higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

RADIO THEORY N1

(11040851)

23 November 2022 (X-paper)
09:00–12:00

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

171Q1E2223

Copyright reserved

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. Start each question on a new page.
6. Write neatly and legibly.

Copyright reserved

QUESTION 1

Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–J) next to the question number (1.1–1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1	Blocks DC	A	oscillator
1.2	Capacitors in parallel	B	transistor
1.3	Generates a frequency	C	inductor
1.4	Displays a waveform	D	diode
1.5	Negative charge	E	AF
1.6	Three-terminal device	F	capacitor
1.7	Henry	G	electron
1.8	Current flows for half of the input signal	H	oscilloscope
1.9	Output of a detector	I	common emitter
1.10	180° phase shift	J	$C_T = C_1 + C_2$

(10 × 1) **[10]**

QUESTION 2

2.1 List FOUR factors that determine the resistance of a conductor. (4)

2.2 Make a neat sketch of the atomic structure of a silicon atom. (6)

[10]

QUESTION 3

A 3 Ω resistor is connected in series with two parallel resistors with values of 8 Ω and 6 Ω. 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 voltage drop across the 3 Ω resistor. (2)

[10]

Copyright reserved

QUESTION 4

4.1 Explain the term *inductance*. (3)

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

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

[10]

QUESTION 5

5.1 Calculate which series-multiplier resistor is needed to enable a moving-coil meter with a full-scale deflection current of 120 mA and 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 is used to measure current and voltage respectively in a circuit. The circuit must include an ammeter, voltmeter, battery and a resistor. (4)

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

[10]

QUESTION 6

6.1 Make neat, labelled sketches of two sine waves to show the phase relationship between *current* and *voltage* in a circuit containing capacitance only. (4)

6.2 Briefly explain how an AC waveform is generated by an AC generator. (5)

6.3 Give the unit of frequency. (1)

[10]

QUESTION 7

7.1 Make a neat, labelled sketch to show how two earth stations communicate using radio waves. The diagram must include the earth, ionosphere, satellite, ground wave, space wave and sky wave. (6)

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

[10]

Copyright reserved

QUESTION 8

8.1 Draw a labelled sketch of the internal structure of an NPN transistor. (3)

8.2 Briefly explain the process of electron flow. (3)

8.3 Give the TWO materials used to make diodes. (2)

8.4 Name the TWO legs of a diode. (2)
[10]

QUESTION 9

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

9.1.1 Transformer

9.1.2 Variable coil

9.1.3 Preset resistor

(3 × 1) (3)

9.2 What is the value of a resistor coloured red, violet, orange and gold? (4)

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

QUESTION 10

10.1 Draw a fully labelled circuit diagram of a full-wave power supply. The drawing must 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

Copyright reserved

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

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

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

Copyright reserved