.4.3 Calculate the voltage drop across the 30 Ω resistor.

(3 x 3) (9)
[20]

QUESTION 4

4.1 A circuit consists of TWO capacitors with values of 10 μF, 15 μF which are connected in series.

Calculate:

4.1.1 The total capacitance of the circuit. (4)

4.1.2 The charge across the circuit with an applied voltage of 12 V. (3)

4.2 There are THREE factors that affect the capacitance of a capacitor.

What effect will the following factors have on the capacitance of a capacitor?

4.2.1 The distance between the plates.

4.2.2 The cross-sectional area of the plates.

4.2.3 The type of the insulating material.

(3 x 3) (9)

4.3 Explain the following terms:

4.3.1 *Polarisation* of cells.

4.3.2 *Ampere-hour* of a battery.

(2 x 2) (4)
[20]

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QUESTION 5

5.1 Explain the term *doping*. (4)

5.2 State Lenz's Law (4)

5.3 Show by means of a neat, labelled circuit diagram how an ammeter is connected to the load. (4)

5.4 Name the terminals of a diode. (2)

5.5 Explain how a junction barrier of a diode is formed. (4)

5.6 Name TWO advantages of using a transistor as a switch. (2)
[20]

TOTAL: 100

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INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

$$P = V \times I$$

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

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

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

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

$$Q = C \times V$$

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

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

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

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

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

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