higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1520**(E)**(A5)T

# NATIONAL CERTIFICATE

# RADIO THEORY N3

(11040873)

**5 April 2019 (X-Paper)**
**09:00–12:00**

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

Copyright reserved


Downloaded from www.mycourses.co.za

# 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 according to the numbering system used in this question paper.
4. Rule off on completion of each question.
5. Write neatly and legibly.

---

Copyright reserved 

Downloaded from www.mycourses.co.za

## QUESTION 1

1.1 Name the SIX basic parts that a cathode-ray oscilloscope consists of. (6)

1.2 Calculate the wavelength and period of a signal with a frequency of 10,7 MHz. (4)
**[10]**

## QUESTION 2

Explain FM/IF alignment when using a sweep signal generator and an oscilloscope. **[10]**

## QUESTION 3

3.1 Draw the circuit diagram of an integrated operational amplifier applied as a non-inverting audio amplifier stage with gain control, coupling capacitors and thermal compensation. (10)

3.2 An amplifier with an input of 100 mV produces a current flow of 120 mA in a loudspeaker which has a 4 Ω impedance. The input impedance is 10 Ω.

Calculate the gain of the amplifier in dB. (5)
**[15]**

## QUESTION 4

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (4.1–4.15) in the ANSWER BOOK.

4.1 An operational amplifier used as an integrator, uses a capacitor in the feedback path.

4.2 The clock-pulse generator generates the signal needed for alignment purposes

4.3 During the night, ionisation increases because some electrons and ions combine.

4.4 The half-wave dipole consists of two quarter-wave lengths.

4.5 In double-sideband transmission, both sidebands as well as the carrier frequency are transmitted.

4.6 The AC bias is fed together with the audio signal to the recording head of the tape recorder to give better linearity.

4.7 The RF stages provide most of the gain in the receiver.

Copyright reserved 

Downloaded from www.mycourses.co.za

4.8 Automatic gain control is associated with FM receivers.

4.9 The de-emphasis network is normally inserted between the detector and the audio amplifier.

4.10 The skip distance decreases when the transmission frequency is raised.

4.11 The adjustment of the tuned circuits in the IF stage is done in order to obtain maximum gain for a given bandwidth.

4.12 The density of ionospheric layers increases at night.

4.13 The Yagi antenna consists of a log periodic antenna as the main transmitting element.

4.14 Frequency modulation produces the better signal-to-noise ratio.

4.15 A fast-recording speed results in the good frequency response of a magnetic tape.

(15 × 1) **[15]**

## QUESTION 5

5.1 Draw a circuit diagram of a Hartley oscillator that uses an NPN transistor. (10)

5.2 Another form of frequency modulation is frequency-shift keying (FSK) which is used in modems.

Briefly explain what is meant by *FSK.* (3)

5.3 Make a neat, labelled drawing of the carrier and upper sideband of a single-sideband (SSB) transmission. (2)

**[15]**

## 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 Explain the term *de-emphasis*. (3)

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

**[15]**



Downloaded from www.mycourses.co.za

## QUESTION 7

Make clear, simple sketches of the following antennae:

7.1 Half-wave dipole

7.2 Folded dipole

7.3 Yagi

7.4 Rhombus

7.5 Loop

(5 × 2) **[10]**

## QUESTION 8

8.1 State FOUR possible faults that will result in a variation of speed and resultant distortion of sound in a tape recorder. (4)

8.2 If the tape speed is not kept constant, *wow* and *flutter* will result.

Briefly explain these TWO phenomena. (2)

8.3 State the relationship between *recording speed* and *frequency response* with regard to tape recorders. (4)

**[10]**

**TOTAL: 100**

Copyright reserved

Downloaded from www.mycourses.co.za

# RADIO THEORY N3

## 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)* $N = 20\log\frac{V_0}{V_1}$

Copyright reserved

Downloaded from www.mycourses.co.za