higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T690**(E)**(A5)T

APRIL EXAMINATION

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

5 April 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 item 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	Provide larger currents	A	coil
1.1.2	Is available in various sizes	B	electrons
1.1.3	Flow from negative terminal to positive terminal	C	capacitor
1.1.4	Stores a charge	D	transistor
1.1.5	Capacitor value increases	E	magnetic
1.1.6	Has a collector as a terminal	F	dielectric
1.1.7	Core of a transformer	G	transformer
1.1.8	Mutual induction	H	wire wound resistor
1.1.9	Gives a very accurate value	I	secondary cells
1.1.10	An inductor	J	parallel connection
		K	shell
		L	series connection
		M	primary cell

(10 × 1) (10)

1.2 A cellular telephone uses two 1,5 volt cells in series as a power source and consumes 900 milliwatt.

Calculate the following:

1.2.1 Current flow at 900 milliwatt

1.2.2 Minimum resistance of the cellular telephone

(2 × 3) (6)

1.3 Give FOUR advantages of primary cells (4)

[20]

QUESTION 2

2.1 State FOUR characteristics of the magnetic lines of force. (4)

2.2 Three resistors with values of 200 ohm, 400 ohm and 600 ohm are connected in series across a 36 volt direct current power source.

Calculate the following:

2.2.1 Total resistance of the circuit (3)

2.2.2 Total current flow through the circuit (3)

2.2.3 Voltage drop through the 200 ohm resistor (3)

2.2.4 Power consumed in the circuit (4)

2.3 Give the colour code for the 4k7Ω resistor (3)
[20]

QUESTION 3

3.1 A copper conductor is 70m long and has a cross-sectional area of 4 mm^2. The resistivity of copper is 1,728 x 10^{-6} Ωm.

Calculate the resistance of the conductor. (3)

3.2 A tube filled with Mercury has a resistance of 11 Ω at 0 °C. The temperature coefficient of Mercury is 0,0042 Ω/°C.

If the tube is heated to 33 °C what will be its resistance? (3)

3.3 Three capacitors with values of 1,8 μF, 2,1 μF and 10 μF respectively are connected in series.

Calculate the following:

3.3.1 Total capacitance of the circuit (4)

3.3.2 Charge across the circuit with an applied voltage of 100 V (3)

3.4 A transformer has an input voltage of 220 V and a turns ratio of 10 : 1. The primary current is 2 A.

Calculate the following:

3.4.1 Secondary voltage (4)

3.4.2 Current flow through the secondary (3)
[20]

QUESTION 4

4.1 Sketch the IEC symbol for the following components:

4.1.1 Fixed resistor

4.1.2 Variable resistor

4.1.3 Pre-set capacitor

4.1.4 Inductor

4.1.5 Saw-tooth waveform

(5 × 1) (5)

4.2 Define the term *frequency of the waveform.* (3)

4.3 Make a sketch to show a charging curve for a capacitor in terms of voltage and time. (3)

4.4 Give ONE disadvantage of connecting cells in parallel. (2)

4.5 Mutual induction occurs when two coils are placed next to one another.

Make a neat, labelled sketch to show mutual induction between two coils. (7)

[20]

QUESTION 5

5.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (5.1.1–5.1.10) in the ANSWER BOOK.

5.1.1 The polarity of a neutron is positive.

5.1.2 An insulator has an abundance of free electrons.

5.1.3 A cation is formed when electrons are added to an atom.

5.1.4 A pentavalent atom is a donor atom.

5.1.5 The process where arsenic is added to germanium is called donor doping.

5.1.6 Pentavalent atoms have five valency electrons.

5.1.7 Trivalent atoms have six valency electrons.

5.1.8 When a trivalent atom is added to silicon it will create an abundance of electrons.

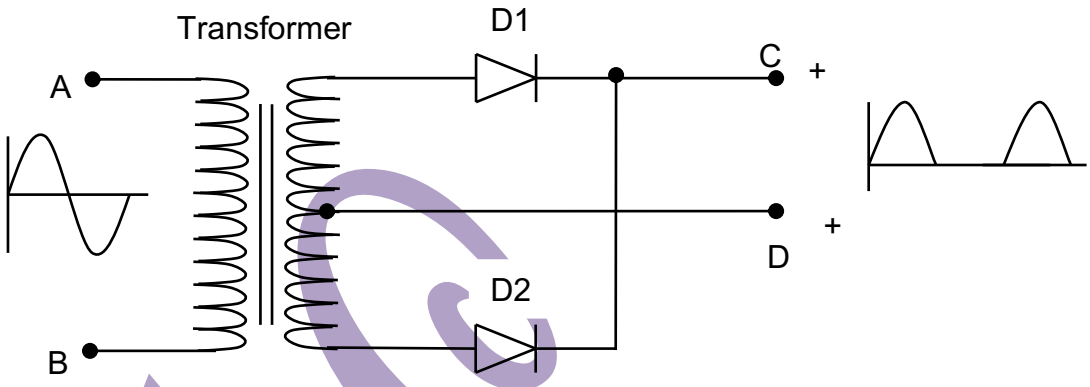
5.1.9 A transistor is a semiconductor rectifier device.

5.1.10 A transistor can be likened to two diodes connected back-to-back.

(10 × 1) (10)

5.2 Name TWO particles of a nucleus of an atom. (2)

5.3 Refer to the FIGURE below that shows the circuit diagram of a full-wave rectifier with two diodes and answer the questions.



FIGURE

5.3.1 Give the name of the transformer that is used. (2)

5.3.2 The output wave form at C and D shows a faulty condition.

Name the faulty condition and the component that has caused the faulty condition. (2 × 2) (4)

5.3.3 What could be the problem with the faulty component mentioned in QUESTION 5.3.2? (2)

[20]

TOTAL: 100

INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

$$P = V \times I$$

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

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

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

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

$$Q = C \times V$$

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

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

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

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

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