higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1480**(E)**(A8)T

NATIONAL CERTIFICATE

RADIO AND TELEVISION THEORY N2

(11040832)

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09:00–12:00

Calculators may be used.

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. 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 Capacitors provide low impedance to low frequencies.

1.2 The time constant of a circuit containing a resistor and a capacitor in series can be derived from the formula $C = \frac{T}{R}$.

1.3 In a series resonant circuit consisting of R, L and C the impedance is equal to $X_C + X_L + R$.

1.4 Crystal oscillators are popular because of their low sensitivity.

1.5 Another name for the tuner in a TV receiver is front end.

1.6 The local oscillator's frequency in a receiver is set to the AF above the incoming frequency.

1.7 An NPN transistor only has three terminals.

1.8 The total capacitance of three capacitors in parallel is $\frac{1}{C_T} = C_1 + C_2 + C_3$

1.9 The current gain for a transistor connected in the common-emitter mode is high.

1.10 The notch filter is only operative during colour transmission.

(10 × 1) **[10]**

QUESTION 2

Draw the circuit diagram of a common emitter amplifier using an NPN transistor and show the output waveform for a sine-wave input. **[10]**

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QUESTION 3

3.1 Draw ONE cycle of a sine-wave that has a peak-to-peak value of 400 V and a frequency of 50 Hz.

Indicate the following clearly on the wave:

- Peak value (2)
- Peak-to-peak value (2)
- Degrees where the wave intersects the x-axis (3)
- Value in seconds for ONE cycle (3)

3.2 A coil with an inductance OF 3 H and a resistance of 700 Ω is connected to a 200 V 50 Hz AC supply.

Calculate the following:

3.2.1 Inductive reactance of the coil (1)

3.2.2 Impedance of the coil (2)

3.2.3 Value of the current through the coil (2)

3.2.4 Phase angle between the supply voltage and supply current. (3)

3.3 Draw the impedance diagram from the information in QUESTION 3.2. (2)
[20]

QUESTION 4

4.1 Draw a neat, labelled circuit diagram of a Foster-Seeley discriminator. (10)

4.2 Explain what will happen in the circuit in QUESTION 4.1 above if the modulated frequency is 100 kHz above and 100 kHz below the centre frequency (10,7 MHz). (4)

4.3 State the disadvantages of this circuit. (1)
[15]

QUESTION 5

Explain the operation of the video detector and the video amplifier with regards to a monochrome television receiver. **[5]**

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QUESTION 6

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

QUESTION 7

An oscilloscope displays one full cycle of a sine wave which spans over 8 time-base units and 6 peak-to-peak amplitude units. The T/D switch is set to 3 m/s and the V/D switch is set to 4 mV. The probe's ratio is set to 1:1.

Calculate each of the following:

7.1 Maximum voltage value of the wave

7.2 Time in which the waveform is displayed

7.3 Frequency of the wave

7.4 RMS value of the wave

7.5 Average value of the wave

7.6 Peak-to-peak voltage of the wave

(6 × 2) **[12]**

QUESTION 8

State 10 important points regarding the service of a TV receiver which are simple and quick to check. **[10]**

TOTAL: 100

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RADIO AND TELEVISION THEORY N2

FORMULA SHEET

CAPACITOR CALCULATIONS

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

Capacitors in parallel: $C_T = C_1 + C_2 + ...$

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

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: $X_L = 2 . \pi . F . L$

Capacitive reactance: $X_c = \frac{1}{2 . \pi . F . C}$

Impedance for RL, RC and RLC circuits:

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

Circuit current for RL, RC and RLC circuits:

$I_T = \frac{V}{X_L}$ $I_T = \frac{V}{X_C}$ $I_T = \frac{V}{Z}$

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Voltage drop across components:

$V_R = I \times R \quad V_L = I \times X_L \quad V_C = I \times X_C$

Power factor: $Cos\,\theta = \frac{R}{Z}$

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

Resonant frequency: $f_r = \frac{1}{2\,.\,\pi\,.\,\sqrt{L\,.\,C}}$

Q-factor: $Q = \frac{1}{R}\,.\,\sqrt{\frac{L}{C}}$

OHM'S LAW

Resistors in series: $R_T = R_1 + R_2 + ...$

Resistors in parallel: $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

Voltage drop: $V = I \times R$

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

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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