higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

RADIO THEORY N3

(11040873)

14 April 2021 (X-paper)
09:00–12:00

This question paper consists of 4 pages and 1 formula sheet.

173Q1A2114

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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. Write neatly and legibly.

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QUESTION 1

Choose the correct term from those in brackets. Write only the answer next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 A voltage-follower operational amplifier produces a gain of (infinity/unity).

1.2 A (watt/impedance) meter is used to measure the output of an RF transmitter.

1.3 During the night ionisation (increases/decreases) because some electrons and ions combine.

1.4 The Yagi antenna has of a (dipole/log periodic) antenna as main transmitting element.

1.5 (SSB/DSB) is frequently used by amateur radio operators.

1.6 A (flywheel/pinch wheel) is attached to the capstan and is used to eliminate variations in tape speed.

1.7 (IF/RF) stages provide most of the gain in a receiver.

1.8 When FM is transmitted it is essential that the (peak/centre) frequency around which the deviation occurs, remains constant.

1.9 An RF amplifier isolates the (IF amplifier/local oscillator) signal from the antenna.

1.10 A (sideband/spectrum) analyser is used to display sidebands.

(10 × 1) **[10]**

QUESTION 2

An amplifier with an input impedance of 200 Ω is terminated with a 4 Ω loudspeaker.

Calculate the gain of the amplifier if an input voltage of 50 mV produces a current of 2 A in the loudspeaker, **[10]**

QUESTION 3

Describe the *alignment of a radio receiver* and give reasons for the respective adjustments. **[10]**

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QUESTION 4

4.1 Draw a circuit diagram of a Colpitts oscillator used in a radio transmitter. (12)

4.2 Draw a frequency-spectrum chart of a modulated signal in a system in which a carrier frequency of 10 kHz is modulated by a voice-frequency signal occupying the frequency-spectrum 300 Hz to 3000 Hz. (8)

[20]

QUESTION 5

5.1 Name SIX stages of a single-sideband transmitter as represented in a block diagram and give a short description of each stage. (12)

5.2 Name SIX kinds of modulation used in transmission systems (do not use abbreviations). (6)

5.3 Briefly explain what is meant by FSK. (2)

[20]

QUESTION 6

Explain why digital data is preferred to analogue data for transmission of information. **[6]**

QUESTION 7

Briefly explain each of the following with reference to radio wave propagation:

7.1 Tropospheric ducting (5)

7.2 Tropospheric scatter (5)

7.3 Maximum usable frequency (4)

[14]

QUESTION 8

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

8.2 Briefly explain the resultant 'wow' and 'flutter' if tape speed is not kept constant. (2)

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

[10]

TOTAL: 100

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

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