higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

RADIO THEORY N1

(11040851)

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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. 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 Electrons have a positive charge.

1.2 A tantalum capacitor is a polarised capacitor.

1.3 Longitudinal waves can travel in space.

1.4 A bridge rectifier uses two diodes.

1.5 When inductors are connected in series, the total resistance increases.

1.6 Transistors have two 'legs'.

1.7 The acronym AM stands for audio modulation.

1.8 When measuring current the ammeter is always connected in series with the battery.

1.9 Ground waves travel along the ground.

1.10 Diodes can pass current in only one direction.

(10 × 1) **[10]**

QUESTION 2

2.1 Determine the length of a conductor with a resistance of 2 Ω and cross-sectional area of 1 mm^2. The resistivity of the conductor is 35 μΩ.m. (4)

2.2 Name FOUR forms of matter. (4)

2.3 Briefly define a molecule. (2)

[10]

QUESTION 3

Two resistors of 800 Ω and 1 kΩ respectively are connected in parallel with a 10 V DC supply.

3.1 Draw and label the circuit diagram. (2)

3.2 Calculate the total resistance. (3)

3.3 Calculate the total current. (2)

3.4 What is the voltage drop across the 800 Ω resistor? (1)

3.5 Calculate the current through the 1 kΩ resistor. (2)

[10]

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QUESTION 4

4.1 Explain the term *inductance*. (3)

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

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

[10]

QUESTION 5

5.1 List FOUR factors that determine the strength of an electromagnet. (4)

5.2 A moving-coil meter has a coil resistance of 100 Ω. A current of 12 mA through the coil gives full-scale deflection.

Calculate the value of a shunt resistor required to enable the meter to have a range of 0 – 5 A. (3)

5.3 Name THREE controls on an oscilloscope. (3)

[10]

QUESTION 6

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

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

6.3 List the THREE parts of a simple alternating current generator. (3)

6.4 What is the unit of frequency? (1)

[10]

QUESTION 7

7.1 Define *AM modulation.* (2)

7.2 Make a neat labelled sketch of a simple moving-coil microphone. (4)

7.3 Give ONE example of a longitudinal wave. (1)

7.4 Make a neat labelled sketch to show how a sky wave is refracted/reflected from the ionosphere. (3)

[10]

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QUESTION 8

8.1 Explain how P-type semiconductor material is made. (3)

8.2 Draw a labelled sketch of the internal structure of a PN junction diode. Include the barrier potential and depletion region. (4)

8.3 Name the THREE legs of a transistor. (3)
[10]

QUESTION 9

9.1 Draw the IEC symbols of each of the following components:

9.1.1 NPN-transistor

9.1.2 Coil

9.1.3 Variable resistor

(3 × 1) (3)

9.2 The value of a resistor is 270 kΩ with a tolerance of 5%.

Give the colour code for this resistor. (4)

9.3 List THREE factors that affect the capacitance of a capacitor. (3)
[10]

QUESTION 10

10.1 Draw a fully labelled circuit diagram of a full-wave power supply. Include a transformer, FOUR diodes, a capacitor filter and a load resistor. (5)

10.2 Explain, with the aid of a block diagram, the operation of an oscillator. (5)
[10]

TOTAL: 100

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FORMULA SHEET

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

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

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

4. $Rp = \frac{Im \times Rm}{It - Im}$

5. $Rs = \frac{V}{Im - Rm}$

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

7. $A = \frac{\pi.D^2}{4}$

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

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

10. $L_T = L_1 + L_2 + L_3 \ldots$

11. $C_T = C_1 + C_2 + C_3 \ldots$

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

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