higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1500**(E)**(A4)T

NATIONAL CERTIFICATE

RADIO THEORY N1

(11040851)

4 April 2019 (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
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. Sketches and diagrams must be large, neat and fully labelled.
5. 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 Matter can be defined as anything that occupies space and has weight.

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 valence electrons? (2)

2.3 Explain Kirchhoff's first and second laws. (2 × 3) (6)

[10]

QUESTION 3

A 3 Ω resistor is connected in series with two parallel resistors with the values of 8 ohms and 6 ohms respectively. This combination is connected across a 12 V battery.

3.1 Draw and label the circuit diagram. (3)

3.2 Calculate the total resistance. (3)

3.3 Calculate the total current. (2)

3.4 Calculate the volt drop across the 3 Ω resistor. (2)

[10]

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QUESTION 4

4.1 Briefly explain what is meant by *mutual inductance*. (4)

4.2 Name FOUR characteristics of magnetic lines of force. (4)

4.3 Explain how the left-hand rule can be used to determine the direction of the magnetic field and the direction of the current flowing in a conductor. (2)

[10]

QUESTION 5

5.1 Calculate the series multiplier resistor needed to enable a moving coil meter with a full-scale deflection current of 120 mA and a coil resistance of 150 Ω to measure 100 V at full-scale. (3)

5.2 Show, by means of a neat, labelled sketch, how an ammeter and a voltmeter are used to measure current and voltage in a circuit. Your circuit must include an ammeter, voltmeter, battery and a resistor. (4)

5.3 Give the definition of Lenz's law. (3)

[10]

QUESTION 6

6.1 Make a neat, labelled sketch of a simple alternating-current generator. (4)

6.2 Make a neat, labelled sketch of an alternating current and direct-current waveform to indicate the difference between an alternating current and a direct current. (4)

6.3 Give a definition of *frequency*. (2)

[10]

QUESTION 7

7.1 Make a neat, labelled drawing of a permanent magnet speaker. (6)

7.2 Explain how a sky wave travels from one radio station to another radio station. (2)

7.3 What does the acronym *FM* stand for? (2)

[10]

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QUESTION 8

8.1 Transistors have three legs (connections).

Name and explain the function of each leg. (6)

8.2 Make TWO neat, labelled sketches to show how a diode can be connected in forward bias and reverse bias mode. Your sketches must include a battery, a resistor and a diode. (4)

[10]

QUESTION 9

9.1 Draw the IEC symbols of the following components:

9.1.1 Preset capacitor

9.1.2 Coil

9.1.3 Variable resistor

(3 × 1) (3)

9.2 The value of a resistor is 56 K ohms with a tolerance of 5%.

Give the colour code for this resistor. (4)

9.3 Draw a fully labelled circuit diagram symbol of a power transformer. (3)

[10]

QUESTION 10

10.1 Explain, with the aid of a block diagram, the operation of an oscillator.

10.2 Draw a fully labelled circuit diagram of a full-wave power supply. Your drawing should include a centre-tap transformer, two diodes, a capacitor filter and a load resistor.

(2 × 5) **[10]**

TOTAL: 100

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RADIO THEORY N1

FORMULA SHEET

Any applicable formula may also be used.

1. $I = \frac{V}{R}$; $R = \frac{V}{I}$; V = I x R

2. $R_T = R_1 + R_2 + R_3 + ...$

3. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ...$

4. $R_p = \frac{I_m \times R_m}{(I_t - I_m)}$

5. $R_s = \frac{V}{I_m} - R_m$

6. $R = \frac{\rho.\ell}{A}$

7. $f = \frac{1}{t}$

8. $F = \frac{1}{t}$

9. $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

10. $L_T = L_1 + L_2 + L_3$

11. $C_T = C_1 + C_2 + C_3$

12. $\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3}$

13. F = BIL

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