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Department:
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REPUBLIC OF SOUTH AFRICA

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NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N4

(8080164)

1 April 2019 (X-Paper)

09:00–12:00

This question paper consists of 6 pages.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
INDUSTRIAL ELECTRONICS N4
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.
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QUESTION 1

1.1 Give the name of each of the following theorems:

1.1.1 The power transferred from a signal source into a load will be a maximum when the load resistance is equal to the resistance of the source.

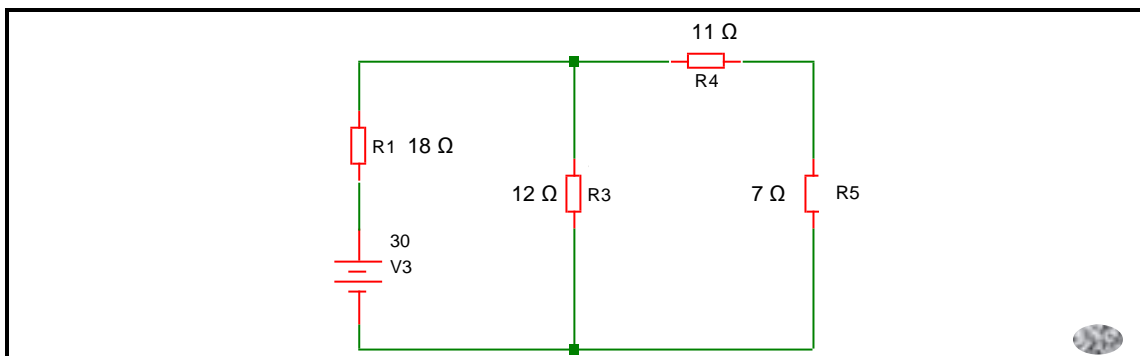
1.1.2 In any linear multiple-source network, the resultant current in any branch is the algebraic sum of the currents that would be produced by each source acting separately.

1.1.3 In any closed circuit, the algebraic sum of the products of the current and the resistance of each part of the circuit is equal to the resultant emf in the circuit.

1.1.4 Any network can be viewed as a two-terminal network and can be replaced by a single source of emf in series with a single resistance.

(4 × 1) (4)

1.2 Study the circuit diagram below and answer the question.



Calculate the current flowing across 12 Ω using Thévenin's theorem.

(8)
[12]

QUESTION 2

2.1 Explain the quality factor of a resonant circuit.

(2)

2.2 Calculate the value of Q of a resonant circuit where $X_L = X_C = 2,5 \text{ k}\Omega$ and the resistor value is 1 kΩ.

(1)

2.3 A circuit consists of $Z_1 = 23 + j18$, $Z_2 = 40 - j31$, $Z_3 = 55 + j30$. Z_1 is connected in series with Z_2 and the entire combination is then connected in parallel with Z_3 .

Calculate the total current using j-notation if the supply AC voltage is 240 V at 50 Hz.

(8)
[11]

QUESTION 3

- 3.1 Explain the negative ion in a PN-junction diode. (2)
- 3.2 Explain the effect of each of the following types of bias applied to a PN-junction:
- 3.2.1 Forward-bias voltage
- 3.2.2 Reverse-bias voltage (2 × 2) (4)
- 3.3 A silicon diode with an unknown diode current has an applied forward bias of 0,6 V and $I_S = 45 \mu\text{F}$.
Calculate the value of the unknown diode current at a room temperature of 27 °C. (3)
- 3.4 Calculate the forward current (in milliamps) of a diode if it has a forward resistance of 0,805 Ω at a room temperature of 32 °C. (3)
- [12]**

QUESTION 4

- 4.1 Explain each of the following terms:
- 4.1.1 Transformation ratio
- 4.1.2 Ripple factor (2 × 2) (4)
- 4.2 A full-wave rectifier has $R_L = 250 \Omega$, $C = 120 \mu\text{F}$, $V_m = 280 \text{ V}$ and $f = 60 \text{ Hz}$.
Calculate:
- 4.2.1 The average DC voltage supplied to the load
- 4.2.2 The ripple factor (2 × 2) (4)
- 4.3 An LC- π filter has a choke resistance of 150 Ω and 178 Ω load resistance.
The voltage input = 200 V.
Calculate the output DC voltage. (2)
- 4.4 Give TWO disadvantages of an LC- π filter. (2)
- [12]**

QUESTION 5

- 5.1 List and explain the THREE regions found on the output of a common emitter transistor. (3 × 2) (6)
- 5.2 Give TWO disadvantages of noncomplementary class-B push-pull amplifiers. (2)
- 5.3 What is the difference between *MOSFET* and *JFET*? (3)
- [11]**

QUESTION 6

- 6.1 Name TWO inputs of an operational amplifier. (2)
- 6.2 Draw a labelled circuit diagram of an inverting operational amplifier with input and output voltage. (4)
- 6.3 Draw a labelled circuit diagram of a differentiator. (4)
- [10]**

QUESTION 7

- 7.1 Explain the forward-blocking state of a thyristor. (2)
- 7.2 Name THREE practical applications of SCR. (3)
- 7.3 Explain each of the following components of a closed-loop system:
- 7.3.1 Comparator
- 7.3.2 Feedback
- 7.3.3 Correcting signal
- (3 × 2) (6)
- [11]**

QUESTION 8

- 8.1 Draw a circuit construction and circuit symbols of a photodiode. (5)
- 8.2 What is the function of a demodulator that is sometimes connected to a linear variable differential transformer? (2)
- 8.3 What is the function of the base terminal in a three-terminal phototransistor? (3)
- 8.4 Explain the effect of increasing the light of a phototransistor. (2)
- [12]**

QUESTION 9

- 9.1 A cathode-ray oscilloscope (CRO) is the most important electronic measuring instrument.
Name THREE measurements that can be performed using a CRO. (3)
- 9.2 Explain each of the following components obtained from the front panel of an oscilloscope:
- 9.2.1 Reference line
 - 9.2.2 Intensity
 - 9.2.3 Trigger-level control
- (3 × 1) (3)
- 9.3 List THREE basic outputs produced by a function generator. (3)
[9]
- TOTAL: 100**