higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

10 April 2018 (X-Paper)
09:00–12:00

This question paper consists of 7 pages and 1 formula sheet.

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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. Keep subsections of questions together.
5. Use the value for π as 3,142.
6. Answer each question on a new page in your ANSWER BOOK.
7. Use only BLUE or BLACK ink.
8. ALL the final answers must be approximated accurately to THREE decimal places.
9. Write neatly and legibly.

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QUESTION 1

1.1 Choose an item from COLUMN B that matches a description in COLOMN 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	An atom that has five valence electrons	A	series
1.1.2	Majority charge carriers of P-type materials	B	capacitor
1.1.3	Used to measure specific gravity/relative density	C	conductor
1.1.4	Blocks direct current	D	doping
1.1.5	Has an abundance of free electrons	E	transistor
1.1.6	Process of adding impurities to pure silicon	F	pentavalent
1.1.7	Can be used as an electronic switch	G	rectification
1.1.8	The process of converting alternating current to direct current	H	semiconductor
1.1.9	Not a good conductor or a good insulator in its pure state	I	henry
1.1.10	Unit of measurement for inductance	J	hydrometer
		K	galvanometer
		L	tetravalent
		M	holes
		N	diode
		O	insulator

(10 × 1) (10)

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1.2

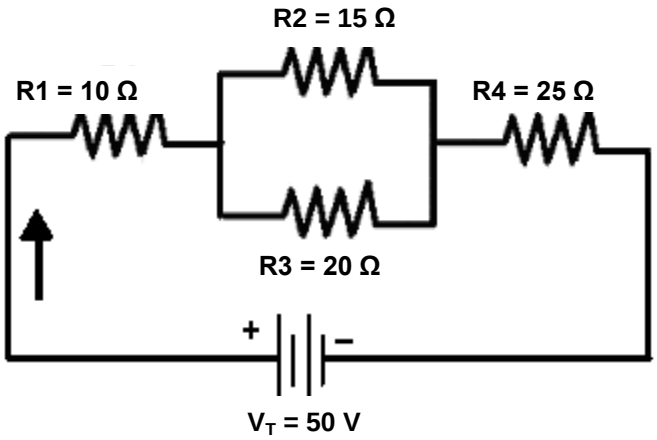


FIGURE 1

Refer to FIGURE 1 and calculate:

1.2.1 The total resistance of the parallel combination (4)

1.2.2 The total resistance of the series combination (2)

1.2.3 The total resistance of the circuit (3)

1.2.4 The current flow through the entire circuit (3)

1.2.5 The voltage drop across the parallel combination (3)

1.2.6 The power dissipated by the parallel combination (3)

1.2.7 The colour code of R_4 which has a tolerance of 2% (4)

1.2.8 The current flow through R_2 (3)

[35]

QUESTION 2

2.1 A single-phase step-up transformer has a turns ratio of 5 : 25 and is connected to a supply voltage of 240 V. The current flowing in the primary winding is 4,5 A.

Determine:

2.1.1 The current that flows in the secondary winding

2.1.2 The secondary voltage

2.1.3 State THREE faults that could occur with the transformer described in QUESTION 2.1.

(3 × 3) (9)

2.2 Sketch the IEC symbols for the following electronic components:

2.2.1 Electrolytic capacitor

2.2.2 Variable inductor

2.2.3 Pre-set resistor

2.2.4 Transformer

2.2.5 Zener diode

2.2.6 Fixed resistor

(6 × 1) (6)

2.3 Name the unit of measurement for the following properties:

2.3.1 Resistance

2.3.2 Inductance

2.3.3 Capacitance

2.3.4 Potential difference

2.3.5 Electromotive force

(5 × 1) (5)
[20]

QUESTION 3

3.1 Draw a fully labelled circuit diagram of a bridge-rectifier circuit. Show the filter capacitor, the load resistor and all the waveforms in the diagram. (10)

3.2 Name FOUR factors that have an influence on resistance. (4)

3.3 Waveforms are classified according to their shapes.

Draw the waveforms of the following:

3.3.1 A square wave

3.3.2 A sawtooth wave

3.3.3 A sine wave

(3 × 2) (6)

3.4 3.4.1 State THREE advantages of a digital multimeter. (3)

3.4.2 State TWO disadvantages of an analogue multimeter. (2)
[25]

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QUESTION 4

4.1 Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (4.1.1–4.1.10) in the ANSWER BOOK.

4.1.1 Polarisation of carbon-zinc cells occur when …

A the zinc plates become weak.
B oxygen bubbles form in the electrolyte.
C electrons move from the carbon rod to the zinc plate.
D hydrogen bubbles form around the carbon rod.

4.1.2 Specific gravity is measured with an instrument called a …

A galvanometer.
B multimeter.
C clamp meter.
D hydrometer.

4.1.3 ONE disadvantage of an analogue meter is …

A it has no error of parallax.
B the display is easy to read.
C it has an autorange feature.
D readings are not very accurate.

4.1.4 The valence shell of an atom is the …

A first shell (K).
B third shell (M).
C outermost shell.
D shell with the most electrons.

4.1.5 A conductor …

A is an element that allows current to flow because it has no free electrons.
B is an element that has an abundance of neutrons.
C allows current to flow because it has an abundance of free electrons.
D does not allow current to flow, especially in metals.

4.1.6 The colour code for a 6 Ω resistor with a 10% tolerance value is …

A blue black black silver.
B blue brown black silver.
C blue black gold gold.
D blue black gold silver.

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4.1.7 Inductance is measured in …

A farads.
B ohms.
C lumens.
D henrys.

4.1.8 ONE factor that influences the resistance of a conductor is …

A the cross-sectional area of its plates.
B the type of material it is made of.
C dielectric constant.
D electromagnetic induction.

4.1.9 Doping is the process of mixing …

A intrinsic and extrinsic materials with one another.
B intrinsic semiconductor materials with impurities.
C silicon with germanium.
D boron with arsenic to form a PN-junction.

4.1.10 Inductors are …

A small transformers
B electronic components that do not allow current to flow.
C also referred to as coils.
D always the same size and shape as resistors and capacitors.

(10 × 1) (10)

4.2 Transistors are semiconductor devices that can be used as a switch or as an amplifier.

Draw neat circuit diagrams to indicate:

4.2.1 A transistor used as a switch (4)

4.2.2 A transistor used as an amplifier (4)

4.2.3 The circuit symbols for an NPN and a PNP transistor (2)

[20]

TOTAL: 100

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INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

$$V = I \times R$$

$$P = \frac{V^2}{R}$$

$$P = I^2 R$$

$$P = V \times I$$

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

$$Q = C \times V$$

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

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

$$R_t = R_1 + R_2 + R_3 ..... R_n$$

$$C_t = C_1 + C_2 + C_3 ..... C_n$$

$$L_t = L_1 + L_2 + L_3 ..... L_n$$

$$\frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} ..... \frac{1}{C_n}$$

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} ..... \frac{1}{R_n}$$

$$\frac{1}{L_t} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} ..... \frac{1}{L_n}$$

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

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