higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1520(**E**)(J31)T

NATIONAL CERTIFICATE

RADIO THEORY N3

(11040873)

31 July 2018 (X-Paper)
09:00–12:00

This question paper consists of 5 pages and 1 formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
RADIO THEORY N3
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers correctly 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 When using a dipole antenna the direction of the E-lines determines the polarisation direction.

1.2 The antenna gain determines whether an antenna is omnidirectional or directional.

1.3 The time-base selector is used for selecting the band width at which the time-base generator must operate.

1.4 A sweep signal generator is most suitable for application to stages where oscillator circuits are involved.

1.5 A decibel expresses the proportion of two signals in a logarithmic form.

1.6 An operational amplifier used as an integrator uses resistors in the input as well as the feedback paths (loop).

1.7 The frequency of the modulation signal determines the rate of change of the carrier wave.

1.8 A loudspeaker is used to convert the IF signals into sound waves.

1.9 Limiting in an FM receiver is the clipping of the top of the IF signal to reduce feedback to the loudspeaker.

1.10 The function of the record oscillator is to produce a constant DC bias onto which the audio signal is modulated.

(10 × 1) **[10]**

QUESTION 2

An amplifier with an input impedance of 500 Ω is terminated with a 2 Ω loudspeaker.

Calculate the gain of the amplifier if an input voltage of 150 mV produces a current of 1 A in the loudspeaker. **[10]**

QUESTION 3

3.1 Give FIVE ideal characteristics that an operational amplifier displays when operated in the open-loop mode. (5)

3.2 Draw an operational amplifier differentiator circuit (high-pass filter). Also draw the output wave for an input square wave. (5)

[10]

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QUESTION 4

Draw a circuit diagram of a transistor push-pull audio output amplifier coupled to a single integrated preamplifier. **[15]**

QUESTION 5

5.1 Explain, with the aid of simple sketches, each of the following forms of modulation:

5.1.1 Pulse-amplitude modulation (PAM)

5.1.2 Pulse-width modulation (PMW)

5.1.3 Pulse-position modulation (PPM)

(3 × 3) (9)

5.2 What does *modem* stand for regarding transmission systems? (1)

[10]

QUESTION 6

6.1 State the main purpose of a detector stage in a receiver. (2)

6.2 Draw a neat circuit diagram of a ratio detector. (8)

6.3 Use a simple sketch and explain the term de-emphasis. (3)

6.4 What is the function of a limiter? (2)

[15]

QUESTION 7

7.1 Explain, with the aid of a simple sketch, the construction and operation of the rhombic antenna. Also sketch the polar diagram to show the radiation pattern produced by the antenna. (6)

7.2 Explain the following terms with reference to radio transmission:

7.2.1 Critical angle (2)

7.2.2 Maximum usable frequency (2)

[10]

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QUESTION 8

8.1 Briefly explain the phenomena of wow and flutter when tape speed is not kept constant. (2)

8.2 State the relationship between recording speed and frequency response regarding tape recorders. (3)
[5]

QUESTION 9

Explain FM/IF alignment when using a sweep signal generator and an oscilloscope. **[15]**

TOTAL: 100

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FORMULA SHEET

DC THEORY

(i) $V = I \times R$

(ii) $R_T = R_1 + R_2$

(iii) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$

(iv) $P = V \times I$

(v) $P = I^2 \times R$

(vi) $P = \frac{V^2}{R}$

DECIBEL RELATIONS

(i) $N = 10\log\frac{P_0}{P_1}$

(ii) $N = 20\log\frac{I_0}{I_1} + 10\log\frac{R_0}{R_1}$

(iii) $N = 20\log\frac{V_0}{V_1} + 10\log\frac{R_1}{R_0}$

If $R_1 = R_0$

(iv) then $N = 20\log\frac{I_0}{I_1}$

(v) $N = 20\log\frac{V_0}{V_1}$

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