higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T380**(E)**(M27)T

NATIONAL CERTIFICATE

COMMUNICATION-ELECTRONICS N4

(8080224)

27 March 2018 (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
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. Write neatly and legibly.

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QUESTION 1: DIRECT-CURRENT THEORY (NETWORK THEOREMS)

1.1 Define *Nortan's theorem*. (3)

1.2 Differentiate between the following TWO networks:

1.2.1 Passive network

1.2.2 Active network

(2 × 3) (6)

1.3 Define the *superposition theorem*. (3)

[12]

QUESTION 2: ALTERNATING-CURRENT THEORY (VECTORS)

2.1 Refer to the parallel RLC circuit in FIGURE 1 to calculate the following:

2.1.1 The current in each branch (5)

2.1.2 The total supply current (2)

2.1.3 The phase angle (1)

2.2 Draw the phasor diagram.

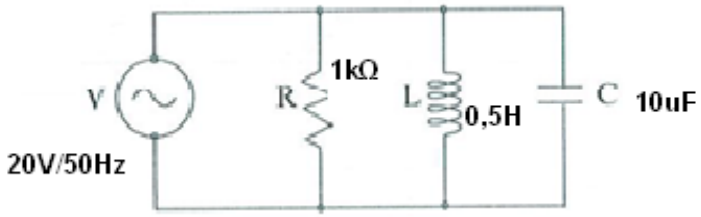

FIGURE 1

(2)

2.3 Differentiate between the following resonant circuits on THREE existing conditions:

2.3.1 Series resonant

2.3.2 Parallel resonant

(2 × 3) (6)

[16]

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QUESTION 3: FREQUENCY RESPONSE (FILTERS, ATTENUATORS AND RC TIME CONSTANTS)

3.1 Explain in detail the construction of a composite filter. (4)

3.2 Explain the principle of the piezoelectric effect on a crystal filter. (4)

3.3 State FOUR requirements that an attenuator must provide as a resistance network to reduce voltage, current or power in controllable and known amounts that are independent of frequency. (4)

3.4 Differentiate between the following RC circuits in terms of the output voltage and the waveform of the output:

3.4.1 RC integrator circuit

3.4.2 RC differentiator circuit

(2 × 4) (8)
[20]

QUESTION 4: MODULATION

4.1 Define *phase modulation.* (2)

4.2 Explain the process that takes place at the receiving end of the circuit during the transmission of the double-sideband transmission. (2)

4.3 Explain THREE main reasons for using single-sideband (reduced carrier) working for point-to-point communication. (6)
[10]

QUESTION 5: DEMODULATION

5.1 Explain in detail why the full-wave voltage detector provides more efficient filtering of the intermediate frequency signal. (4)

5.2 Draw the circuit diagram of an AM half-wave detector. (6)
[10]

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QUESTION 6: COMMUNICATION SYSTEMS

The block diagram in FIGURE 2 shows an FM receiver.

Explain the function of each stage.

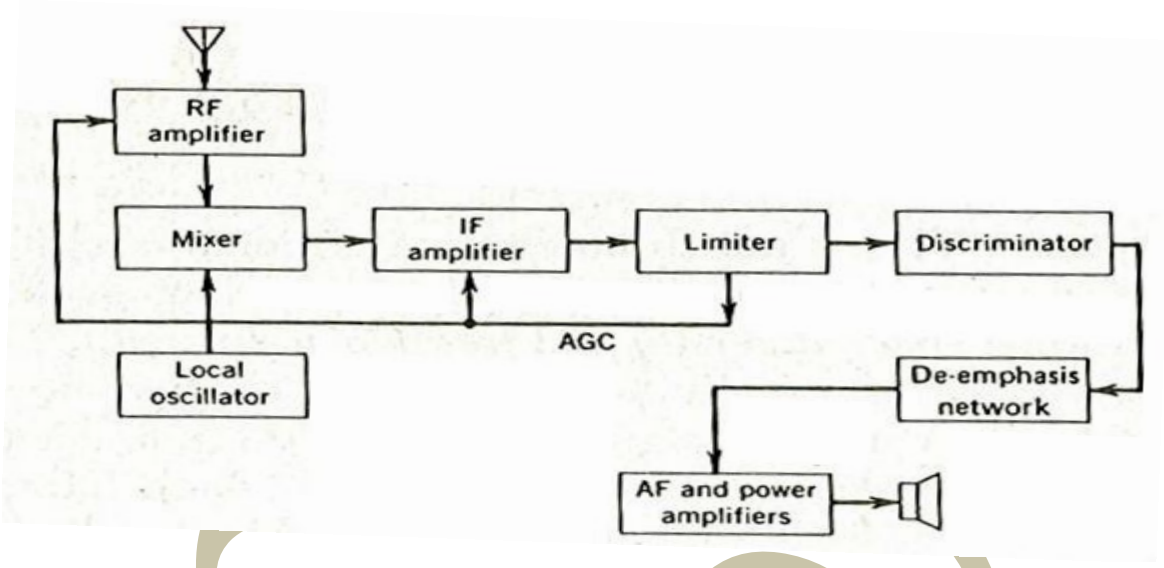

FIGURE 2 **[20]**

QUESTION 7: RADIO-WAVE PROPAGATION

Explain the following terms with reference to the propagation of radio waves:

7.1 Angle of reflection

7.2 Angle of incidence

7.3 Angle of refraction

7.4 Refracted wave

7.5 Reflected wave

7.6 Ionosphere

(6 × 2) **[12]**

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. $Q = \frac{X_L}{R} = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{f_R}{bandwidth}$
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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