higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1480**(E)**(M27)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

RADIO AND TELEVISION THEORY N2

(11040832)

27 March 2013 (X-Paper)
09:00–12:00

Calculators may be used.

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

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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. Show ALL the steps and calculations.
5. Keep questions and subsections of questions together.
6. ALL the sketches and diagrams must be large, clear and neat.
7. Write neatly and legibly.

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QUESTION 1

1.1 Give TWO main functions of a capacitor. (2)

1.2 State THREE factors that will influence the ability of a capacitor to store a charge. (3)

1.3 Define the *time constant of a capacitor.* (4)

1.4 A 12 V battery is connected across a 0,01 µF capacitor which is in series with a 100 kΩ resistor.

Determine each of the following:

1.4.1 The time constant (2)

1.4.2 The voltage across the capacitor after 2 min (3)

1.4.3 The voltage across the resistor (2)

1.4.4 The instantaneous current after 1 min (3)

1.4.5 The instantaneous current after 2 min (3)
[22]

QUESTION 2

2.1 A series RLC circuit consists of a 30 ohm resistor, an inductor of 60 mH and a capacitor of 10 µF connected to a 220 V/50 Hz supply.

Draw the circuit. (4)

2.2 Use the information in QUESTION 2.1 and determine each of the following:

2.2.1 The inductive reactance (2)

2.2.2 The capacitive reactance (2)

2.2.3 The impedance of the circuit (2)

2.2.4 The current flow in the circuit (2)

2.2.5 The phase angle (2)

2.2.6 The voltage drop across each component (6)
[20]

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QUESTION 3

3.1 The velocity of a sine wave in the air is 340 m/s. A burglar alarm emits supersonic waves at 40 kHz.

Calculate the wavelength. (2)

3.2 A sine wave has a cycle period of 7 µs and a velocity of 30,000000 m/s.

Determine the following:

3.2.1 The frequency of the wave (2)

3.2.2 The length of the wave (2)
[6]

QUESTION 4

4.1 Draw a neat, labelled circuit diagram of a common emitter amplifier using an NPN transistor. Show the input and output waveforms. (10)

4.2 State SEVEN characteristics of a common emitter amplifier. (7)
[17]

QUESTION 5

Draw a neat, labelled circuit diagram of a cathode-ray tube. **[10]**

QUESTION 6

Draw a neat, labelled circuit of a monochrome TV set and show ALL the interconnections and directions. **[15]**

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QUESTION 7

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (7.1–7.10) in the ANSWER BOOK.

7.1 A transistor has three terminals.

7.2 The current gain of a common collector amplifier is high.

7.3 The reactance of a capacitor is lower when the frequency increases.

7.4 Capacitors connected in series add.

7.5 Inductive reactance is measured in hertz.

7.6 The function of a tuner in television receivers is to eliminate RF.

7.7 The time it takes to charge a capacitor is known as resonance.

7.8 A monochrome television is also known as a black and white television.

7.9 The function of a synchronising separator is to produce sound.

7.10 The circuit of a phase shift oscillator consists of capacitors and resistors only.

(10 × 1) **[10]**

TOTAL: 100

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RADIO AND TELEVISION THEORY N2

FORMULA SHEET

CAPACITOR CALCULATIONS

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

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

Impedance for RL, RC and RLC circuits:

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

Circuit current for RL, RC and RLC circuits:

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

Voltage drop across components:

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

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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: $V = I \times R$

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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