higher education & training

Department:
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REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

COMMUNICATION ELECTRONICS N4

(8080224)

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
COMMUNICATION 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. Start each section on a new page.
5. Use only a black or blue pen.
6. Write neatly and legibly.

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QUESTION 1

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 The current that flows away from the junction is equal to the current entering the same junction.

1.2 Thevenin's theorem states that a two-terminal network consisting of impedances and generators can be replaced by a single equivalent voltage generator and series impedance.

1.3 In an inductive network the current lags the voltage by 90º.

1.4 An ideal filter has a sharp cut-off frequency in its pass band and zero attenuation in the attenuation band.

1.5 A ladder-type attenuator uses only fixed resistors.

1.6 The time constant of RC circuits is a period required for a voltage of a capacitor to increase to 63,2% of maximum value or decrease to 36,8% of minimum value.

1.7 In-depth modulation distortion is produced by over-modulation.

1.8 Oscillator modulation is one of the methods used in modulation.

1.9 The antenna of an AM transmitter is omnidirectional.

1.10 The angle of reflection is the angle that lies between the reflected ray and the norm to the surface of reflection.

(10 × 1) **[10]**

QUESTION 2

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 (1.1–1.10) in the ANSWER BOOK.

2.1 … theorem states that a linear circuit containing independent sources, dependent sources and passive elements can be replaced by a model containing a current source and an equivalent resistance.

A Thevenin's
B The superposition
C Norton's
D Kirchoff's

2.2 Any physical quantity that possesses both magnitude and direction:

A Polar coordinates
B j-Notation
C Complex numbers
D Phasors

2.3 In RLC circuits the … opposes the flow of current in an inductive network.

A inductor
B resistance
C supply voltage
D capacitor

2.4 The term … is not used in conjunction with filters.

A attenuation band
B cut-off frequency
C resonance frequency
D pass band

2.5 … filters are made of a material that, when subjected to mechanical strain, the mechanical energy expended is converted to electrical energy.

A Derived
B Ceramic
C Composite
D Electrostatic

2.6 Through the … modulation process the frequency of a carrier is made to vary in accordance with the instantaneous value of the modulating signal.

A frequency
B phase
C amplitude
D pulse

2.7 The type of AM transmission whereby the carrier wave is completely suppressed and at the receiving end the receiver accepts the side band, and the carrier wave generated locally has to be supplied to the demodulator:

A Independent sideband transmission
B Single sideband transmission
C Double sideband transmission
D Single sideband suppressed carrier transmission

2.8 The … amplifier of the AM transmitter amplifies the signal from the microphone to the suitable frequency before it enters the modulator.

A buffer
B music
C power
D speech

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2.9 The … is the microwave device which is widely employed in radar transmitters.

A reflex klystron
B multicavity magnetron
C travelling-wave amplifier
D multicavity klystron

2.10 The widely used non-resonant antenna array for point-to-point radio-wave propagation:

A Rhombic
B Pyramidal
C Sectoral
D Helical

(10 × 1) **[10]**

QUESTION 3: NETWORK THEOREMS

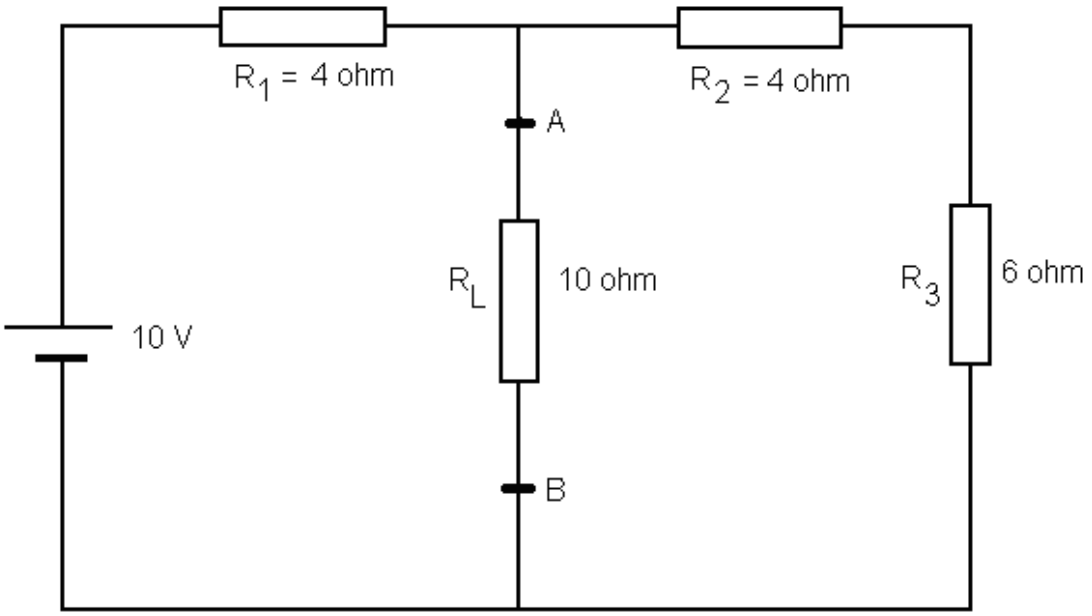
3.1 Define the following:

3.1.1 Superposition theorem

3.1.2 Norton's theorem

(2 × 2) (4)

3.2 Use the Norton's theorem to find the equivalent circuit of the network in the FIGURE below.



FIGURE

(6)
[10]

QUESTION 4: ALTERNATING-CURRENT THEORY

A series circuit consists of a capacitor with a capacitance of 10 nF, a resistor with a resistance of 500 Ω and an inductor with an inductance of 10 mH which are connected to a supply of 20 V at a frequency of 12 kHz.

Calculate the following:

4.1 Inductive reactance

4.2 Capacitive reactance

4.3 Total impedance

4.4 Total supply current

4.5 Phase angle

4.6 Voltage across the inductor

4.7 Q-factor

4.8 Prove the answer to QUESTION 4.7 using any alternative method.

(8 × 2) **[16]**

QUESTION 5: ATTENUATORS AND FILTERS

5.1 Define an *attenuator*. (2)

5.2 Make a neat, labelled drawing of an O-type attenuator. (1)

5.3 Make a neat, labelled drawing of the circuit diagram of a low-pass filter. (1)

5.4 Which filter saves space and is light in weight? (1)

[5]

QUESTION 6: MODULATION

Define the following:

6.1 Pulse-position modulation

6.2 Pulse-amplitude modulation

6.3 Pulse-width modulation

(3 × 2) **[6]**

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QUESTION 7: DEMODULATION

7.1 Draw a fully labelled circuit diagram of an AM full-wave detector. (3)

7.2 Explain the operation of the circuit diagram mentioned in QUESTION 7.1. (7)
[10]

QUESTION 8: COMMUNICATION SYSTEMS

8.1 Draw a block diagram of an AM super heterodyne receiver. (6)

8.2 Explain the function of each stage of the diagram of the receiver mentioned in QUESTION 8.1. (9)
[15]

QUESTION 9: RADIO-WAVE PROPAGATION

9.1 Determine the length of a standard half-wave dipole antenna used to receive a 60 MHz radio signal. Assume that the velocity of the electromagnetic wave in the antenna is 3×10^8 m/s. (3)

9.2 What is meant by *vertical polarisation* with regard to antennae? (2)

9.3 Describe the term *ionosphere* as applicable to radio-wave propagation. (2)

9.4 Show, by means of a sketch, the possible ionosphere layers during the day as well as at night. Give a brief description. (5)

9.5 Define *critical angle* as applicable to radio-wave propagation. (2)

9.6 Make a neat, labelled sketch of each of the following antennae:

9.6.1 Loop antenna

9.6.2 Folded dipole antenna

(2 × 2) (4)
[18]

TOTAL: 100

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