higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1480**(E)**(A1)T

NATIONAL CERTIFICATE

RADIO AND TELEVISION THEORY N2

(11040832)

1 August 2018 (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. Write neatly and legibly.

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QUESTION 1

Choose a/an word/item from COLUMN B that matches a/an word/item in COLUMN A. Write only the letter (A–J) next to the question number (1.1–1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1	Notch filter	A	dynamic
1.2	Capacitors in parallel	B	transistor
1.3	Tuner	C	inductor
1.4	To maintain a constant picture	D	Class B amplifier
1.5	Impedance = $\frac{L}{RC}$	E	colour transmission
1.6	Three terminal device	F	± 3 V
1.7	High impedance to high frequencies	G	front end
1.8	Current flows for half of the input signal	H	A.G.C
1.9	Output of a video detector	I	common emitter
1.10	180° phase shift	J	$C_T = C_1 + C_2$

(10 × 1) **[10]**

QUESTION 2

2.1 Draw the circuit diagram of an emitter follower that uses a NPN transistor. (8)

2.2 Give the characteristics of the emitter follower for the following:

2.2.1 current gain

2.2.2 voltage gain

2.2.3 power gain

2.2.4 input impedance

(4 × 1) (4)
[12]

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QUESTION 3

3.1 Draw a labelled block diagram of an A.M. superhetrodyne receiver. (10)

3.2 If the input frequency to the receiver above is 1000 KHz give the value of the FOUR signals that will appear in the mixer. (4)

3.3 When audio (sound) waves are transmitted at its original frequency three main problems exist.

Describe these problems and state how these problems may be solved. (4)

3.4 Give a brief description of the process of amplitude modulation. (2)

[20]

QUESTION 4

A 100V/50 Hz A.C. voltage is obtained from the secondary of a step-down transformer.

Determine the following:

4.1 The peak voltage

4.2 The average value after full-wave rectification

4.3 The wavelength

4.4 The generation time (period).

(4 × 2) **[8]**

QUESTION 5

5.1 With regard to a rejector circuit (parallel resonance) as found in a radio receiver.

Give FOUR properties of this circuit. (4)

5.2 An electrical circuit consists of an inductor of 10 mH in parallel with a 100 µF capacitor. The circuit is supplied with an A.C. supply of 100 V.

5.2.1 Determine the resonant frequency

5.2.2 Prove by means of calculation: that $X_L = X_C$ for this circuit

(2 × 3) (6)

[10]

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QUESTION 6

6.1 Describe briefly the purposes of the following components in relation to audio circuits.

6.1.1 Coupling capacitor

6.1.2 Collector resistor

6.1.3 Transistor

(3 × 2) (6)

6.2 Draw a neat, labelled circuit diagram of a two-transistor audio amplifier. (14)
[20]

QUESTION 7

7.1 Explain in detail frequency modulation (FM). (4)

7.2 Make neat comparative sketches to show the principle of FM modulation. (8)

7.3 What is the purpose of the ratio detector as used in a radio receiver? (2)

7.4 Why is the ratio detector a popular detector? (2)

7.5 Explain the function of a limiter as used in a FM radio receiver. (2)

7.6 Besides the ratio detector name one other FM detector you have studied. (2)
[20]

TOTAL: 100

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FORMULA SHEET

CAPACITOR CALCULATIONS

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

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/WS-TEORIE

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:

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

Voltage drop across components:

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

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

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

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

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

OHM'S LAW/OHM SE WET

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/OSSILLOSKOOPBEWERKINGS

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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