higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T670(E)(N24)T
NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

24 November 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 Sketch the IEC symbols for the following components:

1.1.1 A variable resistor

1.1.2 A N-P-N transistor

1.1.3 A transformer with a steel core

1.1.4 A pre-set capacitor

1.1.5 An inductor

(5 x 1) (5)

1.2 Make a neat, labelled sketch to show the magnetic lines of force around two opposite poles of bar magnets. (5)

1.3 Choose the correct word(s) from those given in brackets. Write only the word(s) next to the question number (1.2.1–1.2.10) in the ANSWER BOOK.

1.3.1 A/An ... (ammeter/voltmeter) must be connected in parallel in a circuit.

1.3.2 ... (Ionisation/Polarisation) is the process of gaining or losing electrons.

1.3.3 ... (Waves/Shells) are paths around which electrons in an atom move.

1.3.4 A/An ... (cathode/anode) is formed from a P-type semiconductor material.

1.3.5 A PN junction voltage for a silicon diode is ... (0,2 V/0,6 V)

1.3.6 A diode will conduct when it is ... (forward/reverse) biased.

1.3.7 Hydrogen forms around a ... (negative/positive) electrode of a cell.

1.3.8 A ... (compass/galvanometer) will measure very small currents.

1.3.9 If an atom loses an electron it becomes a/an ... ion

1.3.10 The material that separates the plates of a capacitor is called a ... (junction layer/dielectric). (10 x 1) (10)

[20]

QUESTION 2

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

2.2 You are given FOUR 1,5 V cells to build a project.

Draw a circuit diagram to show how you would supply a torch (load) that operates at 3 V, using all FOUR cells. (5)

2.3 Does the circuit diagram that you have drawn in 2.2 above, have:

2.3.1 (a) A higher applied voltage?
(b) A greater current capacity?
(c) Both higher applied voltage and greater current capacity? (2)

2.3.2 Motivate your answer. (2)

2.4 State the law for magnetism. (2)

2.5 Give THREE types of wave forms. (3)

2.6 State THREE characteristics of the lines of force. (3)

2.7 The difference between the *conductor* and the *insulator* is that the conductor allows electric current to flow easily, while the insulator does not allow electric current to flow.

State the difference between the *conductor* and the *insulator* in terms of atomic theory. (2)
[20]

QUESTION 3

3.1 A 45 m long conductor with a diameter of 10 mm has a resistivity of 0.017 micro-ohm-metres.
HINT: Convert 'mm' to 'm'.

Calculate the following:

3.1.1 The cross-sectional area of the conductor (5)

3.1.2 The resistance of the conductor (3)

3.2 FOUR resistors connected in series across a 240 V supply have the following values: R1 = 2 kΩ; R2 = 180 Ω; R3 = 56 Ω and R4 = 27 Ω.

Calculate the following:

3.2.1 The total resistance of the circuit

3.2.2 The current flow through the circuit

3.2.3 The power consumed by the load

3.2.4 Give the colour code for the 180 Ω resistor

(4 x 3) (12)
[20]

QUESTION 4

4.1 Almost every electronic circuit has got inductance.

Give a brief description of inductance. (3)

4.2 A transformer is a device that steps-up or steps-down the voltage.

Give another application of a transformer. (2)

4.3 Show by means of a sketch a voltage/time curve, of a charging capacitor. (3)

4.4 The resistance of the conductor is 11 Ω at 0 °C.

Determine the resistance of a conductor at 25 °C. Take α as 0,0043 Ω/ °C. (3)

4.5 A 0,5 μF capacitor has a charge of 110 μC.

Determine the voltage across the capacitor. (3)

4.6 Briefly explain what effect will the following factors have on the resistance of a conductor:

4.6.1 The length of the conductor

4.6.2 The Area of the conductor

4.6.3 The cross-sectional area of the conductor

(3 x 2) (6)
[20]

QUESTION 5

5.1	State Faraday's Law.	(3)
5.2	Describe a P-type semi-conductor material.	(2)
5.3	Give TWO uses of a transistor.	(2)
5.4	Make a neat, labelled full wave rectifier circuit, using TWO diodes, a centre-tap transformer and a load resistor. Show the polarity at the load terminals.	(5)
5.5	Show the input and output waveforms for the circuit in QUESTION 5.4 above.	(4)
5.6	Describe how a junction barrier of a diode is formed.	(4)
		[20]

TOTAL: 100

INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

$$P = V \times I$$

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

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

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

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

$$Q = C \times V$$

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

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

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

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

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