higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

(8080641)

18 November 2019 (X-Paper)
09:00–12:00

This question paper consists of 5 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 the ANSWER BOOK.
5. Keep subsections of questions together.
6. Sketches must be large, neat and fully labelled.
7. Use π as 3,142.
8. Write neatly and legibly.

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QUESTION 1

THREE resistors, R_1 = 4k7 Ω, R_2 = 5k6 Ω and R_3 = 560 Ω are connected to one another in a series arrangement across a 120 V power supply.

1.1 Draw a neat, fully labelled diagram of this circuit. (6)

1.2 Determine the total resistance of the circuit. (3)

1.3 Calculate the total current consumption of this series circuit. (3)

1.4 Determine the voltage drop across each resistor. (6)

1.5 Indicate the colour code for the resistor R_2 which has a tolerance value of 5%. (4)

1.6 Calculate the total power consumed by this circuit. (3)

[25]

QUESTION 2

2.1 THREE capacitors with the following values are connected in series to one another: C_1 = 15 µF/16 V; C_2 = 100 µF/63 V and C_3 = 470 µF/25 V.

Calculate the following :

2.1.1 The total capacitance of the circuit, using the appropriate formula (3)

2.1.2 The charge developed across each capacitor in coulombs (6)

2.2 State THREE factors that can influence the capacitance of these capacitors. (3)

2.3 A high voltage step-up transformer that is used in a microwave oven has 250 turns on the primary winding and 2 500 turns on the secondary winding. It is connected to an alternating current supply of 240 V. The current drawn by the primary coil is 1, 5 A when the oven is switched on.

Determine the following:

2.3.1 The turn's ratio of this transformer (2)

2.3.2 The voltage developed across the secondary winding (3)

2.3.3 The current flow in the secondary coil (3)

2.4 State TWO faults that can occur with the transformer mentioned in QUESTION 2.3. (2)

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2.5 State the unit of measurement for each of the following:

2.5.1 Frequency

2.5.2 Inductance

2.5.3 Battery capacity

(3 × 1) (3)
[25]

QUESTION 3

3.1 Define the following terms:

3.1.1 Ohms law

3.1.2 Lenz's law

3.1.3 Fleming's left-hand rule

3.1.4 Faraday's law

(4 × 3) (12)

3.2 Briefly describe FIVE ways in which one can take care of and maintain a lead-acid battery. (5)

3.3 FOUR cells, each with an EMF of 1, 5 V and an internal resistance of 0, 4 Ω, are connected in series. Two external resistors of 6 Ω and 8 Ω respectively, are first connected in parallel with each other and then across the terminals of the battery.

Determine the following:

3.3.1 The current flow through the circuit (5)

3.3.2 The potential difference across the external resistors (3)
[25]

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QUESTION 4

4.1 Draw THREE separate diagrams to show how each of the following measuring instruments are connected in a circuit. A switch must be included to indicate whether the circuit should be on or off. Indicate the correct polarity in each case.

4.1.1 A voltmeter

4.1.2 An ammeter

4.1.3 An ohmmeter

(3 × 4) (12)

4.2 State FOUR advantages and FOUR disadvantages of secondary cells.

(2 × 4) (8)

4.3 Draw a neat, fully labelled circuit diagram of a full-wave rectifier circuit using TWO diodes and ONE centre-tap transformer. (5)

[25]

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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