higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

RADIO THEORY N1

(11040851)

29 November 2023 (X-paper)
09:00–12:00

This question paper consists of 6 pages and a formula sheet.

161Q1E2329

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
RADIO THEORY N1
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. Use only a blue or black pen.
5. Write neatly and legibly.

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QUESTION 1

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 Matter can be defined as anything that occupies space and has weight/mass.

1.2 Different elements can combine to form a compound.

1.3 Sound waves can move through a vacuum.

1.4 An ion is a charged atom.

1.5 When resistors are connected in parallel, the total resistance increases.

1.6 Transistors can be used as a switch or an amplifier.

1.7 Cells are connected in parallel to increase the voltage output.

1.8 When measuring ohms, the multimeter is always used in series with the battery.

1.9 Radio waves are longitudinal waves.

1.10 The north poles of two bar magnets attract each other.

(10 × 1) **[10]**

QUESTION 2

2.1 Give a brief definition of an *atom*. (2)

2.2 What are electrons in the outer orbit of an atom called? (2)

2.3 A 4-m long conductor has a resistance of 2 Ω. The resistivity of the conductor is 0,0035 μΩ.m.

Calculate the cross-sectional area of the conductor. (4)

2.4 Name the TWO forces acting on an orbiting electron. (2)

[10]

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QUESTION 3

3.1 Three identical cells with a combined EMF of 4,5 V and a total internal resistance of 1,5 Ω are connected to one another in series. This battery is then connected across an external resistor with a value of 20 Ω.

Calculate each of the following values:

3.1.1 The internal resistance of ONE cell (2)

3.1.2 The current flow through the circuit (3)

3.1.3 The potential difference of the circuit (3)

3.2 Define *Kirchhoff's first law*. (2)
[10]

QUESTION 4

4.1 Define *Lenz's law.* (3)

4.2 Make a neat, fully labelled sketch of TWO bar magnets to show how they attract each other. Show the poles and direction of the magnetic fields. (4)

4.3 Explain Fleming's right-hand rule. (3)
[10]

QUESTION 5

5.1 A moving-coil meter has a coil resistance of 300 Ω. A current of 120 mA flowing through the coil gives a full-scale deflection. A shunt resistor is connected to the meter to enable the meter to have a range of 0–3 A.

5.1.1 Draw a circuit diagram of the meter and shunt resistor. (2)

5.1.2 Calculate the value of the shunt resistor. (3)

5.2 Make a neat, labelled sketch of a series-type ohmmeter using a moving-coil meter. (5)
[10]

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QUESTION 6

6.1 Calculate the frequency of a sine wave if the time period is 10 milliseconds. (2)

6.2 Make a neat, labelled sketch of TWO sine waves to show the phase relationship between current and voltage in a capacitive circuit. (4)

6.3 Give a short explanation of how an AC waveform is generated by an AC generator. (4)

[10]

QUESTION 7

7.1 Briefly explain the operation of a loudspeaker. (4)

7.2 Define *groundwaves*. (2)

7.3 Classify the following as either *transverse waves* or *longitudinal waves*:

7.3.1 Waves to and from a satellite

7.3.2 Waves from a loudspeaker

7.3.3 Waves to a microphone

7.3.4 Waves emitted from an RF antenna

(4 × 1) (4)

[10]

QUESTION 8

8.1 Make a neat, labelled sketch to show how a diode can be connected in forward bias. Your sketch must include a diode, a resistor and a battery. (3)

8.2 State TWO functions of diodes. (2)

8.3 Explain how N-type semiconductor material is made. (4)

8.4 Explain the function of the base in a transistor. (1)

[10]

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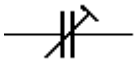
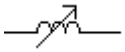
QUESTION 9

9.1 What components do the following IEC symbols represent?

9.1.1 

9.1.3 

9.1.2 

(3 × 2) (6)

9.2 The value of a resistor is 560 Ω with a tolerance of 10%. Give the colour code for this resistor. (4)

[10]

QUESTION

10.1 Draw a fully labelled circuit diagram of a full-wave power supply. Your drawing must include a centre-tap transformer, two diodes, a capacitor filter and a load resistor. (5)

10.2 What is the function of a local oscillator as used in a radio receiver? (2)

10.3 Explain the operation of a simple oscillator as used in a radio receiver. (3)

[10]

TOTAL: 100

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RADIO THEORY N1

FORMULA SHEET

Any applicable formula may also be used.

$I = \frac{V}{R}$	$R = \frac{V}{I}$
V = I x R	$R_T = R_1 + R_2 + R_3 + ...$
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ...$	$R = \frac{\rho.\ell}{A}$
E = V + I x r	$I_T = \frac{EMF}{R + r_T}$
$R_p = \frac{I_m \times R_m}{(I_t - I_m)}$	$R_s = \frac{V}{I_m} - R_m$
$C_T = C_1 + C_2 + C_3$	$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$
$L_T = L_1 + L_2 + L_3$	$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$
$f = \frac{1}{t}$	F = BIL

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