higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

RADIO AND TELEVISION THEORY N2

(11040832)

6 August 2021 (X-paper)
09:00–12:00

Drawing instruments and scientific calculators may be used.

This question paper consists of 5 pages and a formula sheet of 3 pages.

231Q1G2106

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
RADIO AND TELEVISION THEORY N2
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. Start each question on a new page.
5. Only use a black or blue pen.
6. Write neatly and legibly.

Copyright reserved

QUESTION 1

Choose a statement from COLUMN B that matches a term 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	AC supply frequency	A	resonant RLC circuit
1.2	$Z = \sqrt{R^2 + X_L{}^2}$	B	sawtooth waveform
1.3	Phase angle = 0°	C	front end
1.4	180° phase shift	D	amplitude
1.5	Time-base generator	E	colour transmission
1.6	Ohmmeter	F	0,05 kHz
1.7	Tuner	G	effective value
1.8	maximum value	H	series RL circuit
1.9	Notch filter	I	common emitter
1.10	RMS	J	parallel with the load

(10 × 1) **[10]**

QUESTION 2

2.1 Draw a simple phasor diagram showing capacitive reactance (X_C) versus frequency (f). (4)

2.2 Two capacitors, each with a value of 100 nF and 25 µF, are connected in series across a 100 V DC supply.

Calculate:

2.2.1 The total charge developed. (4)

2.2.2 The voltage drop across each capacitor. (2)

2.3 A 100 µF capacitor is connected in series with a 200 kΩ resistor across a 100 V, DC supply.

Calculate:

2.3.1 The time constant (τ) of the circuit. (2)

2.3.2 The time taken to fully charge the capacitor. (2)

Copyright reserved

2.3.3 The voltage drop across the capacitor when it has reached 63,2% of the applied charge. (2)

2.3.4 The voltage drop across the resistor, with reference to QUESTION 2.3.3. (2)

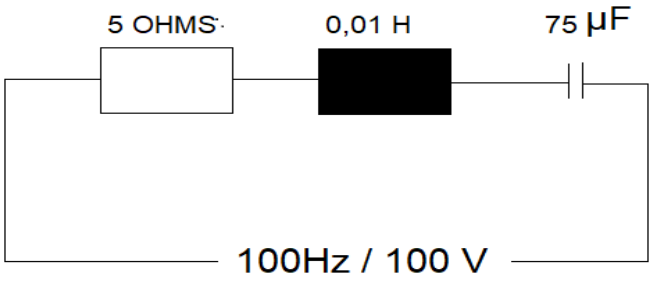
2.4 Define *impedance* as used in AC circuits. (2)
[20]

QUESTION 3

3.1 Explain what you understand by *a rejector circuit* as used in AC theory. (2)

3.2 Give SIX conditions that exist in a series resonant RLC circuit. (6)

3.3



FIGURE

Calculate the following for the circuit shown in the FIGURE above:

3.3.1 The impedance of the circuit (Z_T) (4)

3.3.2 The phase angle (Θ) (2)

3.3.3 The resonant frequency (f_r) (3)
[17]

QUESTION 4

Draw a neat, labelled circuit diagram of the common emitter amplifier that uses an NPN transistor. Include the waveforms that appear at the input and output of the circuit. **[10]**

QUESTION 5

Define the following radio terms:

5.1 Gang tuning

5.2 Selectivity

5.3 Sensitivity

5.4 Detector

5.5 Limiter

(5 × 2) **[10]**

QUESTION 6

Draw a neat, labelled block diagram of a 625-line colour television receiver. **[18]**

QUESTION 7

7.1 Give SEVEN advantages that a digital meter has over an analogue meter. (7)

7.2 Give THREE waveforms that can be produced by a signal generator. (3)

[10]

QUESTION 8

8.1 Give THREE uses of an oscilloscope. (3)

8.2 List TWO symptoms of a faulty line output stage of a TV receiver. (2)

[5]

TOTAL: 100

Copyright reserved

RADIO AND TELEVISION THEORY N2

FORMULA SHEET

CAPACITOR CALCULATIONS

Capacitors in series: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots$

Capacitors in parallel: $C_T = C_1 + C_2 + \cdots$

Instantaneous voltage across a capacitor: $V_C = V(1 - e^{\frac{-t}{RC}})$

Initial charging current through a capacitor: $i = \frac{V}{R} \times e^{\frac{-t}{RC}}$

Time constant: $T = R \times C$

Charge of capacitor: $Q = C \times V$

AC THEORY

Inductive reactance: $X_L = 2 \bullet \pi \bullet F \bullet L$

Capacitive reactance: $X_C = \frac{1}{2 \bullet \pi \bullet F \bullet C}$

Copyright reserved

Impedance for RL, RC and RLC circuits:

$$Z = \sqrt{R^2 + X_L^2} \qquad Z = \sqrt{R^2 + X_C^2} \qquad Z = \sqrt{R^2 + (X_L - X_C)^2}$$

Circuit current for RL, RC and RLC circuits:

$$\mathrm{I}_T = \frac{V}{X_L} \qquad \mathrm{I}_T = \frac{V}{X_C} \qquad \mathrm{I}_T = \frac{V}{Z}$$

Voltage drop across components:

$$V_R = \mathrm{I} \times R \qquad V_L = \mathrm{I} \times X_L \qquad V_C = \mathrm{I} \times X_C$$

Power factor:

$$Cos\,\theta = \frac{R}{Z}$$

Phase angle:

$$\phi = Cos^{-1}\frac{R}{Z}$$

Resonant frequency:

$$f_r = \frac{1}{2 \bullet \pi \bullet \sqrt{L \bullet C}}$$

Q-factor:

$$Q = \frac{1}{R \bullet}\sqrt{\frac{L}{C}}$$

OHM'S LAW

Resistors in series:

$$R_T = R_1 + R_2 + \cdots$$

Resistors in parallel:

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$$

Voltage drop:

$$V = I \times R$$

Circuit current:

$$\mathrm{I} = \frac{V}{R}$$

Copyright reserved

OSCILLOSCOPE CALCULATIONS

Period = Time/Division × Horizontal divisions

Amplitude = Volts/Division × Vertical divisions

$$Frequency = \frac{1}{Period}$$

RMS voltage = 0,707 × Peak

Average voltage = 0,637 × Peak

Voltage (peak-to-peak) = 2 × Peak

Copyright reserved