higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

5 April 2019 (X-Paper)
09:00–12:00

This question paper consists of 6 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. Answer each question on a new page in your ANSWER BOOK
5. Keep subsections of questions together
6. Sketches must be large, neat and fully labelled.
7. π = 3,142
8. Write neatly and legibly.

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QUESTION 1

1.1 THREE resistors, R_1, R_2 and R_3, with values of 30 Ω, 45 Ω and 90 Ω respectively are connected to one another in parallel. This parallel combination is then connected in series to resistor R_4, which has a value of 75 Ω.

Calculate the following if the supply is 180 V:

1.1.1 Total resistance of the circuit (6)

1.1.2 Current flow through the circuit (2)

1.1.3 Power dissipated by the parallel combination (5)

1.1.4 Current flow through R_1, R_2, and R_3 (6)

1.1.5 Voltage drop across R_4 (2)

1.2 What is the colour code of R_2 which has a tolerance of 2%? (4)

[25]

QUESTION 2

2.1 An aluminium conductor with a diameter of 4 mm has a length of 35 m and a specific resistance of 0, 02824 μΩm.

Determine each of the following:

2.1.1 Cross-sectional area of the conductor (4)

2.1.2 Resistance of the conductor (3)

2.2 Define each the following terms:

2.2.1 Magnetic induction

2.2.2 Self-induction

2.2.3 Electromagnetic induction

2.2.4 Mutual induction

(4 × 3) (12)

2.3 State FOUR characteristics of magnetic lines of force. (4)

2.4 Sketch the IEC symbol for each of the following capacitors:

2.4.1 Pre-set

2.4.2 Polarised

(2 × 1) (2)

[25]

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QUESTION 3

3.1 Complete the following sentences by filling in the missing word or words. Write only the word or words next to the question number (3.1.1–3.1.10) in the ANSWER BOOK.

3.1.1 Adding impurity atoms to pure semiconductor material is called …

3.1.2 An insulating material called a … separates the two plates of a capacitor.

3.1.3 A diode will not conduct if it is …

3.1.4 The outermost shell of an atom is referred to as the … shell.

3.1.5 An ammeter is used to measure …

3.1.6 A positive ion is also known as a …

3.1.7 An … is a material that does not allow current to flow through it.

3.1.8 One advantage of a … cell is that it can be recharged.

3.1.9 Opposite poles of a magnet … each other.

3.1.10 A transistor can be used as a switch as well as an … .

(10 × 1) (10)

3.2 The primary winding of a single-phase transformer has 250 turns and is connected to a 240 V AC supply. The secondary voltage is 60 V and carries a current of 1,5 A

Determine the following values:

3.2.1 Number of turns of the secondary winding (3)

3.2.2 Current flow through the primary winding (3)

3.2.1 Turns ratio (2)

3.3 Draw a neat, fully labelled sketch of a sine wave with a peak-to-peak value of 20 V and a frequency of 100 Hz. (3)

3.4 THREE cells, each with an emf of 2,5 V and an internal resistance of 1 Ω, are connected to each other in a series arrangement.

Determine the following:

3.4.1 Total emf of the battery

3.4.2 Total internal resistance

(2 × 2) (4)

[25]

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QUESTION 4

4.1 Choose the correct word or words from those given in brackets. Write only the word or words next to the question number (4.1.1–4.1.10) in the ANSWER BOOK.

4.1.1 N-type semiconductor material is (intrinsic/extrinsic).

4.1.2 The term *pentavalent* refers to (four/five/six) valence electrons per atom.

4.1.3 A/An (digital/analogue) measuring instrument is accurate and easy to use.

4.1.4 A zener diode is a (voltage regulator/current regulator).

4.1.5 A galvanometer is normally used to measure (small/large) currents.

4.1.6 Power is the (rate/ability) of doing work.

4.1.7 A bipolar transistor has (two/three) junctions.

4.1.8 An atom that has no free electrons is known as a (conductor/insulator).

4.1.9 Magnetic lines of force are also referred to as (flux/force/charge).

4.1.10 The specific gravity of a battery is measured using a (hydrometer/voltmeter/ohmmeter).

(10 × 1) (10)

4.2 Draw a neat, fully labelled circuit diagram of a half-wave rectifier circuit. Show the input and output waveforms as well as the load resistor. (5)

4.3 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (4.3.1–4.3.10) in the ANSWER BOOK.

4.3.1 A relay is an electro-magnetic switch.

4.3.2 Magnetic lines of force move from south to north inside a bar magnet.

4.3.3 A voltmeter is always connected in series with the load.

4.3.4 Cells must be connected in parallel with one another in order to increase the current capacity of a battery.

4.3.5 The colour code of a 1 Ω resistor with a tolerance value of 5% is brown, black, black, gold.

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4.3.6 Capacitors have a larger capacitance if the plates are far apart.

4.3.7 The second shell of an atom can hold a maximum of eight electrons.

4.3.8 The strength of an electromagnet is not determined by the type of core used.

4.3.9 Silicon and germanium are good conductors.

4.3.10 Electrons and protons are found in the nucleus of an atom.

(10 × 1) (10)
[25]

TOTAL: 100

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INDUSTRIAL ELECTRONICS N1

FORMULA SHEET

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

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

$$P = V \times I$$

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

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

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

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

$$Q = C \times V$$

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

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

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

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

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

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