higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T300**(E)**(A8)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

COMMUNICATION-ELECTRONICS N4

(8080224)

8 April 2016 (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
COMMUNICATION-ELECTRONICS N2
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

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 The impedance for a parallel circuit at resonance is a minimum.

1.2 An AM-signal with 95% modulation is undermodulated.

1.3 The reflex klystron oscillator produces an AC-output.

1.4 A π-type filter is used to convert AC to DC.

1.5 A receiver antenna converts electromagnetic waves into sound waves.

1.6 Satellite communication is effective because dishes concentrate signals onto small pick-up units.

1.7 Analogue signals do not get corrupted by noise.

1.8 A car antenna is omnidirectional.

1.9 A multi-cavity magnetron is an example of a microwave oscillator in radio communication.

1.10 The advantage of digital transmission is that it enables transmission of signals over a long distance.

(10 × 1) **[10]**

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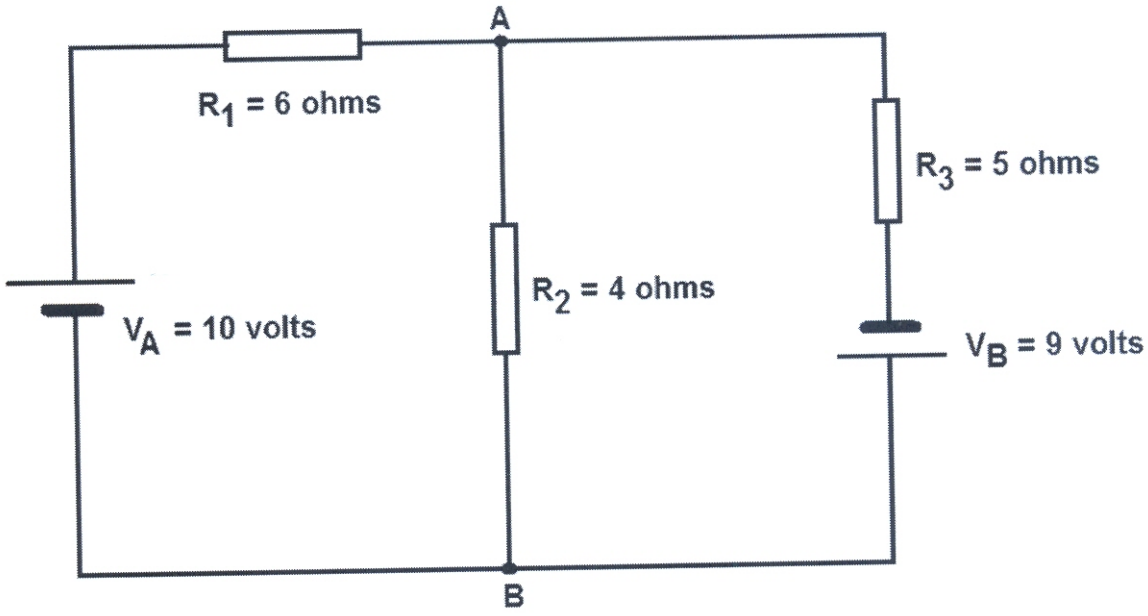
QUESTION 2

2.1 Define the following:

2.1.1 Kirchhoff's voltage law (2)

2.1.2 Norton's theorem (2)

2.2 Use Norton's theorem to find Norton's equivalent circuit for the network in FIGURE 1 below. Draw the equivalent circuit.



(6)
[10]

FIGURE 1

QUESTION 3

A series circuit consists of a coil with a DC resistance of 10 Ω, an inductance of 200 µH and a variable capacitor tuned to 400 nF.

3.1 Determine the frequency at which the circuit is tuned.

3.2 Determine the bandwidth.

3.3 Determine the Q-factor of the circuit.

3.4. Prove the answer in QUESTION 3.2 using any alternative method.

3.5 Prove the answer in QUESTION 3.3 using any alternative method.

(5 x 2) **[10]**

QUESTION 4

4.1 Define an *attenuator.* (2)

4.2 Draw the O-type attenuator. (2)

4.3 Draw a circuit diagram of a low-pass filter. (3)

4.4 Explain how frequencies are passed or blocked by the filter in QUESTION 4.3. (3)
[10]

QUESTION 5

5.1 Make a neat, fully labelled sketch of a travelling wave tube. (5)

5.2 Explain the operation of the sketch in QUESTION 5.1. (10)
[15]

QUESTION 6

6.1 Draw a block diagram of an AM superheterodyne receiver. (5)

6.2 Briefly explain the function of each stage of the receiver in QUESTION 6.1. (10)

6.3 Draw a neat, labelled circuit diagram of an AM half-wave detector. (5)
[20]

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QUESTION 7

7.1 Draw a block diagram of an FM-transmitter. (5)

7.2 Draw a neat, labelled circuit diagram of ratio detector. (5)
[10]

QUESTION 8

8.1 Define the following:

8.1.1 Silent zone

8.1.2 Critical frequency

8.1.3 Polarisation

(3 × 2) (6)

8.2 Explain the difference between a *directional antenna* and an *omnidirectional antenna.* (2)

8.3 Show, by means of sketches, the possible ionosphere layers by day as well as by night. (3)

8.4 Make neat, fully labelled sketches of the following:

8.4.1 The rhombic antenna

8.4.2 The folded-dipole antenna

(2 × 2) (4)
[15]

TOTAL: 100

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COMMUNICATION-ELECTRONICS N4

FORMULA SHEET

1. $I = \frac{V}{R}$
2. $X_L = 2\pi fL$
3. $X_C = \frac{1}{2\pi fc}$
4. $Z = \sqrt{R^2 + (X_L - X_C)^2}$
5. $I = \frac{V}{Z}$
6. $V_R = I \,.\, R$

   $V_L = I \,.\, X_L$

   $V_C = I \,.\, X_C$
7. $Cos\phi = \frac{R}{Z}$
8. $I = \sqrt{I_R + I_C^2}$
9. $\theta = Tan^{-1}\frac{I_C}{I_R}$
10. $I = \sqrt{I_R^2 + I_L^2}$
11. $I = \sqrt{I_R^2 \ + (I_L - L_C)^2}$
12. $\theta = Tan^{-1}\frac{(I_L - I_C)}{I_R}$
13. $f_r = \frac{1}{2\pi\sqrt{LC}}$
14. $C = \frac{1}{4 \,.\, \pi^2 \,.\, f_r^2 \,.\, L}$
15. $L = \frac{1}{4 \,.\, \pi^2 \,.\, f_r^2 \,.\, C}$
16. $Q = \frac{X_L}{R} = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{f_R}{bandwidth/bandwydte}$
17. $V_c = V \times Q \ and/en \ V_L = V \times Q$
18. $Z = \frac{L}{CR}$
19. $I_c = I \times Q$
20. $I_L = I \times Q$
21. $f = \frac{\nu}{\lambda}$
22. $B - W = \frac{R}{2\pi L}$
23. $V_T = \sqrt{V_R{}^2 + (V_C - V_L)^2}$

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