higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1480**(E)**(A6)T

NATIONAL CERTIFICATE

RADIO AND TELEVISION THEORY N2

(11040832)

6 April 2018 (X-Paper)
09:00–12:00

Calculators may be used.

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

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QUESTION 1

Choose the correct word from those given in brackets. Write only the word next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 The ability of a capacitor to store charge is determined by the (volume/area) of the plates.

1.2 To calculate the instantaneous voltage of a sine wave the (cos/sin) of the angle θ is needed.

1.3 In a parallel resonant circuit the total current will be a (maximum/minimum).

1.4 The power gain of a transistor connected in the common emitter mode is (unity/high).

1.5 When a carrier frequency is amplitude modulated by an audio signal (2/3) frequencies are produced.

1.6 If a dead stage is detected in the video detector stage the (diode/transistor) is immediately checked for a faulty condition.

1.7 The line oscillator provides (vertical/horizontal) scanning of the screen with an electron beam.

1.8 The luminance travels (faster/slower) than the chrominance through a luminance circuitry.

1.9 In Class A amplifiers the current flows in the output circuit for (180°/360°).

1.10 Pattern bar generators provide (10 kHz/1 kHz) sound output for audio circuit repairs.

(10 × 1) **[10]**

QUESTION 2

An alternating waveform is represented by the equation e = 100 sin 314,2t volts.

Determine:

2.1 The maximum value of the emf (1)

2.2 The rms value and average value (after full-wave rectification) (4)

2.3 The frequency of the supply (3)

2.4 The time period (2)

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2.5 The instantaneous value of the emf 12 milliseconds after zero increasing positively (4)

2.6 The time that it would take the waveform to reach 55 volts for the first time from zero (6)
[20]

QUESTION 3

3.1 Give FOUR conditions that exist when a circuit with R, L and C in series, resonates. (4)

3.2 A coil with a resistance of 15 Ω and an inductance of 128 mH is connected in series with a 58 µF capacitor. The supply voltage to this circuit is 100 V.

Determine:

3.2.1 The resonant frequency (4)

3.2.2 The quality factor (Q) of the coil (2)
[10]

QUESTION 4

4.1 Give the SEVEN main subsections of an oscilloscope. (7)

4.2 The probes of a cathode-ray oscilloscope are classified as being active, passive or current.

Briefly describe the active probes. (3)
[10]

QUESTION 5

Draw the circuit diagram of an envelope detector as found in radio receivers. Use an NPN transistor in the circuit. **[10]**

QUESTION 6

Explain interlaced scanning as it relates to a monochrome television receiver. Use simple sketches to support the explanation. **[15]**

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QUESTION 7

Using the test pattern shown below, explain how each of the following can aid in acquiring the best picture possible on the television screen:

7.1 The circle (2)

7.2 The black and white castellations around the edge of the pattern (2)

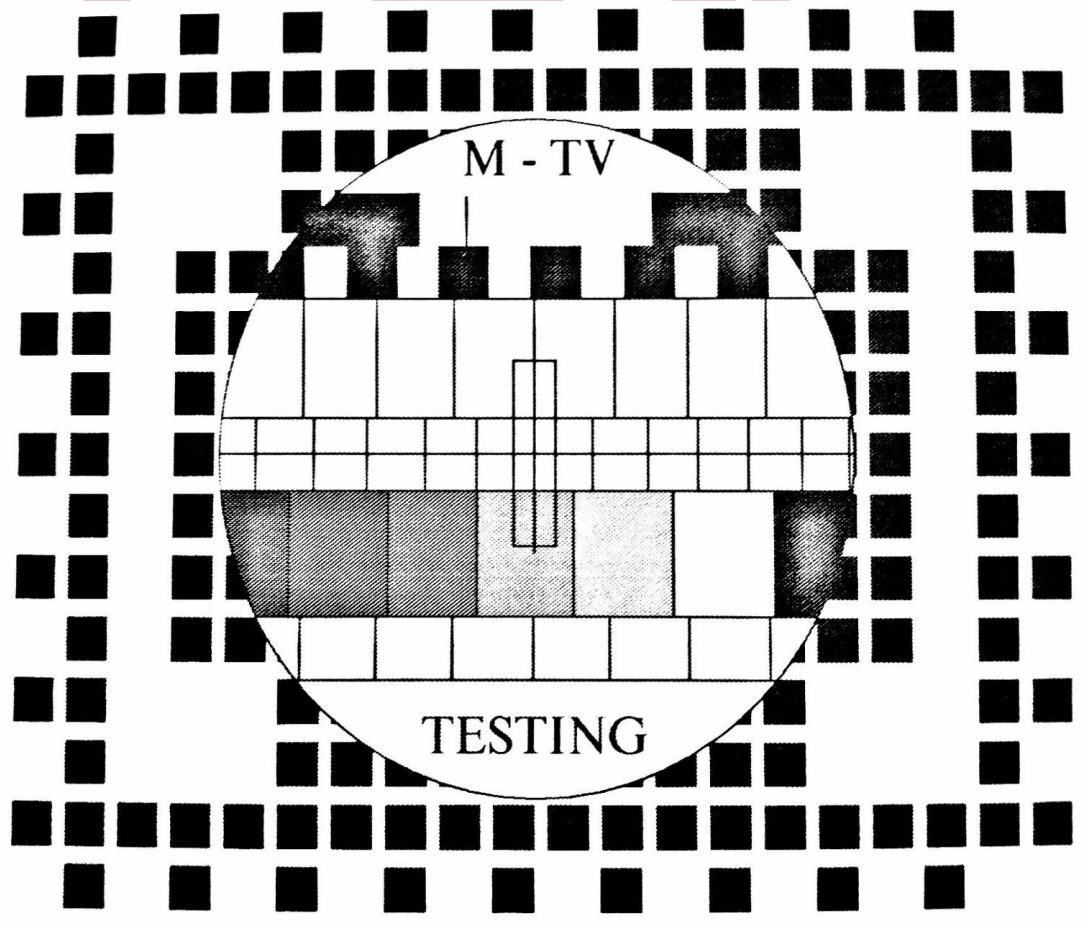
7.3 Scanning linearity (2)

7.4 Convergence (3)

7.5 Contrast (2)

7.6 Ghost images (2)

7.7 Colour settings (2)



[15]

QUESTION 8

Describe the procedures to follow before attempting a fault-finding process. **[10]**

TOTAL: 100

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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: $\mathrm{T} = \mathrm{R} \times \mathrm{C}$

Charge of capacitor: $\mathrm{Q} = \mathrm{C} \times \mathrm{V}$

AC THEORY

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

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

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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:

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

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: $\mathrm{V} = \mathrm{I} \times \mathrm{R}$

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

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OSCILLOSCOPE CALCULATIONS

Period = time/division × horizontal divisions

Amplitude = volts/division × vertical divisions

$$\text{Frequency} = \frac{1}{\text{period}}$$

RMS voltage = 0,707 × peak

Average voltage = 0,637 × peak

Voltage (peak-to-peak) = 2 × peak

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