higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1400(E)(N12)T
NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

RADIO AND TELEVISION THEORY N2

(11040832)

12 November 2014 (Y-Paper)
13:00–16:00

This question paper consists of 4 pages and 2 formula sheets.

ENGINEERING

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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

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

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QUESTION 1

1.1 Three capacitors of 1 µF, 2 µF and 3 µF are connected in series to a 9 V DC supply voltage.

Draw the circuit. (4)

1.2 Calculate the total capacitance. (3)

1.3 Calculate the total charge. (2)

1.4 Calculate the voltage across each capacitor. (6)

1.5 What is a rejector circuit? (2)
[17]

QUESTION 2

2.1 Define the time constant of a capacitor. (3)

2.2 How long does it take to charge the capacitor fully? (1)

2.3 A 9 Volt DC battery is connected to a 100 KΩ resistor and a capacitor of 0.01 µF in series.

Determine the following:

2.3.1 The time constant (2)

2.3.2 The voltage across the capacitor after 2 ms (5)

2.3.3 The voltage across the resistor (2)

2.3.4 The instantaneous current after 1 ms (3)

2.3.5 The instantaneous current after 2 ms (3)
[19]

QUESTION 3

A series RLC circuit consists of a 50 µH inductor, a resistor of 7.5 Ω and a capacitor of 40 µF to a 50 V supply.

Determine the following:

3.1 The resonant frequency (2)

3.2 The capacitive reactance (2)

3.3 The inductive reactance (2)

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3.4	The impedance of the circuit	(2)
3.5	The total current	(2)
3.6	The voltage across each component	(6)
3.7	The power factor	(2)
3.8	The phase angle	(2)

[20]

QUESTION 4

4.1	Draw a neatly labelled block diagram of an AM superhetrodyne receiver.	(10)
4.2	What is super heterodyning?	(4)
4.3	What is the function of AVC?	(3)

[17]

QUESTION 5

Draw a neatly labelled circuit diagram of an AM detector with the relevant waveforms. **[6]**

QUESTION 6

Draw a neatly labelled block diagram of a 625 line monochrome television receiver. **[15]**

QUESTION 7

Describe the following terms with reference to a television receiver

7.1	Video detector	(4)
7.2	AGC	(2)

[6]

TOTAL: 100

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FORMULA SHEET

RADIO AND TELEVISION THEORY N2

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

Capacitors in parallel $C_T = C_1 + C_3 + \cdots$

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

Capacitance reactance $X_c = \frac{1}{2.\pi.F.L}$

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

Voltage drop across components $V_R = I \times R$ $V_L = I \times X_L$
$V_C = I \times X_C$

Power factor $\cos\theta = \frac{R}{Z}$

Phase angle $\emptyset = \cos^{-1}\frac{R}{Z}$

Resonant frequency $f_r = \frac{1}{2.\pi.\sqrt{LC}}$

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

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OHM'S LAW

Resistors in series $R_T = R_1 + R_2 \ldots$

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

Voltage drop $V = I \times R$

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

OSCILLOSCOPE CALCULATIONS

Period = Time/Division × Horizontal divisions

Amplitude = Volts/ Division × Vertical divisions

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

RMS voltage $= 0{,}707 \times Peak$
Average voltage $= 0{,}637 \times Peak$
Voltage (Peak-to-Peak) $= 2 \times Peak$

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