higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

RADIO AND TELEVISION THEORY N2

(11040832)

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

This question paper consists of 5 pages and a formula sheet of 2 pages.

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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. Use only a blue or black pen.
5. Drawings, graphs and diagrams should be clear, neat and labelled. A pencil may be used.
6. Write neatly and legibly.

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QUESTION 1

Complete the following sentences by writing only the missing words next to the question number (1.1.1–1.5.2) in the ANSWER BOOK.

1.1 The luminance travels (1.1.1) ... than the (1.1.2) ... through the luminance circuitry.

1.2 To maintain a relatively (1.2.1) ... picture under varying reception conditions, (1.2.2) ... is used to alter the gain of the IF amplifiers.

1.3 The frequency of the field oscillator is (1.3.1) … while that of a line oscillator is (1.3.2) ….

1.4 In a (1.4.1) ... resonant circuit the (1.4.2) ... is equal to R.

1.5 Capacitors consist of (1.5.1) … metal plates separated by (1.5.2) ….

(5 × 2) **[10]**

QUESTION 2

2.1 A certain sine wave has a frequency of 50 Hz and a maximum value of 100 volts.

Draw ONE cycle of this sine wave clearly indicating on the wave the following:

- The period of the wave (3)
- 0; π/2; π; 3π/2; 2π (5)
- The amplitude of the wave (2)
- The peak-to-peak value (2)

2.2 The equation $i = I \sin 2\pi ft$ represents an alternating current.

Name the following and give the unit of each one:

2.2.1 I

2.2.2 i

2.2.3 f

2.2.4 t

(4 × 2) (8)
[20]

QUESTION 3

3.1 Use the table below to compare the characteristics of common base, common collector and common emitter amplifier transistors. Write only the word or words next to the question number (3.1.1–3.1.6) in the ANSWER BOOK.

	Common base	**Common collector**	**Common emitter**
Input impedance	3.1.1	3.1.2	3.1.3
Current gain	3.1.4	3.1.5	3.1.6

(6 × 1) (6)

3.2 An electrical circuit that is supplied by an AC supply of 100 V has a 100 mH inductor in series with a 100 µF capacitor and a 100 Ω resistor.

3.2.1 Calculate the resonant frequency. (2)

3.2.2 Prove that $X_L = X_C$ for this circuit. (3)

3.2.3 Calculate the voltage across R, L and C. (4)

3.2.4 Draw the phasor diagram (3)

3.3 Name TWO classes of amplification. (2)
[20]

QUESTION 4

Draw a neat, fully labelled characteristic curve of the common emitter amplifier showing the collector current versus the collector emitter voltage as well as the base currents. Also, show the THREE operating regions of the transistor. **[10]**

QUESTION 5

The local oscillator plays a major role in the heterodyning process as found in a superheterodyne receiver.

Draw the circuit diagram of a Collpits oscillator that uses an NPN transistor. **[10]**

QUESTION 6

Explain interlaced scanning, as found in a monochrome television receiver, as follows:

6.1 Give a detailed explanation. (11)

6.2 Make simple sketches. (4)
[15]

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QUESTION 7

Draw a neat, labelled block diagram of an oscilloscope. Clearly show all inputs and signal directions. **[10]**

QUESTION 8

8.1 State the symptom of each of the following faulty stages of a TV receiver:

8.1.1 Field oscillator

8.1.2 Sync separator

8.1.3 Horizontal deflection coils

(3 × 1) (3)

8.2 Explain what is meant by *demodulation* as used in radio receivers. (2)

[5]

TOTAL: 100

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 × C

Charge of capacitor: Q = C × V

AC THEORY

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

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

Impedance for RL, RC and RLC circuits:

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

Circuit current for RL, RC and RLC circuits:

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

Voltage drop across components:

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

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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 × R

Circuit current: $\mathrm{I} = \frac{V}{R}$

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

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