higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1050**(E)**(N22)T
NOVEMBER 2011

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

22 November (X-Paper)
09:00 – 12:00

Calculators may be used.

This question paper consists of 5 pages and a 1-page 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 correctly according to the numbering system used in this question paper.
4. Write neatly and legibly.

QUESTION 1

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

1.2 Name the poles of a bar magnet. (1)

1.3 Define *Lenz's law*. (2)

1.4 Three identical cells are connected in series across a resistor of 6,8 ohms. A voltmeter connected across the terminals of this circuit shows a reading of 3 V. However, on open circuit, the voltmeter reading is 4,5 V.

Calculate the following:

1.4.1 The total current flow through the circuit (3)

1.4.2 The total internal resistance of the cells (5)

1.5 Draw a saw tooth wave form. (1)

1.6 Give the units in which the following are measured:

1.6.1 Power (1)

1.6.2 Frequency (1)

1.6.3 Inductance (1)

1.6.4 Electromotive force (1)

1.6.5 The charge across a capacitive circuit (1)

1.7 State TWO advantages of primary cells. (2)

1.8 State TWO advantages of lead-acid cells. (2)
[25]

QUESTION 2

2.1 A 45 m long conductor with a diameter of 2,5 mm has a resistivity of 0.017 micro-ohm-metres.

Calculate the following:

2.1.1 The cross sectional area of the conductor (4)

2.1.2 The resistance of the conductor (3)

2.2 A conductor has a resistance of 0,12 ohms at 0 °C. Calculate the resistance of the conductor at 60 °C. The resistance temperature coefficient of the conductor is 0,0058 ohms per °C. (3)

2.3 Three resistors with values of 27 Ω, 54 Ω and 81 Ω are connected in series to a 32 volt direct-current power source.

Calculate the following:

2.3.1 The total resistance of the circuit (3)

2.3.2 The total current through the circuit (3)

2.3.3 The voltage drop across the 54 Ω resistor (3)

2.3.4 The power drawn by the 27 Ω resistor (4)

2.4 State TWO uses of resistor devices. (2)
[25]

QUESTION 3

3.1 A circuit consists of TWO capacitors with values of 2,7 μF and 8,1 μF.

Calculate the following:

3.1.1 The charge across the 2,7 μF capacitor at 36 V voltage drop (3)

3.1.2 The total capacitance if the TWO capacitors are connected in parallel (3)

3.2 State THREE factors that will influence the capacitance of the capacitor. (3)

3.3 Define *inductance*. (3)

3.4 Describe the effect that the following components will have on an alternating current:

3.4.1 A transformer (2)

3.4.2 A diode (2)

3.5 Explain what effect will the following factors have on the resistance of a conductor:

3.5.1 The length of the conductor (2)

3.5.2 The cross-sectional area of the conductor (2)

3.5.3 The temperature (2)

3.6 Draw a charging curve for a capacitor. (3)
[25]

QUESTION 4

4.1 Describe what will take place during a reverse biasing condition of a diode. (6)

4.2 State TWO faults that may occur in diodes. (2)

4.3 Describe how conventional current flows through an NPN transistor when it is forward-biased (turned on). (3)

4.4 A 150 kVA transformer has an input voltage of 1 100 V and an output voltage of 400 V, at a frequency of 50 Hz. If the transformer has 80 turns on the secondary winding, calculate the following:

The primary current (4)

4.5 Indicate whether the following statements are TRUE or FALSE. Write only 'true' or 'false' next to the question number (4.5.1 – 4.5.10) in the ANSWER BOOK.

4.5.1 A galvanometer is an instrument designed to measure very small currents. (1)

4.5.2 A voltmeter is connected in series in a circuit. (1)

4.5.3 A diode has got three conductor elements. (1)

4.5.4 The elements of a transistor are: diode, collector, emitter. (1)

4.5.5 When impurity atoms are removed from the pure semi-conductor material, the semi-conductor is said to be doped. (1)

4.5.6 Silicon and germanium atoms have six valence electrons in their valence shells. (1)

4.5.7 In the elementary common emitter amplifier, the output signal is smaller than the input signal. (1)

4.5.8 The silicon diode will conduct when the junction voltage is 0,3 V. (1)

4.5.9 The process of generating free electrons is called donor doping. (1)

4.5.10 When the PNP transistor is turned on, the current (conventional) will flow from both the base and the collector to the emitter. (1)

[25]

TOTAL: 100

INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

$$P = V \times I$$

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

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

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

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

$$Q = C \times V$$

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

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

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

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

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